

Medicine cost of chronic disease list (CDL) conditions in the South African private health sector

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***“Healthy citizens are the greatest asset any country
can have.”***

~ Winston Churchill ~

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ABSTRACT

Title: Medicine cost of chronic disease list (CDL) conditions in the South African private health sector.

Keywords: Chronic disease list conditions, co-morbid, prevalence, medicine cost, single exit price, dispensing fee, potential cost savings, generic medicine, pricing regulations, under-supply, over-supply and adherence.

The general research objective of this study was to investigate the prevalence and direct medicine cost of the 27 chronic disease list conditions in a section of the private health sector in South Africa from 2008 until 2012.

Globally, it was predicted that deaths from chronic non-communicable diseases would increase by 77.00% between 1990 and 2020 and that most of these deaths would occur in developing countries. Cardiovascular disease will remain the single leading cause of death by 2015, with an estimated 20 million people dying from cardiac diseases and stroke. Estimations show that the prevalence of people with chronic disease list conditions may increase from 11.00% in 2009 to 13.00% in 2025. The proportion of people with co-morbid chronic disease list conditions is estimated to increase from 3.20% in 2009 to 4.00% in 2025. As a result prescribed minimum benefits have been developed to cover treatment, diagnosis and care for 270 medical conditions, including chronic conditions known as the chronic disease list conditions, for all members of medical schemes to be covered fully. Strategies implemented to increase access to quality and affordable medicines include generic substitution (from 2003) and pricing regulations such as the single exit price (from 2004).

The results of this study found that the prevalence of patients with at least one chronic disease list condition increased by 25.39% ($n = 54\,406$) and the prevalence of all chronic disease list conditions increased by 41.30% ($n = 139\,336$) between 2008 and 2012. The average number of chronic disease list conditions per patient also increased from 1.57 ± 0.85 (95%CI:1.57-1.58) in 2008 to 1.77 ± 0.97 (95%CI:1.77-1.78) in 2012 ($p < 0.05$). Male and female patients had a chronic disease list condition prevalence increase of 9.38% ($n = 8\,319$) and 12.87% ($n = 18\,564$) respectively between 2008 and 2012 ($p < 0.05$). Age group: 70 > years had the highest average number of chronic disease list conditions in 2008 and 2012 when compared with the other age groups with 1.85 ± 1.00 (95%CI:1.85-1.86) and 2.07 ± 1.97 (95%CI:2.06-2.07) respectively ($p < 0.05$). Patients with chronic disease list conditions, when adjusted for of age and gender between 2008 and 2012, had an overall increase of 0.20 chronic disease list conditions ($p < 0.05$). Patients with a single and co-morbid chronic disease list conditions increased with 4.86% ($n = 6\,298$) and

56.95% (n = 48 108) respectively from 2008 until 2012 ($p < 0.05$). The prevalence and total cost of all chronic disease list medicine items increased with 20.14% (n = 513 812) and 31.49% (R105 296 602.00) respectively from 2008 to 2012. The average medicine cost per item also increased from R131.08 $\pm$ R259.92 (95%CI:R130.77-R131.41) in 2008 to R143.86 $\pm$ R483.84 (95%CI:R142.93-R144.01) in 2012.

Patient prevalence with the respective medicine items and cost of the top five (5) chronic disease list conditions changed as follows between 2008 and 2012:

- Asthma: Patient prevalence increased overall by 26.90% (n = 5 923); medicine items increased by 47.19% (n = 80 353) with a total cost increase of 72.21% (R21 439 217.85);
- Diabetes mellitus type 2: Patient prevalence increased overall by 54.33% (n = 17 120); medicine items and total cost increased by 37.45% (n = 149 978) and 62.99% (R37 183 442.32) respectively.
- Hyperlipidaemia: Patient prevalence increased overall by 54.74% (n = 35 490), medicine items increased by 24.46% (n = 143 279), with an decrease in total cost of 7.57% (R6 923 676.81);
- Hypertension: Patient prevalence increased overall by 38.91% (n = 49 531), with a medicine item increase of 17.46% (n = 288 596) with a total cost increase of 20.73% (R36 574 295.00);
- Hypothyroidism: Patient prevalence increased overall by 10.83% (n = 4 288) with decreases in both the number of medicine items and total cost of 87.26% (n = 260 242) and 86.08% (R10 100 155.73) respectively.

Strategies implemented to improve access to quality and affordable medicine to treat prescribed minimum conditions and other conditions include generic substitution (from 2003) and pricing regulations such as the single exit price (from 2004).

The prevalence of generic medicine items and their associated medicine item cost increased by 33.72% and 46.81% respectively between 2008 and 2012. The average cost per generic medicine item increased constantly from R86.62 $\pm$ R65.43 (95%CI:R86.53-R86.73) in 2008 to R95.10 $\pm$ R78.06 (95%CI:R95.00-R95.21) in 2012. This average cost per generic medicine item was still lower than for any of the original medicine claimed with the largest practical significant difference between generic medicine items, when compared to all the other generic indicator groups.

Overall, the average single exit price per prescription and single exit price per medicine item increased between 2008 and 2012. In contrast, the average dispensing fee per prescription and

average dispensing fee per medicine item decreased between 2008 and 2012. Potential cost savings per medicine item from changes in single exit price for all chronic disease list conditions as well as for four of the top 5 chronic disease list medicine items. All of the top 5 chronic disease list conditions had 3.52 times more (n = 306 662) medicine items, with a total cost, 30.26 times higher (R891 414 894.44) in the under-supplied group (not yet paid for by the medical scheme or patient) than the over-supplied group.

It can be concluded that there was a noted increase in the number of patients with chronic disease list conditions and their associated medicine treatment cost in this study. Many of these conditions may be cost-effectively treated through adherence education and the possible implementation of certain managed care principles such as generic substitution to reduce medicine treatment cost. The recommendation can be made to conduct a detailed study of the medicine use and treatment cost of the chronic disease list conditions in the public health sector especially regarding the implementation of the National Health Insurance that may involve both the private and public health sectors.

OPSOMMING

Titel: Medisynekoste van chroniese siektelys-toestande in die Suid-Afrikaanse private gesondheidsektor.

Sleutelwoorde: Chroniese siektelys-toestande, ko-morbiditeit, voorkoms, medisynekoste, enkele-uitgangsprys, resepteerfooi, maandelike kostebesparings, generiese medisyne, prys regulering, ondervoorsiening, oorrovoorsiening en meewerkendheid.

Die algemene navorsingsdoelstelling van hierdie studie was om ondersoek in te stel na die voorkoms en direkte medisynekoste van die 27 chroniese siektelys toestande in 'n gedeelte van die private gesondheidsektor in Suid-Afrika vanaf 2008 tot 2012.

Wêreldwyd word daar voorspel dat sterfgevälle van chroniese nie-oordraagbare siektes met 77.00% sal toeneem vanaf 1990 tot 2020, en dat die meeste van hierdie sterfgevälle in ontwikkelende lande sal voorkom. Kardiovaskulêre siektes sal die oorsaak van die meeste sterfgevälle teen 2015 wees, met 'n beraamde twintig miljoen mense wat sal sterf as gevolg van hartsiektes en beroertes. Voorspellings deur toon dat die voorkoms van mense met chroniese siektelys-toestande kan toeneem van 11.00% in 2009 tot 13.00% in 2025. Die voorspelling is dat die hoeveelheid mense met ko-morbiede chroniese siektelys-toestande sal toeneem vanaf 3.20% in 2009 tot 4.00% in 2025. As gevolg hiervan is voorgeskrewe minimum voordele ontwikkel om die behandeling, diagnose en versorging van 270 mediese toestande, insluitend chroniese toestande, te dek. Hierdie chroniese toestande staan ook bekend as die chroniese siektelys toestande en moet ten volle gedek word vir alle mediese fondselede. Geïmplementeerde strategieë om die toegang tot kwaliteit en bekostigbare medisyne maandelik te maak sluit generiese vervanging (vanaf 2003) en prys-regulering soos die enkele-uitgangsprys in (vanaf 2004).

Die resultate van die studie het bevind dat die voorkoms van pasiënte met ten minste een chroniese siektelys-toestand toegeneem het met 25.39% ($n = 54\,406$) en die voorkoms van al die chroniese siektelys-toestande het toegeneem met 41.30% ($n = 139\,336$) tussen 2008 en 2012. Die gemiddelde hoeveelheid chroniese siektelys-toestande per pasiënt het ook toegeneem van 1.57 ± 0.85 (95%CI:1.57-1.58) in 2008 tot 1.77 ± 0.97 (95%CI:1.77-1.78) in 2012 ($p < 0.05$). Manlike en vroulike pasiënte het 'n toename in chroniese siektelys- toestande getoon van onderskeidelik 9.38% ($n = 8\,319$) en 12.87% ($n = 18\,564$) tussen 2008 en 2012 ($p < 0.05$). Die ouderdomsgroep: 70 > jaar het die hoogste gemiddelde hoeveelheid chroniese siektelys-toestande gehad tussen 2008 en 2012 in vergelyking met ander ouderdomsgroepe, met onderskeidelik 1.85 ± 1.00 (95%CI:1.85-1.86) en 2.07 ± 1.97 (95%CI:2.06-2.07) ($p < 0.05$). Die aantal pasiënte met chroniese siektelys-toestande het vanaf 2008 tot 2012 met aanpassing vir

ouderdom en geslag 'n algehele toename van 0.20 chroniese siektelys-toestande getoon ($p < 0.05$). Pasiënte met enkel en ko-morbiede chroniese siektelys-toestande het vanaf 2008 tot 2012 met onderskeidelik 4.86% ($n = 6\ 298$) en 56.95% ($n = 48\ 108$) toegeneem ($p < 0.05$). Die voorkoms en totale koste van alle chroniese siektelys-medisyn items het onderskeidelik tussen 2008 en 2012 met 20.14% ($n = 513\ 812$) en 31.49% (R105 296 602.00) toegeneem. Die gemiddelde medisyne-koste per item het ook toegeneem van R131.08 $\pm$ R259.92 (95%CI:R130.77-R131.41) in 2008 tot R143.86 $\pm$ R483.84 (95%CI:R142.93-R144.01) in 2012.

Pasiënt-voorkoms met die onderskeie medisyne items en koste van die top vyf (5) chroniese siektelys-toestande het as volg tussen 2008 en 2012 verander:

- Asma: Pasiënt-voorkoms het toegeneem met 26.90% ($n = 5\ 923$); medisyne-items het toegeneem met 47.19% ($n = 80\ 353$), met 'n total koste-toename van 72.21% (R21 439 217.85);
- Diabetes mellitus tipe 2: Pasiënt-voorkoms het met 54.33% ($n = 17\ 120$) toegeneem; medisyne-items en totale koste het met onderskeidelik 37.45% ($n = 149\ 978$) en 62.99% (R37 183 442.32) toegeneem.
- Hiperlipidemie: Pasiënt-voorkoms het toegeneem met 54.74% ($n = 35\ 490$), medisyne-items het toegeneem met 24.46% ($n = 143\ 279$) en die totale koste het afgeneem met 7.57% (R6 923 676.81);
- Hipertensie: Pasiënt-voorkoms het met 38.91% ($n = 49\ 531$) toegeneem, medisyne-items het met 17.46% ($n = 288\ 596$) toegeneem en totale koste het met 20.73% (R36 574 295.00) toegeneem;
- Hipotiroidisme: Pasiënt-voorkoms het met 10.83% ($n = 4\ 288$) toegeneem, terwyl sowel die hoeveelheid medisyne-items as die totale koste met onderskeidelik 87.26% ($n = 260\ 242$) en 86.08% (R10 100 155.73) afgeneem het.

Die voorkoms van generiese medisyne-items and die geassosieerde medisyne-item koste het tussen 2008 en 2012 met onderskeidelik 33.72% en 46.81% toegeneem. Die gemiddelde koste per generiese medisyne-item het vanaf R86.62 $\pm$ R65.43 (95%CI:R86.53-R86.73) in 2008 tot R95.10 $\pm$ R78.06 (95%CI:R95.00-R95.21) in 2012 toegeneem. Hierdie gemiddelde koste per generiese medisyne-item was steeds laer as vir enige van die oorspronklike medisyne-items wat geëis was, met die grootste prakties beduidende verskil tussen generiese medisyne in vergelyking met die ander generiese aanwysergroepe.

Oor die algemeen het die enkele-uitgangsprys per voorskrif en enkele-uitgangsprys per medisyne-item toegeneem tussen 2008 en 2012. In teenstelling het die gemiddelde resepteerfooi per voorskrif asook per medisyne-item afgeneem tussen 2008 en 2012. Daar was moontlike koste besparings per medisyne-item vir alle asook vir vier van die top 5 chroniese siektelys-toestande as gevolg van veranderinge in die enkele-uitgangsprys. Al vyf die top 5 chroniese siektelys-toestande het 3.52 meer medisyne-items gehad ($n = 306\,662$) met 'n totale koste 30.26 keer hoër (R891 414 894.44) in die onder-voorsiende groep (nog nie deur die mediese skema of pasiënt betaal nie) as die oor-voorsiende groep.

Ter samevatting was daar 'n beduidende toename in die hoeveelheid pasiënte met chroniese siektelys-toestande en geassosieerde medisynebehandelingskoste in hierdie studie. Baie van hierdie toestande kan koste-effektief behandel word deur onderrig en moontlike implementering van sekere bestuurde gesondheidsorg-beginsels, soos generiese vervanging, om medisynekoste te verminder. Die voorstel word gemaak om met behulp van 'n gedetailleerde studie ondersoek in te stel na die medisyneverbruik en behandelingskoste van die chroniese siektelys-toestande in die openbare gesondheidssektor. Een rede om 'n studie in die openbare sektor aan te voer is dat beide die private en openbare gesondheidssektore betrokke kan wees by die implementering van die Nasionale Gesondheidsversekering.

LIST OF ABBREVIATIONS

All abbreviations listed were evident in chapter 1 to chapter 4 as well as the appendices.

\$	United States dollar
%	Percentage
α	Alpha
β	Beta
<	Less than
=	Equal to
>	More than
$\pm$	Plus or minus
$\leq$	Less than or equal to
$\geq$	More than or equal to
μg	Microgram
5-ASA	5-Aminosalicylic acid.
ACE	Angiotensin-converting-enzyme
ADH	Anti-diuretic hormone
AIDS	Acquired-immune-deficiency-syndrome
ANC	African National Congress
ANDA	Abbreviated new drug application
ANOVA	Analyses of variance
ARB	Angiotensin-receptor blocker
ARVC	Arrhythmogenic right ventricular cardiomyopathy
AV	Atrioventricular node
BMI	Body mass index
BP	Blood pressure
Ca^{++}	Serum calcium
CAD	Coronary artery disease

CCB	Calcium channel blocker
CCF	Chronic/congestive cardiac failure
CDL	Chronic disease list
CDPI	Chronic disease prevalence index
CI	Confidence interval
CKD	Chronic kidney disease
CNS	Central nervous system
COMT	Catecholamine–O-methyltransferase-inhibitors
COPD	Chronic obstructive pulmonary disease
CPI# (chapter 2)	Consumer-price index
CPI*(chapter 1)	Cost-prevalence index
Cr/Serum	Serum creatinine
CRI	Chronic renal insufficiency
CVD	Cardiovascular disease
DALY	Disability-adjusted-life-year
DBR	Days between refills
DCM	Dilated cardiomyopathy
dL	Decilitre
DM	Diabetes mellitus
DMARD	Disease modifying anti-rheumatic drug
DSM	Diagnostic and statistical manual
DSP	Designated service provider
DTP	Diagnosis treatment pair
DUR	Drug utilisation review
ESRD	End-stage renal disease
EU	European Union
FDA	Food and drug administration
FEV1	Forced expiratory volume in 1 (one) second

FPG	Fasting plasma glucose
GDP	Gross domestic product
GEK	Gmünder ErsatzKasse
GEMS	Government Employees Medical Scheme
GFR	Glomerular filtration rate
GLM	General linear models
Hb	Haemoglobin
HbA1c	Glycosylated haemoglobin
HCM	Hypertrophic cardiomyopathy
HDL	High-density-lipoprotein
HF	Heart failure
Hg	Mercury
HIV	Human-immune-virus
HMG-CoA reductase	3-Hydroxy-3-methylglutaryl-coenzyme A reductase
IBM	International Business Machines Corporation
ICD	International classification of diseases and health-related problems
IDPIG	International drug price indicator guide
IMPP	Interchangeable multi-source pharmaceutical products
INN	International non-proprietary name
INR	International normalized ratio
IV	Intravenous
IX	9 (nine)
Kg	Kilogram
Km	Kilometre
LDL	Low-density-lipoprotein
LV	Left ventricular
M	Original medicine provided (patent not expired) and generic medicine available.

MDI	Metered dose inhaler
Mg	Milligram
MIMS®	Monthly index of medical specialties®
Min	Minute
mm	Millimetre
mmol	Milimoles
MPR	Medication possession ratio
MSE	Mean square error
N	Original medicine provided (no generic medicine available)
n	Total number
Na ⁺	Serum sodium
NAPM	National Association of Pharmaceutical Manufacturers
NAPPI	National approved product pricing index
NCD	Non-communicable disease
NDP	(National drug policy
NHI	National Health Insurance
NHS	National Health Service
NSAID	Non-steroidal anti-Inflammatory drug
NWU	North-West University
NYHA	New York Heart Association
O	Original medicine provided (patent expired) and generic medicine available
PBM	Pharmaceutical benefit management
PCD	Proportion of days covered
PEF	Peak expiratory flow
PMA	Pharmaceutical Manufacturers Association
PMB	Prescribed minimum benefits
PO ₄	Phosphate

PPI	Production-Price-Index
PPP	Purchasing power parity
PSSA	The Pharmaceutical Society of South Africa
R	Rand
REF	Risk equalisation fund
SA	South Africa
SAGES	South African Gastroenterology Society
SARS	South African Revenue Service
SAS®	Statistical Analysis System®
SASH study	South African Stress and Health study
SEP	Single exit price
Serum K ⁺	Serum potassium
SF-36	Short Form-36
SHI	Social Health Insurance
SPSS®	Statistical Package for the Social Sciences®
SR	Slow-release
STG	Standard Treatment Guidelines
TSH	Thyroid stimulating hormone
UK	United Kingdom
US	United States
VAT	Value-added-tax
VIII	8 (eight)
VS	Versus
WHO	World Health Organization
XI	11 (eleven)
Y	Generic medicine provided

LIST OF DEFINITIONS

- Addison's disease.

Addison's disease can be defined as underactive adrenal glands, resulting in a deficiency of adrenal hormones (Grossman, 2003:956). Addison's disease can further defined as being an uncommon disorder caused by destruction or dysfunction of the adrenal cortices, thereby leading to a decrease in aldosterone and cortisol production (Fitzgerald, 2007:1189; Ross & Levitt, 2013:1).

- Adequate-supply.

Adequate-supply can be defined for the purpose of this study as an MPR $\geq 80\%$, and $\leq 110\%$. This would be considered acceptable (adherent).

- Adherence.

Adherence can be defined as all aspects of how well or poorly a patient follows a prescribed medicine-dosing regimen or medical advice (Van der Walt & Maartens, 2008:103). Adherence is synonymous with the term "compliance", but is preferred as it is more patient centred (compliance implies following orders).

- Analysis of variance.

The analysis of variance (ANOVA) (also known as the F-test) is used to test hypothesis for one or more factors concerning the variance among two or more group means, where the variance in one or more populations is unknown (Gravetter & Wallnau, 2013:387; Privitera, 2012:349; Rubin, 2010:185).

- Analytical epidemiology.

Analytical epidemiology refers to how the hypotheses of associations of risk factor exposures with health outcomes are assessed (Szklo & Nieto, 2007:3).

- Arithmetic mean (average).

The mean can be defined as an average that uses the exact value of each entry (Brase & Brase, 2010:77).

- Asthma.

Asthma can be defined as episodic or chronic symptoms of airflow obstruction, including breathlessness, cough, wheezing, and chest tightness (Chesnutt & Prendergast, 2007:230). Ellis (1999:556) defines asthma as a pulmonary disease characterised by reversible airway obstruction, airway inflammation, and increased airway responsiveness to a variety of stimuli.

- Bipolar mood disorder.

Bipolar mood disorder can be defined as a cyclic mental disorder which causes recurrent mood and energy fluctuations including behaviour encompassing the extremes of human experiences (Drayton, 2011:1191 & Fankhauser, 2002:1265). Bipolar disorder (manic-depressive illness) can also be defined as episodes of depression alternate with episodes of mania or lesser degrees of joyousness or elation (Sussman, 2003:620).

- Bronchiectasis.

Bronchiectasis can be defined as irreversible focal bronchial dilation, usually accompanied by chronic infection and associated with diverse conditions, some congenital or hereditary (Snider, 1999:584; Hill, 2012:6). Bronchiectasis is also accompanied by a chronic productive cough, airway obstruction, and recurrent infections (Baydarian & Walter, 2008:516).

- Burden of disease.

The burden of disease can be defined as the impact of impaired health from the perspective of epidemiology (morbidity and mortality), cost of illness, and quality of life and other risk factors (De Lissoyov, 2007:1046; Econex, 2009:1).

- Capitated schemes.

Capitated schemes are constructed by a scheme entering into contracts with various medical service providers, such as doctors and dentists, who have to service a defined number of patients belonging to a scheme (Edwards, 2005).

- Cardiac failure.

Cardiac failure is a pathophysiological state comprising of a complex clinical syndrome that can result from either a structural or functional cardiac disorder. The heart is then unable to pump sufficient blood to meet the metabolic needs of the body (Hunt *et al.*, 2009:e397; Schwinghammer, 2003d:56).

- Cardiomyopathy.

Primary cardiomyopathies is defined as disorders that affect either the structure or function of the myocardium in the absence of other known causes of heart disease (Nappi & Zile, 2002:312).

- Chi-square tests.

Chi-square tests is defined a statistical procedure used to test hypotheses about the discrepancy between the observed and expected frequencies in two or more nominal categories (Privitera, 2012:547). In addition X^2 calculates the magnitudes of the discrepancies between the expected and observed cell counts (Devore & Peck, 1993:808).

- Chronic bronchitis.

Chronic bronchitis is associated with chronic or recurrent excess mucus secretion into the bronchial tree with cough that occurs on most days during a period of at least three (3) months of the year for at least two (2) consecutive years (Chesnutt & Prendergast, 2007:242; Schwinghammer, 2003b:839).

- Chronic disease.

Chronic disease can be defined as having a long course of illness (Bureau of Chronic Disease, 2012).

- Chronic disease list (CDL).

The specific conditions included in the chronic disease list were identified and selected by the Council for Medical Schemes in South Africa, because they were the most common, are life-threatening, and those in which cost-effective treatment would sustain and improve the quality of a member's life (Council for Medical Schemes, 2010a).

- Chronic disease-prevalence index (CDPI).

The Chronic disease-prevalence index can be used as a measure to determine the relationship between the number of chronic disease items and the number of patients with a CDL condition.

- Chronic medicine.

Chronic medicine can be defined as medicine that has to be taken continuously (Hugtenburg *et al.*, 2005:353).

- Chronic obstructive pulmonary disease (COPD).

Chronic obstructive pulmonary disease can be defined as a disease that is characterised by chronic bronchitis or emphysema which may be accompanied by airway hyper-reactivity, which may be partially reversible and airflow obstruction that is generally progressive. COPD is further associated with systemic effects and lung hyperinflation (Abdool-Gaffar *et al.*, 2011:64; Snider, 2003:281).

- Chronic renal disease (CKD).

Chronic kidney (renal) disease (CKD) is defined as kidney damage or a glomerular filtration rate (GFR) of <60 ml/minute/1.73 m² for 3 months or more (Davids, 2007:10).

- Chronic renal failure.

Chronic renal failure is defined as a reduction in GFR below normal values of approximately 120 to 130ml/minute developing over months to years (Kraut, 2012:884).

- Co-morbidity.

Co-morbidity can be defined as a patient having any additional co-existing disease to a particular index disease (Feinstein, 1970:455-466). Co-morbidity can further be defined as a person having more than one disease or conditions at a particular time (Centers for Disease Control and Prevention, 2014).

- Compliance.

Refer to adherence.

- Concurrent drug utilisation review (DUR).

Concurrent drug utilisation review assists in the continuous monitoring of medicine therapy during the course of treatment. Concurrent reviews prevent therapeutic misadventures by intervening at the point of dispensing, such as checking for medicine interactions, duplications or contraindications relative to the condition of the patient (Academy of Managed Care Pharmacy, 2009; Kreling, 2000; Truter, 2008:95).

- Confidence interval (CI).

Confidence intervals reveal how great that effect is determined by the *p-value* (Rowe, 2007:85; Devore & Peck, 1993:391).

- Consumer-price index (CPI).

The consumer price index can be defined as the changes in pricing over time of consumer products and services that a household pays for (also known as headline inflation) (Econex, 2013:5; Statistics South Africa, 2013:1).

- Co-payments.

Co-payments can be defined as the amount paid by the medical scheme member at the point of dispensing for each visit to a medical practice, emergency room or purchasing of medication not paid for by the medical scheme (Badenhorst *et al.*, 2013:24; Mosby's dictionary of medicine, nursing and health professions, 2013:438).

- Coronary artery disease.

Coronary artery disease can be defined as a condition in which the blood supply to the heart muscle is partially or completely blocked (Steyn, 2007:4; Warnica, 2003:199).

- Cost.

Cost can be defined as resources that are used in the production of a product or service (Larson, 1996:45). Cost can also be defined as the consumption of a resource that otherwise could have been used for another purpose (Strom *et al.*, 2012:922; Struwig, 1997:169).

- Cost-prevalence index (CPI).

The cost-prevalence index can be used as an indication to show the relationship between the number of medicine items per prescription and the total medicine cost (Serfontein, 1989:180).

- *Cramer's statistical V-test.*

Cramer's statistical V-test can be defined as a measure of the correlation (correlation coefficient), or degree of relationship, between two dichotomous nominal variables, where one of the nominal variables has more than two categories (McLaughlin, 2002:530; Rubin, 2010:211). *Cramer's statistical V-test* can also be defined as a chi square-based measure of association between nominally measured variables organised into a bivariate contingency table with any number of rows and columns (Healey, 2012:514; Ellis, 2010:11).

- Crohn's disease.

Crohn's disease can be defined as a non-specific chronic transmural inflammatory disease of the mucosa that mostly affects the distal ileum and colon but may occur in any part of the gastrointestinal tract. In addition, fistula development, abscess formation and ulceration is possible (McQuaid, 2007:636; Sachar, 1999:302).

- Dependent variable.

Two variables can be defined as being dependent if the occurrence and non-occurrence of one changes the probability that the other one will occur (Brase & Brase, 2010:167).

- Descriptive epidemiology.

Descriptive epidemiology refers to data used to examine how rates (e.g. mortality) vary according to variable demographics (e.g. census data) (Szklo & Nieto, 2007:3).

- Descriptive statistics.

Descriptive statistics can be defined as ways in which numerical information in samples and populations are organised and summarised (Brase & Brase, 2010:9). Descriptive statistics can further be defined as summarising the distribution of a single variable or measuring the relationship between two or more variables (Healey, 2012:16).

- Descriptive studies.

The aim of descriptive studies is to characterize the amount and distribution of health and disease within a population (Friis, 2010:8).

- Designated service providers (DSP).

Designated service providers refer to health care provider(s) that have been "selected by the scheme to provide its members with diagnosis, treatment and care in respect of one or more of the PMB conditions" (Medikredit, 2004:54).

- Diabetes insipidus.

Central diabetes insipidus can be defined as a lack of ant-diuretic hormone (ADH) secretion or a lack of response to the hormone at the target organ, that causes excessive production of very dilute urine (polyuria) (Chapman, 2003:944; Ozer & Balasubramanyam, 2012:691). Diabetes insipidus can also be defined as a temporary or chronic disorder of the neurohypophyseal system due to deficiency of vasopressin and characterised by excretion of excessive quantities of very dilute (but otherwise normal) urine and by excessive thirst (Jospe, 1999:78).

- Diabetes mellitus (DM).

Diabetes mellitus can be defined as a group of metabolic disorders which are characterised by abnormalities in fat, carbohydrates hyperglycaemia and fat metabolism (Schwinghammer, 2003c:170).

- Diabetes mellitus type 1.

Type 1 diabetes mellitus or insulin-dependent diabetes accounts for about 10.00% of all diabetic cases and usually results from immune-mediated destruction of β -cells. This destruction is predominantly due to an autoimmune process which results in an absolute deficiency of insulin (Masharani, 2007:1219; Schwinghammer, 2003c:170).

- Diabetes mellitus type 2.

Type 2 diabetes mellitus (formerly known as non-insulin-dependent diabetes) accounts for as many as 90.00% of all cases of DM and is characterised by the presence of both relative insulin deficiency and insulin resistance (Masharani, 2007:1219; Schwinghammer, 2003c:170).

- Direct cost.

Direct cost can be defined as cost directly related to prevent, detect and treat an injury or disease. This may also include staff cost and medicine acquisition cost (Currie *et al.*, 2000:175; Gattani *et al.*, 2009:17).

- Disability-adjusted life year (DALY).

The global burden of disease measures burden of disease using the disability-adjusted life year (WHO, 2011b). The DALY is a health gap measure, which combines information on the impact of premature death, disability and other non-fatal health outcomes (Nielsen, 2000:2).

- Dispensing fee.

The “dispensing fee” can be defined as the fee paid to the dispenser (pharmacy or pharmacist) to provide a service (professional service/fee) plus profit, and is normally the fee charges for the work done in dispensing the prescription (WHO/HAI, 2011:51).

- Drug utilisation review (DUR).

Drug utilisation review can be defined as an authorised, structured, and continuing programme that reviews, analyses, and interprets patterns of medicine use against predetermined standard, with changes to therapy where standards are not met (Academy of Managed Care Pharmacy, 2009; Lipton & Bird, 1993:1069). Drug utilisation review was further defined as the marketing, distribution, prescribing and use of medicine in a society, with special emphasis on the resulting medical, social and economic consequences (WHO, 2003a:8).

- Dysrhythmias (Arrhythmias).

Arrhythmia is defined as a loss of cardiac rhythm, especially irregularity of heartbeat (Schwinghammer, 2003a:35).

- Effect size.

Talheimer and Cook (2002:3) stated that an effect size is the difference between two means divided by the largest standard deviation of the two conditions. Effect sizes can further be defined as a statistical measure of the size of an effect in a population to determine how far scores shifted in a population or the variance percentage explained by a given variable (Privitera, 2012:246).

- Emphysema.

Emphysema is characterised by abnormal, permanent enlargement of the airspaces distal to the terminal bronchioles, accompanied by destruction of their walls, but without obvious fibrosis (Chesnutt & Prendergast, 2007:242; Schwinghammer, 2003b:839).

- Epidemiology.

Epidemiology can be defined as the study of the way determinants of problems are distributed which is health related in specific human populations and the control of these problems (Aschengrau & Seage, 2008:6; Strom, 2012a:5; Szklo & Nieto, 2007:3).

- Epilepsy.

Epilepsy can be defined as any disorder characterised by recurrent unprovoked seizures (Aminoff, 2007:1004, Epilepsy South Africa, 2014).

- Essential drug list (Essential medicine).

Essential medicine refers to medicine that is accessible and available to all for South Africa described (The National Drug Policy, 1996:3). The standard treatment guidelines (STG) and EDL are aligned with scientific advances and current developments in medicine that are cost-effective and efficient and available to treat the majority of conditions in a country (The National Department of Health, 2012:ii).

- Experimental study.

An experimental study requires the researcher to introduce an intervention and normally consists of randomised controlled trials (Aldous *et al.*, 2011:26).

- Formularies.

Formularies can also be effective in limiting access or driving to certain medicine use to the formulary/preferred medicine and improve the quality of medicine prescribing. If cost is a criterion for formulary assignment and high cost medicine are omitted, or if the formulary is associated with differential or tiered co-payments and/or rebates, it can reduce program costs (Kreling, 2000).

- Frequency.

The frequency for a data value can be defined as the number of times the value occurs in a particular category of a variable or a data set (Jaisingh, 2000:6; Rubin, 2010:316).

- Generic medicine.

Generic medicine is the equivalent of the brand-name medicine. They obtain the exact same active ingredient, strength and dosage form as the original product (Mestern, 2003).

- Generic substitution.

Generic substitution is where the doctor's choice to write a prescription with a generic or a brand name, the pharmacist can intervene without consulting either the doctor or pharmacist. This means that the pharmacist has the freedom to dispense any generic version of the product instead of the brand name written on the prescription by the doctor (The Association of the British Pharmaceutical Industry, 2009).

- Glaucoma.

Glaucoma can be defined as a group of ocular diseases characterised by optic neuropathy that is associated with a loss of visual sensitivity and field and changes in the optic nerve head (optic disc) (Fiscella *et al.*, 2011:1633; Hamilton, 2003a:649).

- Haemophilia.

Haemophilia can be defined as a bleeding disorder as a result of a congenital deficiency in plasma coagulation protein (Bickert & Kwiatkowski, 2002:1747). Haemophilia can also be defined as inherited bleeding disorders caused by deficiency of specific coagulation factors (Mahlangu & Gilham, 2007:1297).

- Health-related quality of life.

Health-related quality of life was defined by the Centers for Disease Control and Prevention (2000:6) as health perceptions on a mental and physical level, which includes social support, health risk and conditions, socioeconomic status and functional status.

- Hyperlipidaemia.

Hyperlipidaemia can be defined as an elevation of one or more of the following blood lipids: cholesterol esters, cholesterol, triglycerides or phospholipids (Steyn, 2007:25; Talbert, 2002:396).

- Hypertension.

Hypertension can be defined as a persistently elevated systolic and/or diastolic arterial blood pressure of 140/90 mmHg or more in subjects aged 15 years and above (Lemogoum *et al.*, 2003:1993; Sutters, 2012:420). Hypertension can further be defined as a persistent elevation of blood pressure that exceeds an arbitrarily normal set level (Perloff *et al.*, 1993:2461).

- Hypothyroidism.

Hypothyroidism can be defined as the clinical and biochemical syndrome resulting from decreased thyroid hormone production (Reasner & Talbert, 2002:1370). Hypothyroidism can further be defined as the characteristic clinical response to thyroid hormone deficiency in the adult (Braverman, 1999:93). In addition, Fitzgerald (2012:1078) defined hypothyroidism as a failure or resection of the thyroid gland itself or deficiency of pituitary thyroid-stimulating-hormone (TSH).

- Independent variable.

Two variables can be defined as being independent if the occurrence or non-occurrence of one does not change the probability that the other one will occur (Brase & Brase, 2010:167). Independent variables were further defined as a classification of one case on one variable has no effect on the probability that the case will be classified in any particular category of the second variable (Healey, 2012:515).

- Indirect cost.

Indirect cost can be defined as a loss of productivity in the economy as a result of short as well as long term disability (Currie *et al.*, 2000:175).

- Inferential statistics.

Inferential statistics are used when drawing conclusions and, in some cases, making predictions about the properties of a population based on information obtained from a sample (Brase & Brase, 2010:9; Devore & Peck, 1993:4; Gravetter & Wallnau, 2013:8).

- International classification of diseases and health-related problems (ICD-10 code).

The ICD-10 code is used to translate the diagnosis of diseases and health-related problems into an alphanumeric code from descriptions, that allow data to be easily stored, retrieved and analysed (Council for Medical Schemes, 2010c).

- Levy.

Refer to co-payments.

- Managed health care.

Managed health care can be defined as financial and clinical risk management and assessment of health care to facilitate cost-effective and appropriate health services which are affordable, through the use of clinical and rule based management programmes (Council for Medical Schemes, 2003:12).

- Mark-up price.

A mark-up price differs from the single exit price and can be defined as the difference between the selling price and purchase price (cost price of a commodity) (medicine) (WHO/HAI 2011:1).

- Medicine.

Medicine is defined as a substance taken or given for the treatment of disease and maintenance of health (Butterworths medical dictionary, 1978:1050).

- Medicine possession ratio (MPR).

The definition of compliance/adherence used in retrospective assessments is the number of doses dispensed in relation to the dispensing period, which is also called the “medicine possession ratio (MPR)” (Cramer *et al.*, 2007:3).

- Metabolic syndrome.

According to the International Diabetes Federation (2006:10), metabolic syndrome can be defined as central obesity (body mass index (BMI) > 30 kg/m² with ethnicity specific values) together with two or more of the following:

- Raised plasma triglycerides (≥ 1.7 mmol/L; 150 mg/dL) or specific treatment for the lipid abnormality (International Diabetes Federation, 2006:10);
- Reduced HDL-cholesterol (< 1.03 mmol/L, 40 mg/dL for males; < 1.29 mmol/L, 50 mg/dL for females) or specific treatment for the lipid abnormality (International Diabetes Federation, 2006:10);
- Raised fasting plasma glucose (Fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L). If FPG > 100 mg/dL (5.6 mmol/L), an oral glucose tolerance test is recommended, although not necessary to defined the presence of the syndrome) or specific treatment for diabetes mellitus type 2 (International Diabetes Federation, 2006:10);
- Raised blood pressure (systolic blood pressure (BP) ≥ 130 mmHg or diasolic BP ≥ 85 mmHg or specific treatment for hypertension (International Diabetes Federation, 2006:10).

- Multiple sclerosis.

Multiple sclerosis can be defined as a slowly progressive central nervous system (CNS) disease characterised by disseminated patches of demyelination in the brain and spinal cord, resulting in multiple and varied neurologic symptoms and signs, usually with remissions and exacerbations (Apatoff, 1999:1474).

- National health insurance.

The NHI is basically a medical scheme-to be governed by a board of trustees in the form of an authority to be created by legislation and making available only a prescribed set of benefits from a prescribed but legally accredited set of healthcare providers including doctors and hospitals for discussed costs between the state and the healthcare provider (Kirby, 2009). Usually the same taxpayers would be the contributors but everyone would be entitled to benefits (McLeod, 2009a:1).

- Observational studies.

The different types of observational studies include descriptive and analytical studies. Descriptive studies consist of a cross-sectional study (e.g. determining prevalence), a prospective / retrospective cohort study (e.g. determining incidence) or a retrospective study (Aldous *et al.*, 2011:25). Analytical studies are normally used to show the association between a risk factor (exposure) and an outcome, can either consist in determining prevalence (e.g. case-control study or cross-sectional study), or determining incidence (e.g. cohort study) (Aldous *et al.*, 2011:26; Merrill, 2013:179).

- Out-of-pocket payments.

Refer to co-payments.

- Over-supply.

Over-supply can be defined for the purpose of this study as a medicine possession ratio > 110%. This would be considered as an over-supply (non-adherent).

- Parkinson's disease.

Parkinson's disease is defined as an idiopathic, slowly progressive, degenerative central nervous system disorder characterised by slow and decreased movement, muscular rigidity, resting tremor, and progressive postural instability (Aminoff & Kerchner, 2012:971; Feigin, 1999:1466). Idiopathic Parkinson's disease can be defined as having highly characteristic neuropathologic findings and clinical presentation including motor deficits and, in some cases, mental retardation (Schwinghammer, 2003e:551).

- Percentage.

A percentage can be defined as number, rate or amount in or for every 100 (Concise Oxford English dictionary, 2011:1063). A percentage can also be defined as any proportion or share in relation to a whole (Concise Oxford English dictionary, 2011:1063).

- Persistence.

Persistence can be defined as the time of continuous therapy, demarcated by the time from initiation of therapy to discontinuation of therapy (Cramer *et al.*, 2007:3). Persistence was further defined as time over which a patient continues to fill a prescription, or the time from the initial fillings of the prescription until the patient discontinues refilling a prescription (Peterson *et al.*, 2007:6).

- Pharmacoepidemiology.

Pharmacoepidemiology can be defined as the measurement and study of the source, utilisation and effects, whether beneficial or adverse, of medicine in large numbers of individuals in a specific population (Strom, 2012a:3; Walker, 2006; Waning & Montagne, 2001:5).

- Pharmerging countries.

Pharmerging countries can be defined as countries with > \$1 billion on absolute spending growth between 2012 and 2016 and has a GDP per capita of < than \$ 25 000 at purchasing power parity (PPP) (IMS Institute of Healthcare Informatics, 2012:5).

- Prescribed minimum benefits (PMB).

Prescribed minimum benefits are defined as a set of benefits to ensure that all medical scheme members have access to certain minimum health services; regardless of the benefit option they have selected (Council for Medical Schemes, 2010b).

- Prescription.

A prescription can be defined as a written direction or instruction from a doctor to a pharmacist for the preparation of a medication in a suitable form for administration to a patient (Butterworths medical dictionary, 1978:1373).

- Prevalence.

Prevalence can be defined as the number of existing cases of a specific disease in a specific population at a specific point in time (Waning & Montagne, 2001:20; Webb & Bain, 2011:429). Prevalence can further be defined as the number of people with a specific disease at a given point in time divided by the total number of people in the population (with or without the specific disease) (Coolidge, 2006:371).

- Procurement.

Procurement refers to the acquisition of medicine at the best possible cost in the right quantity and quality, at the right time, in the right place and from the right source (Pharmaceutical Industry Association of South Africa, 2011:21) (PIASA).

- Prospective drug utilisation review.

Prospective drug utilisation review is used when evaluating a patient's medicine therapy before the medicine is dispensed (Academy of Managed Care Pharmacy, 2009; Kreling, 2000; Truter, 2008:95).

- *p*-value.

The *p*-value measures statistical significance and can be defined as a unit of measurement between the null hypothesis and the observed data (Aschengrau & Seage, 2008:321). The *p*-value is an estimate or the probability that a particular result occurred by chance if the hypothesis were true Crawley (2005:3).

- Quality of life.

Quality of life can be defined as the perception that an individual has of their position in life in the context of the value systems and culture in which they live in relation to their standards, goals, expectations and concerns (WHO, 1997:1). Quality of life is also defined as aspects of satisfaction and happiness with life as a whole, but also an overall sense of well-being (Centers for Disease Control and Prevention, 2000).

- Reference price lists.

Reference pricing is the price of a certain medicine in a specific class that is set as a reference for other medicine. The reference medicine is normally the least expensive medicine in that class (Almarsdóttir & Traulsen, 2005:146).

- Reliability.

Reliability can be defined as the consistency of data within a database by producing similar results in different circumstances and its repeatability (Friis, 2010:204; Merrill, 2013:299; Park & Stergachis, 2008:531).

- Retrospective drug utilisation review.

Retrospective drug utilisation review is used to review medicine therapy after the patient received the medicine and to check for patterns of inappropriateness (Academy of Managed Care Pharmacy, 2009; Kreling, 2000; Lipton & Bird, 1993:1069; Truter, 2008:95).

- Rheumatoid arthritis.

Rheumatoid arthritis is defined as chronic disease, mainly characterised by symmetrical inflammation of the lining, or synovium, of the joints. It can result in chronic pain and leading to long-term joint damage, loss of function and disability but other joints can also include the involvement of other organs (Arthritis Foundation, 2010; Schuna, 2011:1583).

- Risk Equalisation.

Risk equalisation can be defined as a system of financial transfers to ensure expected cost sharing for providing benefits to all medical scheme members (SA, 2008:5).

- Schizophrenia.

Schizophrenia can be defined as a heterogeneous syndrome of psychotic condition that include hallucinations, bizarre thoughts, inappropriate affect delusions, disorganised speech and behaviour as well as impaired psychosocial functioning (Crismon & Dorson, 2002:1219; Swingler, 2013:153).

- Single exit price (SEP).

Single exit price can be defined as the price set by the manufacturer or importer of a medicine or scheduled substance in terms of these regulations, combined with the logistics fee for distribution and VAT (SA, 2004a:6).

- Social health insurance (SHI).

Social health insurance can be defined as only those persons who contribute are entitled to prescribed benefits. Contributors may all be employed people, or defined groups in certain industries or all taxpayers (McLeod, 2009a:1).

- Standard deviation.

Standard deviation refers to the deviation value representing the average distance of a set of scores from the mean (Barlo, 2007). Standard deviation can also be defined as a measure of variability of the average distance that scores deviate from the mean (De Muth, 1999:91; Kirkwood, 1988:14; Privitera, 2012:113).

- Standard error.

Standard error can be defined as the standard deviation of a sampling distribution (Brase & Brase, 2010:281; Rubin, 2010:321). The standard error of the mean is the standard deviation of a distribution of sample means (McLaughlin, 2002:290).

- Student's *t*-test.

The student's *t*-test (also known as the independent sample's *t*-test or two-sample *t*-test) can be defined as a comparison between two distinct individuals or samples (Coolidge, 2006:215; Rowe, 2007:68).

- Supply.

Supply however can be defined as making a product or service available to a person (Concise Oxford English dictionary, 2011:1449).

- Systemic lupus erythematosus.

Systemic lupus erythematosus can be defined as an inflammatory autoimmune disorder that may affect multiple organ systems. Many of its clinical manifestations are secondary to the trapping of antigen-antibody complexes in capillaries of visceral structures or to autoantibody-mediated destruction of host cells (Hellmann & Stone, 2007:853).

- Therapeutic substitution.

Therapeutic substitution occurs when the pharmacist dispenses a medicine with a different pharmacological active ingredient that the physician actually prescribed (World Medical Association, 2011).

- Ulcerative colitis.

Ulcerative colitis is a chronic disease characterised by diffuse mucosal inflammation of the colon (Langan *et al.*, 2007:1323). Ulcerative colitis can further be defined as an idiopathic inflammatory condition that involves the mucosal surface of the colon, resulting in diffuse friability and erosions with bleeding (McQuaid, 2007:641).

- Under-supply.

Under-supply can be defined for the purpose of this study as an MPR < 80%. This would be considered as an under-supply (non-adherent).

- Utilisation.

Utilisation can be defined as not making effective use of a product or service (Concise Oxford English dictionary, 2011:1594).

- Validity.

Validity can be defined as the degree to which a variable actually measures what it is designed to measure (Friis, 2010:205; Merrill, 2013:299; Waning & Montagne, 2001:123).

- Value-added-tax.

Value-added-tax can be defined as a tax levied and paid for to benefit the national revenue and calculated at the rate of 14.00% on the value of the supply concerned or the importation thereof (SA, 1991:19).

- Variable.

A variable can be defined as a property or characteristic that can take on different values at different times (Privitera, 2012:617). A variable can further be defined as a characteristic of a population for which more than one value occurs in that population (McLaughlin, 2002:17).

TABLE OF CONTENTS

ACKNOWLEDGEMENTS	II
ABSTRACT	III
OPSOMMING	VI
LIST OF ABBREVIATIONS	IX
LIST OF DEFINITIONS	XIV
CHAPTER 1	1
1.1 Introduction and scope of this study	1
1.2 Background and problem statement.....	1
1.3 Research questions.....	6
1.4 Research objectives	6
1.4.1 General research objective	6
1.4.2 Specific research objectives	6
1.4.2.1 Specific objectives of the <i>literature study</i> :	6
1.4.2.2 Specific objectives of the <i>empirical investigation</i> :.....	7
1.5 Research phases	7
1.6 Research design.....	9
1.6.1 Pharmacoepidemiology	9
1.6.1.1 Advantages and disadvantages of different pharmacoepidemiological studies	12
1.6.2 Drug utilisation review (DUR).....	13
1.6.2.1 Types of drug utilisation review.....	13
1.6.2.1.1 Retrospective DUR	14

1.7	Data source.....	15
1.8	Validation and reliability of the data source	15
1.8.1	Overview of validity and reliability	15
1.9	Target and study population.....	17
1.10	Study variables	21
1.10.1	Independent variables	21
1.10.1.1	Age groups	21
1.10.1.2	Gender groups.....	23
1.10.1.3	Medicine pharmacological groups, active ingredients and trade names.....	23
1.10.1.4	Chronic disease list conditions.....	24
1.10.1.5	Generic indicators.....	26
1.10.1.6	Cost.....	27
1.10.2	Dependent variables.....	27
1.10.2.1	Prevalence	28
1.10.2.2	Cost.....	28
1.10.2.3	Cost-prevalence index	30
1.10.2.4	Chronic disease-prevalence index	31
1.10.2.5	Medicine possession ratio (MPR)	31
1.11	Statistical methods and analysis.....	33
1.11.1	Descriptive statistics	33
1.11.1.1	Frequency	34
1.11.1.2	Prevalence	34
1.11.1.3	Arithmetic mean (average)	34

1.11.1.4	Standard deviation.....	35
1.11.1.5	Standard error	36
1.11.1.6	Percentage	36
1.11.2	Inferential Statistics	37
1.11.2.1	Chi-square (X^2) test	37
1.11.2.2	Student's <i>t</i> -test.....	37
1.11.2.3	Analysis of variance (ANOVA)	37
1.11.2.4	Linear mixed-effects models (MIXED)	38
1.11.3	Statistical and practical significance.....	39
1.11.3.1	The <i>p</i> -values and confidence interval (CI).....	39
1.11.3.2	Effect sizes	39
1.11.3.2.1	Effect size for the comparison between two or more sample means.....	40
1.11.3.2.2	Cramer's statistical V-test	40
1.12	Ethical aspects	41
1.13	Results and discussion.....	41
1.14	Chapter division	41
1.15	Chapter summary	42
CHAPTER 2:		43
2.1	Introduction	43
2.2	South Africa demographic statistics.....	43
2.3	Background of the South African health sector	43
2.3.1	National Health Act.....	44
2.3.1.1	National health system	44

2.3.1.2	Provincial health system	44
2.3.1.3	District health system.....	45
2.3.1.4	Municipal health system	46
2.3.1.5	National Drug Policy	46
2.3.1.5.1	Medicine expenditure interventions in South Africa.....	49
2.3.2	Public health sector	49
2.3.2.1	Procurement and tender pricing in the public health sector.....	50
2.3.2.2	Medicine pricing.....	52
2.3.2.2.1	Inflation in the South African health sector.....	53
2.3.2.3	Essential drug list (EDL)	53
2.3.3	Private health sector	54
2.3.3.1	Background of the medical scheme environment in South Africa.....	55
2.4	Managed health care	57
2.4.1	Advantages of managed care	57
2.5	Medicine pricing structures	58
2.5.1	Medicine pricing structures in South Africa	58
2.5.1.1	Prescribed minimum benefits (PMBs).....	58
2.5.1.1.1	Overview and legislation of PMBs.....	58
2.5.1.1.2	Coverage of PMBs	59
2.5.1.1.3	Advantages and disadvantages of PMBs.....	60
2.5.1.2	Medicine co-payments.....	60
2.5.1.2.1	Factors that result in increasing co-payments / out-of-pocket costs of medicine	60

2.5.1.3	Designated service providers (DSPs)	61
2.5.1.4	Formulary medicine	62
2.5.1.4.1	Obstacles with formularies.....	63
2.5.1.5	Medicine substitution	63
2.5.1.5.1	Therapeutic substitution.....	63
2.5.1.5.2	Generic substitution	64
2.5.1.6	Transparent pricing system in South Africa.....	67
2.5.1.6.1	Single exit price (SEP).....	67
2.5.1.7	National Health Insurance (NHI)	72
2.5.1.7.1	Difference between social health insurance (SHI) and NHI.....	73
2.5.1.7.2	Funding of the NHI system	75
2.5.1.7.3	Worldwide obstacles with regard to NHI implementation	79
2.5.1.7.4	The NHI model	80
2.5.2	Pricing structures in other countries.....	81
2.5.2.1	Health systems and strategies in reducing the cost of pharmaceuticals in South Africa and other countries.....	81
2.5.2.1.1	Patient co-payments.....	81
2.5.2.1.2	Reference price lists	82
2.5.2.1.3	Positive and negative formulary lists.....	82
2.5.2.1.4	Limits on prescribing.....	82
2.5.2.1.5	Generic substitution in other countries.....	83
2.5.2.1.6	Formularies	90
2.6	Chronic disease	91

2.6.1	Definition and overview.....	91
2.6.2	Chronic disease list conditions (CDL)	92
2.6.3	Chronic conditions in South Africa and other countries and relationship between co-morbid diseases.	93
2.6.4	Chronic disease co-morbidity in other countries.....	98
2.6.5	Risk factors pertaining to chronic diseases	100
2.6.5.1	Physical activity and obesity	103
2.6.5.2	Smoking	104
2.6.5.3	Diabetes	104
2.6.5.4	Hypertension	105
2.6.5.5	Hypercholesterolaemia	105
2.7	Chronic medicine	105
2.7.1	Overview	105
2.7.2	CDL conditions with their recommended medicine therapies	106
2.7.2.1	Addison's disease.....	106
2.7.2.2	Asthma	107
2.7.2.3	Bipolar mood disorder.....	108
2.7.2.4	Bronchiectasis	109
2.7.2.5	Cardiomyopathy	110
2.7.2.6	Chronic obstructive pulmonary disease	111
2.7.2.7	Coronary artery disease	112
2.7.2.8	Chronic renal disease	113
2.7.2.9	Crohn's disease.....	115

2.7.2.10	Diabetes insipidus	115
2.7.2.11	Diabetes Mellitus	116
2.7.2.11.1	Diabetes mellitus type 1.....	116
2.7.2.11.2	Diabetes mellitus type 2.....	117
2.7.2.12	Dysrhythmias (Arrhythmias).....	118
2.7.2.13	Epilepsy.....	118
2.7.2.14	Glaucoma	120
2.7.2.15	Haemophilia	120
2.7.2.16	Cardiac failure	121
2.7.2.17	Hyperlipidaemia.....	122
2.7.2.18	Hypertension	123
2.7.2.19	Hypothyroidism.....	124
2.7.2.20	Multiple sclerosis	125
2.7.2.21	Parkinson's disease.....	126
2.7.2.22	Rheumatoid arthritis.....	127
2.7.2.23	Schizophrenia.....	128
2.7.2.24	Systemic lupus erythematosus	128
2.7.2.25	Ulcerative colitis.....	129
2.8	Quality of life and chronic disease	130
2.9	Adherence, compliance and persistence.....	131
2.9.1	An overview	131
2.9.2	Methods to determine refill persistence.....	134
2.9.3	Methods to determine adherence	135

2.9.4	Strategies to enhance medicine adherence	136
2.9.5	Barriers to adherence	136
2.9.5.1	Obstacles with chronic diseases and adherence	137
2.9.5.1.1	Possible adverse outcomes related to non-adherence with medicine regimens.....	139
2.10	Chapter summary	139
CHAPTER 3:		140
3.1	Number of patients with at least one CDL condition according to total population.	140
3.2	Prevalence of CDL conditions.	145
3.2.1	Number of patients with at least one CDL condition.....	145
3.2.2	Number of patients with individual CDL conditions.	156
3.2.3	Number of patients with a single CDL condition.....	159
3.2.4	Number of CDL conditions per patient per year adjusted for age and gender.	164
3.2.5	Number of patients with the top 5 co-morbid CDL conditions.....	167
3.2.6	Different number of CDL conditions and the number of patients with these conditions.	172
3.2.7	Number of patients with different CDL co-morbid condition combinations.....	177
3.3	Medicine cost of patients with at least one CDL condition according to the total patient population.	184
3.4	Medicine cost for CDL conditions	186
3.4.1	Medicine cost for patients with at least one CDL condition according to different cost types.	187

3.4.2	Medicine cost per item per patient with the top 5 CDL conditions according to different cost types.....	198
3.4.3	Medicine cost according to the different number of CDL conditions.	217
3.4.4	Medicine cost for all CDL medicine according to generic indicator.....	221
3.4.4.1	Statistical and practical significance of medicine cost for CDL conditions according to generic indicator.	233
3.4.5	Average cost per prescription per patient according to different cost structures.....	246
3.4.6	Average medicine cost per item per patient according to different cost structures.....	250
3.4.7	Potential cost savings per medicine item from changes in SEP	256
3.4.8	Patient adherence of CDL medicine and associated medicine cost.	264
3.5	Chapter summary	269
CHAPTER 4:		270
4.1	Introduction	270
4.2	Conclusions	270
4.2.1	Conclusions based on the literature study	270
4.2.2	Conclusions based on the empirical investigation.....	274
4.2.2.1	Number of patients with at least one CDL condition according to total population.....	274
4.2.2.2	Number of patients and all CDL conditions from 2008 until 2012.	276
4.2.2.3	Number of patients with individual CDL conditions from 2008 until 2012.	277
4.2.2.4	Number of patients with a single CDL condition.....	278
4.2.2.5	Change in the number of CDL conditions per patient per year adjusted for age and gender.	278

4.2.2.6	Number of patients with the top 5 co-morbid CDL conditions.....	279
4.2.2.7	Different combinations of CDL conditions and the number of patients with these combinations.....	280
4.2.2.8	Number of patients with different CDL co-morbid condition combinations.....	282
4.2.2.9	Medicine cost for patients with at least one CDL condition according to the total patient population.....	284
4.2.2.10	Medicine cost for patients with at least one CDL condition according to different cost types.....	284
4.2.2.11	Medicine cost per item per patient with the top 5 CDL conditions according to different cost types.....	287
4.2.2.12	Medicine cost according to the different number of CDL conditions.	290
4.2.2.13	Medicine cost for all CDL medicine according to different generic indicators. .	291
4.2.2.14	Average cost per prescription per patient according to different cost structures.....	293
4.2.2.15	Average medicine cost per item per patient according to different cost structures.....	294
4.2.2.16	Potential cost savings per medicine item from changes in SEP.	295
4.2.2.17	Patient adherence by determining under- and over-supply of CDL medicine and associated medicine cost.....	296
4.3	Limitations	297
4.4	Recommendations.....	298
4.5	Chapter Summary.....	298
BIBLIOGRAPHY		299
APPENDIX A		344
APPENDIX B		372
APPENDIX C		373

APPENDIX D	374
APPENDIX E	399
APPENDIX F	414
APPENDIX G	444
APPENDIX H	449
APPENDIX I: CONFERENCE PRESENTATIONS	454
APPENDIX J: ARTICLE SUBMITTED FOR PUBLICATION	458

LIST OF TABLES

Table 1.1:	Advantages and disadvantages of different pharmacoepidemiological studies.	12
Table 1.2:	Summary of different types of drug utilisation review studies.	13
Table 1.3:	Inclusion and exclusion criteria used for selection of study population.	17
Table 1.4:	Outline of the target and study population in this study.	18
Table 1.5:	CDL conditions and ICD-10 codes and medicine used to identify patients for the target population.	19
Table 1.6:	Different age groups used in this study.	22
Table 1.7:	Generic indicators and associated abbreviations.	26
Table 2.1:	Summary of the SEP regulation changes on the “dispensing fee”.	72
Table 2.2:	Cost containment strategies in different countries.	85
Table 2.3:	Co-payments as cost containment strategies in different countries.	88
Table 2.4:	Classification of the 27 CDL conditions.	92
Table 2.5:	Estimate of people needing treatment for chronic disease utilising NHI in South Africa.	95
Table 3.1:	Number of patients on the database compared to patients with CDL conditions.	143
Table 3.2:	Number of patients with at least one CDL condition according to age and gender from 2008 until 2012.	146
Table 3.3:	Change in number of patients and CDL conditions according to age and gender (2008 vs 2012).	147
Table 3.4:	Statistical and practical significant difference in the average number of patients with CDL conditions according to age and gender from 2008 until 2012 (as indicated in Table 3.2).	148

Table 3.5:	Number of patients with a CDL condition and associated CDL medicine according to age and gender from 2008 until 2012.....	155
Table 3.6:	Number of patients with the individual CDL conditions as a contribution to the total database from 2008 until 2012.	157
Table 3.7:	Number of patients with the individual CDL conditions from 2008 until 2012.....	158
Table 3.8:	Number of patients with a single CDL condition as a contribution to the total database from 2008 until 2012.	160
Table 3.9:	Number of patients with a single CDL condition from 2008 until 2012.	161
Table 3.10:	Number of all CDL conditions per patient per year adjusted for age and gender from 2008 until 2012.	164
Table 3.11:	Number of patients with the top 5 co-morbid CDL conditions from 2008 until 2012.	168
Table 3.12:	Statistical and practical significance of the average number of co-morbid CDL conditions per patient from 2008 until 2012.....	169
Table 3.13:	Number patients with the different number of CDL conditions as a percentage of the total number of patients on the database from 2008 until 2012.	173
Table 3.14:	Number patients with the different number of CDL conditions as a percentage of the total number of patients with CDL conditions from 2008 until 2012.	174
Table 3.15:	Number of patients with the different combinations of CDL conditions from 2008 until 2012.	178
Table 3.16:	Medicine cost of patients with CDL conditions compared to the total medicine cost of the database from 2008 until 2012.....	185
Table 3.17:	Medicine cost for all CDL condition items according to different cost types for 2008.	188
Table 3.18:	Medicine cost for all CDL condition items according to different cost types for 2009.	189

Table 3.19:	Medicine cost for all CDL condition items according to different cost types for 2010.	190
Table 3.20:	Medicine cost for all CDL condition items according to different cost types for 2011.	191
Table 3.21:	Medicine cost for all CDL condition items according different cost types for 2012.....	192
Table 3.22:	Medicine cost for patients with asthma according to different cost types from 2008 until 2012.	199
Table 3.23:	Medicine cost for patients with diabetes mellitus type 2 according to different cost types from 2008 until 2012.....	200
Table 3.24:	Medicine cost for patients with hyperlipidaemia according to different cost types from 2008 until 2012.....	201
Table 3.25:	Medicine cost for patients with hypertension according to different cost types from 2008 until 2012.	202
Table 3.26:	Medicine cost for patients with hypothyroidism according to different cost types from 2008 until 2012.	203
Table 3.27:	Medicine cost of CDL items for different number of CDL conditions from 2008 until 2012.	218
Table 3.28:	Medicine cost of all CDL items according to generic indicator (2008 vs 2012).....	222
Table 3.29:	All generic indicator medicine as percentage of all CDL medicine from 2008 until 2012.	223
Table 3.30:	Total cost of all CDL medicine items according to generic indicator from 2008 until 2012.	224
Table 3.31:	Medical scheme contribution of all CDL medicine items according to generic indicator from 2008 until 2012.....	225
Table 3.32:	Patient levy of all CDL medicine items according to generic indicator from 2008 until 2012	226

Table 3.33:	Statistical and practical significant difference between the total average cost per medicine item for all CDL conditions according to generic indicator from 2008 until 2012.	234
Table 3.34:	Statistical and practical significant difference between the average medical scheme contribution per medicine item for all CDL conditions according to generic indicator from 2008 until 2012.	236
Table 3.35:	Statistical and practical significant difference between the average patient levy per medicine item for all CDL conditions according to generic indicator from 2008 until 2012.....	238
Table 3.36:	Most practical significant differences between the average cost per medicine item according to generic indicator for all CDL conditions from 2008 until 2012.	240
Table 3.37:	Most practical significant differences between the average cost per medicine item according to generic indicator for asthma from 2008 until 2012.....	241
Table 3.38:	Most practical significant differences between the average cost per medicine item according to generic indicator for diabetes mellitus type 2 from 2008 until 2012.	242
Table 3.39:	Most practical significant differences between the average cost per medicine item according to generic indicator for hyperlipidaemia from 2008 until 2012.	243
Table 3.40:	Most practical significant differences between the average cost per medicine item according to generic indicator for hypertension from 2008 until 2012.	244
Table 3.41:	Most practical significant differences between the average cost per medicine item according to generic indicator for hypothyroidism from 2008 until 2012.	245
Table 3.42:	Cost per prescription for all CDL conditions according to different cost structures from 2008 until 2012.	247
Table 3.43:	Medicine cost per item for all CDL conditions according to different cost structures from 2008 until 2012.	251

Table 3.44:	Potential cost savings at time of change in the SEP between 2010 and 2012.....	256
Table 3.45:	Overall potential cost savings of all and the top 5 CDL conditions between 2010 and 2012.....	260
Table 3.46:	Overall potential cost savings of all CDL conditions and hypertension according to generic indicator between 2010 and 2012.....	261
Table 3.47:	Overall potential cost savings of asthma and hyperlipidaemia according to generic indicator between 2010 and 2012.....	262
Table 3.48:	Overall potential cost savings of diabetes mellitus type 2 and hypothyroidism according to generic indicator from 2010 and 2012.	263
Table 3.49:	Medicine supply type of the number of items for the top 5 CDL conditions.....	264
Table 4.1:	Changes in patient and co-morbidity prevalence between 2008 until 2012.....	280
Table 4.2:	Patient changes for combinations of different numbers of CDL conditions.....	281
Table 4.3:	Changes of CDL medicine items and medicine cost between 2008 and 2012.....	286
Table 4.4:	Changes in the number of medicine items and cost between 2008 and 2012.....	288
Table 4.5:	Change in medicine cost of CDL items for different number of CDL conditions from 2008 until 2012.....	290
Table 4.6:	Summary of average cost per prescription for CDL conditions.	293
Table 4.7:	Summary of average cost per medicine item for CDL conditions.....	294

LIST OF FIGURES

Figure 1.1:	Different types of epidemiological/pharmacoepidemiological study designs.	10
Figure 1.2:	Cost type composition.	29
Figure 1.3:	Cost structure composition.	29
Figure 2.1:	Algorithm for co-payments applying to PMBs.	61
Figure 2.2	Possible influence of the NHI on the private health sector.	74
Figure 2.3:	Envisaged flow of funds under mandatory health insurance administration of the NHI.	77
Figure 2.4:	Etiological models of co-morbid diseases.	94
Figure 2.5:	Prevalence of CDL condition registrations.	96
Figure 2.6:	Illustration of the life-course perspective on heart disease and other chronic diseases.	101
Figure 2.7:	Chronic diseases of lifestyle: interrelationships and risk factors.	102
Figure 2.8:	Definitions of compliance and persistence.	132
Figure 3.1:	Overview of the presentation of the results.	142
Figure 3.2:	Number of patients with at least one CDL condition from 2008 until 2012. .	150
Figure 3.3:	Number of patients with at least one CDL condition according to gender from 2008 until 2012.	152
Figure 3.4:	Number of patients with at least one CDL condition according to age from 2008 until 2012.	154
Figure 3.5:	Average number of CDL conditions/patient adjusted for age and gender from 2008 until 2012.	165
Figure 3.6:	Average medicine cost for all CDL conditions from 2008 until 2012.	197

Figure 3.7:	Average patient levy per generic medicine item for the top 5 CDL conditions from 2008 until 2012.....	232
Figure 3.8:	Average dispensing fee per medicine item of all CDL and the top 5 CDL conditions from 2008 until 2012.....	254
Figure 3.9:	Average SEP per medicine item of all CDL and the top 5 CDL conditions from 2008 until 2012.	255

INTRODUCTION AND RESEARCH METHODOLOGY

1.1 Introduction and scope of this study

The focus of this study is to investigate medicine cost of chronic disease list conditions (CDL) in the South African private health sector. This chapter provides the research objectives, as well as the research methodology followed in this study.

1.2 Background and problem statement

The prevalence of chronic conditions continues to increase, and by 2020 nearly 50% of the American population (estimated 157 million people) are projected to have at least one chronic condition (Wolff *et al.*, 2002:2269). Globally, it is predicted that deaths from chronic non-communicable diseases (NCD) will increase by 77.00% between 1990 and 2020 and most of these deaths will occur in the developing regions of the world (Medical Research Council, 2009). It has further been predicted that by 2015, 41 million people may die globally from chronic diseases (WHO, 2011c:57). Chronic conditions not only cause enormous human suffering, they threaten the economies of many countries as they impact on the older and experienced members of the workforce (Medical Research Council, 2009). Annually, approximately 38 million deaths occur globally due to chronic NCDs, 73.68% (28 million) of these in developing countries and 42.12% (16 million) before the age of seventy (70) years (WHO, 2014).

A chronic disease can be defined as an occurrence with irreversible presence, accumulation, or latency of states or impairments that involve the total human environment for supportive care, maintenance of function and prevention of further disability (National Public Health Partnership, 2001:10). Chronic diseases are also of long duration and generally slow progression (WHO, 2011a).

According to Grumbach (2003:4), chronic conditions, not acute ailments, are currently the most common problems in healthcare. Chronic conditions, including cardiovascular diseases (CVD), diabetes, obesity, cancers and respiratory diseases, account for 59.00% of the 56.5 million deaths annually worldwide and for 45.90% of the global burden of disease (WHO, 2003b). CVD is responsible for one third of deaths and is a leading contributor to the global disease burden and death globally (WHO, 2003b; WHO, 2015a). The World Health Organization (2011c:57) confirmed that CVD will remain the single leading cause of death by 2015, with an estimated 20 million

people dying from cardiac diseases and stroke. It has further been predicted that 23.3 million people may die as a result of CVD in 2030, increasing from 17.3 million in 2008 (WHO, 2015b).

A study by Montz and Seshamani (2009) confirmed that 71.00% of the American population in high-cost households have one or more chronic conditions, compared to 44.00% of individuals in lower-cost households. Thirty-three per cent of individuals in high-cost households have three or more chronic conditions, compared to 10.00% in lower-cost households. People in high-cost households are three times more likely to have cancer, diabetes, or cardiac diseases and twice as likely to have hypertension as people in lower-cost households (Montz & Seshamani, 2009).

The demand for lower-cost medicine is an ever-increasing trend worldwide, and, in a cost conscious environment; pressure to select the least expensive medicine is exerted on prescribers and dispensers by governments, consumers and medical schemes (Kanfer, 2007:10). As a result, the purpose of the Medicines and Related Substances Control Amendment Act (90 of 1997) was to make medicine affordable to the South African population and to improve practices relating to the manufacture and sale of medicine. According to Tshabalala-Msimang (2004:5) these regulations are a landmark in terms of an effort to reduce medicine prices.

A study was done in South Africa by Innovative Medicines South Africa, to determine the impact of chronic disease on the proposed National Health Insurance (NHI), with data from four of the largest administrators (Discovery Health (Pty) Ltd, Medscheme (Pty) Ltd, Old Mutual Healthcare (Pty) Ltd and Metropolitan Health Group (Pty) Ltd (McLeod, 2009b:1).

Estimations of this study showed that:

- The prevalence of people with CDL conditions may increase from 11.00% in 2009 to 13.00% in 2025, and;
- The proportion of people with co-morbid CDL conditions is estimated to increase from 3.20% in 2009 to 4.00% in 2025.

The same increasing trend in prevalence of co-occurring chronic conditions was found in the United States. The number of persons with a single chronic condition, as well as the number of persons with co-occurring chronic conditions, is increasing in the United States, Eastern and Central EU (European Union) countries as well as Australia (Gemmill, 2008; Holden *et al.*, 2011; Vogeli *et al.*, 2007:391).

According to Campbell-Scherer (2010:165) and Vogeli *et al.* (2007:392), most studies examining specific co-morbidities, including evidence-based clinical practice guidelines globally, do so from

the perspective of a specific disease rather than from co-morbid chronic conditions. Therefore, understanding how to care effectively for persons with co-morbid chronic conditions is among the most important challenges health systems face (Vogeli *et al.*, 2007:394). Despite, the depth of research into specific chronic conditions, there is a lack of global information and research available regarding non-communicable diseases. This includes the prevalence of co-morbid chronic conditions. Available information suggests an unpredictable impact of specific chronic conditions combinations on health, costs and associated complexity of care (Islam *et al.*, 2014; Vogeli *et al.*, 2007:394; Vlassoff, 2007:50). It was also found that determinants and prevalence of co-morbid conditions in sub-Saharan Africa remained relatively unknown (Alaba & Chola, 2013). In addition, a study was done in Catalonia, Spain to determine co-morbidity among 1 749 710 patients ≥ 19 years (Foguet-Boreu *et al.*, 2014). This study was done with electronic prescription data from 1 January 2010 until 31 December 2010. This study concluded that 46.80% (n = 818 865) of patients presented with co-morbidity, and co-morbidity increased with age (Foguet-Boreu *et al.*, 2014). The authors therefore suggest further research on co-morbidity with emphasis on age and gender (Foguet-Boreu *et al.*, 2014). The need for further research on socio-economic differentials and population suffering from co-morbid diseases in developing countries is also emphasized by Banjare and Pradhan (2014).

It is predicted that the total number of people with CDL conditions in South Africa, owing to an aging population and population growth, will increase as follows (McLeod, 2009b:7):

- 1985: from 2.28 million;
- 1994: to 2.99 million (131% of 1985 figure);
- 2009: to 4.12 million (138% of 1994 figure), and;
- 2025: to 5.13 million (172% of 1994 figure).

The increase in the number of people with chronic diseases has resulted in increased visits to clinics, medical practitioners and specialists, and, an increased use of chronic medicine in hospital events (McLeod, 2009b:7).

In South Africa the burden of non-communicable disease risk factors is high: approximately six (6) million people have hypertension, four (4) million have diabetes, seven (7) million smoke, and four (4) million have hyperlipidaemia[#] (Medical Research Council, 2009). About 56.00% of the population have at least 1 of these risk factors and about 20.00% is at risk for communicable diseases (Medical Research Council, 2009). The current global burden of chronic diseases reflects past exposures to these risk factors, and the future burden will largely be determined by current exposures to risk factors (Yach *et al.*, 2004:2616).

Chronic diseases in South Africa have a major economic impact on individuals, families, the health system and society at large. The treatment of chronic diseases puts much strain on an already overburdened public and private health systems, because of additional resources required (Puoane *et al.*, 2008:79). As a result, prescribed minimum benefits (PMB)'s were developed, including the CDL, to standardise chronic disease treatment among medical scheme beneficiaries (refer to Chapter 2, section 2.5.1.1 and *Appendix A*). The rationale for the inclusion of the 27 CDL conditions in this study is that medical schemes in South Africa should provide full cover for these conditions for all members of the medical scheme. These conditions were the most common and life-threatening (refer to Chapter 2, section 2.5.1.1).

An important observation made by Carrin *et al.* (2009) is that many of the world's 1.3 billion people on very low income still do not have access to effective and affordable medicine, surgeries and other interventions resulting in out-of-pocket payments. Financial barriers prevent millions of people each year from seeking and receiving needed health services (Carrin *et al.*, 2009).

In the United States, as co-payments^{*} on prescription medicine increase, consumers may assume more of the cost of their prescription medicine use. Therefore, increased out-of-pocket expenses may dissuade consumers from obtaining important prescriptions or refills (Kreling, 2000). The result is that other health care utilisation will increase, subsequent to failed therapy (Kreling, 2000). This trend may surely continue for the next few years, and it may even accelerate (Taylor & Leitman, 2002:1).

In 2009, US\$ 5.97 trillion (R50.39 trillion[†]) was spent on health and in low income countries 50.00% of the total health expenditure was due to out-of-pocket payments versus 13.00% in countries with a higher income per capita (WHO, 2012b). In South Africa, the out-of-pocket expenditure increased from 25.00% to 29.60% of private expenditure on health from 2000 to

[#] For the purpose of this study *hyperlipidaemia* and *hypercholesterolaemia* can be viewed as synonymous

^{*} For the purpose of this study *co-payments*, *out-of-pocket expenses/payments* and *levy* can be viewed as synonymous.

[†] Average exchange rate 2009:1US\$ = R8.44 (Nedbank Group, 2015).

2009. In addition, the per capita total health expenditure increased in South Africa from US\$ 251 (R1 746.96^{*}) in 2000 to US\$ 521 (R4 397.24[†]) in 2009 (WHO, 2012b).

In South Africa, households' out-of-pocket payments directly to healthcare providers also accounted for a sizeable contribution of nearly 13.8% of all health care expenditure in 2013 (World Bank, 2015). McIntyre and Thiede (2007:37) elaborate that households' out-of-pocket expenditure was responsible for R16.5 billion of the health care expenditure in South Africa in 2005 to US\$ 1.7 billion (R13.18 billion[†]) from 2011-2012 (Deloitte & Touche, 2014). McIntyre and Thiede (2007:43) describe those direct out-of-pocket payments, as the most regressive form of healthcare finance which account for almost a quarter of private health care financing. Montz and Seshamani (2009) therefore contend that families and individuals who experience the highest levels of out-of-pocket costs are more likely to suffer from common diseases such as diabetes, cardiac disease and cancer. Medicine cost, such as these out-of-pocket costs, are linked to persistence by Hughes *et al.* (2007:499), stating that pharmacoeconomic evaluations assess the persistence on effectiveness, cost-benefit balance and the impact of poor persistence and therefore compliance[‡] on cost. Polypharmacy for chronic diseases may be required by the increasing number of elderly patients (Laufs *et al.*, 2011:268). Thus, a powerful measure to reduce mortality and morbidity is to optimise the adherence of medicine administration (Laufs *et al.*, 2011:268). In 2006 Andrade *et al.* (2006:565) commented that the assessment of medicine adherence and persistence had an important association with economic and clinical outcome evaluation. It is therefore, also important to better understand the factors related to low persistence and adherence (Andrade *et al.*, 2006:565) (refer to Chapter 2, section 2.9, for an overview of adherence and persistence).

Refer to section 1.10.2.5 and Chapter 2, section 2.9.3 for a further overview of methods to determine medicine adherence/compliance.

It can thus be concluded from the literature in the problem statement that chronic diseases and their medicine use are on the increase in South Africa as well as globally.

^{*} Average exchange rate 2000:1US\$ = R6.96 (Nedbank Group, 2015).

[†] Average exchange rate 2011-2012:1US\$ = R7.75 (Nedbank Group, 2015).

[‡] For the duration of this study *compliance*, *adherence* and *persistence* can be viewed as synonymous (also refer to chapter 2, section 2.9).

1.3 Research questions

The following research questions will be answered in this study:

- What does the prevalence of patients with CDL conditions as well as the approved treatment thereof entail?
- What are the medicine prescribing patterns of the 26 (twenty six) CDL conditions as well as their direct medicine cost?
- How do pricing structures such as generic substitution, single exit price (SEP) and patient co-payment of medicine influence the prescription patterns as well as the direct medicine cost of CDL medicine?
- What is the CDL medicine use in under and over-supply with associated direct medicine cost of these conditions?

1.4 Research objectives

The research objectives for the literature and empirical investigation of this study were divided into general and specific research objectives:

1.4.1 General research objective

The general research objective was to investigate the prevalence and direct medicine cost of the 26 CDL conditions in a section of the private health sector in South Africa from 2008 until 2012.

1.4.2 Specific research objectives

1.4.2.1 Specific objectives of the *literature study*:

- The specific research objectives of the literature study were to:
- Specific research objective 1: Outline the general background of the South African private and public health sectors;
- Specific research objective 2: Briefly describe the medicine pricing systems including the principles of managed health care in South Africa as well as internationally;
- Specific research objective 3: Determine the prevalence of patients with chronic diseases and associated treatment cost in South Africa, and internationally;

- Specific research objective 4: Outline the prevalence of patients and approved medicine treatment included in the algorithms of the 27 (twenty seven) CDL conditions in South Africa as well as internationally.

1.4.2.2 Specific objectives of the *empirical investigation*:

The specific research objectives of the empirical investigation included the following:

- Specific research objective 5: Investigate the prevalence of patients with the 26 (twenty six) CDL conditions* and their associated medicine cost in a section of the South African private health sector;
- Specific research objective 6: Investigate possible changes in prevalence of patients with different co-morbid CDL conditions;
- Specific research objective 7: Determine how certain medicine pricing structures such as generic substitution, SEP, dispensing fee and patient co-payment for medicine influence prescription patterns and direct medicine cost of CDL medicine;
- Specific research objective 8: Determine the potential cost savings of CDL medicine from changes in the SEP;
- Specific research objective 9: Investigate adherence as a proxy to determine under-and over-supply of CDL medicine, as well as the associated cost.

1.5 Research phases

This study will consist of two phases, namely a literature review and an empirical investigation.

Phase 1: Literature review

Phase 1 consists of a literature review where relevant search engines, for example Google, Science Direct and Pubmed, were used to obtain books, journals and publications, including South African Acts. These publications will be reviewed in line with the specific objectives outlined in phase 2 of this section.

* Only 26 CDL conditions will be discussed in the empirical investigation, as bipolar mood disorder was excluded. Refer to Chapter 2, section 2.7.2.3

The following keywords were used in the relevant search engines and publications to conduct and assist in the literature review: chronic disease, medicine cost, drug utilisation review, prevalence, compliance/adherence, medication-possession-ratio, pharmacoepidemiology, NHI, SEP, generic substitution, ICD-10 (International Classification of Diseases and health-related problems) coding, PMBs, patient co-payment and co-morbidity.

The literature review included an overview of the health sectors in South Africa, and will focus on the burden of chronic diseases in South Africa and other countries as well as on their respective treatments. The literature review will focus on medicine pricing structures in South Africa; these include the SEP, NHI, as well as a comparison between the different mechanisms in controlling medicine costs between South Africa and other countries. These mechanisms include generic substitution, using formulary medicine and obtaining medicine from designated service providers (DSP).

Phase 2: Empirical investigation

The empirical investigation entailed the following, and will be discussed in more detail from section 1.6:

- Selection of research design;
- Selection of data sources;
- Selection of target and study population;
- Selecting appropriate data;
- Selecting the appropriate study variables;
- Using appropriate statistical methods and data analysis;
- Ethical aspects;
- Results and discussion of results (discussed in Chapter 3);
- Conclusion, limitations and recommendations of the empirical study (discussed in Chapter 4).

1.6 Research design

A quantitative, descriptive, cross-sectional study was performed on retrospective, longitudinal data obtained from a national representative Pharmaceutical Benefit Management (PBM) Company in the private health sector of South Africa. Medicine claims data were obtained for the study period 1 January 2008 until 31 December 2012.

To motivate the specific research design, a brief outline of pharmacoepidemiology and drug utilisation review used in the research methodology will be outlined and discussed below:

1.6.1 Pharmacoepidemiology

Epidemiology can be defined as the study of the way determinants of problems are distributed which is health related in specific human populations and the control of these problems (Aschengrau & Seage, 2008:6; Strom, 2012a:5; Szklo & Nieto, 2007:3). Pharmacoepidemiology can be defined as the measurement and study of the source, utilisation and effects, whether beneficial or adverse, of medicine in large numbers of individuals in a specific population (Strom, 2012a:3; Walker, 2006; Waning & Montagne, 2001:5). The definition of pharmacoepidemiology further includes aspects of improving health outcomes by supporting the rationale and cost-effective use of medicine in a population (Sjöqvist & Birkett, 2003:77). The correlation between epidemiology and pharmacoepidemiology can be drawn as studies with health related concerns and problems. These concerns together with the appropriate health and cost related outcomes can be determined in identified populations.

Epidemiology can be classified as either descriptive or analytical. Descriptive epidemiology refers to data used to examine how rates (e.g. mortality) vary according to variable demographics (e.g. census data) (Szklo & Nieto, 2007:3). Analytical epidemiology refers to how the hypotheses of associations of risk factor exposures with health outcomes are assessed (Szklo & Nieto, 2007:3). According to this statement, this study can be classified as a descriptive study.

The benefit of using an epidemiological study design is that it is used increasingly as a core discipline of pharmacy and public health, as the use of medicine is mapped across a given population and evidence of appropriate, inappropriate use or inequalities are gathered (Walker, 2006). Therefore, an epidemiological and pharmacoepidemiological study approach will be followed in this study, since aspects of appropriate medicine use and cost will be analysed.

* For the duration of this study, the terms *drug*, *medicine* and *medication* can be viewed as synonymous.

A summary and description of the different types of epidemiological study designs are provided in Figure 1.1 and discussed below (adapted from Aldous *et al.*, 2011:25-26). The same research methods used in epidemiological research can also be used in pharmacoepidemiological research design, which will be used in this study.

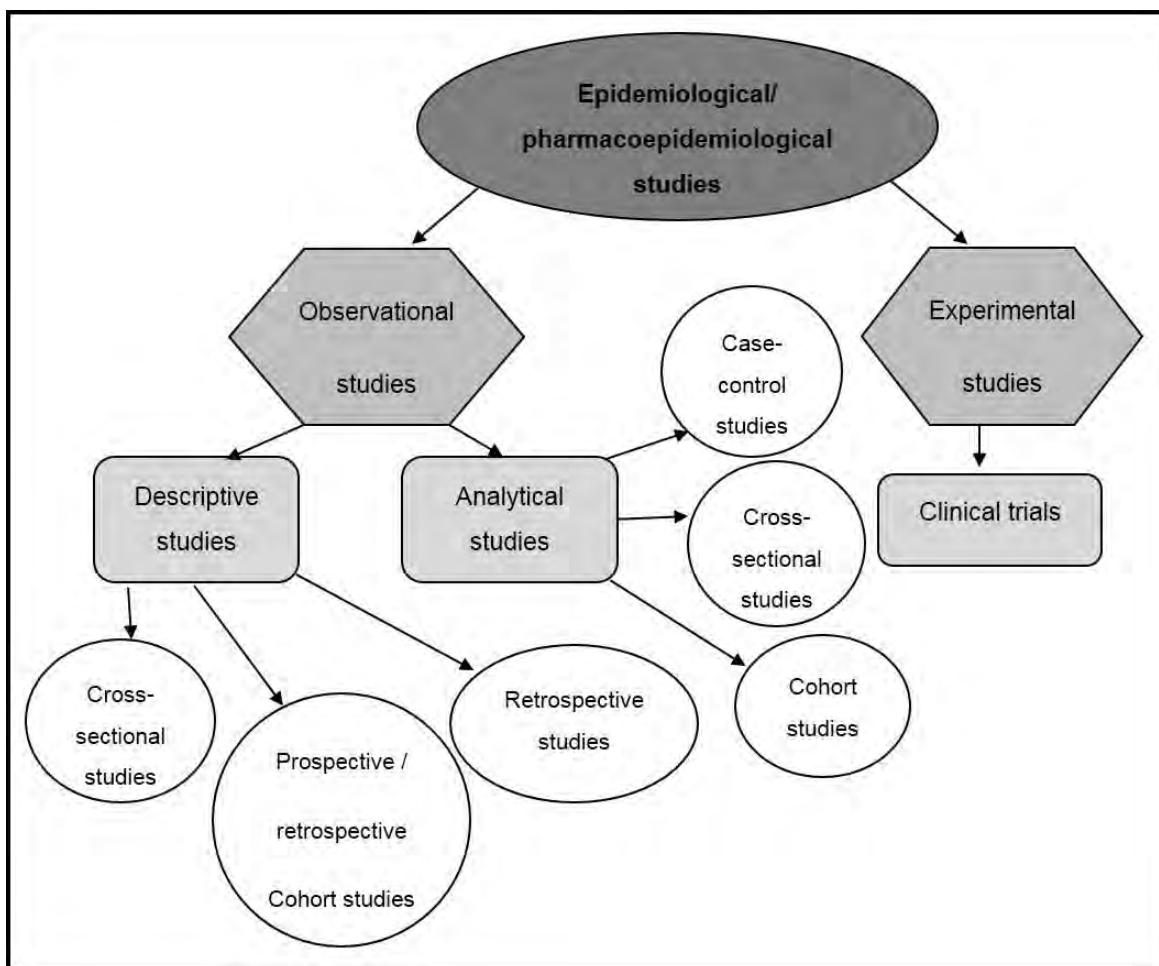


Figure 1.1: Different types of epidemiological/pharmacoepidemiological study designs.

Considering the anatomy of study designs, a distinction can be made between two different types of epidemiological studies, namely *observational* or *experimental study*.

Observational study

The different types of observational studies include descriptive and analytical studies. Both of these studies will be discussed below.

- Descriptive studies consist of a cross-sectional study (e.g. determining prevalence), a prospective / retrospective cohort study (e.g. determining incidence) or a retrospective study (Aldous *et al.*, 2011:25). The aim of descriptive studies is to characterize the amount and distribution of health and disease within a population (Friis, 2010:8). An example of a descriptive study is where a clinician finds unusual features of a disease or effects of a medicine, or a patient's medical history, that lead to the formulation of a new research question or hypothesis (Waning & Montagne, 2001:50).
- Analytical studies are normally used to show the association between a risk factor (exposure) and an outcome, can either consist in determining prevalence (e.g. case-control study or cross-sectional study), or determining incidence (e.g. cohort study) (Aldous *et al.*, 2011:26; Merrill, 2013:179). In a cross-sectional study the relationship between diseases (or other health-related characteristics) and other variables of interest are examined as they exist in a defined population at one particular time (Friis, 2010:68). A cohort study that identifies and investigates subsets of a defined population and then follow over time, looking at difference in their outcomes (Friis, 2010:112; Strom, 2012b:46). Cohort studies are further used to compare exposed patients to unexposed patients, but can also be useful in comparing one exposure to another (Strom, 2012b:46).

Experimental study

An experimental study requires the researcher to introduce an intervention and normally consists of randomised controlled trials (Aldous *et al.*, 2011:26). These studies involve people as the units of analysis and are performed prospectively (Waning & Montagne, 2001:63).

Therefore, for the purpose of this study, only an observational study was performed and not an experimental study.

1.6.1.1 Advantages and disadvantages of different pharmacoepidemiological studies

The advantages and disadvantages of the different types of analytical studies are summarised below (Mann, 2003:59; Merrill, 2013:180-181; Strom, 2012b:43):

Table 1.1: Advantages and disadvantages of different pharmacoepidemiological studies.

Different pharmacoepidemiological studies	Advantages	Disadvantages
Cohort studies	A single study can examine various outcome variables.	If prospective, they are expensive and often take a long time for sufficient outcome events to occur.
	Establish a sequence of events.	Possibility of biased outcome data.
	Determining incidence of disease.	
	Study uncommon exposures.	
	Good way of determining the cause of disease.	
Cross sectional studies	The subjects are neither deliberately exposed, treated, or not.	Weaker evidence of causality than cohort studies.
	Treated and hence there are seldom ethical difficulties.	Inaccurate when studying a rare condition.
	Are relatively quick (time saving).	Case-control studies.
	Can study multiple outcomes.	Need large sample sizes.
	These studies are the best way to determine prevalence.	
	Less expensive.	
	Supply meaningful results.	
Case control studies	Useful for hypothesis outcome.	Case-control studies determine only outcome variable.
	Less expensive/less time to conduct.	Bias is a major problem.
	Can study multiple exposures.	Can only look at one outcome.
	Can study uncommon diseases/ rare outcomes.	
	Efficient.	

Therefore, a descriptive, cross-sectional study was performed as multiple study outcomes were determined (CDL condition prevalence and medicine cost) in a section of the population. The cross-sectional study was further performed as this is the best type of study design to determine prevalence in a population.

1.6.2 Drug utilisation review (DUR)

Drug utilisation review (DUR) can be defined as an authorised, structured, and continuing programme that reviews, analyses, and interprets patterns of medicine use against predetermined standards, with changes to therapy where standards are not met (Academy of Managed Care Pharmacy, 2009; Lipton & Bird, 1993:1069). Drug utilisation review was further defined as the marketing, distribution, prescribing and use of medicine in a society, with special emphasis on the resulting medical, social and economic consequences (WHO, 2003a:8). Kreling (2000) contributes that one of the main objectives of DUR is to reduce costs associated with inappropriate medicine prescribing.

1.6.2.1 Types of drug utilisation review

Drug utilisation review studies can be classified into three different types of studies, namely retrospective studies, concurrent reviews and prospective reviews. These studies are summarised in Table 1.2 below (Academy of Managed Care Pharmacy, 2009; Kreling, 2000; Lipton & Bird, 1993:1069; Truter, 2008:95):

Table 1.2: Summary of different types of drug utilisation review studies.

Type of drug utilisation study	Description
Retrospective DUR	Retrospective DUR is used to review medicine therapy after the patient received the medicine as well as to check for patterns of inappropriateness.
Concurrent DUR	Concurrent DUR assists in the continuous monitoring of medicine therapy during the course of treatment. Concurrent reviews prevent therapeutic misadventures by intervening at the point of dispensing, such as checking for medicine interactions, duplications or contraindications relative to the condition of the patient. Furthermore, concurrent reviews are also more expensive and time consuming to conduct than retrospective studies.
Prospective DUR	Prospective DUR is used when evaluating a patient's medicine therapy before the medicine is dispensed.

For the purpose of this study and regarding the type of data used, a retrospective DUR study was performed.

Therefore a short overview and description of a retrospective DUR will follow.

1.6.2.1.1 Retrospective DUR

A retrospective drug utilisation study is an approved, systematic process that captures, reviews, analyses, and interprets aggregate medicine use data within specific health environments (Erwin, 1991:596). This type of review has a number of beneficial aspects (Lee & Bergman; 2012:380; Serfontein, 1996:9):

- It can be performed quite easily using a database from a medical scheme (Truter, 2008:95);
- Inappropriate prescribing practices such as under- and over-utilisation*, appropriate generic and formulary medicine use can be identified. Through educational interventions, rational prescribing and better quality treatment for the patient can be achieved (Academy of Managed Care Pharmacy, 2009);
- It is a relatively inexpensive type of DUR method with a variety of interesting applications such as identifying new relationships and problems relating to medicine and disease (Truter, 2008:95).
- The use of DUR in pharmacoepidemiology is significant as it describes the determinants, extent and nature of medicine exposure (WHO, 2003a:8). DUR, however, plays a significant role in managed health care as it assists organisations in understanding, interpreting and improving the prescribing, use and administration of medicine (Academy of Managed Care Pharmacy, 2009).

*Utilisation can be defined as making effective use of a product or service (Concise Oxford English dictionary, 2011:1549). Supply however can be defined as making a product or service available to a person (Concise Oxford English dictionary, 2011:1449). Under-and over supply will further be discussed in Chapter 3, section 3.4.8.

The type of study design used in this study included a quantitative, descriptive, cross-sectional study performed on retrospective, longitudinal data. The reason for this is that, during this study, the prevalence of patients with at least one CDL condition and direct medicine treatment cost thereof are determined and compared in different groups of the sample population over specific

time periods. Continuous longitudinal data were also required, as certain trends in medicine use over specific time periods in certain patients were determined.

1.7 Data source

The data used in this study were extracted from a medicine claims database of a nationally (South African) representative PBM Company. This company provides services to four capitation providers and thirty-two medical schemes, and four sick benefit society funds which are all administered by fifteen administrators. The medicine benefits of approximately 1.6 million beneficiaries are maintained by this PBM Company (Rademan, 2011). The PBM Company is not directly identified to maintain ethical, patient and provider confidentiality. All information regarding beneficiaries, service providers, medical schemes and prescribers were made unidentifiable or encrypted by the PBM Company prior to making data available for analyses.

Medicine claims data for reimbursement used are more complete and reliable, especially in groups such as children and the elderly (Schneeweiss & Avorn, 2005:323). Advantages of using medicine claims data include plentiful data, inexpensive to access and anonymity of supplier, service provider and patient. (Fever *et al.*, 2009:11). To reduce errors and ensure validity and reliability of the data used in this study, the checklist in section 1.8.1 was used.

The data were divided into individual study periods from 1 January 2008 to 31 December 2012, and studies were conducted on a yearly basis.

1.8 Validation and reliability of the data source

The importance of validity and reliability of data used to ensure its quality outlined below.

1.8.1 Overview of validity and reliability

Validity can be defined as the degree to which a variable actually measures what it is designed to measure (Friis, 2010:205; Merrill, 2013:299; Waning & Montagne, 2001:123). Validity further involves the establishment of a clinically appropriate definition for that variable as well as the determination of the positive predictive value thereof (United States Department of Health and Human Services *et al.*, 2013:20). Several factors can reduce data validity when conducting research with automated databases. This is the result from when the people with the condition may not seek medical attention; if the condition cannot be diagnosed easily or inaccurate diagnoses may be entered into the database (Park & Stergachis, 2008:528). Furthermore, database validity can be measured by comparing information found in the database with that ascertained independently.

Automated database selection and use in pharmacoepidemiological studies have potential strengths and for use in this study (Strom, 2012c:160):

- Providing large sample sizes;
- Relatively inexpensive to use;
- Complete data can be obtained, as all medical care data are available;
- Databases can be population-based, by including out-patient medicine and diseases;
- These databases can be connected to external electronic databases (e.g. death records);
- Limitations of automated databases and recommendations to overcome these limitations include (Hall *et al.*, 2011; International Society of Pharmacoepidemiology, 2008:201-202; Strom, 2012c:161):
- Appropriate database selection: which includes the population covered, study variables and consistent data captured. The population should be in terms of place, time period, persons and selection criteria.
- Extraction and analyses of data from the study population: The affectivity of the study population, variables and output data to be extracted. Data analyses may further include procedures to control bias and their influence on results due to misclassification, missed data and confounding results.
- Security and privacy: Complying with security and privacy policies, such as limited use and identification of patient information.

Methods to determine and ensure the correctness and validation of data used by the PBM Company in this study, as well as additional database validation criteria include (Rademan, 2010):

- Claim field format checks;
- Provider validation checks;
- Member validation checks;
- Verify dependant code;
- Waiting period checks, and;

- Duplicate checks.
- Hall *et al.* (2011) add that rules applicable to the guidelines for good pharmacoepidemiological practices should be followed and adhered too, such as the documentation of specification extraction, quality testing, output, resources merging and privacy.

Reliability can be defined as the consistency of data within a database by producing similar results in different circumstances and its repeatability (Friis, 2010:204; Merrill, 2013:299; Park & Stergachis, 2008:531). They also state that the concept of reliability is based on an assumption that no database can be a complete source of information. Tyree *et al.* (2006:274) list limitations of research questions investigated by using claims data include the ICD-10 coding, diagnoses may be inaccurate or incomplete due to inaccurate coding that the claims data only apply to the population on the medicine claim database.

1.9 Target and study population

The target population included all patients on the database that were members of medical schemes in South Africa that claimed medicine through the PBM Company used in this study. The study population was then further determined by selecting patients with at least one of the 26 CDL conditions where this condition was registered as a chronic condition between 2008 until 2012. Medicine for these patients was then claimed according to appropriate ICD-10 codes. The specific conditions included in the CDL were identified and selected by the Council for Medical Schemes because they were the most common, are life-threatening, and those in which cost-effective treatment would sustain and improve the quality of a member's life (Council for Medical Schemes, 2010a).

In order to identify and select appropriate data used in this study, the following *inclusion* and *exclusion* criteria were selected and applied:

Table 1.3: Inclusion and exclusion criteria used for selection of study population.

Inclusion criteria	Exclusion criteria
All active members (patients) with at least one of the 26 CDL conditions where this condition was registered as a chronic condition with the respective medical scheme between 2008 until 2012. Of these members, only those with paid medicine claims were included.	Patients with unspecified ICD-10 codes; All medicine not included in MIMS® (Monthly Index of Medical Specialities) with no NAPPI code (National Approved Product Pricing Index), and; Members without a listed age or gender.

Table 1.4 below summarises the total number of patients on the database (target population) and the total number of patients with at least one CDL condition (study population) that claimed medicine on the South African database for each study year respectively.

Table 1.4: Outline of the target and study population in this study.

Description	2008	2009	2010	2011	2012
Total number of patients on the database.	974 497	1 307 528	1 220 289	1 077 834	1 029 699
Total number of patients with at least one CDL condition (n).	214 279	254 934	251 295	233 351	268 685

Table 1.5 below summarises the ICD-10 codes used for each CDL condition and the appropriate medicine claimed to assist in identifying patients in the study population (Snyman, 2012:29a-32a). Table 1.5 contains 25 CDL conditions as haemophilia A and B are combined and bipolar mood disorder is not included.

Table 1.5: CDL conditions and ICD-10 codes and medicine used to identify patients for the target population.

Chronic disease list condition	ICD-10 code	Description	Medication claimed with appropriate ICD-10 code
Addison's disease	E27.1	Primary adrenocortical insufficiency	Hydrocortisone and fludrocortisone.
Asthma	J45	Asthma	β_2 -agonist, inhaled corticosteroid, theophylline and oral corticosteroids.
	J46	Status asthmaticus	
Bronchiectasis	J47	Bronchiectasis	Amoxicillin and doxycycline.
	Q33.4	Congenital bronchiectasis	
Cardiac failure	I50	Heart failure	ACE-inhibitors, thiazide diuretics, loop diuretics, spironolactone, β -blockers, digoxin and potassium supplementation.
	I11.0	Hypertensive heart disease with (congestive) heart failure	
	I13.0	Hypertensive heart and renal disease with (congestive) heart failure	
	I13.2	Hypertensive heart and renal disease with both (congestive) heart failure and renal failure	
Cardiomyopathy	I42	Cardiomyopathy	ACE inhibitor, thiazide diuretic, loop diuretic, spironolactone, β -blocker, digoxin and warfarin.
	I25.5	Ischaemic cardiomyopathy	
Chronic renal disease	N03	Chronic nephritic syndrome	ACE inhibitors, calcium channel blockers, thiazide diuretic, β -blocker, calcium carbonate, elemental iron, folic acid and erythropoietin.
	N05	Unspecified nephritic syndrome	
	N11	Chronic tubulo-interstitial nephritis	
	N18	Chronic renal failure	
	N19	Unspecified renal failure	
Chronic obstructive pulmonary disease	J43	Emphysema	β_2 -agonist, ipratropium bromide, theophylline and prednisone.
	J44	Other chronic obstructive pulmonary disease	
Coronary artery disease	I20	Angina pectoris	Aspirin, nitrates, β -blocker and dihydropyridine.
	I25	Chronic ischaemic heart disease	
Chron's disease	K50	Crohn's disease [regional enteritis]	fluoroquinolone, metronidazole, azathioprine, methotrexate and corticosteroids.
Diabetes insipidus	E23.2	Diabetes insipidus	Desmopressin.
Diabetes mellitus type 1	E10	Insulin-dependent diabetes mellitus	Insulin.
	E12	Malnutrition-related diabetes mellitus	
	O24	Diabetes mellitus in pregnancy	
Diabetes mellitus type 2	E11	Non-insulin-dependent diabetes mellitus	Sulphonylurea, metformin, thiazolidinediones and insulin.
	E12	Malnutrition-related diabetes mellitus	
	O24	Diabetes mellitus in pregnancy	

Chronic disease list condition	ICD-10 code	Description	Medication claimed with appropriate ICD-10 code
Dysrhythmias	I47.1	Supraventricular tachycardia	Warfarin, β -blockers, digoxin, verapamil and amiodarone.
	I47.2	Ventricular tachycardia	
	I48	Atrial fibrillation and flutter	
Epilepsy	G40	Epilepsy	Phenytoin, carbamazepine, sodium valproate, valproic acid, phenobarbitone, lamotrigine, topiramate, oxcarbazepine, ethosuximide and clonazepam.
	G41	Status epilepticus	
Glaucoma	H40	Glaucoma	β -blocker eye drops, α_2 -agonist, prostaglandin analogue and carbonic anhydrase inhibitor.
	Q15.0	Congenital glaucoma	
Haemophilia	D66	Hereditary factor VIII deficiency	Desmopressin, factor VIII, paracetamol, opioids, tranexamic acid and factor IX.
	D67	Hereditary factor IX deficiency	
Hyperlipidaemia	E78.0	Pure hypercholesterolaemia	Statins and fibrates.
	E78.1	Pure hypertriglyceridaemia	
	E78.2	Mixed Hyperlipidaemia	
	E78.3	Hyperchylmicronaemia	
	E78.4	Other hyperlipidaemia	
	E78.5	Hyperlipidaemia, unspecified	
Hypertension	I10	Essential (primary) hypertension	α -blockers, ACE inhibitors, angiotensin receptor blockers, β -blockers, furosemide, spironolactone and calcium channel blockers
	I11	Hypertensive heart disease	
	I12	Hypertensive renal disease	
	I13	Hypertensive heart and renal disease	
	I15	Secondary hypertension	
	O10	Pre-existing hypertension complicating pregnancy, childbirth and puerperium	
Hypothyroidism	E01.8	Other iodine-deficiency-related thyroid disorders and allied conditions	Thyroxine.
	E02	Subclinical iodine-deficiency hypothyroidism	
	E03	Other hypothyroidism	
	E89.0	Postprocedural hypothyroidism	
Multiple sclerosis	G35	Multiple sclerosis	Methotrexate, cyclophosphamide, azathioprine, baclofen, oxybutynin, imipramine, amitriptyline, carbamazepine, opioid analgesics and methylprednisolone.
Parkinson's disease	G20	Parkinson's disease	Selegiline, dopamine agonists, levodopa, amantadine and anti-cholinergics.
	G21	Secondary parkinsonism	
Rheumatoid arthritis	M05	Seropositive rheumatoid arthritis	Non-steroidal anti-inflammatory agents (NSAIDs), corticosteroids, disease modifying anti-rheumatic medication (DMARD).
	M06	Other rheumatoid arthritis	
	M08.0	Juvenile rheumatoid arthritis	
Schizophrenia	F20	Schizophrenia	Typical antipsychotics, atypical antipsychotics and mood stabilisers.
Systemic lupus erythematosus	M32	Systemic lupus erythematosus	Non-steroidal anti-inflammatory medication (NSAIDs), corticosteroids, cytotoxic medication and aspirin.
	L39	Lupus erythematosus	
Ulcerative colitis	K51	Ulcerative colitis	5-aminosalicylic acid (5-ASA) suppositories, corticosteroids and azathioprine.

1.10 Study variables

For the purpose of this study, the study variables include both independent and dependent *variables*.

A *variable* can be defined as a property or characteristic that can take on different values at different times (Privitera, 2012:617). A variable can further be defined as a characteristic of a population for which more than one value occurs in that population. Because more than one value occurs, the value of the characteristic *varies* in the population (McLaughlin, 2002:17).

These *variables* will be discussed below:

1.10.1 Independent variables

Two variables can be defined as being independent if the occurrence or non-occurrence of one does not change the probability that the other one will occur (Brase & Brase, 2010:167). Independent variables are further defined as a classification of one case on one variable which has no effect on the probability that the case will be classified in any particular category of the second variable (Healey, 2012:515).

1.10.1.1 Age groups

The medical scheme members used in this study were divided into different age categories. The relevance of using age as a measure can be confirmed by a study done in South Africa using medical schemes data from 2001, from 26 medical schemes and 1 341 892 members (McLeod *et al.*, 2002:iii). The study found that there was an almost complete lack of co-morbid diseases in the group under the age of 25 years and the emergence of co-morbid diseases in the 30's. Therefore, it could be concluded from the study that the occurrence of co-morbid and more complex diseases occur later in life (McLeod *et al.*, 2002:34). Paez *et al.* (2009:22) also showed that age is an important factor in determination of the cost of chronic disease in a study done in the United States on out-of-pocket spending in 2005. They found that out-of-pocket spending and chronic disease prevalence are increasing, not only among old people but also in midlife without regarding gender, race, ethnicity, or income (Paez *et al.*, 2009:22). The PBM Company used in this study revealed that age is an established and important factor that may influence medicine utilisation (Badenhorst *et al.*, 2011a:8). In addition, Badenhorst *et al.* (2011a:8) agree with Paez *et al.* by stating that an increase in age is associated with an increase in utilisation and thus expenditure.

Thus, the different age groups were determined as follows:

- There was a steady increase in the number of beneficiaries on the PBM between ages 10-19 years according the Council for Medical Schemes annual report of 2009 until 2010 (Badenhorst *et al.*, 2011a:8). There is also an increase in chronic diseases as well as chronic disease risk factors in children (age group 1). Statistics South Africa report that in 2010 nearly 15 504 200 (31.01%) of the South African population were younger than 15 years that increased to 16 179 765 (29.96%) in 2014 (Statistics South Africa, 2010:9; Statistics South Africa, 2014:9) (refer to Chapter 2, section 2.6.6.1 as well as Chapter 3, Table 3.1 and Table 3.2).
- Age group 2 was chosen as it accommodates the majority of patients. There was also a peak in the number of beneficiaries on the PBM for this group in the Council for Medical Schemes report with most beneficiaries (Badenhorst *et al.*, 2011a:8) (also refer to Chapter 3, Table 3.1 and Table 3.2).
- Age groups 3, 4 and 5 were chosen because the number of patients with CDL conditions increases with increased age (also refer to Chapter 3, Table 3.1 and Table 3.2). According to the PBM Company, the average population age of beneficiaries also increased between 2009 and 2010. Statistics South Africa report that in 2010, approximately 3 795 100 (7.59%) of the South African population were 60 years and older that increased to 4 542 065 (8.41%) in 2014 (Statistics South Africa, 2010:9; Statistics South Africa, 2014:9).
- The age groups for this study were divided into the following categories as shown in Table 1.6 below, and used in Chapter 3, sections 3.1, 3.2, 3.3, and 3.4:

Table 1.6: Different age groups used in this study.

Age group	Age (years)
1	0 > age ≤ 12
2	12 > age ≤ 50
3	50 > age ≤ 60
4	60 > age ≤ 70
5	age > 70

1.10.1.2 Gender groups

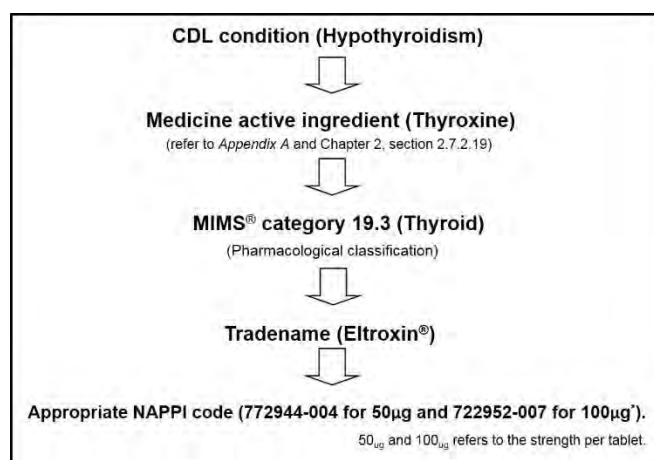
The medical scheme members in this study were divided into three categories, namely male and female patients, and unidentified for which the gender could not be determined from the medical scheme database. The importance of using gender was noted by Vlassoff (2007:47) who indicates that in the last decade, a considerable amount of research has been conducted in the area of gender and health, including gender differences in vulnerability to, and the impact of specific health conditions. Furthermore, Vlassoff (2007:57) concludes that in both developing and developed countries, awareness of the importance of a gender analyses in health is growing, with respect to both infectious and chronic diseases. The importance of gender analyses is relevant in this study as there are differences in CDL condition prevalence between male and female patients (refer to Chapter 3, sections 3.1, 3.2, 3.3 and 3.4).

1.10.1.3 Medicine pharmacological groups, active ingredients and trade names

The pharmacological classification was done by using the MIMS® where medicine are listed according to pharmacological active ingredients and registered trade names (Snyman, 2011:7a). Although all the medicine classes are listed in the MIMS®, only those medicine classes were selected for data analyses that are indicated in the treatment algorithms for the different CDL conditions (refer to *Appendix A*). A further classification was done according to the NAPPI codes which are unique nine digit product codes implemented with electronic transactions in mind (Snyman, 2011:7a). The medicine claimed were identified by the appropriate ICD-10 codes linked to MIMS® categories for treatment of each CDL condition (also refer to Table 1.5).

An example of the process of identifying the appropriate medicine claimed for a CDL condition, is shown below (Snyman, 2011:327):

Example:



1.10.1.4 Chronic disease list conditions

Medicine treatments for each chronic condition was derived from the appropriate treatment algorithms and classification was done according to the individual CDL condition (refer to *Appendix A* and Table 1.5).

When a comparative analysis within a section of the private health sector within South African context was done, the classification of the PMB will be done according to the ICD-10 code. The ICD-10 coding specifies the indication (CDL condition) for which the medicine is prescribed, as some medicines have more than one indication (also refer to Table 1.5).

The ICD-10 code is used to translate the diagnosis of diseases and health-related problems into an alphanumeric code from descriptions, that allows data to be easily stored, retrieved and analysed (Council for Medical Schemes, 2010c). Furthermore, all PMBs are identified through a diagnosis code. This coding will allow the appropriate medical scheme to allocate and identity health care benefits and therefore allow medical scheme members access to healthcare that includes PMBs (Council for Medical Schemes, 2010c). The ICD-10 codes further facilitate the timeous and appropriate reimbursement of providers that rendered relevant health services (Council for Medical Schemes, 2010c).

The following classification system was used as determined by the Medical Schemes Act (131 of 1998) (SA, 2003b; SA, 2009) to classify the CDL conditions used in this study:

- Hypertension;
- Hyperlipidaemia;
- Coronary artery disease;
- Cardiac failure;
- Asthma;
- Bipolar mood disorder (excluded from the empirical investigation);
- Bronchiectasis;
- Cardiomyopathy disease;
- Chronic obstructive pulmonary disease;
- Chronic renal disease;
- Crohn's disease;
- Diabetes insipidus;
- Diabetes mellitus type 1;
- Diabetes mellitus type 2;
- Dysrhythmia;
- Epilepsy;
- Glaucoma;
- Haemophilia A;
- Haemophilia B;
- Hypothyroidism;

- Addison's disease;
- Multiple sclerosis;
- Parkinson's disease;
- Rheumatoid arthritis;
- Schizophrenia;
- Systemic lupus erythematosus, and
- Ulcerative colitis.

*** When the treatment algorithms for the CDL conditions were published in 2003, the treatment algorithm for bipolar mood disorder was not available. In 2009 a formal algorithm was made available as an amendment to the Medical Schemes Act (131 of 1998) (SA, 2009) (refer to Appendix A). Therefore, since no accurate data were available during 2008 for bipolar mood disorder, this CDL condition was not analysed in the empirical investigation of this study.***

1.10.1.5 Generic indicators

Generic indicators were used in this study to distinguish between the original and generic medicine and include:

Table 1.7: Generic indicators and associated abbreviations.

Generic indicator	Abbreviation used
Original medicine provided (patent not expired) and generic medicine available.	M
Original medicine provided (no generic medicine available).	N
Original medicine provided (patent expired) and generic medicine available.	O
Generic medicine provided.	Y

Data analyses of generic indicators were included in this study for the reason that CDL conditions are normally of long duration and require on-going treatment. Generic substitution is thus a measure of cost containment and cost savings for medical schemes and patients (refer to Chapter 2, section 2.3.2.2, section 2.5.1.5.2 and Chapter 3, section 3.4.4). In addition, Shrank *et al.* (2011:1351) note the importance of generic substitution in the United States, especially in cardiovascular disease. Generic medicines are often overlooked in cost-effectiveness of chronic

disease management and can reduce overall costs for a healthcare system and save patient lives (Shrank *et al.*, 2011:1354).

A further data analysis of the different generic indicators was done on data for all 26 and the top 5 CDL conditions. This data analysis was further done on the total medicine cost, medical scheme contribution and patient co-payment (refer to Chapter 3, section 3.4.4).

1.10.1.6 Cost⁷

The concept of cost deals with the resources that are used in the production of a product or service (Larson, 1996:45). Strom *et al.* (2012:922) and Struwig (1997:169) state that most economists would define cost as the consumption of a resource that otherwise could have been used for another purpose. The PBM Company used in this study define cost when reviewing and analysing their data as the amount charged for the medicine, irrespective of how the payment is divided between the patient and medical scheme (Badenhorst *et al.*, 2011b:10).

Medicine cost associated with under-and over-supply of the top 5 CDL condition medicine items were calculated using the following formulas:

$$\text{Medicine cost of each CDL condition (under-supplied)} = \frac{\text{Average medicine cost per day}}{\text{Number of days medicine was under-supplied}}$$

$$\text{Medicine cost of each CDL condition (over-supplied)} = \frac{\text{Average medicine cost per day}}{\text{Number of days medicine was over-supplied}}$$

Refer to Chapter 3, section 3.4.8 for the application of these two formulas.

Aspects of direct and indirect cost as well as the application of direct cost in this study will be discussed in section 1.10.2.2.

1.10.2 Dependent variables

Two variables can be defined as being dependent if the occurrence and non-occurrence of one changes the probability that the other one will occur (Brase & Brase, 2010:167). These include prevalence and medicine cost. Cost will then be divided into medical scheme contribution paid for

⁷ All aspects regarding cost are rounded to two decimals where applicable.

by medical schemes in South Africa as well as patient co-payments made by medical schemes beneficiaries according to different scenarios where patient co-payment may be levied.

1.10.2.1 Prevalence⁸

Prevalence refers to the number of existing cases of a specific disease in a specific population at a specific point in time (Waning & Montagne, 2001:20; Webb & Bain, 2011:429). Prevalence can further be defined as the number of people with a specific disease at a given point in time divided by the total number of people in the population (with or without the specific disease) (Coolidge, 2006:371). Prevalence data were used in this study in Chapter 3, sections 3.1, 3.2 and 3.4.

1.10.2.2 Cost

Cost can be divided in either *indirect* or *direct* medical cost.

Indirect cost

Indirect cost can be defined as a loss of productivity in the economy as a result of short as well as long term disability (Currie *et al.*, 2000:175). For the duration of this study *indirect* cost will not be discussed and analysed.

Direct cost

Direct cost[#] can be defined as cost directly related to prevent, detect and treat an injury or disease. This may also include staff cost and medicine acquisition cost (Currie *et al.*, 2000:175; Gattani *et al.*, 2009:17). For the purpose of this study, only direct cost of medicine (that includes medicine only) to treat and further prevent CDL conditions were determined and analysed as follows:

- Total medicine cost was sub-divided for application in section 3.4.1 and 3.4.2:

⁸ All aspects regarding *prevalence* are rounded to two decimals where applicable.

[#] For the purpose of this study, *direct cost* and *medicine cost* can be viewed as synonymous.

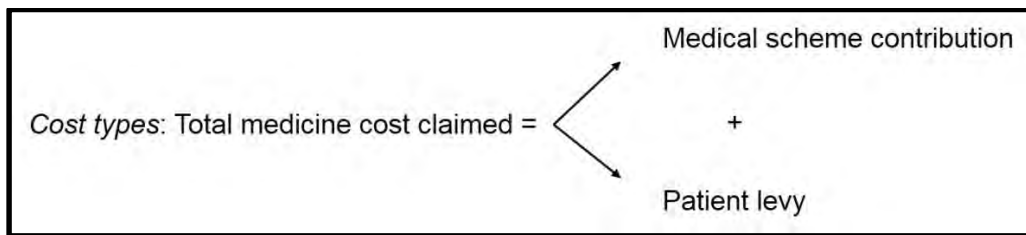


Figure 1.2: Cost type composition.

- Medical scheme contribution: Cost contribution paid for by the medical scheme (Total medicine cost claimed – patient levy).
- Patient levy: Refer to Chapter 2, section 2.5.1.2.
- Total medicine cost was sub-divided for application in section 3.4.5 and 3.4.6:

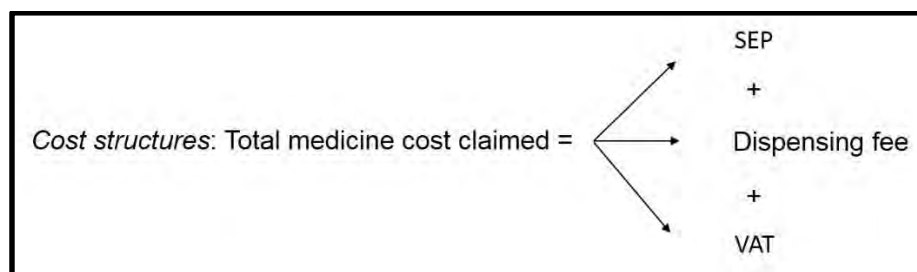


Figure 1.3: Cost structure composition.

- SEP: Refer to Chapter 2, section 2.5.1.6.1.
- Dispensing fee: Refer to Chapter 2, section 2.5.1.6.
- VAT: Refer to Chapter 2, section 2.5.1.6.1.

Direct medicine cost was used in Chapter 3, sections 3.3, and 3.4.

During this study *medicine cost* was determined and analysed according to the following:

Medicine cost of patients with at least one CDL condition according to the total patient population. (refer to Chapter 3, section 3.3).

- Medicine cost for patients with at least one CDL condition according to different cost types (refer to Chapter 3, section 3.4.1) (total cost and average cost per item were discussed);

- Medicine cost per item per patient with the top 5 CDL conditions according to different cost types (refer to Chapter 3, section 3.4.2) (total and average cost per item were discussed);
- Medicine cost according to the different number of CDL conditions (refer to Chapter 3, section 3.4.3) (data were discussed according to total cost and average cost per item for each number of CDL conditions);
- Medicine cost for all CDL medicine according to different generic indicators (refer to Chapter 3, section 3.4.4) (medicine cost was divided into total, and average cost per item for medical scheme contribution and patient levy);
- Average cost per prescription per patient according to different cost structures (refer to Chapter 3, section 3.4.5) (medicine cost was divided into total and average cost per prescription);
- Average medicine cost per item per patient according to different cost structures (refer to Chapter 3, section 3.4.6) (data were analysed according to total and average cost per item);
- Potential cost savings per medicine item from changes in SEP (refer to Chapter 3, section 3.4.7) (data were analysed according to the average cost per medicine item);
- Patient adherence of CDL medicine and associated medicine cost (refer to Chapter 3, section 3.4.8) (total cost per patient was summarised and analysed).

1.10.2.3 Cost-prevalence index

The cost-prevalence index (CPI)⁹ can be used as an indication to show the relative relationship between the number of medicine items per prescription and the total medicine cost (Serfontein, 1989:180). The CPI was used to determine and illustrate how expensive medicine treatment for CDL conditions was between age and gender groups in all the study years (refer to Chapter 3, section 3.4.1).

The cost – prevalence index can be calculated by using the following formula:

$$\text{Cost – prevalence index (CPI)} = \frac{\text{Cost \%}}{\text{Prevalence \%}}$$

⁹ Refer to list of abbreviations.

Where:

- **Cost index > 1:** Shows that the therapy is relatively expensive.
- **Cost index = 1:** Shows equilibrium between the cost and prevalence of the therapy.
- **Cost index < 1:** Shows that the therapy is relatively inexpensive.

1.10.2.4 Chronic disease-prevalence index

The chronic disease-prevalence index (CDPI) was amended from the cost-prevalence index by Serfontein (1989:180). The CDPI can be used as a measure to determine the relationship between the number of chronic disease items and the number of patients with a CDL condition. The chronic disease item percentage (%) can be determined dividing the number of CDL medicine items in the appropriate group by the total number of CDL items. The prevalence (%) can be determined dividing the number of patients with a CDL condition in the appropriate group by the total number of patients with a CDL condition (refer to section 1.11.1.6 and Chapter 3, section 3.2.1 and Table 3.5). Differences in CDPI between patient genders and well as different age groups were determined (refer to Chapter 3, section 3.2.1 and Table 3.5).

$$\text{Chronic disease-prevalence index (CDPI)} = \frac{\text{Chronic disease items \%}}{\text{Prevalence \%}}$$

Where:

- **CDPI ≤ 1:** Chronic disease items in relation to the number of patients (relatively low);
- **CDPI > 1:** Chronic disease items in relation to the number of patients (moderate to relatively high).

1.10.2.5 Medicine possession ratio (MPR)

The definition of compliance/adherence used in retrospective assessments is the number of doses dispensed in relation to the dispensing period, which is also called the “medicine possession ratio (MPR)” (Cramer *et al.*, 2007:3). The medicine possession ratio can be defined as the number of days supplied during a specific period divided by the period of refill intervals as a percentage (Andrade *et al.*, 2006:569). MPR calculations can be used in medicine claims data due to the information being objective, convenient, non-invasive and acceptably accurate as used in a study to determine MPR in antidepressant treatment by Slabbert *et al.* (2015:140).

Certain set criteria for adherence as the minimum level of medicine consumption can, for instance be greater than 70%, 80% or 90% (Fogarty *et al.*, 2002:95). These measures include several variations; one study defines adherence as the ratio of days of medicine supply to days between medicine dispensing and subsequent refill of greater than 90% (Fogarty *et al.*, 2002:95). One of these studies defined adherence as the percentage of weeks a patient took medicine at least 70%, or greater than 80% of consumption based on pill count. In addition, in another study, adherence was defined categorically as having filled a prescription < 7 days from the expected refill date (Fogarty *et al.*, 2002:95). However, a study done by Stroupe *et al.* (2004:444) defines a moderately over-supply of medicine between 110%-120%, and Chen *et al.* (2014:379) use an MPR > 110% and > 120% as cut-off points of medicine over-supply in their study. Thus, 110% was set for the upper limit of adequate supply, and that any over-supply for CDL conditions will result in unnecessary addition medicine costs (refer to Chapter 3, section 3.4.8). Therefore, according to Ito (2013:129) no gold standard for improving and measuring patient adherence exist. Ho *et al.* (2009:3029) stated that value ranging will depend on the specific medicine, its formulation and specific disease condition. Since 26 CDL conditions were included in this empirical investigation, each treatment may differ with regard to its compliance outcomes. To ensure uniformity within these conditions in this study, the value range between $\geq 80\%$, and $\leq 110\%$ was chosen.

Therefore, adherence can be used to in this study to determine the MPR as stated by Cramer *et al.* (2007:3).

By calculating the adherence to determine MPR, the result can be interpreted as medicine over or under-supply as mentioned above.

Therefore, for the duration of this study calculated MPR values range, where:

- MPR $\geq 80\%$, and $\leq 110\%$: will be considered acceptable (adherent) and of adequate supply of CDL medicine;
- MPR < 80%: will be considered as an under-supply (non-adherent) of CDL medicine due to refill gaps, and;
- MPR > 110%: will be considered as an over-supply (non-adherent) of CDL medicine (refer to Chapter 3, section 3.4.8).

MPR was included in this study because non-adherence resulting from under-and over supply of medicine may have a direct effect on increased medicine use and treatment cost (refer to Chapter 2, section 2.9.5).

The MPR determined adherence in this study with regard to the number of patients as well as the number of days medicine was claimed for the top 5 CDL conditions and gave a reflection of the average and total cost per patient, resulting from under- and over- supplied medicine (refer to Chapter 3, section 3.4.8).

The adherence % can be calculated as follows, as used illustrated by Hess *et al.* (2006:1283), and used in this study:

$$\text{Adherence\%} = 1 - \frac{\{[(\text{days between first and last claim date}) - \text{total days' supply}]\}}{(\text{days between first and last claim date})} \times 100$$

(DBR)
(Days-between-refills)

Where: DBR (Days-between-refills) was calculated where the days between refill adherence rate was used to subtract the total days' supply from the number of days between refill dispensing. This difference was then divided by the number of days between refill dispensing. The value obtained resulted in a non-adherence value, the dividend was subtracted from 1 to obtain an adherent value (Hess et al., 2006:1282).

Inclusion criteria: Only medicine items on more than 1 prescription claimed throughout the study period.

1.11 Statistical methods and analysis

Statistical methods used in the empirical investigation of this study was analysed by using the Statistical Analysis System®, SAS 9.3® (SAS Institute Inc., 2009). The data analyses used in Chapter 3, section 3.2.4 to determine the number of CDL conditions per patient adjusted for age and gender were done by using Statistical Package for the Social Sciences (IBM SPSS® 22).

1.11.1 Descriptive statistics

Descriptive statistics can be defined as ways in which numerical information in samples and populations are organised and summarised (Brase & Brase, 2010:9). Healey (2012:16) defined descriptive statistics as summarising the distribution of a single variable or measuring the relationship between two or more variables. This information and data are used for better understanding and presentation thereof (Devore & Peck, 1993:4).

1.11.1.1 Frequency¹⁰

The frequency for a data value is the number of times the value occurs in a particular category of a variable or a data set (Jaisingh, 2000:6; Rubin, 2010:316). Frequency can therefore be used to determine the number of patients with a CDL condition, or the number of CDL conditions per patient. For the duration of this study, *frequency* and *number* can be viewed as synonymous. The number of patients and/or CDL conditions was discussed in Chapter 3, sections 3.1, 3.2 and 3.4.

- Number of patients with at least one CDL condition according to total population (refer to Chapter 3, section 3.1).
- Number of patients with at least one CDL condition (refer to Chapter 3, section 3.2.1).
- Number of patients with individual CDL conditions (refer to Chapter 3, section 3.2.2).
- Number of patients with a single CDL condition (refer to Chapter 3, section 3.2.3).
- Number of CDL conditions per patient per year adjusted for age and gender (refer to Chapter 3, section 3.2.4).
- Number of patients with the top 5 co-morbid CDL conditions (refer to Chapter 3, section 3.2.5).
- Different number of CDL conditions and the number of patients with these conditions (refer to Chapter 3, section 3.2.6).
- Number of patients with different CDL co-morbid condition combinations (refer to Chapter 3, section 3.2.7).

1.11.1.2 Prevalence

Prevalence was defined in section 1.10.2.1. Prevalence of the number of patients and/or CDL conditions will be discussed in Chapter 3, sections 3.1, 3.2 and 3.4.

1.11.1.3 Arithmetic mean (average)

Brase and Brase (2010:77) state that an average that uses the exact value of each entry is the *mean*¹¹. To compute the mean, the sum of all the values are added and then divided by the number of values/observations (Rubin, 2010:313; Walker & Almond, 2010:16).

¹⁰ All aspects regarding *frequency* are rounded to two decimals where applicable.

¹¹ For the purpose of this study *mean* and *average* can be viewed as synonymous.

The mean was used in this study in Chapter 3, section 3.2 and 3.4.

The mean can be calculated by using the following formula (Healey, 2012:68; Kirkwood, 1988:12):

$$\text{Mean, } \bar{x} = \frac{\sum x}{n}$$

Where:

x = values of the variable/scores;

$\sum$ = the sum of;

n = number of observations/cases.

1.11.1.4 Standard deviation

Barlo (2007) states that the deviation value represents the average distance of a set of scores from the mean. De Muth (1999:91), Kirkwood (1988:14) and Privitera (2012:113) define the standard deviation as a measure of variability of the average distance that scores deviate from the mean.

The standard deviation was used in this study in Chapter 3, section 3.2 and 3.4.

The standard deviation can be determined by taking the *square root* of the variance which can be calculated by using the following formula (Kirkwood, 1988:14; Privitera, 2012:113):

$$\begin{aligned} \text{s.d., } s &= \sqrt{\left[\frac{\sum (x - \bar{x})^2}{(n - 1)} \right]} \\ &\text{or equivalently} \\ s &= \sqrt{\left[\frac{\sum x^2 - (\sum x)^2/n}{(n - 1)} \right]} \end{aligned}$$

Where:

S = standard deviation;

$\sum$ = the sum of;

x = values of the variable;

n = number of observations.

1.11.1.5 Standard error

Standard error can be defined as the standard deviation of a sampling distribution (Brase & Brase, 2010:281; Rubin, 2010:321). The standard error of the mean is the standard deviation of a distribution of sample means (McLaughlin, 2002:290).

The standard error was used in this study in Chapter 3, section 3.2.4.

The standard error can be calculated by using the following formula (Brase & Brase, 2010:281; Healey, 2012:150):

$$\sigma_{\bar{x}} = \frac{\sigma}{\sqrt{n}}$$

Where

σ = standard deviation of the population of scores from which the samples were taken;

n = sample size.

1.11.1.6 Percentage

A percentage can be defined as number, rate or amount in or for every 100 (Concise Oxford English dictionary, 2011:1063). A percentage can also be defined as any proportion or share in relation to a whole (Concise Oxford English dictionary, 2011:1063).

Percentage and percentage change is applied throughout Chapter 3.

$$\text{Percentage (\%)} = \frac{\text{Number/amount}}{\text{Total number/amount in that specific group}} \times 100$$

$$\text{Percentage change (\%)} = \frac{\text{Number/amount (group 1)} - \text{number/amount (group 2)}}{\text{Number/amount (group 1)}} \times 100$$

1.11.2 Inferential Statistics

Inferential statistics are used when drawing conclusions and, in some cases, making predictions about the properties of a population based on information obtained from a sample (Brase & Brase, 2010:9; Devore & Peck, 1993:4; Gravetter & Wallnau, 2013:8). However, the risk involved with this type of analysis is that a conclusion about a population can be made from incomplete data (Devore & Peck, 1993:4).

1.11.2.1 Chi-square (X^2) test

Chi-square tests can be defined as a statistical procedure used to test hypotheses about the discrepancy between the observed and expected frequencies in two or more nominal categories (Privitera, 2012:547). Devore and Peck (1993:808) confirm this definition by stating that X^2 calculates the magnitudes of the discrepancies between the expected and observed cell counts. Thus, X^2 was used to test if an association exists between the number of patients with their respective number of CDL conditions (refer to Chapter 3).

1.11.2.2 Student's t -test

The student's t -test (also known as the independent sample's t -test or two-sample t -test) compares two distinct individuals or samples. The student's t -test is determined by calculating the mean value of the end-point of each group and determining the difference between the two mean values on the same dependent variable (Coolidge, 2006:215; Rowe, 2007:68). The student's t -test was used in this study to determine the difference between the means of two different groups (gender groups in Chapter 3, Table 3.4).

1.11.2.3 Analysis of variance (ANOVA)

The analysis of variance (also known as the F-test) is used to test hypothesis for one or more factors concerning the variance among two or more group means, where the variance in one or more populations is unknown (Gravetter & Wallnau, 2013:387; Privitera, 2012:349; Rubin, 2010:185). Analysis of variance is used to analyse variation statistically in a response variable measured under conditions defined by discrete factors (Larson, 2008:115). ANOVA was used in this study to determine the difference between the means in more than two different groups (Chapter 3, Tables 3.4, 3.12, 3.33, 3.34 and 3.35). A common multiple comparison procedure such as *Tukey's* procedure can be used as a second procedure to determine whether differences among various sample means are significant, after a statistically significant difference was indicated by using ANOVA (Sprinthal, 2003:637). In this study *Tukey's* procedure was used in conjunction with ANOVA in Chapter 3.

1.11.2.4 Linear mixed-effects models (MIXED)

One of the methods data were analysed in IBM SPSS® 22 was by using MIXED linear modelling (refer to Chapter 3, section 3.2.4). A variety of linear models are accommodated by using the MIXED procedure, which enables statistical inferences to be made regarding data. The MIXED procedure in IBM SPSS® 22 is applied to data sampled from normal distributions to fit linear-mixed effects (SPSS® Inc., 2005).

In addition, models more general than those of the general linear models (GLM) procedure are fitted by the MIXED procedure. The MIXED procedure can further be differentiated from the GLM procedure, in that the MIXED procedure can handle and correlate data in unequal variances (SPSS® Inc., 2005).

Assumptions of PROC MIXED analyses include that (SAS Institute Inc., 2014):

- Means (expected values) of the data are linear in terms of set parameters;
- Variance and co-variances of the data are in terms of a different set of parameters, and exhibit a structure matching one of those available in PROC MIXED.

Gaussian data can be modelled in terms of their means and variances/co-variances; the two sets of parameters in a mixed linear model specify the data's probability distribution. Thus, parameters of the mean model are also known as fixed-effects parameters, and parameters of the variance-co-variance model are known as co-variance parameters (SAS Institute Inc., 2014).

Fixed-effect parameters are associated with known explanatory variables (standard linear model). Fixed-effect parameters can be classified as either quantitative (standard linear regression) or qualitative (traditional analyses of variance). Co-variance distinguishes standard linear models from mixed linear models (SAS/STAT® user's guide, version 8, 1999).

Co-variance parameters are can be used in the following typical applications (SAS/STAT® user's guide, version 8, 1999):

- Data from a common cluster are correlated by clusters, consisting of experimental units on which data are measured, and;
- Repeated measurements taken show a variability that changes, after that repeated measurement was taken on the same experimental unit.

In this study, these co-variance parameters include that the patient was taken as the cluster and experimental unit, where different measurements on the same patient were inter-correlated.

Although MIXED linear modelling can be used in IBM SPSS® 22 and SAS 9.3®, only IBM SPSS® 22 was used for data analysis in this study.

This method was applied to assist in determining the increases and decreases in average number of CDL conditions per patients when adjusted for age and gender (refer to Chapter 3, section 3.2.4).

1.11.3 Statistical and practical significance

Statistical methods used in this study to determine statistical significance will be discussed below:

1.11.3.1 The p -values and confidence interval (CI)

The p -value measures statistical significance and can be defined as a unit of measurement between the null hypothesis and the observed data (Aschengrau & Seage, 2008:321). Crawley (2005:3) elaborated that a p -value is an estimate or the probability that a particular result occurred by chance if the hypothesis were true. Something would be viewed as statistically significant if something is unlikely to have occurred by chance e.g. $p < 0.001$ (Crawley, 2005:4).

Although the p -value only determines whether there is an effect, different confidence intervals such as a 90, 95 and 99 percentiles (CI) reveal how great that effect is. (Rowe, 2007:85; Devore & Peck, 1993:391). A 95 percentile confidence interval (CI), as used in this study, therefore reveals the upper and lower limit of estimates that would occur in 95 out of 100 experiments. From these limits the researcher can determine the importance of difference, etc. Thus:

- if $p \leq 0.05$, the result is interpreted as being statistically significant, and;
- if $p > 0.05$, the result can be interpreted as not being statistically significant.

Confidence intervals were applied in this study in Chapter 3, sections 3.2 and 3.4.

1.11.3.2 Effect sizes

Effect sizes for comparison between two or more sample means will be discussed below:

Effect sizes were used in this study in Chapter 3, sections 3.2 and 3.4.

1.11.3.2.1 Effect size for the comparison between two or more sample means

Talheimer and Cook (2002:3) state that an effect size is the difference between two means divided by the largest standard deviation of the two conditions. In ANOVA the difference between means is divided by the square root of MSE (mean square root), where the square root of MSE gives an estimation of the standard error after accounting for the differences between the groups (Steyn, 1999:9). Effect sizes can further be defined as a statistical measure of the size of an effect in a population to determine how far scores shifted in a population (Privitera, 2012:246). Furthermore, effect size is a good indicator to the degree that study results have practical (clinical) significance in the study population (Hojat & Xu, 2004:241).

The following guidelines can be used to evaluate the Cohen's *d*-values (Hojat & Xu, 2004:243; Steyn, 1999:3):

- ***d* = 0.2:** small effect – (negligible practical significance);
- ***d* = 0.5:** medium effect – observable and may give significant results, which may be between the means of two groups (moderate practical significance);
- ***d* = 0.8:** large effect – the results are significant (large practical significance).

Effect sizes were applied in Chapter 3 sections 3.2 and 3.4.

1.11.3.2.2 Cramer's statistical V-test

Cramer's statistical V-test can be defined as a measure of the correlation (correlation coefficient), or degree of relationship, between two dichotomous or nominal variables, where one of the nominal variables has more than two categories (McLaughlin, 2002:530; Rubin, 2010:211). Healey (2012:514) and Ellis (2010:11) defined *Cramer's statistical V-test* as a chi square-based measure of association between nominally measured variables organised into a bivariate contingency table with any number of rows and columns.

Thus, *Cramer's V-test* was used to test the practical significance of the association between the number of patients with their respective number of CDL conditions as determined by X^2 (refer to Chapter 3, sections 3.2 and 3.4).

The following formula and criteria were used to determine *Cramer's V-test* (Rubin, 2010:211):

$$V = \sqrt{\frac{\chi^2}{N(k-1)}}$$

Where

V = Cramer's V ;

χ^2 = Calculated chi-square;

N = Total number of cases;

k = Number of rows of columns, whichever is smaller.

Correlation coefficient criteria: All correlation coefficients have a value of between -1 and +1, where (Diamantopoulos & Schlegelmilch, 2000:200):

- **0.1** = small significant association between the two variables;
- **0.3** = medium significant association between the two variables; and
- **0.5** = large significant association between the two variables.

1.12 Ethical aspects

Approval was obtained from the appropriate PBM Company as well as from the Human Ethics Committee of the North-West University (Potchefstroom campus) (number NWU-0046-08-A5) to conduct this drug utilisation study. Data used in the analyses were obtained where each prescription record contained a unique number to identify each patient, medical practice, pharmacy or medical scheme. These numbers were randomly allocated by the medical scheme administrator providing the data to ensure confidentiality. Therefore, no specific patient, medical practice, pharmacy or medical scheme could be identified and confidentiality of information and anonymity was maintained throughout the study.

1.13 Results and discussion

Results of the empirical investigation derived from the data obtained through medical scheme administrators will be illustrated using appropriate Tables and/or Figures, and discussed over the appropriate time periods. The results will be discussed in Chapter 3.

1.14 Chapter division

Chapter 1: Introduction and research methodology;

Chapter 2: Chronic diseases, their treatment and aspects influencing their medicine cost;

Chapter 3: Results and discussion;

Chapter 4: Conclusions, recommendations and limitations.

1.15 Chapter summary

In this Chapter the introduction, research objectives of both the literature and empirical investigations were discussed. The Chapter also contained a discussion of the research design and methodology, as well as the statistical methods used during data analyses.

Chapter 2 will give an overview of the burden and treatment of CDL conditions as well as the different factors that have an impact on the treatment cost of chronic conditions.

CHAPTER 2:

CHRONIC DISEASES, THEIR TREATMENTS AND ASPECTS INFLUENCING THEIR MEDICINE COST

2.1 Introduction

In this chapter an overview of the South African health sector will be outlined and discussed. Further, this chapter will be sub-divided into two sections, where section 1 will comprise of regulating treatment aspects of the public and private health sectors, including the National Health Insurance (NHI). Section 2 will contain a discussion of the chronic disease list (CDL) conditions together with aspects pertaining to their adherence.

2.2 South Africa demographic statistics

South Africa is a country with an estimated physical size of 1 220 813 km² as reported in the South African Census conducted in 2011 (Statistics South Africa, 2012:9). The 2010, 2011 and 2014 South African Census reported that the South African population had increased from 40 583 573 in 1996 to 44 819 778 in 2001, 49 991 300 in 2010 and 54 002 000 in 2014 (Statistics South Africa, 2010:4; Statistics South Africa, 2012:9; Statistics South Africa, 2014:3). Of the 1996 population, 19 520 887 (48.10%) were male that increased to 24 329 000 (48.67%) in 2010 and 26 366 000 (48.82%) in 2014. In 1996, 21 062 685 (51.90%) were female that increased to 25 662 300 (51.33%) in 2010 and 27 635 900 (51.18%) in 2014 (Statistics South Africa, 2010:4; Statistics South Africa, 2012:9; Statistics South Africa, 2014:3).

2.3 Background of the South African health sector

The South African healthcare system consists of private and public health sectors which will be discussed separately. To achieve adequate health care in both these sectors, their goals include:

- A South African health system that is cost-effective, quality driven and efficient, which optimises the utilisation of private and public sector resources which will benefit the entire population;
- Public and private sectors to work together in a relationship of mutual cooperative trust and respect in order to improve the scope, accessibility and quality of care at all levels of the health system.

2.3.1 National Health Act

The National Health Act (61 of 2003) is applicable and implemented in both the public health, and private health sectors and will be discussed briefly on national, provincial, district and provincial level below.

2.3.1.1 National health system

South African health according to the National Health Act (61 of 2003) at national level is striving to:

- Unite the various elements of the national health system in a common goal to actively promote and improve the national health system in South Africa (SA, 2004b:30).
- Establish a health system based on decentralised management, sound governance, equity, principles, efficiency, sound governance, internationally recognised standards of research and a spirit of enquiry and advocacy which encourages participation (SA, 2004b:30).
- Facilitate and promote the provision of health services for the management, prevention and control of communicable and non-communicable diseases, and to co-ordinate health services rendered by the National Department with the health services rendered by provinces and provide such additional health services as may be necessary to establish a comprehensive national health system (SA, 2004b:30).

2.3.1.2 Provincial health system

The services of the South African health services at provincial level according to the National Health Act (61 of 2003) include (SA, 2004b:34):

- Provide specialised hospital services;
- Plan the development of private and public hospitals, other health establishments and health agencies;
- Control the quality of all health services and facilities, and;
- Promote health and healthy lifestyles.

South Africa consists of the following provinces where these services are implemented: Eastern Cape province, Free State province, Gauteng province, KwaZulu-Natal province, Limpopo province, Mpumalanga province, Northern Cape province, North West province and Western Cape province (Health Systems Trust, 2014:2).

2.3.1.3 District health system

Services to be delivered at a district health level according to the National Health Act (61 of 2003) are to (SA, 2004b:40):

- Promote co-operative governance;
- Advise the Executive Committee of any matters regarding health and health services in that health district, as well as to;
- Ensure the co-ordination of budgeting, planning, providing and monitoring of health services of applicable to the residents of the specific district area.

The district health system is also the vehicle for primary health care service delivery across South Africa (Department of Health, 2014:27). This vehicle includes coordinating and promoting the implementation of health programmes, promoting primary health care and ensuring standards for all aspects included in the district health system (National Treasury, 2012:16). Primary health care facilities include district hospitals, community health centres and clinics (Department of Health, 2014:27).

District health areas where health services are delivered to in the different provinces include:

Eastern Cape province: A. Nzo, Amathole, Buffalo City, C. Hani, Cacadu, J. Gqabi, N. Mandela Bay and O.R. Tambo (Massyn *et al.*, 2014:371-410).

Free State province: F. Dabi, Lejweleputswa, Mangaung, T. Mofutsanyana and Xhariep (Massyn *et al.*, 2014:411-435).

Gauteng province: Ekurhuleni, Johannesburg, Sedibeng, Tshwane and West Rand (Massyn *et al.*, 2014:436-460).

KwaZulu-Natal province: Amajuba, eThekweni, H. Gwala, iLembe, Ugu, uMgungundlovu, uMkhanyakude, uMzinyathi, uThukela, uThungulu and Zululand (Massyn *et al.*, 2014:461-515).

Limpopo province: Capricorn, Mopani, Sekhukhune, Vhembe and Waterberg (Massyn *et al.*, 2014:516-540).

Mpumalanga province: Ehlanzeni, G. Sibande and Nkangala (Massyn *et al.*, 2014: 541-555).

Northern Cape province: F. Baard, J.T. Gaetsewe, Namakwa, Pixley ka Seme and Z.F. Mgcawu (Massyn *et al.*, 2014: 556-580).

North West province: Bojanala, Dr. K. Kaunda, N.M.Molema and R.S. Mompoti (Massyn *et al.*, 2014:581-600).

Western Cape province: Cape Town Metropolitan, Cape Winelands, Central Karoo, Eden, Overberg and West Coast (Massyn *et al.*, 2014:601-630).

2.3.1.4 Municipal health system

The services that should be delivered at a municipal health level according to the National Health Act (61 of 2003) include the following (SA, 2004b:42):

- Appropriate health services should be equitably and effectively provided by each metropolitan and district municipality. These health services must be assigned to each municipality by the relevant member of the Executive Council in each province (SA, 2004b:42).
- All of the health systems, including National, Provincial, District and Municipal should provide quality health and health services to all citizens. These include essential and cost-effective medicines as stated in the National Drug Policy below and the ten point plan by the Minister of Health to improve the health of all South Africans (SA, 2004b:42).

2.3.1.5 National Drug Policy

The goal of the National Drug Policy (NDP) for South Africa is to ensure an adequate and reliable supply of safe, cost-effective medicine of acceptable quality to all citizens of South Africa (SA, 1996:3). The rational use of medicine by prescribers, dispensers and consumers are also promoted (WHO, 2001:59).

The specific health and economic objectives of the NDP include (SA, 1996:3):

- Ensure accessibility and availability to essential drugs to all citizens (also refer to section 2.3.2.3);
- Ensure good prescribing and dispensing practices. This may include the use of approved treatment algorithms and appropriate use of relevant ICD-10 codes by health professionals as used in this study (refer to *Appendix A* and Chapter 1, section 1.10.1.4 and Table 1.5);

- Promote individual responsibility to health, informed decision making and preventative care. The link to this study can be made by the appropriate use of designated service providers, and generic substitution as results of informed decision making (refer to sections 2.5.1.5.2 and 2.5.1.3 as well as Chapter 3, section 3.4.4);
- The efficacy, quality and safety of drugs to all citizens
- Establish a complimentary partnership between private providers in the pharmaceutical sector and Government bodies (also refer to section 2.5.1.7.2);
- Optimize the use of scarce resources through co-operation between regional and international agencies
- Promoting the rational and cost-effective use of medicine (also refer to sections 2.3.2.3 and 2.4). The rational and cost-effective use include generic substitution and adequate supply of medicine (refer to Chapter 3, sections 3.4.4 and 3.4.8).
- Lowering the cost of medicines in both the public and private sectors (also refer to sections 2.3.2.2, 2.3.2.3 and 2.5.1.5.2). To further apply the objective to this study, increased use of generic substitution and adequate supply of medicine items will be investigated (refer to Chapter 3, sections 3.4.4 and 3.4.8).

The Minister of Health published a ten point plan covering 2009 until 2014 as part of the National Development Plan to further improve the accessibility and affordability to medicines and health profile of all South Africans. The plan includes (Department of Health, 2011a):

- Provision of strategic leadership and creation of a social compact for better health outcomes;
- Implementation of NHI (refer to section 2.5.1.7);
- Improving the quality of health services;
- Overhauling the health system by:
 - Refocusing on primary health care, and;
 - Improving the functionality and management of the health system;
- Improving human resources, planning, development and management;
- Revitalisation of infrastructure, with focus on:

- Accelerating the delivery of health infrastructure through public private partnerships (PPP);
- Revitalising primary level facilities;
- Accelerating the delivery of health technology and information communication technology (ICT) infrastructure;
- Accelerating implementation of human-immune-virus (HIV) and acquired immune deficiency syndrome (AIDS) and Sexually Transmitted Infections Strategic Plan, 2007-2011, and reducing of mortality due to tuberculosis and associated diseases (Department of Health, 2011a). One of the planned targets for of the NDP is to reduce non-communicable diseases, which include cancer, chronic respiratory disease, diabetes and cardiovascular disease with their associated risk factors (refer to section 2.6.6) by 2030 (National Planning Commission, 2011:298).
- Mass mobilisation for better health for the population;
- Review of the drug policy, and;
- Strengthening research and development.

According to the World Health Organization (2001:18), a successful implementation of an NDP should have the following prerequisites to monitor progress:

- Monitoring and evaluation: Continuous review and analysing implementation of planned activities and progress towards meeting the pre-determined objectives goals and objectives. This will enable assessment of progress and make the necessary management decisions (WHO, 2001:18).
- Periodic evaluation: An NDP should be periodically evaluated, for example every four years. These evaluations are necessary and should form an integral part of the pharmaceutical master plan (WHO, 2001:20).

As a result, no comprehensive, official review of the South African NDP has been conducted since 1996 and is long overdue. However, some assessment and re-evaluation are in progress (Gray, 2009:19; Pharasi & Miot, 2013:178).

2.3.1.5.1 Medicine expenditure interventions in South Africa

South Africa has implemented certain interventions in relation to driving cost-effective medicine as set out in the NDP. These include:

- **Producer price control measures:** A policy for generic substitution is in place and the SEP provides transparency that also limits annual increases set to a maximum (Gray, 2009:19) (also refer to sections 2.5.1.5.2 and 2.5.1.6.1).
- **Distribution chain cost controls:** A single flat professional fee and suitable dispensing fee proved challenging, while VAT remains in place (Gray, 2009:19) (also refer to sections 2.5.1.6 and 2.5.1.6.1).
- **Bulk purchase measures:** Taking volume discounts into account (limited to the public sector) and the use of tender strategies (Gray, 2009:19) (also refer to section 2.3.2.1).
- **Demand side measures:** Although co-payments are routinely used in the private sector, prescribing of newly launched medicines may be reducing the potential cost savings from generic medicine (Gray, 2009:19) (also refer to sections 2.5.1.5.2, 2.5.1.2 and Chapter 3, section 3.4.4).
- **International trade agreement relief measures:** Issuing of licences is in place to allow parallel importation, although it has not been used yet.

As stated above, some of these interventions will be discussed throughout this chapter and applied in Chapter 3.

2.3.2 Public health sector

This section will contain aspects of the pricing structure and how the cost saving option of generic medicine is used in the public sector.

Public sector funding does normally consist of general tax funds. These taxes are usually collected by the Government and comprise of Income tax, VAT, fuel levies, as well as other taxes (McIntyre, 2009:2) (details of these taxes will be listed below). With Income taxes, the higher-income groups normally contribute a larger percentage of their income to Income tax, which is used to finance the public health sector (McIntyre, 2009:2). This is also known as progressive contribution, which is also international best practice. The lowest income earners contribute approximately 18.00% of their income and the highest earners approximately 40.00% (McIntyre, 2009:2). The budget revenue collected an estimated from the different taxes is listed below. Some

or all of these taxes may be used to fund the public health sector including the NHI (refer to section 2.5.1.7). Some of these taxes include (National Treasury, 2014:46; National Treasury, 2015:44):

- *Taxes on income and profits*: R426 584 million (2011/2012) to R507 759 million (2013/2014) and estimated R744 473 million (2017/2018);
- *VAT*: R191 020 million (2011/2012) to R237 667 million (2013/2014) and with an estimated R346 711 million (2017/2018);
- *Mineral and petroleum (fuel)*: R5 612 million (2011/2012) to R6 439 million (2013/2014) and an estimated R7 301 million (2017/2018)
- *Total tax revenue*: R113 775 million (1994/1995) to R742 650 million (2011/2012) to R900 013 million (2014/2015) and with an estimated R1 289 711 million (2017/2018).
- *Tax revenue as % of GDP*: 24.1% of R3 080.9 million (2011/2012) to 24.9% of R3 609.8 million (2014/2015) to an estimated 26.2% of R4 926.1 million (2017/2018).

2.3.2.1 Procurement and tender pricing in the public health sector

Procurement refers to the acquisition of medicine at the best possible cost in the right quantity and quality, at the right time, in the right place and from the right source (Pharmaceutical Industry Association of South Africa, 2011:21) (PIASA). Public procurement refers to the process by which public entities and Government purchase services and goods. This procurement resulted in a Government expenditure of an estimated expenditure of above R1.1 trillion (29.1% of the GDP) for the 2014/2015 financial year (The Department of Trade and Industry, 2013:35).

The pharmaceutical sector also plays an important role in the South African economy, especially in tertiary education, science and healthcare (The Department of Trade and Industry, 2013:97). The public health sector plays an important role by contributing by 35.00% by value and 75.00% by volume to the pharmaceutical sector (The Department of Trade and Industry, 2013:98). Therefore, the public (tender) sector is essential to the majority of local manufacturers, especially by providing sufficient production to ensure relatively low prices and costs (The Department of Trade and Industry, 2013:98). This may result in an increase in treatment non-communicable diseases, including cancer, diabetes and cardiovascular disease (The Department of Trade and Industry, 2013:98).

Within the general framework of South African national formularies, based on national consensus treatment guidelines, district health authorities should be empowered to ensure the best possible health outcomes by means of medicine selection and procurement that address the health

priorities and challenges of that particular district (PIASA, 2011:22). According to the NDP, the role of procurement in the public sector is to maintain a system to ensure medicine and medical supplies be procured at the best possible prices (SA, 1996:13).

According to Gray (2014:209), the procurement process in the public sector, the standard treatment guidelines and essential drug list (EDL) (refer to section 2.3.2.3) is in place and procurement through competitive, local tendering is done every two years. Unless a tender has been split between two suppliers, each medicine has one contracted supplier (Gray, 2014:209). The procurement of medical supplies and essential drugs (medicine)' pricing discussions should be determined through national and international tenders (SA, 1996:13). These tender prices are usually lower than the SEP charges in the private sector (Gray, 2014:209). Therefore, all purchasing of essential drugs by public sector institutions should be done through public sector tendering (SA, 1996:13). As a result of this tendering and in the event of a medicine of medical supply shortage and the need to supply the volumes required in the public sector, alternative supply options may be limited (Gray, 2014:209).

The process and framework for the procurement policy in South Africa set out in the Preferential Procurement Policy Framework Act (5 of 2000) included (SA, 2000:4):

- Contracts with a rand value above a predetermined amount will be awarded a maximum of 10 points for specific goals, with the lowest acceptable tender scores 90 points for price;
- Contracts with a rand value equal to or below a predetermined amount will be awarded a maximum of 20 points, with the lowest acceptable tender scores 80 points for price;
- The contract must be awarded to the tender with the highest score, unless objective criteria justify the award to another tender.
- Some of the goals as listed above include: contracts with individuals, or categories thereof which are historically disadvantaged by unfair discrimination on the basis of gender, race or disability. Specific goals for which points may be awarded must clearly be specified in the invitation to submit the appropriate tender.
- The Minister may interject, on request, in the allocation of the tender, if the tenderers are international suppliers, since it is in the best public interest or interest of national security.

In addition, no incentives, rebates or discounts are permitted as stated by the Medicine and Related Substance Control Amendment Act (90 of 1997) and the World Health Organization (SA, 1997:12; WHO/HAI, 2011:38).

PIASA (2011:27) reported on a study done by an independent researcher who sought to compare pharmaceutical costs in the South African public sector at prevailing tender prices to costs from international sources as indicated in the International Drug Price Indicator Guide (IDPIG). Public sector tender documents were used for twelve major tenders and comparisons were weighted by the volumes awarded in these tenders (PIASA, 2011:27). This study concluded that South Africa is buying from local suppliers at generally favourable prices compared to international sources (PIASA, 2011:27). The pharmaceutical sector plays an important role in the South African economy, especially in tertiary education, science and healthcare (The Department of Trade and Industry, 2013:97).

2.3.2.2 Medicine pricing

The aim of medicine pricing in the public health sector of South Africa, according to the NDP for South Africa will be achieved through discussions and rationalisation of medicine prices, and by using and promoting generic medicine (SA, 1996:9).

Key aspects include as stated by the NDP include:

Pricing structure (SA, 1996:9)

- A pricing committee with clearly defined functions will be established from within the Ministry of Health that monitors and regulate medicine prices within the Ministry of Health;
- All medicine is supplied free of charge at primary care patient level. At secondary and tertiary levels a fixed affordable co-payment for medicine supplied by the State will be levied;
- A database will be developed to monitor the cost of medicine in the country in comparison with prices in developing and developed countries;
- Price increases will be regulated. Pricing regulations through the SEP were introduced in 2004, are applicable to the public and private health sectors and are still effective in 2013 (refer to section 2.5.1.6.1).

Generic medicine (SA, 1996:10)

The use of interchangeable multi-source pharmaceutical products (IMPP), using the international non-proprietary name (INN), or generic name, is a recommended step to reduce medicine cost and expenditure.

- The availability of generic essential medicine will be encouraged through the implementation of incentives that favour generic medicine and their production in the country;

- The policy will aim at achieving generic prescribing in both private and public sectors. The pharmacist should, prior to dispensing a prescription, inform the patient on the benefits of generic substitution, and ensure that substitution takes place with the patient's full understanding and consent (refer to section 2.5.1.5.2), and;

This is also a major aspect in reducing medicine prices in the private health system. Generic substitution will be discussed in more detail in section 2.5.1.5.2.

2.3.2.2.1 Inflation in the South African health sector

Medicine pricing in both the public and private health sectors is influenced by inflation, which is again influenced by the consumer-price index (CPI)[#] and will be discussed below.

The CPI can be defined as the changes in pricing over time of consumer products and services that a household pays for (also known as headline inflation) (Econex, 2013:5; Statistics South Africa, 2013:1). The CPI is determined by measuring the cost of purchasing a fixed basket of consumer goods and services of similar characteristics and constant quality (Statistics South Africa, 2013:1). The CPI has two objectives which include:

- To measure changes in cost of living of South African households to ensure there is equity in the measures to adjust grants, wages and service agreements (Statistics South Africa, 2013:1);
- Measuring inflation of the economy so that macro-economic policy can be formulated on up-to-date and comprehensive information and provide a deflator to economic expenditure (Statistics South Africa, 2013:1).

Medical inflation is measured as by the change in the health component of the CPI, and from 2001-2012, except for 2007-2009 and 2012, medical inflation in South Africa has exceeded the headline inflation by 2.10% points on average (Econex, 2013:7). The constant expenditure above inflation in the private health sector per medical scheme beneficiary can be attributed to an increase in the number of beneficiaries using private hospital services with the burden of chronic diseases, annual inflation and changes in disease (Econex, 2012:2).

2.3.2.3 Essential drug list (EDL)

The National Drug Policy (NDP) (1996:3) for South Africa describes essential medicine as medicine that is accessible and available to all citizens. The standard treatment guidelines (STG)

[#] Refer to list of abbreviations.

and EDL are aligned with scientific advances and current developments in medicine that are cost-effective and efficient and available to treat the majority of conditions in a country (The National Department of Health, 2012:ii). The concept does not imply that no other medicine is useful, but that these medicines are the most needed for the health care of the majority of the population. The EDL forms an integral part of the National Development Plan with rationalisation of a constant variety of medicine in the public sector (The National Department of Health, 2012:xv). The private sector is encouraged to use these guidelines and EDL wherever appropriate (The National Department of Health, 2012:xvi).

2.3.3 Private health sector

South Africa has a large, well-developed, resource intensive and highly specialised formal private health sector. This sector, primarily funded through contributions to medical schemes, provides health insurance coverage to some seven million beneficiaries of a total South African population of approximately 47 million (Harrison *et al.*, 2007:xiii). Health care expenditure in South Africa was slightly more than R100 billion in 2005. This was equivalent to 7.70% of the Gross Domestic Product (GDP) in that year (McIntyre & Thiede, 2007:36). This has declined from a level of 8.00% to 8.50% of the GDP throughout the 1990s and early 2000s, largely due to the rapid growth in GDP in recent years. Despite this decline in health care expenditure relative to GDP, South Africa's level of spending is relatively high by international standards; it exceeds that of the majority of countries on a similar level of economic development and is similar to that in some high income countries (McIntyre & Thiede, 2007:36). Thereafter, healthcare expenditure in South Africa accounted for 8.8% of the GDP in 2012 (Organisation for Economic Co-operation and Development, 2015:1). Approximately 60.00% of the total funds for health care in South Africa flow via private sector financing intermediaries (primarily the national, provincial and local departments of health), while 40.00% flow via public intermediaries (McIntyre & Thiede, 2007:36).

Private health care is relatively expensive and out-of-pocket payments for major medical expenses are likely to be financially catastrophic, even for the relatively well-off. South African families therefore make monthly contributions to medical schemes to insure themselves and their families against this potential financial loss. The Medical Schemes Act (131 of 1998) regulated that contributions to medical schemes should be community rated, rather than risk-rated (SA, 2003b). Contributions can thus not be determined on the basis of factors such as age and health status, as with ordinary insurance arrangements (Harrison *et al.*, 2007:ix; SA, 2003b).

During 2010/2011, the Minister of Health, on the recommendation of the pricing committee implemented the following interventions to regulate costs of medicine in the private sector (Department of Health, 2011a):

- Published a maximum “dispensing fee” for pharmacists and other health professionals;
- Determined that there should not be increases in the SEP for 2011 due to the favourable exchange rates and consumer price indices;
- Published draft regulations for the international benchmarking of originator medicine;
- Published draft regulations on the maximum logistics fees that may be charged by wholesalers (also refer to section 2.5.1.6.1), and
- Published draft regulations on the submission of pharmacoeconomic analysis.

Medicine pricing of the private health care sector in South Africa will be discussed in more detail under medicine pricing structures.

2.3.3.1 Background of the medical scheme environment in South Africa

The medical scheme industry in South Africa is regulated by the Council for Medical Schemes which Acts a regulatory authority, administers and enforces the Medical Schemes Act (131 of 1998). This council is a public agency funded through levies charged by medical schemes in the public and private sectors and are accountable to the national Minister of Health (Council for Medical Schemes, 2012:11).

The number of medical schemes in South Africa has decreased from 144 in 2000 to 110 in 2009, 100 at the end 2010, 92 in 2012 and 87 by the end of 2013, and this trend is likely to continue (Council for Medical Schemes, 2010d:34; Council for Medical Schemes, 2011:112; Council for Medical Schemes, 2013; Council for Medical Schemes, 2014:47). The number of principal members increased by 2.9% (n = 3 488 009) in 2009, 3.6% (n = 3 612 062) in 2011, 2.3% (n = 3 815 431) in 2012 to 3 878 267 members by end 2013. Dependants increased by 2.1% to 4 580 496 in 2009, 2.7% to 4 703 656 in 2010 and 1.4% to 4 864 042 in 2012 to 4 898 012 dependants by end 2013 (Council for Medical Schemes, 2010d:43; Council for Medical Schemes, 2011:114; Council for Medical Schemes, 2013; Council for Medical Schemes, 2014:47).

Therefore, the total number of medical scheme beneficiaries increased constantly: by 2.5% in 2009 to 8 086 505, 3.1% in 2010 to 8 315 718, 1.8% in 2012 to 8 679 473 and 1.1% to 8 776 279 in 2013 with an overall increase from 2004 to 2013 of 31.70% (n = 2 120 000) beneficiaries (Council for Medical Schemes, 2010d:43; Council for Medical Schemes, 2011:114; Council for Medical Schemes, 2013; Council for Medical Schemes, 2014:146).

The gross contribution income for all medical schemes in South Africa increased from R74.1 billion to R84.8 billion (14.5%) from 2008 to 2009. Medical schemes expenditure increased to R76.3 billion in 2009 from 64.7 billion in 2008 (increase of 17.9%). The gross income increased by a total of R96.5 billion (13.7%), of which R84.9 billion (increase of 11.3%) were paid out in benefits from 2010 to 2011. The gross contribution income in 2012 increased by R117.5 billion (9.4%) from 2011, of which R103.7 billion were paid out in healthcare benefits and an increase of 10.7% on 2011 (Council for Medical Schemes, 2010d:43; Council for Medical Schemes, 2011:34; Council for Medical Schemes, 2013). The healthcare expenditure by medical schemes further increased by 8.9% by R9.2 billion to R112.9 billion by end 2013 (Council for Medical Schemes, 2014:158).

It can be concluded that although medical scheme income increased from 2008 until 2012, medical scheme expenditure for health services also increased.

The PBM company used in this study is the largest independent, pharmaceutical specialist benefit management organisation in South Africa (Mediscor, 2015). The pharmaceutical benefit management (PBM) company that provided data in this study was the first managed care organisation to be accredited by the Council for Medical Schemes in South Africa, and was also the first to implement a pharmaceutical benefit management system (Rademan, 2013:3). The clients of this PBM Company in 2011 included 32 medical schemes, four sick benefit society funds, four capitation* provider clients and five new generation insurance products (Rademan, 2011). These members' benefits increased from 1.5 million in 2008 to 1.6 million in 2012 (Rademan, 2009; Rademan, 2013:3). The association between the PBM and the respective medical schemes is that more than 300 000 real-time claims and 30 000 doctor transactions are processed per day, which result in savings to medical scheme clients and members (Mediscor, 2015). Furthermore, fully integrated services provided by the PBM to the medical schemes and its members in South Africa, Swaziland, Lesotho and Namibia include: electronic claims services, data analysis and reporting, consulting and advisory services client support services, supplementary services, quality management programs and pharmacy management. This PBM further supports the initiatives for the implementation of the NHI in South Africa as introduced by the Minister of Health (also refer to section 2.5.1.7) (Mediscor, 2015).

*Capitated schemes are constructed by a scheme entering into contracts with various medical service providers, such as doctors and dentists, who have to service a defined number of patients belonging to a scheme (Edwards, 2005).

2.4 Managed health care

Managed health care can be defined as financial and clinical risk management and assessment of health care to facilitate cost-effective and appropriate health services which are affordable, through the use of clinical and rule based management programmes (Council for Medical Schemes, 2003:12). Pilnick *et al.* (2001:79) confirmed this statement that managed health care should provide cost-effective and clinically effective outcomes by restricting treatment behaviours provided by health care professionals.

Managed health care, within the South African context, is a term used to refer to a diverse range of healthcare organisational strategies aimed at improving access, controlling cost, and assuring higher levels of quality of care provided to those covered by medical schemes (Council for Medical Schemes, 2003:19). The dimensions of managed care further interact in the attempt to containing costs while delivering quality health care. Managed health care works through the actions of doctors (or other professionals initiating care) to eliminate inappropriate treatments and ensure that cost effective practice is adopted (Fairfield *et al.*, 1997:1825). Thus, managed health care is an international initiative to reduce medical costs.

2.4.1 Advantages of managed care

The following are included among the several advantages of managed care (Health Care Financing Administration, 1996):

- It is easier to budget medical costs as patients are aware of any premiums in advance, and the total of other out-of-pocket expenses, is likely to be less than the fee-for-service.
- The patient generally pays a normal co-payment when they use a service. Some plans do not charge co-payments for certain specified services.
- Paperwork may possibly be eliminated.

As stated above managed care strives to contain medical and treatment costs. Implemented managed care methods used in South Africa therefore include the use of *generic medicine*, the use of *formulary medicine as well the use of DSP*.

These three managed care methods will be discussed in more detail below.

2.5 Medicine pricing structures

2.5.1 Medicine pricing structures in South Africa

Medicine pricing structure include PMBs and the CDL, where medical schemes have identified and pay for the diagnosis and treatment of the 27 most prevalent chronic medical conditions and is governed by the Council for Medical Schemes (Council for Medical Schemes, 2012:10). These also include co-payments incurred by its members as a result of generic substitution, non-formulary items and the use of non-DSP by medical schemes members. These conditions apply to all South African medical schemes, but the specific regulations and the impact on its members vary between medical schemes (also refer to sections 2.5.1.1.3 and 2.5.1.2).

The pricing structures will be discussed in more detail throughout this chapter.

2.5.1.1 Prescribed minimum benefits (PMBs)

PMBs are currently used in South Africa and will be discussed below:

2.5.1.1.1 Overview and legislation of PMBs

PMBs are defined as a set of benefits to ensure that all medical scheme members have access to certain minimum health services; regardless of the benefit option they have selected (Council for Medical Schemes, 2010b).

PMBs which came into effect in South Africa on 1 January 2004, oblige health care funders to fully cover costs of a minimum of 26 conditions (currently 27) for all members of the medical aid scheme, regardless of the level of scheme (Council for Medical Schemes, 2007a; Rayner, 2004:623).

PMBs were implemented, as the choice of medical scheme structures and the variety of choices within each option are confusing and overwhelming for medical scheme members (Edwards, 2005).

The objectives of the PMBs are two-fold. To:

- Avoid incidents where individuals lose their medical scheme cover as a result of serious illnesses and the consequent risk of unfunded utilisation of public hospitals (SA, 1999:35).
- Encourage improved efficiency in the allocation of public and private health care resources (SA, 1999:35).

PMBs cover treatment, diagnosis and care for:

- Any emergency medical condition (Council for Medical Schemes, 2010b);
- Two hundred and seventy (270) medical conditions, most of which are life-threatening ones that require treatment in hospital, but the PMBs also include some urgent care for non-life threatening conditions, maternity care and palliative (pain-relieving) care for the terminally ill (Du Preez, 2009);
- All chronic conditions for all members of the medical scheme to be covered fully (Council for Medical Schemes, 2010b). These conditions are also known as the CDL conditions (refer to section 2.6.2).

Any benefit option that is offered by a medical scheme must reimburse in full without co-payment or the use of deductibles, the diagnostic, treatment and care costs of the PMB condition in at least one provider or provider network which must at all times include the public hospital system (SA, 1999:11). Furthermore, the cover in the public hospital system must include all the costs of diagnosis, treatment and care for the PMB diagnosis-treatment-pairs (DTP) equal in quality and intensity to the services provided to publicly funded patients (SA, 1999:11).

A DTP links a specific diagnosis to a treatment and therefore broadly indicates how each of the 270 PMB conditions should be treated. The treatment and care of PMBs should be based on healthcare that has been proven to work best considering the affordability of that treatment (Council for Medical Schemes, 2007b).

2.5.1.1.2 Coverage of PMBs

According to Board of Healthcare Funders (2007), when identifying the chronic diseases, a number of factors were taken into account, such as the nature of the disease and how the disease would affect the quality of life of the individual, the affordability of the treatment for the most common conditions, the fact that they are life threatening and the financial impact to medical schemes.

The PMBs for the CDL differ from the general list of PMBs in that their minimum treatment is specified in therapeutic algorithms for each condition (refer to *Appendix A*) (Medikredit, 2004:54).

2.5.1.1.3 Advantages and disadvantages of PMBs

Advantages of PMBs include (South African Gastroenterology Society, 2008) (SAGES):

- Total funds available for these conditions may increase each year;
- Unlimited benefits, provided the treatment is in accordance with, at a minimum the guidelines published in the Medical Schemes Act (131 of 1998);
- Patients will no longer exhaust their medical funds and face the risk of discontinuing treatment during the course of the year, if they suffer from one of these conditions.

Disadvantages of PMBs include (SAGES, 2008):

- The patient's choice of which doctor they can use may be determined by the medical aid;
- Treatment options for PMB conditions will be restricted in terms of treatment guidelines (refer to section 2.7.2 and *Appendix A*);
- Medical aid funding for non-PMB conditions may be reduced or have to be paid from a patient's savings account.

2.5.1.2 Medicine co-payments

Co-payments/out of pocket payments/levy can be defined as the amount paid by the medical scheme member at the point of dispensing for each visit to a medical practice, emergency room or the purchasing of medication not paid for by the medical scheme (Badenhorst *et al.*, 2013:24; Mosby's dictionary of medicine, nursing and health professions, 2013:438).

Co-payments for PMB conditions apply to circumstances where a DSP is used, formulary medicine is used, and with regard to substitution of generic medicine.

2.5.1.2.1 Factors that result in increasing co-payments / out-of-pocket costs of medicine

These factors that result in increasing co-payments include (Taylor & Leitman, 2002:1):

- The increased use of tiered formularies with large co-payments for medicine in the higher tiers.
- The introduction of new medicines which are more expensive than those used previously;

- Changes in health plans and medicine coverage, with relatively large increases in co-payments[#], deductibles and co-insurance, designed to control rapidly growing health care costs;
- Increases in utilisation, driven partly by the introduction of new medicine and partly by direct-to-consumer advertising.

2.5.1.3 Designated service providers (DSPs)

A DSP refers to health care provider(s) that have been “selected by the scheme to provide its members with diagnosis, treatment and care in respect of one or more of the PMB conditions” (Medikredit, 2004:54). For example, a scheme may insist that a patient consult certain doctors for the diagnosis of a PMB, use certain pharmacies to obtain chronic medicine, or be admitted to certain hospitals for PMB treatment (Du Preez, 2009). However, a patient may use a non-DSP, but in this case the medical scheme does not have to pay in full for the diagnosis, treatment or care of a PMB condition (refer to Figure 2.1 below) (Du Preez, 2009) (Adapted from the Council for Medical Schemes, 2010a).

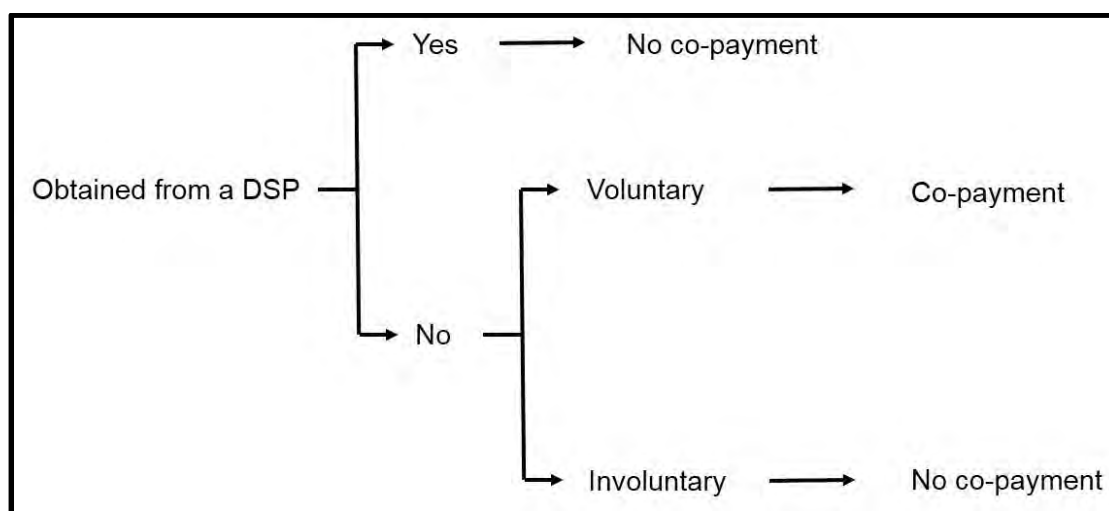


Figure 2.1: Algorithm for co-payments applying to PMBs.

However, if the service was not voluntarily obtained from a non-DSP, no co-payment of deductibles may be supplied. Services would be deemed involuntarily if (SA, 2003b):

- The service was not available from the DSP or could not be provided without reasonable delay;

[#] The co-payments in this regard can possibly be reduced by the use of certain managed care principles (refer to section 2.4).

- Immediate medical or surgical treatment for a PMB condition was required and ability to obtain treatment from a DSP was not possible;
- There was no DSP within reasonable proximity of the beneficiary's residence or place of work.

2.5.1.4 Formulary medicine

The Medical Schemes Act (131 of 1998) confirms that when a formulary includes a medicine that is clinically appropriate and effective for the treatment of a specific PMB condition suffered by a member, and that member knowingly declines the formulary medicine and decides to use another medicine instead of the formulary item, the scheme may impose a co-payment on the relevant member. In these instances, the co-payment cannot exceed the difference between the cost of the formulary medicine and the medicine selected by the medical scheme member (Anon, 2003:5).

Formularies further target medicine utilisation decision-makers, including both prescribers and consumers, and can be considered a benefit structure component intended to control or influence utilisation by specifying which medicine can be used (Kreling, 2000).

Formularies can also be effective in limiting access or driving to certain medicine use to the formulary/preferred medicine and improve the quality of the prescribing of medicine. If cost is a criterion for formulary assignment and high cost medicine are omitted, or if the formulary is associated with differential or tiered co-payments and/or rebates, it can reduce program costs (Kreling, 2000).

Refer to Appendix A for illustrative protocols in the treatment of South African CDL conditions as approved by the Council for Medical Schemes. This can also be viewed as the benchmark for treatment of CDL conditions (Council for Medical Schemes, 2010e).

2.5.1.4.1 Obstacles with formularies

There may potentially be unintended consequences associated with formularies, which include:

- That if changes are made in the medicine that are included or preferred on the formulary, switches in medicine therapy can occur (Kreling, 2000).
- Formulary changes also generate the possibility of disgruntled prescribers, patients, and pharmacists who have to deal with switching medicine and therapies (Kreling, 2000).
- Formularies can further impede therapeutic outcomes by restricting access to medicine that might be optimal for some patients; the therapeutic response to medicines can be as individual as the patients taking them (Kreling, 2000).

2.5.1.5 Medicine substitution

Substitution with regard to medicine includes both generic substitution and therapeutic substitution.

2.5.1.5.1 Therapeutic substitution

Therapeutic substitution occurs when the pharmacist dispenses a medicine with a different pharmacological active ingredient than the physician actually prescribed (World Medical Association, 2011). The medicine substituted by the pharmacist belongs to the same pharmacological class and or the same therapeutic class (World Medical Association, 2011). Therapeutic alternatives according to the International Pharmaceutical Federation (1997:2) are medicinal products containing different active ingredients but which are of the same pharmacological class, and which have similar therapeutic effects and adverse reaction profiles when administered to patients in therapeutic equivalent doses.

Therapeutic interchange, according to the International Pharmaceutical Federation (1997:2) consists of a therapeutic alternative prescribed as agreed upon between prescriber and pharmacist. Therapeutic interchange is a collaborative action between prescriber and pharmacist designed to achieve maximum therapeutic benefit for the patient, and to ensure the most effective, safest and economical use of medicinal products (International Pharmaceutical Federation, 1997:2).

Therapeutic substitution should be supported under the following conditions, if:

- The prescription authority of the physician is maintained so that the patient will receive organised, effective care (World Medical Association, 2011);
- Therapy for patients are individualised on a complete clinical database, compiled from a comprehensive history, current clinical findings, all relevant laboratory data, and psychosocial factors (World Medical Association, 2011);
- The concept of therapeutic is used, using and promoting the relevant expertise of the pharmacist and the prescriber (International Pharmaceutical Federation, 1997:3);
- In cases of emergency (International Pharmaceutical Federation, 1997:3).

Kereiakes and Willerson (2003:2611) discouraged therapeutic substitution due to the fact that randomised controlled comparisons of specific agents within a therapeutic class rarely are performed, and the clinician is forced to rely on much less definitive (and at times misleading) sources of information, such as indirect trial comparisons, meta-analysis of multiple trials, or statistical pooling of agents in a class. The World Medical Association (2011) opposes any governmental law or regulation that permits therapeutic substitution.

2.5.1.5.2 Generic substitution

Although generic medicine has been available for many years, many people are not fully aware of what they have to offer. Generic medicine can provide a less expensive way for people to obtain the medicine they need (The Association of the British Pharmaceutical Industry, 2009). The National Association of Pharmaceutical Manufacturers (NAPM) (2013), reports that if only 5.00% of branded* medicine in South Africa are substituted with a generic equivalent by volume, the healthcare industry and patients would save more than R400 million per annum. In addition, the NAPM (2013) reveals that in the annual report of the Council for Medical Schemes of 2012, generic medicine increased by R734 million (11.70%) versus R317 million (2.70%) of original medicine. South Africa's generic market was further expected to grow by 10.00%-12.00% over the next five years (2014-2019), after a growth of 13% over the past five years (2010-2014) (Makholwa, 2014). In 2014 the local generic market in South Africa was worth R7.5 billion (Makholwa, 2014). Slowing the rate of growth in prescription medicine expenditures could be

* *Branded/brand medicine* and *original medicine* can be viewed as synonymous.

accomplished by increasing the use of generic medicine because of the relatively large cost difference between original name and generic medicine items (Mott & Cline, 2002:663).

According to the National Drug Policy for South Africa, the availability of generic, essential medicine will be encouraged through the implementation of incentives that favour generic medicine and their production in this country. The policy will therefore aim at achieving generic prescribing in both the public and private sectors (refer to section 2.3.2.2).

Generic substitution regulations will be discussed further in the sections below.

Generic medicine

Generic medicine is the equivalent of the original-name medicine. They contain the exact same active ingredient, strength and dosage form as the original product (Mestern, 2003).

Generic medicine, also referred to as interchangeable multisource medicine, is a medical products containing an active pharmaceutical ingredient of which the patent has expired (Kanfer, 2007:10).

Generic substitution is where the doctor's choice to write a prescription with a generic or an original name and the pharmacist intervenes without consulting the doctor. This means that the pharmacist has the freedom to dispense any generic version of the product instead of the original name written on the prescription by the doctor (The Association of the British Pharmaceutical Industry, 2009).

Legislation and generic medicine

Legislation regarding generic substitution in South Africa came into effect on 2 May 2003 (Mestern, 2003). The National Drug Policy for South Africa (1996:10) added that the responsibility of the pharmacist is therefore to inform the patient on the benefits of generic substitution, prior to dispensing the prescription, as well as to ensure that the substitution takes place with the patient's full understanding and consent.

In accordance with the generic medicine legislation as regulated in the Medicine and Related Substance Control Amendment Act (90 of 1997), the following apply (SA, 1997:26):

- If the prescriber of the medicine has written in his or her own handwriting on the prescription the word "no substitution" next to the item prescribed, then the prescribed item should not be substituted (SA, 2003a:MAE30);

- If the product has been declared not substitutable, then the item prescribed should be dispensed (SA, 2003a:MAE30);
- If the retail price of the interchangeable multi-source medicine is higher than that of the prescribed medicine, then the patient should choose whether he/she prefers the innovator or the generic (SA, 2003a:MAE30)
- The patient has the right to refuse the substitution to the generic medicine, then the innovator item should be provided (SA, 2003a:MAE30).

It is thus no longer necessary to consult with the doctor prior to making a generic substitution, the decision to substitute now rests with the patient, following the advice of the pharmacist (Mestern, 2003). The National Drug Policy for South Africa (1996:10) therefore stated that patients have the right to make informed decisions concerning their own health, including a choice of generic medicine.

The Council for Medical Schemes (2010e) states that often the medicines on the formulary list (refer to section 2.5.1.4), will be generic medicines, which are copies of the original name medicines, less expensive but equally effective. If the patient wants to use an original name medicine that is not on the list, the medical scheme may pay only part of the bill and you will have to pay either the difference between the price of the medicine you use and the one on the formulary, or a percentage co-payment as registered in the scheme rules.

Obstacles regarding generic substitution

Obstacles with regard to generic substitution include the following:

- While the generic product should have the same key clinical characteristics as the original product, it is often packaged differently, has a different shape and/or colour. This can create obstacles, especially with older patients who have to take a variety of medicine at different times of day, and this could lead to confusion for the patients, and subsequently to failure to adhere to treatment (The Association of the British Pharmaceutical Industry, 2009).
- The main obstacle would be that the doctor's judgment does not prevail pertaining to the individual patient. Doctors freely prescribe generic medicine in cases where they feel that the generic has no disadvantages compared to the original name product (The Association of the British Pharmaceutical Industry, 2009).

2.5.1.6 Transparent pricing system in South Africa

One of the possible reasons for the implementation and regulation of medicine pricing was that in the past, prices were set by pharmacists and thus unregulated. Pharmacists were left free to establish their own “dispensing fee”. “Dispensing fee” was usually a percentage of the price of the medicine, meaning that the higher the medicine price, the higher that “dispensing fee” (Anon, 2010:442). The “dispensing fee” can be defined as the fee paid to the dispenser (pharmacy or pharmacist) to provide a service (professional service/fee) plus profit margin, and is generally the fee charged for the work done in dispensing the prescription (WHO/HAI, 2011:51).

Therefore, the Medicines and Related Substance Control Amendment Act (90 of 1997) states that a transparent pricing system shall be introduced for all medicine and Scheduled Substances, as well as an appropriate dispensing fee. The dispensing fee shall be charged by a pharmacist or any person licensed in terms of section 22C(1)(a) of the Act. This transparent pricing system shall include (SA, 1997:26):

- An SEP, published as prescribed (refer to section 2.5.1.6.1);
- The SEP shall include the only price by which manufacturers can sell medicines and related substance to any person, excluding the State.

No pharmacist may sell a medicine at a price greater than the appropriate price set at that time (SA, 1997:26).

Therefore, one method to control the “dispensing fee” was to set a predetermined SEP, which will be discussed below.

2.5.1.6.1 Single exit price (SEP)

One of government’s motivations for requiring a SEP for medicine is to ensure that “South Africans have access to affordable, good quality medicine” (Free Market Foundation, 2006).

According to Table 2.2, reference pricing in South Africa occurs through mark-ups and SEP. However, for the purpose of this study only the SEP will be discussed in detail.

SEP can be defined as the price set by the manufacturer or importer of a medicine or scheduled substance in terms of these regulations, combined with the logistics fee for distribution and VAT (SA, 2004a:6). The SEP further includes the price of the lowest unit of the medicine or scheduled substance within a pack, multiplied by the number of units per pack (SA, 2004a:6). In addition, no incentives, rebates or discounts are permitted as stated in section 2.3.2.1.

A mark-up price differs from the SEP and can be defined as the difference between the selling price and purchase price (cost price of a commodity) (medicine) (WHO/HAI 2011:1). Therefore, a mark-up price represents the additional costs and charges in order to cover distribution costs, overhead costs, as well as profit, also known as “gross-profit”. The mark-up is often expressed as a percentage or a fixed value of the purchase price (WHO/HAI, 2011:1). The importance of mark-ups in pricing regulation strategies may lead to the reduction of medicine prices (WHO/HAI, 2011:47). In contrast, mark-up regulation without regulation of retail selling price or manufacturer selling price (such as the SEP) will unlikely result in reduced medicine prices (WHO/HAI, 2011:47).

Method for setting the SEP

Osman (2004) states that the draft regulations require that manufacturers set the SEP at 50.00% below the official listed manufacturer net price contained in a publication known as the “Blue Book”. The final regulations specify that:

- The level of the exit price be determined on a product-by-product basis;
- The SEP will be determined in two phases. In phase 1 the SEP will be the net price at which medicine is currently being sold. In phase 2 the benchmark for the SEP will be based on an international price, calculated according to a prescribed formula. Phase 2 commenced at the end of 2004, early 2005;
- New products will use international pricing as the benchmark from the date of launch. This change in approach rests firmly on the hard evidence secured during the comment period- information never accessed before or large difference in mark-ups across pharmaceutical companies. In a few cases, products were selling below the international average. At the opposite side of the spectrum, products were selling 80.00% above the international price. It was clearly not fair and it simply would not work to impose a simple, undifferentiated pricing formula across the board.

The guide used as a guideline to review the adjustment made to the SEP included the following formula (SA, 2013c:3):

$$\text{\% Adjustment} = 70\% \text{ (South African CPI)} + 15\% \text{ (Euro/Rand exchange rate)} + 15\% \text{ (Dollar/Rand exchange rate)}$$

Implementation of the SEP regulations

The SEP regulations specify that wholesalers, distributors and retailers (community pharmacies) from 2 August 2004 are allowed to sell, medicine only in accordance with the provisions of the regulations. This permitted a three month period to phase regulations in and to sort out technical obstacles. While the regulations make provision for the old and new systems to run parallel, this is clearly not practical, particularly when considering information technology systems (Osman, 2004).

For community pharmacies, these regulations specify that from 2 August 2004 schedule 0 medicine may be sold with the traditional mark-up that is currently used: Schedule 1 and 2 substances sold over the counter, i.e. without a doctor's prescription, will be sold with a "dispensing fee" of 16.00%, capped at R16.00 when the SEP of a product is more than R100.00 (Osman, 2004).

Osman further explains that when sold on prescription, Schedule 1 to 6 medicine will be sold at a "dispensing fee" of 26.00%, capped at R26.00 when the SEP is more than R100.00. The SEP is inclusive of the distribution fee and exclusive of value-added-tax (VAT)*.

*Value-added-tax can be defined as a tax levied and paid for to benefit the national revenue and calculated at the rate of 14.00% on the value of the supply concerned or the importation thereof. This tax will be levied (SA, 1991:19):

- on the importation of any goods into the Republic by any person on or after the commencement date (30 September 1991);
- on the supply by any vendor of goods or services supplied by him on or after the commencement date in the course or furtherance of any enterprise carried on by him;
- on the supply of any imported services by any person on or after the commencement date.

The regulations must be reviewed annually by the Minister with regard to the CPI the PPI (Production-Price-Index), and the need to ensure the availability, affordability and quality of medicine and Scheduled substances in the Republic (SA, 2004a:14).

Tshabalala-Msimang (2004), states that the pricing regulations, will however, take some time to move into top gear. When it does, South African consumers will find themselves on an equal footing with some other countries where the price of medicine is controlled. A year from then, in 2005, we should be paying nearly a third less, on average, for generic and original-name products. In contrast to this, though the South African government may have good intentions in wanting to

increase access to medicine and good quality healthcare, the imposition of a SEP has many unintended consequences, which may reduce access to medicine and compromise South Africa's healthcare system (Free Market Foundation, 2006).

Legal appeal regarding pricing regulations

The Pharmaceutical Society of South Africa (PSSA) and others including the Pharmaceutical Manufacturers Association (PMA) challenged the pricing regulations in the Cape High Court and the Supreme Court of Appeal (SCA). A full bench of the Supreme Court of Appeal ruled in favour of the PSSA and its partners on 20 December 2004. The SCA unanimously agreed that these pricing regulations should be set aside, and that the Department of Health should pay all legal costs (Bester & Hammann, 2005:47).

The Constitutional Court judgement of 30 September 2005, confirmed that the "dispensing fee" regulations were invalid. The court therefore recommended that the Pricing Committee reconsider the fee of 26% of the SEP capped at R26.00, giving regard to the availability of retail pharmacies (especially rural and courier pharmacies) (Tshabalala-Msimang, 2006).

This resulted in the regulated SEP and the "dispensing fee" no longer being in operation. Pharmacists and doctors could then charge any fee that would cover the costs of dispensing (Bester & Hammann, 2005:47). However, the verdict from The Constitutional Court did not influence the way the SEP of medicine was determined.

Current and future SEP

The amendment of the regulations for the transparent pricing system published in July 2010, as reflected in the Medicines and Related Substance Act (101 of 1965) state that (SA, 2010a:5):

- Where the SEP of a medicine or scheduled substance is < R75.00, the "dispensing fee" shall not be > R6.00 plus 46.00% of the SEP;
- Where the SEP is of a medicine or scheduled substance $\geq$ R75.00, but < R200.00, the "dispensing fee" shall not be > R15.00 plus 33.00% of the SEP, or;
- Where the SEP of a medicine or scheduled substance is $\geq$ R200.00, but < R700.00, the "dispensing fee" shall not be > R51.00 plus 15.00% of the SEP.
- Where the SEP of a medicine or scheduled substance is $\geq$ R700.00, the "dispensing fee" shall not be > R121.00 plus 5.00% of the SEP.

The SEP price was amended again and published in November 2010. This amendment stated that the “dispensing fee” to be charged by the pharmacist (SA, 2010b:4):

- Where the SEP of a medicine or scheduled substance is less than R75.00, the “dispensing fee” shall not be > R6.00 plus 46.00% of the SEP;
- Where the SEP of a medicine or scheduled substance is greater than or equal to R75.00, but less than R200.00, the “dispensing fee” shall not be > R15.75 plus 33.00% of the SEP;
- Where the SEP of a medicine or scheduled substance $\geq$ R200.00, but < R700.00, the “dispensing fee” shall not be > R51.00 plus 15.00% of the SEP;
- Where the SEP of a medicine or scheduled substance is $\geq$ R700.00, the “dispensing fee” shall not be > R121.00 plus 5.00% of the SEP.

However, in 2012, a new amendment to the regulations of the transparent pricing system was announced and published, which stated that (SA, 2012:4):

- If the SEP of a medicine or scheduled substance is $\leq$ R90.00, the “dispensing fee” cannot be > 30.00% of the SEP, and;
- If the SEP of a scheduled substance or medicine > R90.00, the “dispensing fee” may not > R27.00.

In September 2013, the regulations were amended again on recommendation of the Pricing Committee. These regulations state that (SA, 2013b:4):

- The “dispensing fee” should not be > R6.30 plus 46.00% of the SEP, if the SEP < than R81.00;
- Where the SEP is $\geq$ R81.00 but < R216.00, the “dispensing fee” should not > R16.00 plus 33.00%;
- If the SEP is $\geq$ R216.00 and < R756.00, the “dispensing fee” shall not > R55.00 plus 15.00%;
- The ‘dispensing fee’ should not be > R131 plus 5.00% of the SEP, if the SEP is $\geq$ R756.00.

Table 2.1 summarises the change in the “dispensing fee” with change in SEP when applied to a set amount example.

Table 2.1: Summary of the SEP regulation changes on the “dispensing fee”.

Time of SEP change	Medicine price example (SEP)	"Dispensing fee"
August 2004	R150.00 (over the counter, schedule 1 and 2)	R 166.00
	R150.00 (on prescription, schedule 1-6)	R 176.00
July 2010	R 50.00	R 79.00
	R 500.00	R 626.00
	R 1 000.00	R 1 171.00
November 2010	R 50.00	R 115.50
	R 100.00	R 148.75
	R 500.00	R 626.00
	R 1 000.00	R 1 171.00
2012	R 50.00	R 77.00
	R 100.00	R 127.00
	R 500.00	R 527.00
	R 1 000.00	R 1 027.00

From Table 2.1 it can be concluded that the changes in SEP resulted in an overall decrease in the “dispensing fee” from July 2010 until 2012, when using R50.00, R100.00, R500.00 and R1 000.00 as reference amounts.

2.5.1.7 National Health Insurance (NHI)

The present South African health system is neither rational nor fair, and the real debate has been about how best to structure and fund an alternative health care system that is both equitable and feasible (Ncayiyana, 2008:229). Furthermore, and as far back as 1944, the adoption of a fully tax-funded national health service was recommended (National Health Service) in the UK (United Kingdom), with health services totally free at the point of delivery. The recommendation was never implemented (Ncayiyana, 2008:229). Universal coverage is neither new nor unique to South Africa, intended to improve the health status of nations, including that of South Africans (Cock, 2009:2).

The NHI will be developed to (Department of Health, 2011b:18):

- Establish a single fund to achieve social solidarity and equity by pooling risks and funds;
- Provide equal access to health care for all South Africans irrespective of employment status;
- Procure services on behalf of all South Africans and effectively control financial resources and;

- Focus on strengthening of the public health service and involve cross-subsidisation due to the unemployment level in South Africa. The success of the NHI will depend on the functioning of the public health system (National Planning Commission, 2011:315).

** The free access to healthcare may discourage patients from paying for medicine, which in turn eliminates co-payments and therefore, can influence patient adherence to medicine treatment (refer to section 2.9).*

It is foreseen that every South African will be obliged to sign up for NHI, and to be registered in a private practice or other primary care facility that will be remunerated through capitation. The private sector will continue to exist, but largely as a contractual partner to the NHI (Ncayiyana, 2009:765).

The NHI is basically a medical scheme-to be governed by a board of trustees in the form of an authority to be created by legislation and making available only a prescribed set of benefits from a prescribed but legally accredited set of healthcare providers including doctors and hospitals for discussed costs between the state and the healthcare provider (Kirby, 2009).

Kirby (2009) states that this is already in place in the form of the Government Employees Medical Scheme (GEMS). This medical scheme represents a model of a NHI. Although GEMS operates as a registered medical scheme for the benefit of its members it uses the legislative structures available to provide access to government employees, one of the largest employee constituencies in the country, to healthcare at the “best” available price in very much the same way as NHI will provide benefits to the public.

2.5.1.7.1 Difference between social health insurance (SHI) and NHI.

SHI: Only those who contribute are entitled to prescribed benefits. Contributors may all be employed people, or defined groups in certain industries or all taxpayers (McLeod, 2009a:1).

NHI: Usually the same taxpayers would be the contributors, but everyone would be entitled to prescribed benefits (McLeod, 2009a:1).

The technical distinction between the two is very blurred in practice, where some technically social systems are called “National Health” and *vice versa* (McLeod, 2009a:1).

The social security system for healthcare will be illustrated below (McLeod, 2009a:2):

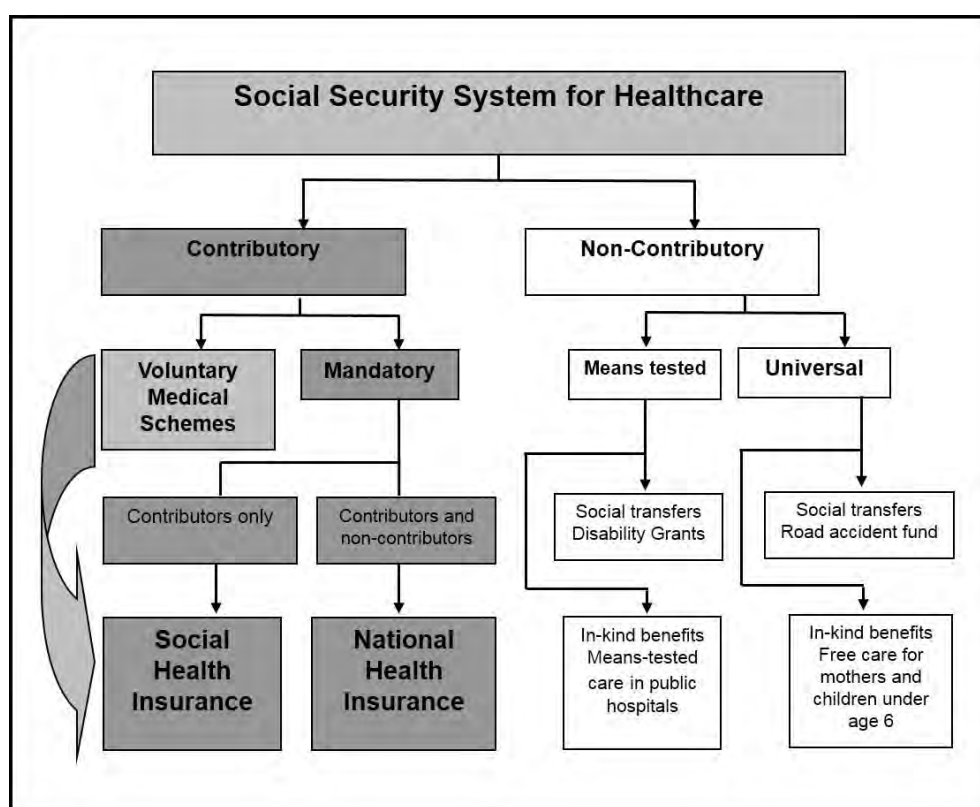


Figure 2.2 Possible influence of the NHI on the private health sector.

The NHI will contract with both NHI-accredited public and private sector organisations. The NHI will impact negatively on the private healthcare industry from a funding point of view and therefore likely to result in the shrinking of the current medical scheme industry (Nyati, 2010).

While the private medical schemes industry is clearly under pressure and facing serious questions about long-term sustainability, it will be difficult to see how projected NHI spending over the next fourteen years can be absorbed by the current tax base (Clark, 2011). Even with the NHI, medical schemes will still need to remain relevant and financially robust in order to provide a private alternative to the single-payer system envisaged (Clark, 2011). Therefore, it is not clear how private medical providers will deliver services to patients of the NHI, and *vice versa*, and whether they will be allowed to offer services to both NHI and private patients alike (Clark, 2011).

Ramjee and McLeod (2010:191) contribute by stating that the precise form of private health insurance is still requires much research and debate amongst all stake holders. It is thus clear that without critical elements such as Risk Equalisation Fund (REF) and mandatory membership of medical schemes, the current medical schemes environment is inherently unstable (*REF is further discussed under funding of the NHI*). Ramjee and McLeod (2010:191) conclude that debates around the issue of private sector participation tend to become politically and

ideologically heated but there are strong economic arguments for looking at the public private mix in technical terms, playing to the strengths of each sector.

2.5.1.7.2 Funding of the NHI system

If the government wants to increase the current public sector health budget from R100 billion to R200 billion to fund the NHI, it will require an 80.00% increase in personal Income tax (Stipp, 2009:2).

The NHI will be funded through a combination of current sources of government health spending, a modest mandatory or compulsory contribution by employer-employee contribution which will be split equally, including the removal of tax subsidy for medical schemes (Cock, 2009:1). Funding mechanisms used in other countries that might be considered in South Africa as used in other countries include (National Planning Commission, 2011:311):

- Private insurance through medical schemes;
- Taxes, which include direct and indirect tax, personal Income tax, value-added-tax (VAT) (also refer to section 2.3.2);
- Community financing;
- Donations; and
- Co-payments/ out-of-pocket fees (also refer to sections 2.3.2.2 and 2.5.1.2).

Contribution will be less than what members and their employers currently pay to medical schemes. Certain categories of workers, due to their low-income status will be exempted from the contribution (Cock, 2009:1).

Medical scheme members will pay 85.00% of their contribution, irrespective of the insurance option they are on, to a global fund which will pay both public and private sector providers. Non-medical scheme members will have to pay 5% of their income to the fund. Medical schemes will only be able to cover benefits not covered by the NHI; therefore a patient will not be able to buy cover in the private sector for cancer treatment, if cancer was covered in the public sector (Van den Heever, 2009a).

Shisana (2009:1) elaborates, stating that in terms of the African National Congress (ANC) plan, contributions will be collected by the South African Revenue Service (SARS) and allocated directly to the central NHI fund that will be responsible for the pooling and purchasing of the health services from approved and accredited healthcare providers in both the public and private sectors.

Risk equalisation can be defined as a system of financial transfers to ensure expected cost sharing for providing benefits to all medical scheme members (SA, 2008:5).

The effect of risk equalisation is to ensure that everyone across all medical schemes pays a similar community rate for the package of benefits (the PMBs), irrespective of their individual health risk (McLeod, 2009a:7). The community rate will no longer be influenced by age and disease, but only by the efficiency of the medical scheme in purchasing and delivering care to its members (Armstrong *et al.*, 2004:18; McLeod, 2009a:7).

Other countries with risk equalisation in a competitive market include Germany, Switzerland, Belgium, the Netherlands, Israel, Australia and the United States (Leu *et al.*, 2009:15; McLeod, 2009a:8). Risk equalisation techniques are also present in many other systems like the United Kingdom where it is used to equalise risk between regions of the country in the National Health System (NHS) (McLeod, 2009a:8).

It is expected that the REF in South Africa will equalise the expected risk faced by all medical schemes on the basis of several risk factors, including age, gender (not yet implemented), maternity events, numbers with one of 26 chronic diseases and numbers with multiple chronic diseases (McLeod, 2009a:8). Figure 2.3 illustrates the proposed flow of funds under mandatory health insurance (McLeod, 2009a:8):

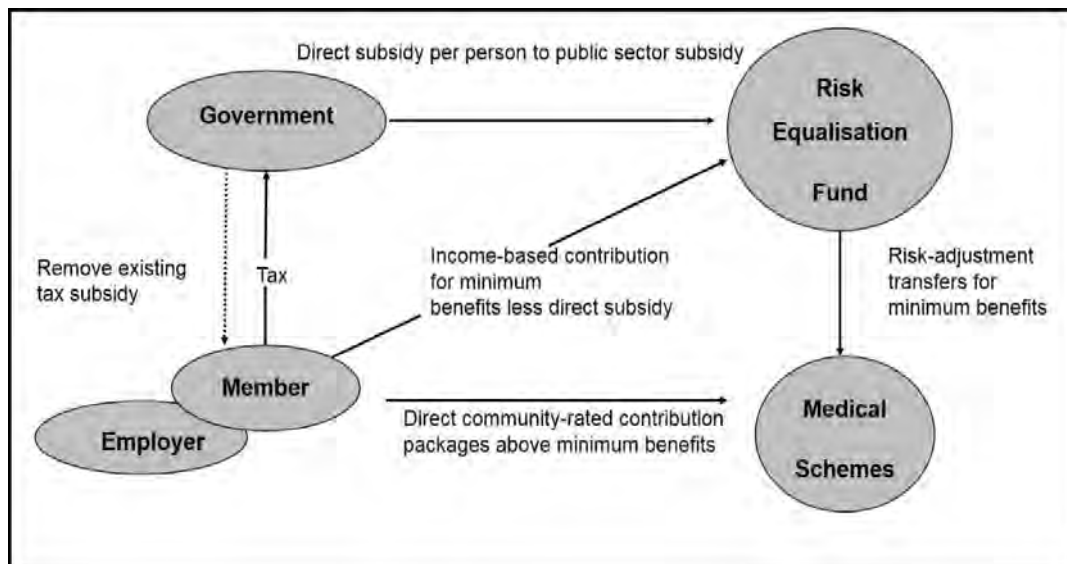


Figure 2.3: Envisaged flow of funds under mandatory health insurance administration of the NHI.

The ANC's view is that the NHI's managing authority will be responsible for the allocation of the resources pooled in the fund, and for the purchasing of health services from private and public healthcare providers, through its provincial and district healthcare authorities (Anon., 2009:1). There is no evidence that private-sector health facilities are more, or less efficient than government facilities; this depends on the setting (WHO, 2010:60).

South African obstacles with regard to the NHI implementation

According to Van den Heever (2009b:1) the ANC (African National Congress) task teams' proposals are so flawed that they cannot even be considered as a long-term objective. Van den Heever (2009b:1) further states that *"it is the wrong model"* and point out that our government's reform efforts should rather focus on strengthening and improving current systems in both public and private sectors, before considering the implementation of a very expensive and complicated NHI plan expected to cost tax payers an additional R100 billion. McLeod (2009a:1) agrees and warns against implementing an NHI system without robust debate and proper research. As a result the NHI was implemented in 2012 through pilot studies in several areas in South Africa. The purpose of the pilot studies will focus on the most vulnerable sections of society across the country and include (Motsoaledi, 2012):

- To assess whether the health service package, the public healthcare teams and a strengthened referral system will improve access to quality health services, particularly in the rural and previously disadvantaged areas of the country;

- Reduce high maternal and child mortality through district based health interventions;
- Strengthen the performance of the public health system in readiness for the full roll-out of NHI;
- To assess the feasibility, acceptability, effectiveness and affordability of innovative ways of engaging private sector resources for public purpose;
- Strengthen the functioning of the district health system;
- Examine the extent to which communities are protected from financial risks of accessing needed care by introducing a district mechanism of funding for health.

Ten pilot study areas in the different provinces were selected for the pilot studies. These are (Health Systems Trust, 2014):

- Free-State Province (T. Mofutsanyana district);
- Eastern Cape Province (O. Tambo district);
- Gauteng Province (Tshwane district);
- Kwazulu Natal Province (Umzinyathi and Umgungundluuvu districts);
- Limpopo Province (Vhembe district);
- Mpumalanga Province (G. Sibande district);
- North West Province (Dr. K. Kaunda district);
- Northern Cape Province (Pixley ka Seme district), and;
- Western Cape Province (Eden district).

Bateman (2012:818) contends that a transition to universal health coverage where everyone could access quality healthcare coverage would be “extraordinarily expensive”. Therefore, no amount of funding will ensure that the NHI will be sustainable unless the systematic challenges and shortcomings in the South African health system are addressed (SA, 2011:43).

Van den Heever and McLeod (2009:1) emphasise that the ANC proposals are totally out of sync with the realities of the current health system and what the country can afford. The estimated total cost ranges between R100 billion and R320 billion, depending on the package of benefits it will cover, placing an unaffordable tax burden on the country’s five million tax payers who will be

expected to fund the system. However, Baleta (2012:1185) reports that this cost will escalate to R225 billion (US\$33 billion) or 6.20% of GDP by 2025.

Despite the effort of government to regulate the private health sector, experts agree that the sector is riddled with insufficiencies, excessive administrative expenses and inflated prices. This has led to the following obstacles (Cock, 2009:2):

- Membership of medical schemes has become increasingly unaffordable for South Africans (Cock, 2009:2).
- Premiums or contributions cost medical scheme members between R12,000 and R80,000 per year and has continued to increase at annual rates far exceeding the inflation rate or wage increases since the 1980's (Cock, 2009:2).
- The high cost of medical schemes and affordability has meant the total number of beneficiaries has decreased since 1994, from approximately 20% of the population to 15% to about seven-million people (Cock, 2009:2).

According to Van den Heever (2009c:4), in developing countries where NHI has been implemented, it was made possible only by a significant growth in formal employment. Van den Heever (2009c:4) also notes that without the necessary growth in employment, NHI will place a heavy burden on government funds. In countries where NHI was introduced, it evolved out of systems such as those currently in place in South Africa's medical scheme environment; not from environments such as our current public health system (Van den Heever, 2009c:4).

Ncayiyana (2008:229) contributes by stating the implementation of the NHI is be easier said than done. There are a number of imponderables to be sorted out in the design and eventual implementation of the NHI, not least of which is the human and managerial capacity that will be required to support a scheme of this magnitude and complexity. Broomberg (2009:4) adds that South Africa needs to accept that the universal access to a comprehensive range of good quality healthcare services cannot be achieved in the short term. In other countries, it took between 25 and 100 years to fully implement NHI.

2.5.1.7.3 Worldwide obstacles with regard to NHI implementation

The World Health Organization (WHO) identified obstacles that restrict countries from moving closer to universal coverage. These include:

- The availability of resources: No country, no matter how rich, has been able to ensure that everyone has immediate access to every technology and intervention that may improve their health or prolong their lives (WHO, 2010:xi);
- The second barrier is an overreliance on direct payments at the time people need care, which includes over-the-counter payments for medicine and fees for consultation and procedures. Even if people have some form of health insurance, they may need to contribute in the form of co-payments (refer to section 2.3.2.2), co-insurance or deductibles (WHO, 2010:xi);
- The third impediment is the inefficient and inequitable use of resources. At a conservative estimate, 20.00% to 40.00% of health resources are being wasted (WHO, 2010:xi).

Thus, the path to universal coverage is simple and countries should raise sufficient funds, reduce the reliance on direct payments to finance services, and improve efficiency and equity. No country has yet been able to guarantee everyone immediate access to all the services that might maintain or improve their health. They all face resource constraints of one type or another, although these are most critical in low-income countries (WHO, 2010:xi).

2.5.1.7.4 The NHI model

Stipp (2009:2) speculates that the organisational and delivery model for South Africa's NHI could be one of the following:

- The ANC model as set out in the 200-page ANC NHI task team document;
- A public-sector contribution model, which is favoured by the private sector;
- An insurance-based model, which is extremely complex.

Hudson (2009:2) confirms that a reimbursement model based on a capitation fee as outlined in the Shisana (2009:1) document will be implemented.

In contrast Stipp (2009:2) says that South Africa doesn't have the resources for an NHI. The country needs 85 000 more beds, 115 000 more nurses and 5 600 more doctors before it can be implemented. Broomberg (2009:4) elaborates on Stipp's statement, saying that the estimated cost of expanding the current medical scheme package to the whole population would be approximately R325 billion, which is about 28% of the country's GDP. Further it would require at least 60 000 more hospital beds, 320 000 more nurses and 124 000 more doctors.

Some progress during the implementation of the NHI in 2013, was the strengthening of the public sector in the first five years, with the implementation of a new central NHI fund in 2014/2015 (Matsoso & Fryatt, 2013:22). This central NHI fund (refer to section 2.5.1.7.3) will have its own governance mechanism with an NHI funding body assigned with different options for roles, relationships and responsibilities (Matsoso & Fryatt, 2013:30). In 2014, a financing paper by the National Treasury and the white paper on NHI was completed and will be tabled in Cabinet (Gordhan, 2014:13). The two main problems are, the high cost of private healthcare which has to be reduced and the improvement of health delivery in the public health sector (Gordhan, 2014:13). NHI pilot project districts have been established in each province with the support of an additional grant (refer to section 2.5.1.7.4 for these selected districts) (Gordhan, 2014:13). Clinic and hospital building and refurbishment programmes are supported by R1.2 billion allocated for piloting general practitioners' contracts (Gordhan, 2014:13). Two other areas of progress with regards to the NHI include, an Office of Health Standards Compliance which has also been established to ensure that public health services meet required standards, and the funding framework of the National Health Laboratory Service and associated research activities (Gordhan, 2014:13).

2.5.2 Pricing structures in other countries

2.5.2.1 Health systems and strategies in reducing the cost of pharmaceuticals in South Africa and other countries

Different countries apply different cost strategies, but many of these strategies are synonymous in many countries as identified possible cost savers and differ with regard to the laws and regulations in these countries.

Some of these strategies include patient co-payments, reference price lists, positive lists (formularies), generic medicine and limits of prescribing (or reimbursements of certain medicine) which will be discussed below:

Refer to section 2.5 for similar cost reducing structures used in South Africa. Also see Table 2.2 and Table 2.3 for a summary of cost reducing structures used in other countries.

2.5.2.1.1 Patient co-payments

Patient co-payments are meant to make prescribers and patients more cost-conscious, therefore reducing the financial burden on the health care systems in the long run (Almarsdóttir & Traulsen, 2005:146) (refer to Table 2.3).

2.5.2.1.2 Reference price lists

Reference pricing is the price of a certain medicine in a specific class that is set as a reference for other medicine. The reference medicine is generally the least expensive medicine in that class. If, however, the physician and/or patient decide to use a more expensive medicine, the difference between the two items will incur a co-payment by the patient (see co-payments above) (Almarsdóttir & Traulsen, 2005:146).

Patient co-payment is common practice in all European countries with the exception of Ireland and Malta. Patient co-payments are usually charged according to one of the following mechanisms (Perry, 2006:8):

- Fixed fee per prescription (per item, per prescription, or according to pack size);
- A percentage of cost of the medicine prescribed (partially reimbursed);
- The difference above the reference price (reference price is equal to the maximum reimbursed price);
- Combinations of the above usually comprise a fixed fee and a percentage of the cost of medicine prescribed.

2.5.2.1.3 Positive and negative formulary lists

Formularies are lists of pharmaceuticals approved for reimbursement by the insurer (Almarsdóttir & Traulsen, 2005:146). If the prescriber uses a medicine that does not appear on the formulary for that specific treatment, the patient may be liable for the payment of that medicine. The negative lists, however, contain medicines that are paid fully by the patient (Tele & Groot, 2009:74).

2.5.2.1.4 Limits on prescribing

Some countries have limits on prescribing and/or reimbursement for certain medicine. These medicines are restricted in some ways, as to certain medical specialists or hospitals (Almarsdóttir & Traulsen, 2005:146). In South Africa, guided limits for diagnoses and treatment were introduced in the public sector through the EDL (refer to section 2.3.2.3). The private sector of South Africa is guided by the use of PMBs and formularies for diagnosis, treatment and reimbursement of medical conditions as well as generic substitution (refer to sections 2.5.1.1, 2.5.1.4 and 2.5.1.5.2)

The effect and potential of generic medicine will be discussed below:

2.5.2.1.5 Generic substitution in other countries

An increase in generic medicine item spending versus original medicine worldwide was estimated to increase from 61% (\$588.65 billion) in 2012 versus 27.00% (\$260.55 billion) to 52.00% (\$624 billion) versus 36.00% (\$432 billion) in 2017 (IMS Institute of Healthcare Informatics, 2013:23). Pharmerging markets were estimated to increase from 58.00% (\$205.27 billion) in 2012 versus original medicine items (31.00%; \$69.44 billion) to 2017 with generic medicine contributing 63.00% (\$233.10 billion-\$252 billion) versus 26.00% of original medicine, claimed \$96.20 billion-\$104 billion) (IMS Institute of Healthcare Informatics, 2013:23).

Pharmerging countries: Pharmerging countries can be defined as countries with > \$1 billion on absolute spending growth between 2012 and 2016 and has a GDP per capita of < than \$ 25 000 at purchasing power parity (PPP) (IMS Institute of Healthcare Informatics, 2012:5). These countries include: China, Brazil, India, Russia, Mexico, Turkey, Poland, Venezuela, Argentina, South Africa, Indonesia, Romania, Thailand, Ukraine, Egypt, Pakistan and Vietnam (IMS Institute of Healthcare Informatics, 2012:5).

Pharmaceutical expenditure is on the increase, and greater focus is placed on policies designed by European policy makers and national health authorities to focus on cost-containment (Carone *et al.*, 2012:5). As a result, the role of generic medicine has been to provide essential medicines that are both high quality and affordable with high cost-saving potential throughout the European Union* (EU) (IMS Health, 2010:3; Carone *et al.*, 2012:5). Significant contributions arising from the efficient use of generic medicine policies and increased patient accessibility to medicine has provided significant savings for EU healthcare systems (IMS Health, 2010:3). Thus, the scope for further savings is dependent on a sustainable generic medicine industry and policy supported by stakeholders, governments and patients (IMS Health, 2010:3).

There has been estimated that, to date, generic medicine in the United States has saved the health system \$ 1.5 trillion from 2004 until 2013 (Generic Pharmaceutical Association, 2014:1). A study done in the United States from 2002-2011 confirms the possible savings that could be achieved through generic substitution as shown above (Generic Pharmaceutical Association, 2012:1). This study, known as the Generic Drug Savings study revealed that generic medicine use saved the United States health care system around \$1.07 trillion from 2002-2011, with

* EU countries include: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden and United Kingdom (Tele & Groot, 2009:74).

savings of \$192.8 billion in 2011 (Generic Pharmaceutical Association, 2012:1). This study further showed that the savings achieved from generic medicine introduced since 2002, total \$481 billion over the past decade and the increase is exponential. Central nervous system generic medicine such as anticonvulsants and antidepressants as well as cardiovascular medicine accounted for 57.00% of the total annual savings (Generic Pharmaceutical Association, 2012:2).

In the EU generic medicines have generated savings of approximately €30 billion and with the expansion of the EU to 27 member states this number is set to double (IMS Health, 2010:1).

The major hurdle to overcome with this cost saving strategy is that there is a lack of transparency between policies and variations in pricing and reimbursement systems, socio-demographics and the management of healthcare within EU countries, which makes comparisons difficult (IMS Health, 2010:2). Therefore, policies relevant in some countries might be irrelevant in other countries.

Across the EU, market forces vary, depending whether the healthcare system in place focuses attention on physicians, pharmacists, wholesalers or patients (refer to Table 2.2).

Where patient co-payment policies are in place, generic medicine may be less attractive for pharmacists to dispense, but offers a lower financial burden for the patient (IMS Health, 2010:10). Some degree of substitution, whether automatic or optional exists in most EU countries which encourages generic medicine utilisation (IMS Health, 2010:11).

Carpenter (2010:1) reports that before a pharmacist in the United States may generically substitute a medicine that has received Abbreviated New Drug Application (ANDA) process from the Food and Drug Administration (FDA), the pharmacist must look at their state law. Generally, a medicine may be generically substituted in the United States if (also refer to table 2.2) the medicine has the same quantity of active ingredient, the same dosage form, meets applicable standards of strength, quality and purity and can be taken in the same quantities that will provide a comparable therapeutic effect as is applicable in South Africa (refer to section 2.5.1.5.2). The different states within the United States, however, are not consistent on how a medicine may be generically substituted and which medicine may be substituted.

Different cost containment strategies have been implemented in different countries and are summarised below in Table 2.2 and Table 2.3 (Modified from IMS Health, 2010:11; Tele & Groot, 2009:74-77):

Table 2.2: Cost containment strategies in different countries.

Country	Formulary		Reference Pricing	Favouring original products	Generic substitution	
	Positive List	Negative List			Use of generic medicine	Substitution at pharmacy level
Austria	✓		Voluntary reference pricing instigated in 2002. The Federation of Austrian Social insurance Institutions seek voluntary price reductions from Companies who have single sourced products in a class once generic medicine are available.!		X	X
Belgium	✓		Reference pricing for generic equivalents.		✓	In exceptional circumstances.
Bulgaria	✓		Reference pricing based on max. value/unit of active substance.		✓	✓
Cyprus	✓		N/A		X	N/A
Czech Republic	✓		At least one product in therapeutic group is fully reimbursed.		N/A	X
Denmark	✓		✓ Lowest priced generic equivalent available on the market.		✓	✓
Estonia	✓		Health insurance establishes maximum reimbursement price with difference between the reference price and medicine of choice, should the latter be higher.‡		✓	No mandatory generic substitution.
Finland		✓	✓ Reimbursed categories classified according to severity of illness and necessity of treatment.		✓	✓ if in certain pricing bracket.
France	✓		✓ Narrow reference groups.		Prices of generic medicine 40% lower than original	✓
Germany	✓	✓	✓ Reference price set by Reference Price Institute.		✓	✓
Greece			Lowest reference price system among 15 EU member states.	✓	Prices of generic medicine cannot exceed 80% of original.	Not permitted.
Hungary	✓		Therapeutic reference pricing from September 2003.		Generic medicine generally 10-20% cheaper than originals.	No incentives for generic prescriptions.
Ireland	✓				✓	X
Italy	✓		✓ Ref. price = weighted average of similar products, whose price < max.price of generic medicine.		Generic market negligible <1%.	✓

Country	Formulary		Reference Pricing	Favouring original products	Generic substitution	
	Positive List	Negative List			Use of generic medicine	Substitution at pharmacy level
Latvia	✓		Reimbursement for treatment of chronic and severe illnesses with 4 reimbursement categories.		Cheapest product on positive list to be issued.	✓
Lithuania	✓	✓	Clustered system in reference pricing.			
Luxembourg	✓		N/A		X	N/A
Malta	✓		Pink card/Yellow card.		N/A	N/A
Netherlands	✓		Reference pricing for therapeutic interchangeable medicine.		✓	✓
Poland	✓		Reimbursement limit = cheapest generic in given class.		✓	✓
Portugal	✓	✓	✓ Reference price implemented in 2003 = highest price of generic medicine.	✓	✓	✓
Romania	✓		Reference price = the lowest priced product in cluster with same active ingredient.		✓	✓
Slovakia	✓		Generic reference pricing and resection of pricing every 3 months Patent protected medicine are reimbursed based upon cheapest product in ATC group.		Generic price downfall due to internal reference pricing.	Generic substitution not legally mandated.
Slovenia	✓		In 2003 reference pricing introduced, in 2007 rules introduced. Maximum price of original medicine was not allowed to exceed 100% of lowest price in reference countries and generic medicine, 85% of average price in these countries.*		✓	Substitution is permitted, but pharmacist is not rewarded if he/she substitutes with cheaper medicine.†
Spain	✓	✓	✓ National reference pricing, Andalucía reference pricing.		✓	✓ With doctors' permission.
Sweden	✓	✓	✓ Reimbursement on basis of cost-effectiveness.		✓	✓ Reference price at pharmacy buying level.
United Kingdom		✓			✓	✓
United States					✓	✓

Country	Formulary		Reference Pricing	Favouring original products	Generic substitution	
	Positive List	Negative List			Use of generic medicine	Substitution at pharmacy level
Australia			Reference pricing, of which therapeutic group pricing is a variant is increasingly used in many jurisdictions. Australia is almost alone among countries in including brands of other medicine in the same therapeutic group as a comparison which includes lowest medicine price within each group is used a benchmark. [%]		✓	Substitution after consultation with the patient or carer. ^{&}
South Africa	✓		Reference pricing through mark-up system and SEP price		✓	✓
Namibia	✓		Reference pricing through Namibian Maximum Price List (NMPL) South African single SEP has influence.		✓	✓

N/A- not applicable

* (Turk, 2008:2).

(Kazakov, 2006:253).

‡ (Kanavos *et al.*, 2009:46).

& (Beecroft, 2007).

! (Godman *et al.* 2010:2493).

% (Sweeny, 2005:4).

Table 2.3: Co-payments as cost containment strategies in different countries.

Country	Co-payments
Austria	Flat fee per script item.
Belgium	Lower co-payment for generic medicine (20% instead of 25%).
Bulgaria	Co-payments for prescribed outpatient medicine.
Cyprus	Patient entitled to reduced fee services are reimbursed, private patients are not reimbursed.
Czech Republic	Co-payments for prescribed medicine where pharmaceuticals exceed reference reimbursement level.
Denmark	Adults: mix of flat fee and tiered percentages as well as co-payments under certain conditions.
Estonia	Different co-payments for pharmaceuticals depending on the severity of disease. Co-payments as co-insurance, flat fee, and difference between reference price and choice of medicine.*
Finland	Co-payments per medicine purchase as well as additional refunds under certain conditions.
France	Co-payment levels are set on the basis of medical necessity and product innovation. Exemptions apply such as for patients with chronic conditions.
Germany	Fixed co-payments based on pack size.
Greece	Reimbursement is based on a three-tiered system of co-payment.
Hungary	The subsidy can be at different percentages or a fixed amount.
Ireland	Depending on the scheme.
Italy	Patients only pay excess over reference price. Co-payments were abolished in 2001, but some regions introduced it in 2002.
Latvia	Reimbursed according to degree of severity.
Lithuania	N/A
Luxembourg	N/A
Malta	No co-payment in The Government Health Services.
Netherlands	Flat co-payment and deductible.
Poland	Patients co-pay the difference in price above the reference price.#
Portugal	Different reimbursement categories for original medicine, generic and for pensioners.
Romania	Patients pay 10% or 50% of reference price. Patients suffering from one more of 31 diseases, do not make co-payments. Lower co-payments on generic medicine.

Country	Co-payments
Slovakia	Average co-payment rate of all partially reimbursed medicine must not exceed 20%.
Slovenia	Patients co-pay the difference in price above the reference price. [#]
Spain	Different co-payments rates such as for the active population and their dependant and for medicine in certain chronic conditions.
Sweden	When certain costs are exceeded, certain reimbursements are granted.
United Kingdom	Flat fee per script item as of 1 April 2002. Co-payments on dentistry.
United States	Co-payments on certain services.
Australia	Co-payment on prescription pharmaceuticals.
South Africa	Co-payments under certain conditions.
Namibia	Co-payments under certain conditions.

[#] (Kazakov, 2006:253).

^{*}(Kanavos *et al.*, 2009:44).

Table 2.2 and Table 2.3 conclude that with the different countries listed, cost incentives such as patient co-payment, price referencing and pharmacy level substitution compare with that of South Africa where they are also implemented. Of the countries listed above 80.60% (n = 31) use generic medicine in some other way. The place where generic substitution usually takes place as a cost saving option is at pharmacy level, and not used in 35.00% of these countries (IMS Health, 2010:11; Tele & Groot, 2009:74-77; Turk, 2008:2; Kazakov, 2006:253; Kanavos *et al.*, 2009:46; Beecroft, 2007; Godman *et al.* 2010:2493; Sweeny, 2005:4).

Furthermore, Tele and Groot (2009:80) conclude that the introduction of generic substitution shifted the trend from an increase into a decrease in patient and society expenditures on medicine. Therefore, the positive impact of generic substitution on efficiency is a known priori; it is still underused by the governments.

Patient co-payments are also the most used cost-control measure in the EU, but the levels differ across these countries. Belgium, Portugal, and Romania have a lower co-payment level for generic medicine compared to the original medicine (Tele & Groot, 2009:81). Austria and UK apply a flat fee, whereas countries such as Greece, France and Romania have a three-tiered system for co-payment. The majority of EU countries have a 100.00% reimbursement scheme in place for highly vulnerable groups and those suffering from serious disease as summarised in Table 2.3.

2.5.2.1.6 Formularies

A study was done in the United States in 2010 to determine the extent to which health plan formularies were consistent with recommended medicine listings and to determine the potential cost savings on total medicine expenditure (Kjos *et al.*, 2010:321). This study concluded that, not only could the improvement of medicine formularies lower overall prescription medicine costs, it also had the potential to promote a more balanced pharmaceutical market to combat the continuous rise of prescription medicine prices (Kjos *et al.*, 2010:329).

It can thus be concluded from this section, that other countries also use and implement interventions such as generic substitution, formularies and reference pricing to maintain and reduce the cost of medicine treatment as in South Africa (refer to sections 2.4 and 2.5 as well as Tables 2.2 and 2.3), although in different ways.

2.6 Chronic disease

2.6.1 Definition and overview

Chronic disease can be defined as having a long course of illness (Bureau of Chronic Disease, 2012). Furthermore, chronic diseases are rarely spontaneously resolved and are generally not cured by medicine or prevented by vaccine (Bureau of Chronic Disease, 2012).

The burden of disease can be defined as the impact of impaired health from the perspective of epidemiology (morbidity and mortality), cost of illness, and quality of life and other risk factors (De Lissovoy, 2007:1046; Econex, 2009:1).

The various sources of burden-disability, absenteeism, caregiver burden, presenteeism burden and premature mortality can impact workers across the spectrum of economic activity (De Lissovoy *et al.*, 2009:7).

The global burden of disease measures the burden of disease using the disability-adjusted life year (DALY) (WHO, 2011b). The DALY is a health gap measure, which combines information on the impact of premature death, disability and other non-fatal health outcomes (Nielsen, 2000:2).

Nielsen (2000:2) further elaborated that one DALY represents one lost year of “healthy” living life. This indicates the burden of disease of a given population as a measurement of the gap between current health status and an ideal situation where everyone lives into old age free of disease and disability (Nielsen, 2000:2).

Chronic diseases are the largest cause of death in the world, led by cardiovascular disease (17 million deaths in 2002, mainly from ischemic heart disease and stroke) and followed by cancer (7 million deaths), chronic lung disease (4 million), and diabetes mellitus (almost 1 million) (Yach *et al.*, 2004:2616). In addition it was reported in the United States that currently 10% of health care dollars spent on overall direct costs related to diabetes, amounting to \$92 billion a year (1.5 times the amount spent on stroke or heart disease) (Swartz, 2010:1).

Michaud and Wolfe (2007:886) state that the more co-morbid illnesses a person has, the greater the interference with treatment and the greater the medical costs, disability and risk of mortality. Thus, it is important to recognise such illnesses and to account for them in the care of the individual patient and in understanding research outcomes (Michaud & Wolfe, 2007:886).

2.6.2 Chronic disease list conditions (CDL)

The CDL conditions in South Africa as listed by the Medical Schemes Act (131 of 1998) are summarised in Table 2.4 below (SA, 2003b). The treatment algorithm for bipolar mood disorder was only made available in 2009 and is therefore not included in the empirical investigation (SA, 2009).

Table 2.4: Classification of the 27 CDL conditions.

CDL Condition	CDL Condition
Cardiovascular disease	Psychiatric Disease
Hypertension	Bipolar Mood Disorder
Hyperlipidaemia	Schizophrenia
Coronary artery disease	Musculoskeletal
Cardiac failure	Rheumatoid Arthritis
Cardiomyopathy disease	Immunological Disease
Dysrhythmias	Systemic Lupus Erythematosus
Respiratory disease	Gastro-Intestinal Disease
Asthma	Crohn's Disease
Chronic Obstructive Pulmonary Disease	Ulcerative Colitis
Bronchiectasis	Renal Disease
Endocrine Disease	Chronic Renal Disease
Diabetes Mellitus Type 1	Haematological Disease
Diabetes Mellitus Type 2	Haemophilia A
Diabetes Insipidus	Haemophilia B
Hypothyroidism	Ophthalmological Disease
Addison's Disease	Glaucoma
Central Nervous System Disease (CNS)	
Epilepsy	
Parkinson's Disease	
Multiple Sclerosis	

2.6.3 Chronic conditions in South Africa and other countries and relationship between co-morbid diseases.

Co-morbidity can be defined as a patient having any additional co-existing disease to a particular index disease (Feinstein, 1970:455-466). Co-morbidity can further be defined as a person having more than one disease or conditions at a particular time (Centers for Disease Control and Prevention, 2014).

Thus, for the purpose of this study, the term co-morbidity is used when an individual has more than one chronic disease at a specific point in time.

In the United States, about 80.00% of Medicare spending is devoted to patients with four or more chronic conditions, with costs increasing exponentially as the number of chronic conditions increases (Valderas *et al.*, 2009:357).

There are three main ways in which different diseases may be found in the same individual: chance, selection bias, or by one or more types of causal association (Valderas *et al.*, 2009:360). Co-morbidity that occurs by chance or selection bias is without causal linkage but is still important because it may lead to erroneous assumptions about causality (Valderas *et al.*, 2009:360). Figure 2.4, below illustrates the different etiological models of co-morbid diseases (Adapted from Valderas *et al.*, 2009:361).

In the *direct causation model*, the presence of one disease is directly responsible for another. From a clinical perspective, this model would also include the situation in which treatment for one disease has caused another condition.

In the *associated risk factors* model, the risk factors for one disease are correlated, making the simultaneous occurrence of the disease more likely.

In contrast to the above, the *heterogeneity model*, disease factors are not correlated, but each is capable of causing diseases associated with other risk factors.

The *independence (distinct disease) model*, the simultaneous presence of the diagnostic features of the co-occurring diseases actually corresponds to a third distinct disease.

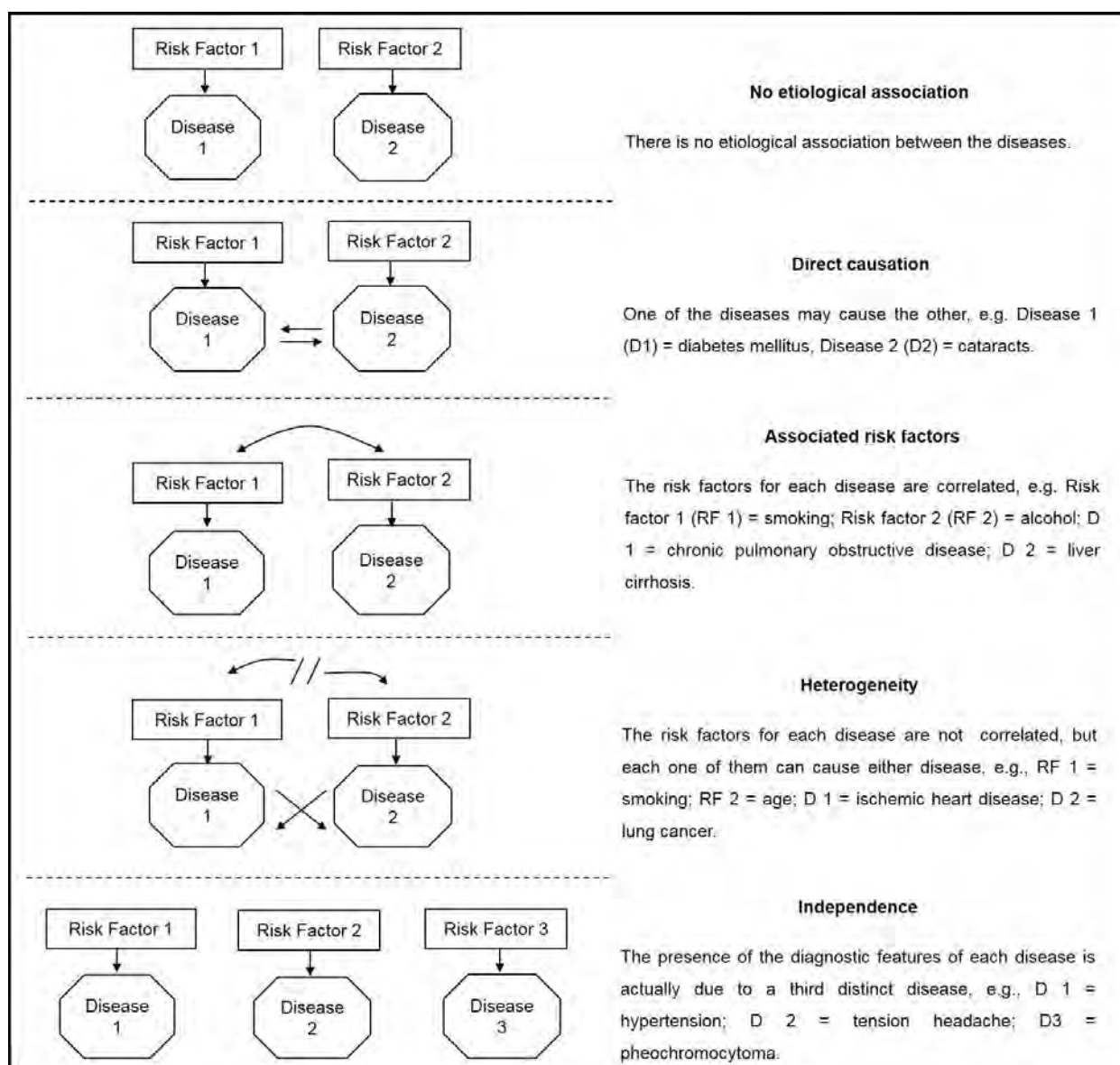


Figure 2.4: Etiological models of co-morbid diseases.

The same study was done by Innovative Medicines South Africa as in Chapter 1, to determine the impact of chronic disease on a future NHI with data from the four largest administrators (Discovery Health (Pty) Ltd, Medscheme (Pty) Ltd, Old Mutual Healthcare (Pty) Ltd and Metropolitan Health Group (Pty) Ltd (McLeod, 2009b:1). Further results revealed are listed below in Table 2.5 as summarised by McLeod (2009b:7):

Table 2.5: Estimate of people needing treatment for chronic disease utilising NHI in South Africa.

Disease	1994	2000	2005	2009	2015	2020	2025
Two simultaneous conditions	663,945	777,774	872,288	946,116	1,057,414	1,152,591	1,247,208
Three simultaneous conditions	151,224	176,103	197,502	214,950	242,077	265,992	289,560
Four or more simultaneous conditions	20,425	23,695	26,585	29,041	32,960	36,469	39,901
Sum of all CDL conditions (including multiple conditions)	4,015,863	4,678,156	5,195,894	5,580,920	6,145,386	6,616,605	7,078,417
Number of people with CDL conditions	2,987,745 9.70%	3,476,626 10.10%	3,848,285 10.60%	4,117,082 11.00%	4,503,996 11.70%	4,821,470 12.40%	5,131,046 13.00%
Number of people with multiple conditions	835,594 2.70%	977,571 2.80%	1,096,375 3.00%	1,190,107 3.20%	1,332,451 3.50%	1,455,052 3.70%	1,576,670 4.00%

It can be concluded from the data that the number of people with CDL conditions and combinations thereof are increasing consistently from 1994 to 2025 and South Africa will therefore have a growing chronic disease burden (McLeod, 2009b:7).

Individuals with multiple chronic conditions have clinical needs that may differentiate them from persons with a single chronic condition. Evidence indicates that chronic conditions cluster, and that persons with one chronic condition are more likely to have other conditions. Moreover, persons with multiple chronic conditions may have more rapid declines in health status and a greater likelihood of disability (Wolff *et al.*, 2002:2269). Horning *et al.* (2007:28) contributes that by the age of 75 years, the average American has two or three chronic medical conditions, therefore, the overall management of patients with multiple disease states can be challenging and costly. Subsequently, adherence to established clinical guidelines becomes extremely important (Horning *et al.*, 2007:28).

Multiple co-morbidities are also common among patients with chronic obstructive pulmonary disease (COPD), and they are often prescribed complex medicine regimens comprising time contingent and as-needed medicine to be administered *via* multiple routes for both respiratory and non-respiratory conditions. Depression is a common co-morbidity in a patient with COPD, and a known risk for non-adherence (George *et al.*, 2005: 3199).

A study was done in South Africa in 2001 to determine the prevalence and cost of CDL conditions by using beneficiaries registered on the MediServe database at Medscheme Integrated Care. Hypertension, asthma, diabetes mellitus and hyperlipidaemia were the most common conditions. The majority of registrations were for CDL conditions as a co-morbidity to another CDL condition (McLeod *et al.*, 2002:v). Further results revealed that 62.50% of beneficiaries had a registered single CDL condition, 25.00% had two conditions and the balance had multiple CDL conditions, with a maximum of eight separate conditions for a single beneficiary. Furthermore, there were 2007 combinations of the 27 CDL conditions (McLeod *et al.*, 2002:v).

The graph below represents the prevalence of the most common CDL condition registrations during 2001 (Adapted from McLeod *et al.*, 2002:19):

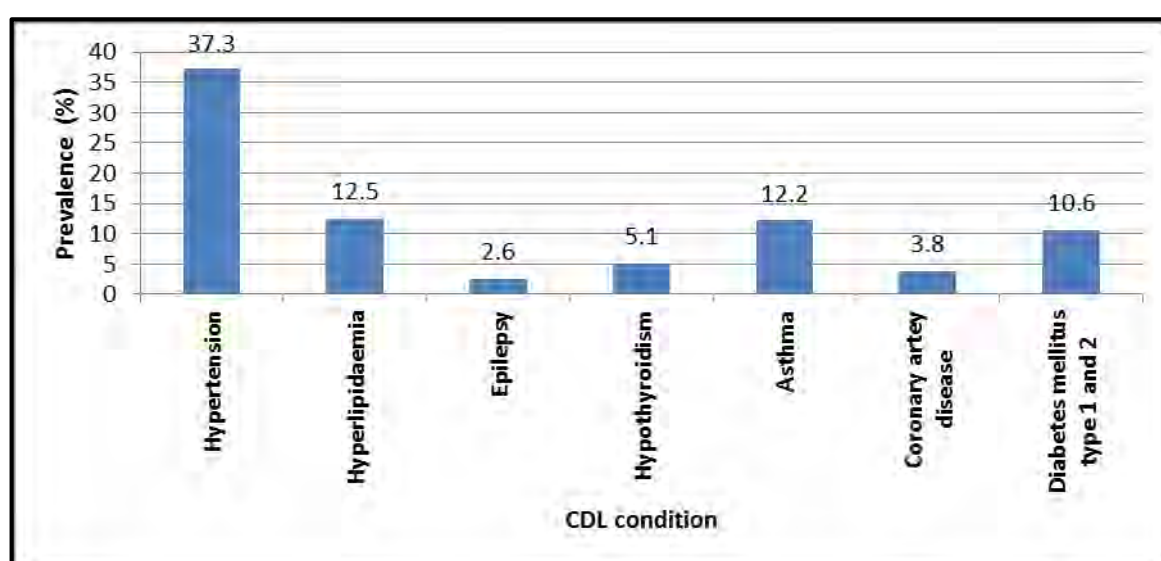


Figure 2.5: Prevalence of CDL condition registrations.

Hypertension was the most common registration, at 37.30% of all registrations for CDL conditions. Hyperlipidaemia, asthma and diabetes mellitus together account for a further 35.30% of registrations. The nine most common registrations accounted for 92.40% of all CDL registrations, with the other 18 conditions accounting for 7.60% (McLeod *et al.*, 2002:19). Only 40.60% of the CDL condition registrations were single CDL conditions (McLeod *et al.*, 2002:19).

In the same study it was revealed that the single CDL condition with the highest prevalence was hypertension with 29.88 per 1000 beneficiaries, and Addison's disease had the lowest prevalence of 0.0006 per 1000 beneficiaries, and Cushing's disease had no cases. The highest average cost for a single CDL condition was for multiple sclerosis with R21, 013 and the lowest average cost was for anticoagulation therapy with only R320.00 per beneficiary (McLeod *et al.*, 2002:25).

For multiple CDL conditions in South Africa, diabetes mellitus type 1 and 2 together with hypertension had the highest prevalence of 6.6 per 1000 beneficiaries whereas coronary artery disease with hyperlipidaemia had the lowest prevalence with 0.83 per 1000 beneficiaries recorded. The highest average treatment cost was for diabetes mellitus together with hypertension and hyperlipidaemia at R7 725.00 and the lowest average cost was for hypertension with hypothyroidism at R2 405.00, whereas the average treatment cost for all CDL conditions in this study was R3 122.00 (McLeod *et al.*, 2002:31). It can be noted that hypertension was prevalent in eight of the top nine multiple disease combinations.

A hospital-based study was done and reported by Kalk and Joffe (2007:108) which aimed at determining the prevalence of coronary heart disease in African white subjects with diabetes mellitus type 2, as well as at evaluating the contribution of the classical coronary heart disease risk factors. The subjects selected were all diabetic African and White patients aged 30 years or more at diagnosis and attended the Diabetes Clinic at Johannesburg Hospital, South Africa, where a cross-sectional evaluation was performed. This study concluded that coronary heart disease has a significantly lower prevalence in the African diabetic population of 4.0% when compared to the 23.00% of the White diabetic population (Kalk & Joffe, 2007:110). In addition it was found that coronary heart disease was uncommon in both African diabetic men and women when compared to a White diabetic group, as some associations with known coronary heart disease risk factors were different. It was also found that White Caucasian patients, but not Africans were associated with insulin resistance-triglyceride concentrations- and the African group was less likely to have this additional risk, however renal disease may be more significant in Africans (Kalk & Joffe, 2007:111).

A study was done in South Africa in 2008 to determine the prevalence of major chronic non-communicable diseases among older South Africans (n = 3 840). Details of the study showed that of the chronic diseases studied, (arthritis, stroke, angina, diabetes, chronic lung infection, asthma, depression and hypertension) males had a higher prevalence in chronic lung infection and depression than females (Phaswana-Mafuya *et al.*, 2013:3). The study revealed that the non-communicable disease prevalence was 51.8%, with a co-morbidity prevalence of 22.50%. The age groups 60-79 years, 70-79 years and females had a higher prevalence of non-communicable diseases (Phaswana-Mafuya *et al.*, 2013:3).

2.6.4 Chronic disease co-morbidity in other countries

The cost of chronic lung disease in the United States, which includes bronchitis, COPD and asthma, more than doubled from \$176.8 billion in 2006 to \$389.2 billion in 2011 and is predicted to reach \$832.9 billion in 2021 (Swartz, 2010:2).

Combining direct medical costs (\$38.9 billion) in Canada and indirect productivity losses (\$54.5 billion), the total economic burden of seven types of chronic disease (cardiovascular diseases, cancer, chronic respiratory illness, diabetes, musculoskeletal disorders, diseases of the nervous system and sense organs, and mental illness), exceeds \$93 billion a year (Mirolla, 2004:iii). Bronchitis, emphysema, and asthma cost the Canadian health care system \$1.19 billion a year in hospital, physician, and medicine costs alone. Other direct costs include private expenditure for other institutions and home care; add \$745 million to this sum, for the total health care spending of \$1.94 billion a year due to these types of chronic obstructive respiratory diseases (Mirolla, 2004:20).

Co-morbidities such as cardiac disease, diabetes mellitus, hypertension, osteoporosis, and psychological disorders are commonly reported in patients with chronic obstructive pulmonary disease (COPD) (Chatila *et al.*, 2008:549). Studies on dyslipidaemia in COPD are limited and have generally relied on questionnaire or diagnostic codes to determine frequency (Chatila *et al.*, 2008:552).

Patients with COPD are believed in particular to have a higher risk for depression compared to healthy individuals (Van den Bemt *et al.*, 2009:108). This belief results from a study done in the Netherlands to compare the risk for physician-diagnosed depression in patients with COPD, patients with diabetes mellitus, and control subjects without chronic conditions. The study was a prospective cohort study based on a continuous morbidity registration database (Van den Bemt *et al.*, 2009:108). The results showed that the risk for depression was approximately 1.7 to 1.8 times higher for patients with COPD compared to diabetes mellitus, as well as for control subjects without chronic conditions (Van den Bemt *et al.*, 2009:112).

Téllez-Zenteno *et al.* (2005:1955) reports on a study done in Canada to determine co-morbidity conditions associated with epilepsy. Data were analysed from two health surveys namely the National Population Health Survey (n = 49 060) with respondents of all ages and the Community Health Survey (n = 130 822), which comprised 98.00% of the Canadian population 12 years or older. The results confirm that common chronic conditions in the general population are even more common in men and women with epilepsy (Téllez-Zenteno *et al.*, 2005:1960). The results further concluded that persons with epilepsy have a two to five-fold risk of stroke, migraine, Alzheimer's disease, upper gastrointestinal tract disorders (ulcers), urinary incontinence, and

chronic fatigue (Téllez-Zenteno *et al.*, 2005:1960). Therefore, the importance of conceptualizing epilepsy as a condition with multiple coexisting morbidities cannot be overemphasized (Téllez-Zenteno *et al.*, 2005:1962).

Depression has a substantial morbidity and mortality, and is a highly prevalent disease which is recognised as an important co-morbidity for a number of chronic medical conditions (Brown *et al.*, 2005:1063). Diabetes is among many chronic medical conditions that appear to be adversely affected by co-morbid depression. Patients with diabetes are one and a half to two times more likely to have depression, compared with people without diabetes (Brown *et al.*, 2005:1063).

Brown *et al.* (2005:1063) therefore conclude that diabetes and depression are important co-morbid conditions, and co-morbid depression is associated with worse outcomes in people with diabetes. It is not entirely clear whether those with a history of depression are somehow predisposed to developing diabetes. O'Connor *et al.* (2009:328) agree, stating that the lack of adequate understanding of the relationship between diabetes and depression is an obstacle that has major clinical and policy implications.

O'Connor *et al.* (2009:329) further report on a historical cohort analysis from 1997 to 2003 of patients with a new (incident) or existing (prevalent) diabetes diagnosis and matched non-diabetic control patients. The study was designed to determine whether diabetes is associated with the likelihood of a subsequent diagnosis of depression. These results revealed that, regardless of the comparison group, men were less likely than women to have a depression diagnosis the likelihood of depression increased with age, and there were significant interactions between the number of primary care visits and the Charlson co-morbidity score, and between the number of primary care visits and enrolment.

In contrast to the above, another study was done by Brown *et al.* (2006:42), using a population-based retrospective cohort study, from the administrative databases of Saskatchewan Health from 1989 to 2001. This study revealed that people who are diagnosed with type 2 diabetes are at no greater risk of developing subsequent depression than people without diabetes.

Egede (2005:46) contributes from a study done in the United States to determine the effect of coexisting chronic conditions on prevalence and odds of depression in individuals with diabetes. Adults 18 years and older were randomly selected to respond to a computer-assisted personal interview questionnaire. This study had two significant findings: Firstly, odds of having major depression increased among adults with diabetes in the presence of two or more coexisting conditions (Egede, 2005:49). Secondly, the coexistence of coronary artery disease (CAD), chronic arthritis, and stroke in patients with diabetes, were associated with increased odds of having major depression (Egede, 2005:49).

Improvements in survival and reduction in fertility result in population ageing; with an increase in population proportion among the older population groups worldwide (United Nations, 2012). A greater share of non-communicable diseases are diagnosed in populations with older age structure, compared to population with a younger age structure. Therefore, in more developed countries more than 20.00% of the population are aged > 60 years, resulting in more than 80.00% of all deaths (United Nations, 2012). The United Nations (2012) further report that the annual number of non-communicable related deaths in Africa will grow from 3.7 million in 2008 to 14 million in 2050, with no changes in non-communicable age related death rates. A study was done in 2010 on Medicare beneficiaries (n = 31 313 344) in the United States to determine the prevalence of the 15 most common chronic conditions (Centers for Medicare & Medicaid Services, 2012:29). The results concluded that over two-thirds of beneficiaries had two or more chronic conditions and 14.00% had 6 more conditions. Of the research subjects, 50.00% < 65 years, 63.00% of subjects (65 to 74 years) and 78.00% (75 to 84 years) had 2 or more chronic conditions. This study further revealed that 65.00% of men had > 2 chronic conditions, with >70.00% of women. The cost in treating the conditions in this study suggested that subjects with no multiple chronic conditions had cost totalling US\$ 20 billion, whereas those with six or more conditions incurred a cost of > US\$ 140 billion (Centers for Medicare & Medicaid Services, 2012:22).

A study was done in Germany in 2004 to explore the field of multi-morbidity to develop strategies for further investigations. This study was the first systematic study on multi-morbidity in the elderly in Germany (Van den Bussche *et al.*, 2011:1). Data for this study included claims data (n = 123 224) from the Gmünder ErsatzKasse (GEK), a statutory health insurance company operating nationwide in Germany, insuring 1.7 million persons. A person was considered as multi-morbid when he/she had three or more chronic conditions from the list (Van den Bussche *et al.*, 2011:3). The results of this study showed that 62% (n = 115 584) of the cohort had three conditions or more from the list of 46 conditions. Females had a higher prevalence than males for the patients with co-morbidity (Van den Bussche *et al.*, 2011:3).

Van den Bussche *et al.* (2011:8) conclude from this study that research on multi-morbidity should aid in developing specific guidelines for those suffering from chronic conditions.

2.6.5 Risk factors pertaining to chronic diseases

In people with multiple risk factors, the chance of suffering a heart attack grows exponentially with each additional risk factor (Steyn, 2007:6). This principle can be illustrated by considering a person with three risk factors. The chance of suffering a heart attack does not increase by 3+3+3 equalling 9, but increases by 3x3x3 equalling 27; thus the risk increases exponentially with

multiple risk factors (refer to Figure 2.6) (Steyn, 2007:5). Refer to Figure 2.7 (adapted from the Medical Research Council, 2010).

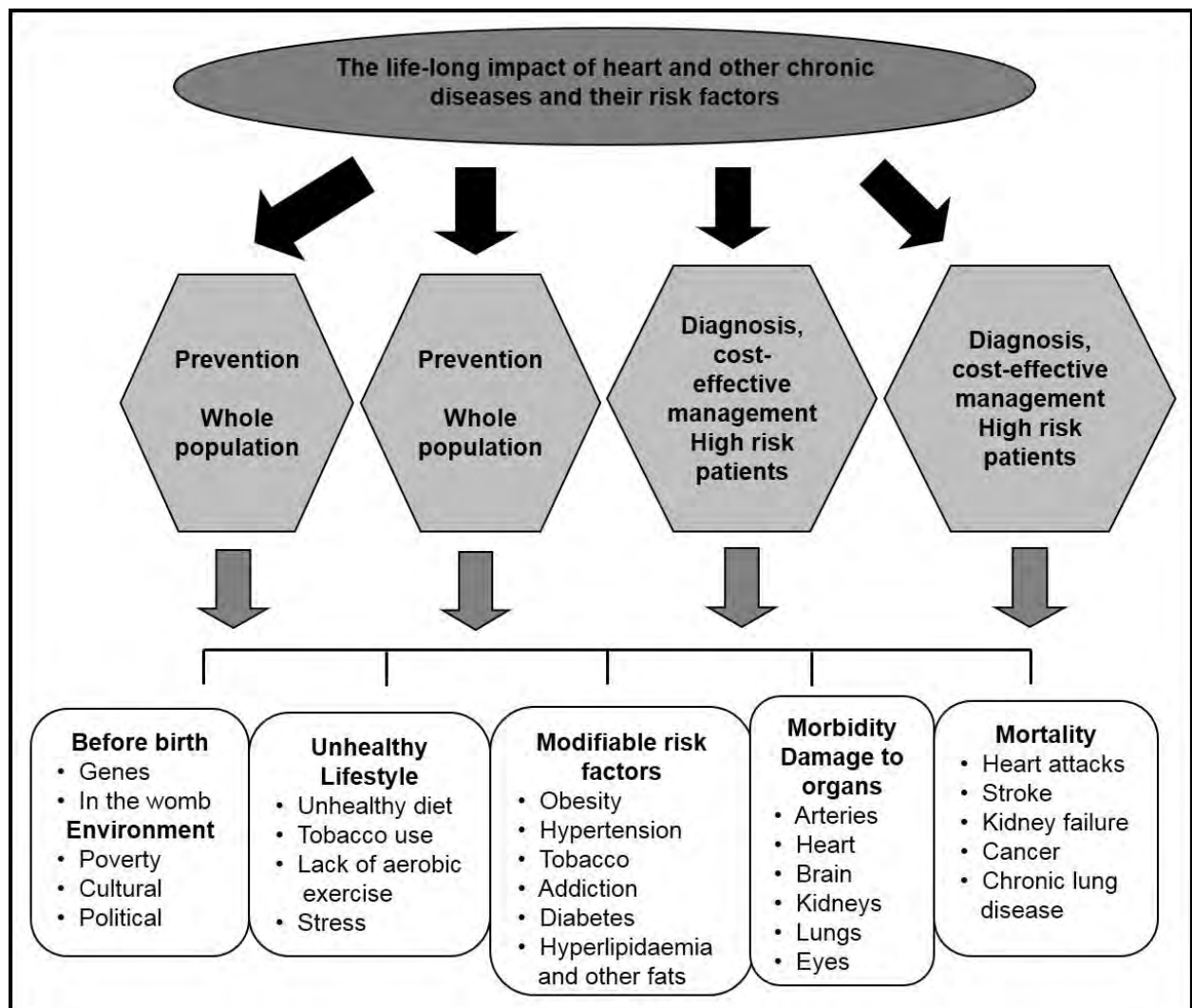


Figure 2.6: Illustration of the life-course perspective on heart disease and other chronic diseases.

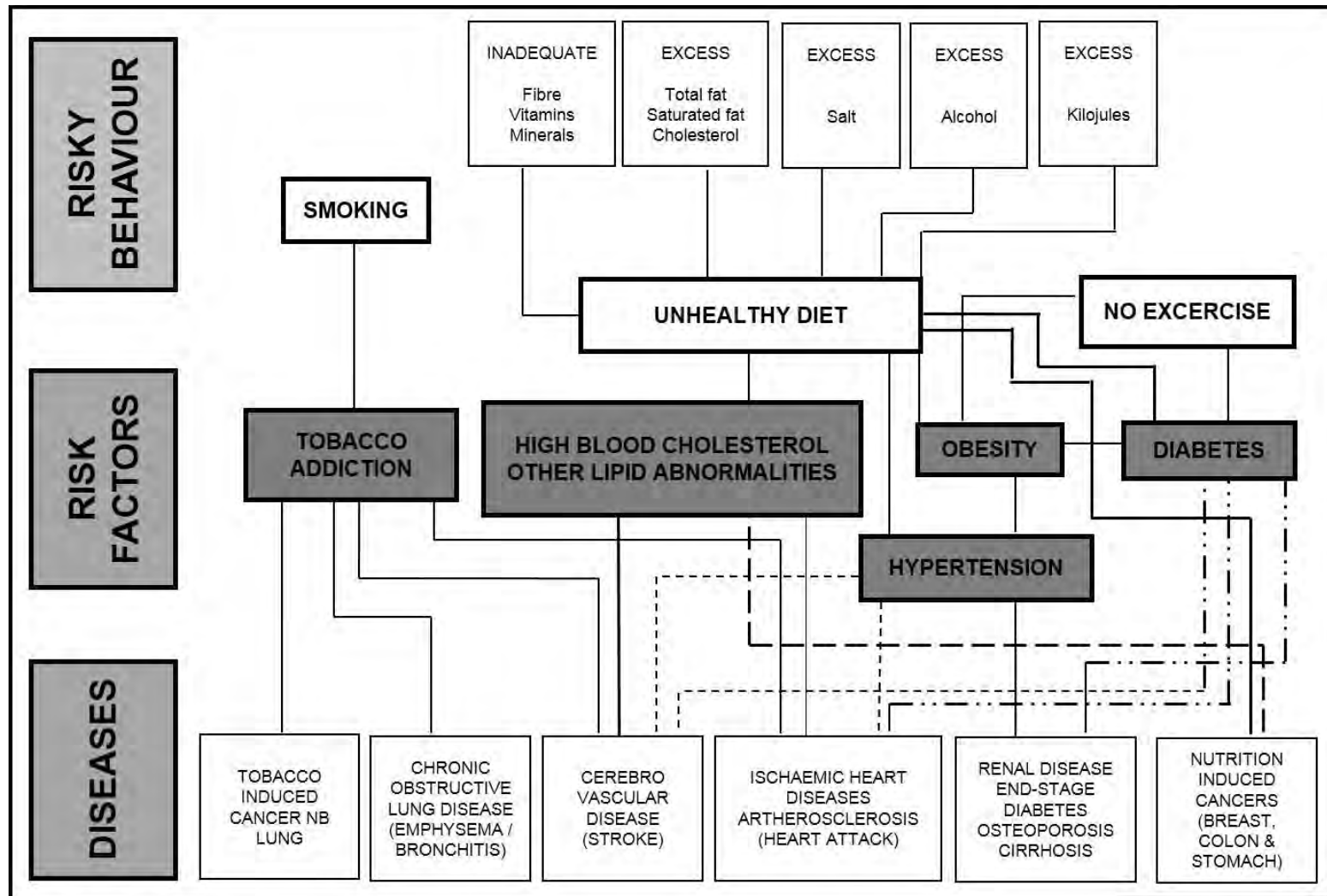


Figure 2.7: Chronic diseases of lifestyle: interrelationships and risk factors.

2.6.5.1 Physical activity and obesity

Evidence is very strong that sedentary lifestyle causes heart disease along with its risk factors (overweight and obesity, high blood pressure, diabetes and abnormal blood fats, such as high cholesterol) (Steyn, 2007:8).

The 2002 South African Youth Risk Behaviour Survey revealed that 43.00% of females and 30.50% of males participated in insufficient or no physical activity, with Black and Coloured learners being the least physically active (Puoane *et al.*, 2008:77). Van Zyl *et al.* (2012:3) further report on a South African study aimed at identifying district risk-factor profiles for chronic lifestyle diseases in urban and rural communities in central South Africa. Methods included interviews, health information and patient habits. The results revealed that self-reported hypertension and physical inactivity were identified as the number one risk factor for rural and urban groups respectively. This study concluded that the prevalence of chronic diseases of lifestyle in South African urban and rural communities is on the increase and is owing to a more sedentary lifestyle (van Zyl *et al.*, 2012:8). A change in physical activity and nutrition may be critical in reversing the epidemic in North America and elsewhere, and reducing the risk of a variety of chronic diseases in developed countries (Prentice *et al.*, 2004:1284).

A person is obese when his/her Body Mass Index (BMI) is 30 kg/m² or higher, and a person is overweight if his/her BMI is between 25 kg/m² and 30 kg/m² (Steyn, 2007:17).

Worldwide obesity has more than doubled since 1980 (WHO, 2012a). This resulted that in 2008, more than 1.4 billion adults, 20 years and older, were overweight. In addition more than 40 million children worldwide under the age of five were overweight in 2010 (WHO, 2012a).

Raised BMI is a major risk factor for non-communicable diseases such as (WHO, 2012a):

- Cardiovascular disease, which was the main cause of death in 2008;
- Diabetes and;
- Musculoskeletal disorders and some cancers.

Thus, an association which is well-documented exists between obesity and hypertension. Obesity is associated with the risk of developing of non-communicable diseases such as hypertension (Van Zyl *et al.*, 2012:2).

2.6.5.2 Smoking

Smoking cigarettes or any other tobacco products is lethal and may possibly kill half the people before the age of 60 years if they start smoking at a young age and continue throughout their adult life (Steyn, 2007:14). In 2000, 93 men and women, aged 30 years and older, died per day because of tobacco use (Steyn, 2007:14).

Each year in the United States 8.6 million people live with serious illness due to smoking and an estimated 443 000 die prematurely from smoking or exposure to second-hand smoke (Centers for Disease Control and Prevention, 2011:2). The result of exposure to primarily second-hand smoke is the estimated death of 3 000 non-smoking Americans due to lung cancer; more than 46 000 die of heart disease, and about 150 000-300 000 children younger than 18 months have lower respiratory tract infections (Centers for Disease Control and Prevention, 2011:2). The economic burden result hereof is more than \$96 billion a year in medical costs and another \$97 billion a year from loss of productivity (Centers for Disease Control and Prevention, 2011:2).

It is estimated that by 2030 smoking may kill 1 in 6 people worldwide, that may include 7 million people in developing countries (Puoane *et al.*, 2008:78). Therefore, from a medical and public health perspective, smoking of tobacco products remains one of the most important chronic conditions. It contributes to a higher morbidity as a leading risk for cardiovascular disease (Steinberg *et al.*, 2010:419).

2.6.5.3 Diabetes

Diabetes is considered a risk factor for other chronic diseases and will be discussed as a chronic disease later in this Chapter.

The mortality of diabetes in the general population is increasing by 1.20% annually (Swartz, 2010:1). Coupled with an exponential growth in the diabetic population (11 million in 2000 to 23.6 million in 2009), and a predicted 52.90% increase in incidence rate between 2003 and 2023, the human and economic burden of diabetes globally in the future is certain to be overwhelming (Swartz, 2010:1).

Patients with type 1 diabetes are at a greater risk of cardiovascular complications (Lenz, 2008:200). Thus, lifestyle prevention strategies can be beneficial in patients with type 1 diabetes to reduce cardiovascular disease (Lenz, 2008:200). Patients with type 2 diabetes also benefit from lifestyle modifications such as weight loss, physical activity, tobacco cessation and physical activity by reducing their risk for cardiovascular disease (Lenz, 2008:201).

Although type 2 diabetes is common in adults, an increasing number of children and adolescents who are overweight are also developing type 2 diabetes (Puoane *et al.*, 2008:77).

In South Africa, the prevalence of diabetes in 2000, among adults older than 30 years, was estimated at 5.50% (Puoane *et al.*, 2008:77). The prevalence of diabetes in Sub-Saharan Africa is estimated to increase from 7 146 patients in 2000 to 18 645 patients in 2030 (Wild *et al.*, 2004:1049). The countries in Sub-Saharan Africa to which the data were extrapolated from South Africa included Lesotho, Swaziland, Zimbabwe, Botswana and Namibia (Wild *et al.*, 2004:1048).

2.6.5.4 Hypertension

Hypertension increases the risk of other cardiovascular diseases (Lenz, 2008:121). The goal of blood pressure reduction is ultimately to reduce renal as well as cardiovascular mortality and morbidity (Lenz, 2008:121). Hypertension will be discussed in more detail in section 2.7.2.18.

2.6.5.5 Hypercholesterolaemia

Hypercholesterolaemia is one of the key components in the development of atherosclerosis (WHO, 2003b). In addition, hypercholesterolaemia is the result of an accumulation of fatty deposits on the inner lining of arteries and therefore predisposes individuals to an increase in risks of heart disease, stroke and other vascular diseases (WHO, 2003b).

In South Africa it is estimated that 30 men and 36 women, 30 years and older, die per day because of the impact of high blood cholesterol (Steyn, 2007:26). Therefore, people who have suffered a heart attack and have high cholesterol can benefit the most if these levels are treated effectively, as this can prevent an additional heart attack (Steyn, 2007:26).

2.7 Chronic medicine

2.7.1 Overview

According to Hugtenburg *et al.* (2005:353) chronic medicine can be defined as medicine that has to be taken continuously.

According to Medihelp (2011), in South Africa chronic medicine is medicine used for a chronic condition which requires long-term treatment of three months or longer, and that meets the following requirements:

- It must be used to prevent a serious medical condition;

- It must be used for an uninterrupted period of three months or longer;
- It must be used to sustain life, to delay the progress of a disease, or to repair natural physiology;
- It must be registered in South Africa for the treatment of the medical condition for which it is prescribed; and
- It must be the accepted treatment according to local and international pharmacological treatment protocols and algorithms.

2.7.2 CDL conditions with their recommended medicine therapies

The treatment of the medicine used in the chronic conditions discussed below is in accordance with the treatment protocols of the Council for Medical Schemes (refer to *Appendix A* for the full treatment protocols of these conditions). The algorithms from the Council for Medical Schemes recommend that combination therapy is used if and where required, according to the level of control.

Additional medicine used in these CDL conditions may also be listed from other sources, but falls outside the scope of this study.

2.7.2.1 Addison's disease

In Addison's disease, the adrenal glands are underactive, resulting in a deficiency of adrenal hormones (Grossman, 2003:956). Addison's disease was further defined as being an uncommon disorder caused by destruction or dysfunction of the adrenal cortices, thereby leading to a decrease in aldosterone and cortisol production (Fitzgerald, 2007:1189; Ross & Levitt, 2013:1).

Addison's disease affects males and females about equally and can start at any age (Grossman, 2003:956). The cause of Addison's disease in 70.00% of people is not precisely known, but the adrenal glands are affected by an autoimmune reaction in which the body's immune system attacks and destroys the adrenal cortex (Grossman, 2003:956). Corrigan (2006) adds that that Addison's disease affects 1 in 100 000 people of all age groups, and occurs when the adrenal glands do not produce enough of the hormone cortisol and in some cases, the hormone aldosterone.

A study was done in South Africa on primary care level of 148 patients to determine Addison's disease prevalence between 2005 and 2010 (Ross & Levitt, 2013:2). The results concluded that

the overall country prevalence of Addison's disease was 3.1 per million, with the figure for the Western Cape province (13.6 per million), Eastern Cape province (4.7 per million), Gauteng province (2.5 per million). Free-State province (1.8 per million), Northern Cape province (1.7 per million) and Kwazulu-Natal province with 0.58 per million (Ross & Levitt, 2013:2).

The pharmacological groups of medicine used in the treatment of Addison's disease, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *corticosteroids* which are listed below and illustrated in *Appendix A*.

- Hydrocortisone;
- Fludrocortisone.

2.7.2.2 Asthma

Asthma can be defined as episodic or chronic symptoms of airflow obstruction, including breathlessness, cough, wheezing, and chest tightness (Chesnutt & Prendergast, 2007:230). Ellis (1999:556) defines asthma as a pulmonary disease characterised by reversible airway obstruction, airway inflammation, and increased airway responsiveness to a variety of stimuli.

Mintz (2004:893) states that asthma accounts for nearly 500 000 hospitalisations, 2 million emergency department visits, and 5 000 deaths in the United States each year. Asthma is a common disease, with rising prevalence throughout the world (Kling, 2007:36). However, in South Africa, the prevalence of asthma has been estimated to be between 10-15% and higher (Kling, 2007:36). Ehrlich and Jithoo (2005:123) report that South Africa ranks 13th worldwide where asthma is a cause of death (1.5% of all deaths) and 18th as a cause of years of life lost (0.9%).

In an asthma attack, the smooth muscles of the bronchi narrow (called bronchoconstriction), and the tissues lining the airways swell from inflammation and secrete mucus into the airways (Kolski, 2012:1046; Martin, 2003:274). The top layer of the lining of the airways can become damaged and shed cells. The actions further narrow the diameter of the airways; the narrowing requires the person to exert more effort to move air in and out of the lungs (Martin, 2003:274).

Medicine used in the treatment of asthma, according to the treatment algorithm summarised by the Medical Schemes Act (131 of 1998) (SA, 2003b), includes *sympathomimetics*, *corticosteroids* and *methylxanthines* which are listed below and also illustrated in *Appendix A*.

- β_2 agonist;

- Inhaled corticosteroid;
- Theophylline;
- Oral corticosteroids;
- Leukotriene receptor antagonist (Gibbon, 2008:511; Martin, 2003:276).

2.7.2.3 Bipolar mood disorder

Drayton (2011:1191) and Fankhauser (2002:1265) define bipolar disorder as a cyclic mental disorder which causes recurrent mood and energy fluctuations including behaviour encompassing the extremes of human experiences. Sussman (2003:620) states that in manic-depressive illness, also called bipolar disorder, episodes of depression alternate with episodes of mania or lesser degrees of joyousness or elation.

A study on the lifetime prevalence estimates of psychotic disorders was performed in Finland. The study sample consisted of 8028 participants 30 years and older, as was based on the Health 2000 study. Data were obtained by using Composite International Diagnostic Interview, medical examination, national registers and self-reported diagnoses (Perälä *et al.*, 2007:19). This study revealed that 0.24% (n = 20) of participants had a lifetime prevalence of obtaining Bipolar I disorder (Perälä *et al.*, 2007:23). Of the 0.24%, 0.31% were male and 0.18% were female (Perälä *et al.*, 2007:23).

A further study was done in the United States, known as the US National Co-morbidity Survey Replication, to estimate the 12-month prevalence, co-morbidity and severity of the DSM-IV (Diagnostic and Statistical Manual, 4th edition) mood, impulse control, anxiety and substance disorders (Kessler *et al.*, 2005:617). Data were obtained from a nationally representative face-to-face household survey conducted between February 2001 and April 2003 (Kessler *et al.*, 2005:617). The data showed that of the 9 282 participants, 2.60% had a twelve-month prevalence of bipolar mood disorder (Kessler *et al.*, 2005:620).

However, Stein *et al.* (2008:112) report that in South Africa no representative data are available on the prevalence of psychiatric disorders as a whole. The lack of epidemiological data on the African continent is consistent with the lack of psychiatric disorder data in South Africa (Stein *et al.*, 2008:112).

A study was, however, done to determine the 12-month and lifetime prevalence of mental disorders in South Africa, called the SASH study (South African Stress and Health study) (Herman

et al., 2009:339). Data were collected from 4 351 adults between 2003 and 2004. This study revealed that 9.80% of the respondents had a lifetime prevalence of a mood disorder (no differentiation was made between different types of mood disorders (Herman *et al.*, 2009:339).

The pharmacological groups of medicine used in the treatment of bipolar mood disorder according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2009) include *lithium*, *anti-epileptics*, *anxiolytics* and *antipsychotics* which are listed below. Also refer to *Appendix A* for the treatment algorithm.

- Lithium;
- Valproate;
- Carbamazepine;
- Lorazepam / clonazepam;
- Typical antipsychotic;
- Atypical antipsychotic: Aripiprazole, clozapine, olanzapine, risperidone, quetiapine, and ziprasidone;
- Lamotrigine;
- Oxcarbazepine (Drayton, 2011:1198).

2.7.2.4 Bronchiectasis

Bronchiectasis can be defined as irreversible focal bronchial dilation, usually accompanied by chronic infection and associated with diverse conditions, some congenital or hereditary (Snider, 1999:584; Hill, 2012:6). Baydarian and Walter (2008:516) agree with Snider, and add that bronchiectasis is also accompanied by a chronic productive cough, airway obstruction, and recurrent infections. Chesnutt and Prendergast (2007:247) define bronchiectasis as a congenital or acquired disorder of the large bronchi characterised by permanent, abnormal dilation and destruction of bronchial walls.

The prevalence of bronchiectasis has been on the decline over the last several decades because of improved antimicrobial therapy and immunizations (Athanazio, 2012:1335; Baydarian & Walter, 2008:520). Worldwide, certain demographic groups have been recognised as having an increased risk for the development of bronchiectasis, which includes individuals with poor access

to health care or high rates of pulmonary infection in childhood (O'Donnell, 2008:816). It was further reported that outside North America, bronchiectasis is a common clinical obstacle, but the worldwide prevalence is unknown (O'Donnell, 2008:816).

In the mechanism of bronchiectasis, areas of the bronchial walls are destroyed and become chronically inflamed, ciliated cells are damaged or destroyed, and secretions (mucus) accumulate. The bronchial wall also becomes less elastic - the affected airways become wider and flabby and may develop sacs that resemble little balloons. The increased mucus production promotes the growth of bacteria, often obstructs the bronchi, and leads to pooling of infected secretions and further damage to the bronchial wall. The inflammation and infection can extend to the small air sacs of the lung (alveoli) and produce pneumonia, scarring and loss of functioning lung tissue (Davis, 2003:289).

Medicine used in the treatment of bronchiectasis include different classes of antibiotics as approved by the Medical Schemes Act (131 of 1998) (SA, 2003b). The medicines are illustrated *Appendix A* and listed below:

- Amoxicillin;
- Doxycycline;
- Ampicillin (Davis, 1999:588);
- Trimethoprim-sulphamethoxazole (Davis, 1999:588);
- Macrolide (e.g. azithromycin or clarithromycin) (Davis, 1999:588);
- Second generation cephalosporin (Davis, 1999:588).

2.7.2.5 Cardiomyopathy

Primary cardiomyopathies can be defined as disorders that affect either the structure or function of the myocardium in the absence of other known causes of heart disease (Nappi & Zile, 2002:312). Heart disease includes ischemic heart disease, hypertension, pericardial disease, valvular disease, or congenital defects or systemic diseases known to affect the heart (Bashore *et al.*, 2007:410).

Cardiomyopathies can be classified as dilated cardiomyopathy (DCM), hypertrophic cardiomyopathy (HCM), restrictive cardiomyopathy, arrhythmogenic right ventricular cardiomyopathy (ARVC), and unclassified cardiomyopathies (Sliwa *et al.*, 2005:3577).

In South Africa and Uganda, DCM accounts for 10.00% to 17.00% of all cardiac conditions encountered at autopsy, and, in many parts of Africa, for 17.00% to 48.00% of patients who are hospitalised for cardiac failure (Sliwa *et al.*, 2005:3578). Whereas the incidence and prevalence of DCM in the United States and elsewhere is reported to be 4 to 8 per 100 000 person-years and 36.5 per 100 000 individuals, respectively - there are no population-based data on the burden of DCM in Africa (Sliwa *et al.*, 2005:3578). There is however a lack of reliable information about incidence, prevalence, determinants, and outcome of cardiomyopathy in the African population (Sliwa *et al.*, 2005:3582).

Medicine used in cardiomyopathy will be discussed below:

The pharmacological groups of medicine used in the treatment of cardiomyopathy, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include the following and are also illustrated in *Appendix A*.

- Angiotensin-Converting-Enzyme-Inhibitor (ACE inhibitor);
- Thiazide diuretic;
- Loop diuretic;
- Spironolactone;
- β -blocker;
- Digoxin;
- Warfarin;
- Calcium channel blockers and antiarrhythmic medicine (Nappi & Zile, 2002:315).

2.7.2.6 Chronic obstructive pulmonary disease

Chronic obstructive pulmonary disease (COPD) can be defined as a disease that is characterised by chronic bronchitis or emphysema which may be accompanied by airway hyper-reactivity, which may be partially reversible and airflow obstruction that is generally progressive. COPD is further associated with systemic effects and lung hyperinflation (Abdool-Gaffar *et al.*, 2011:64; Snider, 2003:281).

Chronic obstructive pulmonary disease can be divided into emphysema and chronic bronchitis:

Chronic bronchitis is associated with chronic or recurrent excess mucus secretion into the bronchial tree with cough that occurs on most days during a period of at least 3 months of the year for at least 2 consecutive years (Chesnutt & Prendergast, 2007:242; Schwinghammer, 2003b:839).

Emphysema is characterised by abnormal, permanent enlargement of the airspaces distal to the terminal bronchioles, accompanied by destruction of their walls, but without obvious fibrosis (Chesnutt & Prendergast, 2007:242; Schwinghammer, 2003b:839).

In the United States, about 16 million people suffer from chronic obstructive pulmonary disease (COPD). It is second only to heart disease in the United States as a cause of disability that forces people to stop working (Snider, 2003:281). A 30-year projection from 1990 predicts a steady rise in the number of COPD deaths to the third most common cause worldwide by 2020 (Abdool-Gaffar *et al.*, 2011:64; Ehrlich & Jithoo, 2005:123). In South Africa, however, COPD alone was responsible for 2.30% of all deaths in 2000, although for only 1.10% of years of life lost, indicating its concentration at older ages (Ehrlich & Jithoo, 2005:123).

The pharmacological groups of medicine used in the treatment of chronic obstructive pulmonary disease according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include *sympathomimetics*, *anticholinergics*, *methylxanthines* and *corticosteroids* that are listed below and also illustrated in *Appendix A*.

- β_2 agonist;
- Ipratropium bromide;
- Theophylline;
- Prednisone;
- Antibiotics including macrolides, second or third generation cephalosporins, amoxicillin-clavulanate, fluoroquinolones and doxycycline (Konzem & Stratton, 2002:523).

2.7.2.7 Coronary artery disease

Coronary artery disease is defined by Steyn (2007:4) and Warnica (2003:199) as a condition in which the blood supply to the heart muscle is partially or completely blocked. This blockage is

due to arteries that harden as a result of a build-up of fatty deposits in the wall of the coronary arteries (Steyn, 2007:4).

Risk factors for coronary artery disease are hypertension, hyperlipidaemia and diabetes (refer to Appendix A). These conditions can largely be prevented through appropriate lifestyle modifications (refer to section 2.6.6) and through medicine therapy (refer to sections 2.7.2.11, 2.7.2.17 and 2.7.2.18). These diseases will be discussed in more detail separately throughout this Chapter.

It has been reported that in South Africa coronary heart disease is 20 times more frequent in the westernised, high risk, white Caucasian population (with an incidence rate of 165.3 per 100 000 people) than in the indigenous Africans (Kalk & Joffe, 2007:107). This African population is in transition from a predominantly rural to a recently urbanised and increasingly westernised way of life (Kalk & Joffe, 2007:107). It is further reported that in South Africa coronary disease is a major cause of death among South Africans of Indian descent with an incidence rate of 101.2 per 100 000 people (Mbewu, 2009:6).

The pharmacological groups of medicine used in the treatment of coronary artery disease according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include *platelet aggregation inhibitors, organic nitrates, β -receptor blockers and calcium channel blockers in conjunction with proper control and treatment of diabetes, hypertension and hyperlipidaemia* which are listed below and illustrated in *Appendix A in the treatment protocol*.

- Aspirin;
- Nitrates;
- β -blocker;
- Dihydropyridine.

2.7.2.8 Chronic renal disease

Hamilton (2003b:802) defines mild chronic renal insufficiency (CRI) as a creatinine clearance (Cr_{Cl}) of 50-80 mL/min, moderate CRI 30-50 mL/min, and severe CRI 15-30 mL/min. Patients requiring chronic dialysis or renal transplantation for relief of uremic symptoms are said to have end-stage renal disease (ESRD) (Hamilton, 2003b:802). Davids (2007:10) contributes that chronic kidney disease (CKD) is defined as kidney damage or a glomerular filtration rate (GFR) of < 60 mL/minute/1.73 m² for three months or more. In addition, chronic renal failure was defined

as a reduction in GFR below normal values of approximately 120 to 130ml/minute developing over months to years (Kraut, 2012:884).

Chronic kidney disease affects as many as one in ten adults, or over 500 million people worldwide (Davids, 2007:10). Diabetic nephropathy is one of the leading causes of chronic kidney disease and end-stage renal disease, and the global epidemic of type 2 diabetes and obesity will therefore result in millions of new cases of chronic kidney disease (Davids, 2007:10).

Naicker (2009:S1-S13) states that chronic kidney disease is at least 3 to 4 times more frequent in Africa than in developed countries. Hypertension affects approximately 25% of the adult population and is the cause of chronic kidney failure in 21% of patients on renal replacement therapy in the South African Registry (Naicker, 2009:S1-S13). Furthermore, Naicker (2009:S1-S13) reports that chronic kidney disease affects mainly people aged 20 to 50 years in sub-Saharan Africa and is primarily due to hypertension and glomerular diseases, unlike developed countries where chronic kidney disease presents in middle-aged and elderly patients and is predominantly due to diabetes mellitus and hypertension. Hypertension is a cause of chronic kidney failure in Africa, especially in blacks (Naicker, 2009:S1-S13).

The pharmacological groups of medicine used in the treatment of chronic renal disease and the treatment algorithm as currently approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) are listed below and illustrated in *Appendix A*.

- ACE inhibitors;
- Calcium channel blockers;
- Thiazide diuretic;
- β -blocker;
- Calcium carbonate;
- Elemental iron;
- Folic acid and erythropoietin.

2.7.2.9 Crohn's disease

Crohn's disease can be defined as a non-specific chronic transmural inflammatory disease of the mucosa that mostly affects the distal ileum and colon but may occur in any part of the gastrointestinal tract. In addition, fistula development, abscess formation and ulceration is possible (McQuaid, 2007:636; Sachar, 1999:302).

The incidence of Crohn's disease is < 1 per 100 000 (but probably increasing) in Asia and South America (Bernstein *et al.*, 2010b:112). Furthermore, the incidence of Crohn's disease was estimated by Bernstein *et al.* (2010b:112) as being 1-3 in 100,000 people in southern Europe and South Africa (Naicker, 2009:S1-S13).

The Medical Schemes Act (131 of 1998) (SA, 2003b) includes the following medicine as treatment guideline in the treatment of Crohn's disease; they are listed below and illustrated in the approved treatment protocol in *Appendix A*.

- Fluoroquinolone;
- Metronidazole;
- Azathioprine;
- Methotrexate;
- Corticosteroid such as budesonide and prednisone;
- Mesalazine and sulfasalazine (Hemstreet, 2011:598; McQuaid, 2007:640);
- Mercaptopurine (McQuaid, 2007:640);
- Infliximab (McQuaid, 2007:640).

2.7.2.10 Diabetes insipidus

Central diabetes insipidus can be defined as a lack of ant-diuretic hormone (ADH) secretion or a lack of response to the hormone at the target organ, that causes excessive production of very diluted urine (polyuria) (Chapman, 2003:944; Ozer & Balasubramanyam, 2012:691). Jospe (1999:78) defines diabetes insipidus as a temporary or chronic disorder of the neurohypophyseal system due to deficiency of vasopressin, characterised by excretion of excessive quantities of diluted (but otherwise normal) urine and by excessive thirst.

The incidence of diabetes insipidus in the global general population is 3 in 100 000, with a slightly higher incidence among males (60%) (Saborio *et al.*, 2000:122).

The pharmacological group of medicine used in the treatment of diabetes insipidus according to the approved treatment algorithm by the Medical Schemes Act (131 of 1998) (SA, 2003b) include the following *anti-diuretics* which is listed below and illustrated in the treatment protocol in *Appendix A*.

- Desmopressin.

2.7.2.11 Diabetes Mellitus

The global burden of diabetes was 124 million in 1997 and it was estimated that that it will double to 221 million in 2010 (Molleutze & Levitt, 2005:112). In Africa, the estimated number of diabetes in 1997 was 7.8 million, of whom 4.5 million were in North Africa, 1.05 million in Eastern Africa, 1.08 million in Western Africa, 0.26 million in Central Africa, and 0.82 million in Southern Africa (Molleutze & Levitt, 2005:112). The International Diabetes Federation (2014) stated that the worldwide prevalence of diabetes is 387 million and caused 4.9 million deaths in 2014. In addition, the number of people with diabetes will increase to 592 million by 2035 (International Diabetes Federation, 2014).

Diabetes mellitus (DM) can be defined as a group of metabolic disorders which are characterised by hyperglycaemia and abnormalities in fat, carbohydrates and protein metabolism (Schwinghammer, 2003c:170).

2.7.2.11.1 Diabetes mellitus type 1

Type 1 DM or insulin-dependent diabetes accounts for about 10.00% of all diabetic cases and usually results from immune-mediated destruction of β -cells. This destruction is predominantly due to an autoimmune process which results in an absolute deficiency of insulin (Masharani, 2007:1219; Schwinghammer, 2003c:170).

Worldwide there are approximately 171 million people who live with diabetes and in South Africa about 4 million people are known to have diabetes mellitus (Clark, 2006:578). The crude prevalence in a study in Umtata, Eastern Cape province is 2.45%, according to Clark (2006:578). Diabetes mellitus was responsible for 1.60% of deaths in South African females and 0.90% in males in 2006 (Clark, 2006:578). The prevalence of type 1 diabetes mellitus varies greatly in different socio-economic and geographical areas. Of Africans living on the African continent 1.00-

6.00% has diabetes, and approximately 25.00% of these patients are treated with insulin (Clark, 2006:578).

The pharmacological groups of medicine used in the treatment of diabetes mellitus type 1 according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include insulin, and its place in the proposed treatment program is illustrated in more detail in *Appendix A*.

- Insulin.

2.7.2.11.2 Diabetes mellitus type 2

Type 2 DM (formerly known as non-insulin-dependent diabetes) accounts for as many as 90% of all cases of DM and is characterised by the presence of both relative insulin deficiency and insulin resistance (Masharani, 2007:1219; Schwinghammer, 2003c:170).

Hays *et al.* (2008:182) report that diabetes mellitus type 2 has a predicted global prevalence of over 300 million by 2025, resulting in an epidemic worldwide. Type 2 diabetes poses a major challenge to our society, although there is a lack of accurate information in the number of people living with diabetes in South Africa (estimates are approximately 2 million) (Levitt, 2009:53).

The pharmacological groups of medicine used in the treatment of diabetes mellitus type 2, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include *oral anti-diabetic agents* and *insulin*, and are listed below and illustrated in *Appendix A*.

- Sulphonylurea;
- Metformin;
- Thiazolidinediones;
- Insulin;
- Alpha glucosidase inhibitors such as acarbose (Gibbon, 2008:77);
- Meglitinides including nateglinide and repaglinide (Gibbon, 2008:78);
- Glucagon-like peptide 1 agonists such as exenatide and liraglutide (Garber, 2011:S280; Reid, 2013:148).

2.7.2.12 Dysrhythmias (Arrhythmias)

Arrhythmia is defined as a loss of cardiac rhythm, especially irregularity of heartbeat (Schwinghammer, 2003a:35).

It was estimated that in the United States, 2.66 million people would have atrial fibrillation in 2010 (Lloyd-Jones *et al.*, 2010:e91). It is predicted that this number will increase to 12 million people who will have the condition by 2050 (Lloyd-Jones *et al.*, 2010:e91). In South Africa the most common cardiac arrhythmia is atrial fibrillation, with an incidence of about 8.00% of the population 70 years and older. Mbewu (2009:8) found that in a cardiac clinic in Soweto, South Africa, 33.00% of patients had some form of arrhythmia and 7.00% had atrial fibrillation.

The pharmacological groups of medicine used in the treatment of dysrhythmia, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include *β-receptor blockers, cardiac glycosides, calcium channel blockers, anti-arrhythmic* medicine which are listed below and illustrated in *Appendix A*.

- Warfarin;
- β-blockers;
- Digoxin;
- Verapamil;
- Amiodarone;
- Sodium channel blockers such as flecainide and procainamide (Mitchell, 2003:166);
- Purine nucleoside such as adenosine (Mitchell, 2003:167).

2.7.2.13 Epilepsy

Epilepsy can be defined as any disorder characterised by recurrent unprovoked seizures (Aminoff, 2007:1004; Epilepsy South Africa, 2014). A seizure can be defined as a transient disturbance of cerebral function due to an abnormal paroxysmal neuronal discharge of the brain (Aminoff, 2007:1004).

Worldwide about 20 to 40 million people are affected by epilepsy (Dwivedi, 2001:197). It is more common in children than adults, with an incidence of about eight per 1000 children under the age

of seven years (Dwivedi, 2001:197). Furthermore, epilepsy is the second most common neurological disorder after stroke (Dwivedi, 2001:197). High rates of epilepsy have been reported in Asia and particularly sub-saharan Africa and countries in South and Central America. This, compared to a lower prevalence of active epilepsy in people of all ages from Europe and North America is 5-8 per 1000. (Forsgren, 2008:21). In South Africa 1 out of 100 people are affected by epilepsy, and since 2004 there has been an increase of 100.00% in sudden unexplained deaths due to epilepsy (Epilepsy South Africa, 2014).

The pharmacological groups of medicine used in the treatment of epilepsy, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include different *anti-epileptics* which are listed below and their place in the treatment program is illustrated in *Appendix A*.

- Phenytoin;
- Carbamazepine;
- Sodium valproate;
- Valproic acid;
- Phenobarbitone;
- Lamotrigine;
- Topiramate;
- Oxcarbazepine;
- Ethosuximide;
- Clonazepam;
- Gabapentin, levetiracetam and vigabatrin (Gibbon, 2008:434).

2.7.2.14 Glaucoma

Glaucoma can be defined as a group of ocular diseases characterised by optic neuropathy that is associated with a loss of visual sensitivity and field and changes in the optic nerve head (optic disc) (Fiscella *et al.*, 2011:1633; Hamilton, 2003a:649).

Despite being common and treatable, glaucoma remains one of the leading causes of preventable blindness in the South Africa and worldwide affects 70 million people (Boreham, 2008:2). Of all the treatable diseases, glaucoma has one the biggest obstacles with poor patient compliance (Boreham, 2008:2). The prevalence of glaucoma is however around 5.00% to 7.00% in the black population and 3.00% to 5.00% in the white population of South Africa (South African Glaucoma Society, 2006:1).

The pharmacological groups of medicine used in the treatment of glaucoma according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include *β -receptor blockers*, *α -blockers*, *diuretics* and *prostaglandin analogues* which are listed below and illustrated in *Appendix A*.

- β -blocker eye drops;
- α_2 -agonist;
- Prostaglandin analogue e.g. latanoprost;
- Carbonic anhydrase inhibitor e.g. acetazolamide;
- Cholinergic agonists e.g. pilocarpine (Fiscella *et al.*, 2011:1642; Gibbon, 2008:541).

2.7.2.15 Haemophilia

Haemophilia can be defined as a bleeding disorder as a result of a congenital deficiency in plasma coagulation protein (Bickert & Kwiatkowski, 2002:1747). Mahlangu and Gilham (2007:1297) defined haemophilia as inherited bleeding disorders caused by deficiency of specific coagulation factors. Haemophilia affect males only and in rare cases clinically affect female carriers (Linker, 2007:538). Haemophilia A is caused by coagulation factor VIII deficiency, haemophilia B by deficiency of coagulation factor IX, and haemophilia C by deficiency of coagulation factor XI.

Haemophilia has an estimated prevalence of around 10 000, Haemophilia A and B have the same clinical presentation, so their specific diagnosis must be established by factor assay (Mahlangu & Gilham, 2007:1297). Haemophilia A is more common than haemophilia B and comprises of

around 80.00%-85.00% of the haemophilia population (World Federation of Hemophilia, 2012:7). Haemophilia A has a prevalence of about 1 in 10 000 males, while haemophilia B has a prevalence of about 1 in 35 000 males (Mahlangu & Gilham, 2007:1297). The combined prevalence of both haemophilia A and B has been established as approximately 1 in 5000 live male births worldwide. The prevalence of haemophilia A in 2006 in South African males were documented at 6 per 100 000 males (Stonebraker *et al.*, 2010:24). Haemophilia C is an autosomally inherited condition with a high prevalence in Ashkenazi Jews and is uncommon in the general population of South Africa (Mahlangu & Gilham, 2007:1297).

The pharmacological groups of medicine used in the treatment of haemophilia, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include haemostatics as well as different *analgesics* and *antipyretics* which are listed below and illustrated in *Appendix A*.

- Desmopressin;
- Factor VIII;
- Paracetamol;
- Opioids;
- Tranexamic acid;
- Factor IX.

2.7.2.16 Cardiac failure

Cardiac failure is a pathophysiological state comprising of a complex clinical syndrome that can result from either a structural or functional cardiac disorder. The heart is then unable to pump sufficient blood to meet the metabolic needs of the body (Hunt *et al.*, 2009:e397; Schwinghammer, 2003d:56). Cardiac failure with reduced ejection fraction was defined as a syndrome where there are signs and symptoms resulting from abnormal left ventricular function (Mpe *et al.*, 2013:661).

Approximately 3.00% to 7.00% of patients admitted to hospitals in Africa have cardiac failure (Damasceno *et al.*, 2007:1690). Furthermore, cardiac failure accounts for approximately 1.00% of the health budget in developed countries (Damasceno *et al.*, 2007:1690).

It was further mentioned that if not addressed, the increased proportion of elderly and the escalating number of patients with obesity, hypertension, diabetes mellitus, metabolic syndromes,

dilated cardiomyopathy and coronary artery disease will lead to rapidly increasing numbers of patients with cardiac failure (Damasceno *et al.*, 2007:1690; Hunt *et al.*, 2009:e397). However, there is a lack of data on the incidence, prevalence, treatment, and outcome of the disease in general and its geographical variation by region and country in Africa (Damasceno, *et al.*, 2007:1691).

Steyn (2007:2) reported that 195 people died per day between 1997 and 2004, because of some form of heart and blood vessel disease in South Africa. Cardiac failure claims the lives of about 37 people per day in South Africa (Steyn, 2007:2).

The pharmacological groups of medicine used in the treatment of cardiac failure, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include the following and are illustrated in *Appendix A*.

- ACE inhibitors;
- Thiazide diuretics;
- Loop diuretics;
- Spironolactone;
- β -blockers;
- Digoxin;
- Potassium supplementation;
- Angiotensin II receptor blockers and vasodilators (Arnold, 2003:156).

2.7.2.17 Hyperlipidaemia

Hyperlipidaemia can be defined as an elevation of one or more of the following blood lipids: cholesterol esters, cholesterol, triglycerides or phospholipids (Steyn, 2007:25; Talbert, 2002:396).

About 56.00% of global heart disease cases are attributable to total cholesterol levels above 3.2 mmol/L as well as almost one fifth (18.00%) of global stroke events (mainly non-fatal events) (WHO, 2003b). This amounts to about 4.4 million deaths (7.90% of the total) and 2.80% of the global disease burden (WHO, 2003b).

The estimation is that one in million persons have the more severe homozygous form in South Africa (Blom, 2011:17; Raal *et al.*, 2011:2202). The less severe form of heterozygous familial hypercholesterolaemia is 1 in 500 worldwide in countries such as the United States and the United Kingdom (Sibley & Stone, 2006:58). The prevalence is much higher in communities with Chinese Canadians, French Canadians, Icelanders, Finns, Dutch, Lithuanian Jews and South African Afrikaners. White South African Afrikaners have a much higher prevalence with an estimation of 1 in 100 (heterozygous) and 1 in 30 000 (homozygous) persons respectively (Raal *et al.*, 2011:2202). This high prevalence is due to the founder effect, when a limited number of individuals with low density lipoprotein (LDL) receptor mutations were introduced into a community (Raal *et al.*, 2011:2022).

Medicine as recommended for the treatment of hyperlipidaemia, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *HMG-CoA reductase inhibitors (statins)* and other cholesterol lowering medicine. These medicines are listed below and illustrated in *Appendix A*.

- Statins;
- Fibrates;
- Bile salt sequestrants e.g. cholestyramine (Gibbon, 2008:164; Talbert, 2002:405);
- Nicotinic acid and ezetimibe (Gibbon, 2008:164; Talbert, 2002:405).

2.7.2.18 Hypertension

Hypertension can be defined as a persistently elevated systolic and/or diastolic arterial blood pressure of 140/90 mmHg or more in subjects aged 15 years and above (Lemogoum *et al.*, 2003:1993; Sutters, 2012:420). Perloff *et al.* (1993:2461) define hypertension as a persistent elevation of blood pressure that exceeds an arbitrarily normal set level.

The Heart and Stroke Foundation of South Africa (2014) states that 6.3 million of the South African population suffer from hypertension, which is one of the highest rates worldwide. A study was done to determine prevalence rates in low-and middle income countries (Lloyd-Sherlock *et al.*, 2014:116). Including China, Ghana, India, Mexico, the Russian Federation and South Africa from 2007 to 2010 in adults ($n = 35\,135 \geq 50$ years). This study found that South Africa had the highest prevalence of hypertension of any of these countries with 77.90% ($n = 2\,583$), with 74.70% (males) and 80.30% (females) (Lloyd-Sherlock *et al.*, 2014:120). Opie and Seedat (2005:3563) report that projections made on hypertension indicate that in mixed South African populations

over 65 years of age, a prevalence of 50.00% to 60.00%. In sub-Saharan Africa, 10 million to 20 million of the population may have hypertension (Opie & Seedat, 2005:3563).

The pharmacological groups of medicine used in the treatment of hypertension, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) include different classes of medicine listed below. Their respective places in the proposed treatment program are illustrated in *Appendix A*.

- α -blockers;
- ACE inhibitors;
- Angiotensin receptor blockers;
- β -blockers;
- Furosemide;
- Spironolactone;
- Calcium channel blockers.

2.7.2.19 Hypothyroidism

Hypothyroidism can be defined as the clinical and biochemical syndrome resulting from decreased thyroid hormone production (Reasner & Talbert, 2002:1370). According to Braverman (1999:93), hypothyroidism can be defined as the characteristic clinical response to thyroid hormone deficiency in the adult. In addition, Fitzgerald (2012:1078) defines hypothyroidism as a failure or resection of the thyroid gland itself or deficiency of pituitary thyroid-stimulating-hormone (TSH).

Thyroid disease has reached a global burden of epidemic proportions, with an estimation of 200 million people with a thyroid disorder (Anon, 2012:1076). Hypothyroidism is second only to diabetes mellitus as the most common endocrine disorder in the United States, and its prevalence may be as high as 18 cases per 1000 persons in the general population. This disorder becomes increasingly common with advancing age, affecting about 2.00% to 3.00% of older women (Hueston, 2001:1717). In Africa, iodine deficiency is depicted as a major health obstacle and a common cause of thyroid disorders, and 2.2 billion people are at risk of an iodine deficiency disorder (Ogbera & Kuku, 2011:S83).

The treatment algorithm of medicine used in the treatment of hypothyroidism according to the Medical Schemes Act (131 of 1998) (SA, 2003b), includes *thyroid medicine*. These are shown below and illustrated in *Appendix A*.

- Thyroxine;
- Levothyroxine and liothyronine (Snyman, 2011:327).

2.7.2.20 Multiple sclerosis

Multiple sclerosis can be defined as a slowly progressive central nervous system (CNS) disease characterised by disseminated patches of demyelination in the brain and spinal cord, resulting in multiple and varied neurological symptoms and signs, usually with remissions and exacerbations (Apatoff, 1999:1474). A further elaboration by Apatoff (2003:557) and Keegan (2012:624) includes that multiple sclerosis refers to the many areas of scarring (sclerosis) that result from autoimmune inflammatory demyelination of nerves.

Specific regions that include 5-30 per 100 000 multiple sclerosis patients, include the southern United States, parts of Australia, South Africa, the southern Mediterranean basin, Russia (including Siberia), the Ukraine and parts of Latin America (Modi *et al.*, 2008:391). The number of South African patients was extrapolated at 1 in 700, thus 63 497 multiple sclerosis sufferers (Modi *et al.*, 2008:391).

Multiple sclerosis typically presents in adults who are 20 to 45 years of age. Occasionally, the disease presents in childhood or late middle age. Twice as many women are affected as men, and persons of Northern European descent appear to be at the highest risk for the disease (Calabresi, 2004:1935; Giampaolo *et al.*, 2013:671).

The cause of multiple sclerosis is unknown, but a likely explanation is that a virus (possibly a herpes or retrovirus) or some unknown antigen somehow triggers a reaction directed against the body's own tissues such as an autoimmune reaction which may include smoking, vitamin D and sunlight (Apatoff, 2003:557, Giampaolo *et al.*, 2013:670). The autoimmune reaction results from inflammation, destruction of myelin, and damage to the myelin sheath and the underlying nerve fibre (Apatoff, 2003:557)

The pharmacological groups of medicine used in the treatment of multiple sclerosis, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *cytostatics*, *immunosuppressant*, *central acting muscle relaxants*, *anti-cholinergics*, *tricyclic*

antidepressants, anti-epileptics, analgesics and corticosteroids which are listed below and their respective use in the treatment protocol is illustrated in *Appendix A*.

- Methotrexate, cyclophosphamide;
- Azathioprine, baclofen;
- Oxybutynin, imipramine;
- Amitriptyline, carbamazepine;
- Opioid analgesics and methylprednisolone.

2.7.2.21 Parkinson's disease

Parkinson's disease can be defined as an idiopathic, slowly progressive, degenerative central nervous system disorder characterised by slow and decreased movement, muscular rigidity, resting tremor, and progressive postural instability (Aminoff & Kerchner, 2012:971; Feigin, 1999:1466). Schwinghammer (2003e:551) defines idiopathic Parkinson's disease as having highly characteristic neuropathological findings and clinical presentation including motor deficits and, in some cases, mental retardation.

Parkinson's disease is the second most neurodegenerative disorder worldwide and occurs in 0.30% of the United States population, and the prevalence increases to 4.00% to 5.00% in those older than 85 years (Okubadejo *et al.*, 2006:2150; Rao *et al.*, 2006:2045). Butler (2010:43) contributes that, based on worldwide studies, the incidence of Parkinson's disease is about 10-20 cases per 100 000 population per year. Prevalence estimates vary, but the currently accepted figure is about 100-200 cases per 100 000 population worldwide (Butler, 2010:43). Although Parkinson's disease is prevalent worldwide, reported incidence and prevalence figures appear to be lower in Africa than those reported in North American or European populations (Butler, 2010:43).

Treatment of Parkinson's disease pharmacologically includes *anti-Parkinson's medicine such as dopaminergics anti-cholinergics*. The treatment algorithm medicines approved by the Medical Schemes Act (131 of 1998) (SA, 2003b) are listed below and illustrated in *Appendix A*.

- Selegiline;
- Dopamine agonists;

- Levodopa;
- Amantadine;
- Anti-cholinergics;
- Catecholamine–O-methyltransferase inhibitors (COMT) (Aminoff, 2007:1034; Gibbon, 2008:440);
- Atypical antipsychotics (Aminoff, 2007:1034).

2.7.2.22 Rheumatoid arthritis

Rheumatoid arthritis can be defined as chronic disease, mainly characterised by symmetrical inflammation of the lining, or synovium, of the joints. It can result in chronic pain and lead to long-term joint damage, loss of function and disability. Other joints can also include the involvement of other organs (Arthritis Foundation, 2010; Schuna, 2011:1583).

Rheumatoid arthritis is the most common inflammatory arthritis, affecting 0.80% of the adult population worldwide, where the onset usually occurs between 30 and 50 years of age (Rindfleisch & Muller, 2005:1037). Approximately 1.3 million people in the United States have rheumatoid arthritis. It can affect anyone, including children, but 70.00% of people with rheumatoid arthritis are women (Arthritis Foundation, 2010). In South Africa it is estimated that 1 in 7 people have arthritis (Arthritis Care, 2007).

The pharmacological groups of medicine used in the treatment of rheumatoid arthritis, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *analgesics and anti-pyretics*, *cytostatics*, *corticosteroids* and *immunosuppressants* that are illustrated in *Appendix A*.

- Non-steroidal anti-inflammatory drugs (NSAIDs) e.g. Ibuprofen;
- Corticosteroids;
- Disease modifying anti-rheumatic medicine (DMARD) e.g. methotrexate, sulphasalazine, penicillamine, azathioprine, cyclophosphamide or leflunomide.

2.7.2.23 Schizophrenia

Schizophrenia can be defined as a heterogeneous syndrome of psychotic condition that includes hallucinations, bizarre thoughts, inappropriate affect delusions, disorganised speech and behaviour as well as impaired psychosocial functioning (Crismon & Dorson, 2002:1219; Swingler, 2013:153).

Schizophrenia is a severe form of mental illness affecting about 7 per thousand of the adult population, mostly in the age group 15-35 years (WHO, 2009). It is reported that schizophrenia affects about 24 million people worldwide, and though the incidence is low (3-10,000), the prevalence is high due to chronicity (WHO, 2009). Fenton (1999:1564) states that, worldwide, the prevalence of schizophrenia appears to be 1.00%, although pockets of higher or lower prevalence exist.

The pharmacological groups of medicine used in the treatment of schizophrenia, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *antipsychotics* and mood stabilisers such as *anti-epileptics* which are listed below and also illustrated in *Appendix A*.

- Typical antipsychotic e.g. haloperidol and chlorpromazine;
- Atypical antipsychotic e.g. olanzapine, clozapine, quetiapine and risperidone;
- Mood stabiliser (that includes anti-epileptics).

Kaufman (2011:1) elaborates on the use of anti-epileptic medicine in psychiatric disorders, whereby epilepsy is the clinical interface between neurology and psychiatry. The result is that anti-epileptic medicine is used to treat epilepsy and psychiatric disorders. Irrespective of the limitations on indications for which anti-epileptic medicine are used, they are used as monotherapy and as addition to current therapy in different psychiatric disorders (Kaufman, 2011:7).

2.7.2.24 Systemic lupus erythematosus

Systemic lupus erythematosus can be defined as an inflammatory autoimmune disorder that may affect multiple organ systems. Many of its clinical manifestations are secondary to the trapping of antigen-antibody complexes in capillaries of visceral structures or to autoantibody-mediated destruction of host cells (Hellmann & Stone, 2007:853). The nature of the antibodies will determine the symptoms and organ involvement (Delafuente & Cappuzzo, 2011:1505).

One study reported a prevalence of 200 cases per 100,000 women (18 to 65 years of age) in England (Gill *et al.*, 2003:2180). Estimations reveal the overall prevalence in the United States of definite systemic lupus erythematosus plus incomplete systemic lupus erythematosus to be 40 to 50 cases per 100,000 persons (Gill *et al.*, 2003:2180). It was further found that the disease is diagnosed 23 times more often in black women than in white men (Gill *et al.*, 2003:2180). Gotlieb (2004) reported that there is a high prevalence of systemic lupus erythematosus in the Western Cape of South Africa among people of mixed ancestry (so-called “coloured” people), but for some reason lupus is rare among black people in rural areas of South Africa.

The pharmacological groups of medicine used in the treatment of systemic lupus erythematosus according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *analgesics*, *anti-pyretics*, *corticosteroids* and *cytostatics* which are also illustrated in *Appendix A*.

- Non-steroidal anti-inflammatory medicine (NSAIDS);
- Topical corticosteroids;
- Corticosteroids e.g. prednisone;
- Cytotoxic medicine e.g. cyclophosphamide or methotrexate;
- Aspirin;
- Antimalarial medicine such as chloroquine and hydrochloroquine (Delafuente, 2002:1574).

2.7.2.25 Ulcerative colitis

Ulcerative colitis is a chronic disease characterised by diffuse mucosal inflammation of the colon (Langan *et al.*, 2007:1323). McQuaid (2007:641) defines ulcerative colitis as an idiopathic inflammatory condition that involves the mucosal surface of the colon, resulting in diffuse friability and erosions with bleeding.

Ulcerative colitis affects approximately 250,000 to 500,000 persons in the United States, with an annual incidence of two to seven per 100,000 persons (Langan *et al.*, 2007:1323). Ardizzone (2003) reports that in Western Europe and in the United States of America, ulcerative colitis has an incidence of approximately 6 to 8 cases per 100,000 populations and an estimated prevalence of approximately 70 to 150 per 100,000 populations. The incidence of ulcerative colitis has been

on the increase in countries with a previously low incidence such as Europe, Asia and developing countries (Bernstein *et al.*, 2010a:2).

The pharmacological groups of medicine treatment used in ulcerative colitis, according to the treatment algorithm approved by the Medical Schemes Act (131 of 1998) (SA, 2003b), include *corticosteroids* and *immunosuppressants* which are illustrated in *Appendix A and are listed below*.

- 5-aminosalicylic acid (5-ASA) suppositories e.g. mesalazine and sulfasalazine;
- Corticosteroids e.g. budesonide;
- Azathioprine;
- Infliximab (Gibbon, 2008:66).

2.8 Quality of life and chronic disease

Quality of life can be defined as the perception that an individual has of his/her position in life in the context of the value systems and culture in which they live in relation to their standards, goals, expectations and concerns (WHO, 1997:1). Quality of life is also defined as aspects of satisfaction and happiness with life as a whole, but also an overall sense of well-being (Centers for Disease Control and Prevention, 2000).

Health-related quality of life was defined by the Centers for Disease Control and Prevention (2000:6) as health perceptions on a mental and physical level, which includes social support, health risk and conditions, socioeconomic status and functional status. Health-related quality of life is related to risk factors (physical inactivity, smoking status and body mass index), and their related chronic diseases (hypertension, cancer, arthritis and diabetes) (Centers for Disease Control and Prevention, 2000:7). By measuring the health-related quality of life, the burden of preventable disease, disabilities and injuries can be determined and thereby indicating the relationships between these risk factors and health-related quality of life (Centers for Disease Control and Prevention, 2000:7).

Lam and Lauder (2000:159) state that in the last two decades health-related quality of life has become an important measure for patients with chronic diseases.

A study was done in eight countries to determine on how the health-related quality of life in the general population was influenced by the most common chronic diseases (Alonso *et al.*, 2004:283). The countries included Denmark, Germany, Italy, France, Japan, the Netherlands,

United States and Norway. Data were retrieved by cross-sectional mail and interview surveys. The self-reported chronic diseases included chronic lung disease, arthritis, hypertension, congestive cardiac failure, ischaemic heart disease and diabetes (Alonso *et al.*, 2004:283). Health-related quality of life was measured by using the SF-36 Health Survey which contains 36 items and gives a score according to the following scales: bodily pain, general health, role limitations as a result of physical health obstacles, vitality, social functioning, mental health, physical health obstacles and limitations due to emotional obstacles (Alonso *et al.*, 2004:285).

The results showed that 55.00% had at least one chronic condition assessed and self-reported chronic disease prevalence was the highest in the United States and Italy and the lowest in Denmark and Japan. The chronic disease with the highest impact on health-related quality of life was arthritis (Alonso *et al.*, 2004:287).

It can therefore be concluded from this section that there is an important correlation between patients with one or multiple chronic diseases (of which many may be CDL conditions) and quality of life.

2.9 Adherence, compliance and persistence

2.9.1 An overview

Adherence/compliance: Adherence describes all aspects of how well or poorly a patient follows a prescribed medicine-dosing regimen or medical advice (Van der Walt & Maartens, 2008:103). Adherence is synonymous with the term “compliance”, but is preferred as it is more patient centred (compliance implies following orders). Persistence can be defined as the time of continuous therapy, demarcated by the time from initiation of therapy to discontinuation of therapy (Cramer *et al.*, 2007:3). Persistence is defined by Peterson *et al.* (2007:6) as time over which a patient continues to fill a prescription, or the time from the initial fillings of the prescription until the patient discontinues refilling a prescription. Due to the nature of this study, the term adherence will be used to determine prescription refills, thus indicating possible chronic disease progression. Other studies use adherence (compliance) and persistence interchangeably.

Adherence is better with acute than chronic medicine and tends to decrease over time in case of chronic disease. Even in ideal circumstances of randomised clinical trials, adherence to chronic medicine is seldom more than 80.00% (Van der Walt & Maartens, 2008:103).

Cramer *et al.* (2007:3) defined medicine compliance as an act of conforming to timing, dosage, and frequency of medicine taking. Therefore, medicine compliance may be defined as “the extent

to which a patient acts in accordance with the prescribed interval and dose of a dosing regimen” (Cramer *et al.*, 2007:3). Compliance is measured over a period of time and reported as a percentage (refer to Figure 2.8 below) (Cramer *et al.*, 2007:2).

Persistence can also be defined as the time between refills, number of refills, renewal of prescription with an allowance for a pre-specified gap (Cramer *et al.*, 2007:2); the proportion of patients to whom a certain number of days’ supply of medicine is dispensed, as well as the proportion of patients continuing to refill prescriptions after a specified time interval (Cramer *et al.*, 2007:2).

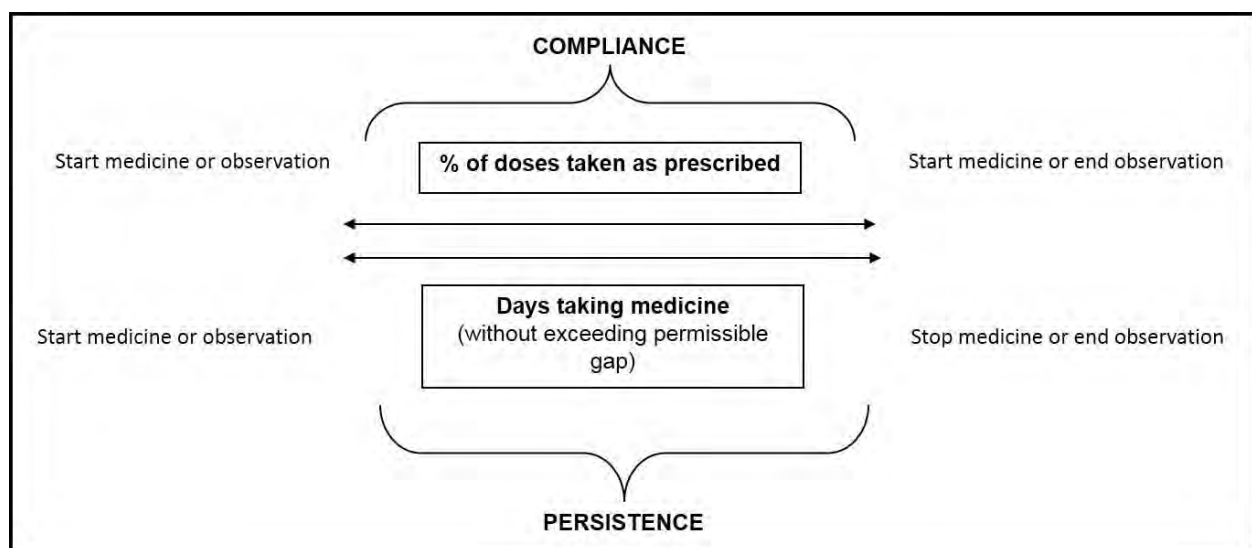


Figure 2.8: Definitions of compliance and persistence.

Discontinuation of chronic treatment is a major obstacle for patients, health care providers, and policy makers. Although for many chronic diseases pharmacotherapeutic options are available and effective as demonstrated in randomized clinical trials, patients often do not only refrain from taking their medicine as prescribed by their physician (non-compliance), but also fail to use it for a long uninterrupted period of time (non-persistence). This non-persistence constitutes a major barrier to controlling chronic diseases leading to an increased morbidity and mortality (Van Wijk *et al.*, 2006:11).

Rademan (2008:2), the Managing Director of Mediscor PBM, mentions that 64.00% of the CDL patients included in the 2007 report of Mediscor Medicines Review, claimed ten or more medicine refills in a period of 12 months and are considered compliant with medicine therapy. Compliance and persistence with medicine use should be top priorities for medical schemes and patients, as the costs of non-compliance are enormous. Furthermore, Rademan (2008:2) elaborates that medical schemes are looking at measures to reduce the medical bill, but potential savings* on

medicine expenditure due to non-adherence to medicine use, will only result in increased expenditure on other healthcare costs.

** Some of these potential savings could be achieved through the potential reduction of co-payments, through a number of ways (refer to section 2.5.1.2).*

Hiligsmann *et al.* (2012:161) further state that although non-adherence reduces therapy costs, the clinical effectiveness declines and therefore increases the healthcare costs associated with the condition. Therefore, to accurately estimate the cost-effectiveness of medicine therapies, concepts of compliance and persistence should be included in these evaluations of health outcomes and cost (Hiligsmann *et al.*, 2012:161).

According to Van der Walt and Maartens (2008:103), three major patterns of non-adherence are recognised:

- Non-acceptance (the patient never actually starts treatment);
- Incomplete execution (extra or missed doses, including “medicine holidays”), and;
- Early discontinuation.

Fleming (2008:S16) elaborates on the above by stating that patients often fail to either fill or take their prescriptions for chronic conditions, but they may also discontinue their medicine early or take their medicine less often than indicated. The implications of these various forms of non-adherent behaviour are significant. Even small gaps in therapy, such as those created by a missed prescription fill or a skipped week of taking prescribed medicine may reduce the benefits of regular therapy.

Cardiac failure and myocardial infarction require long-term use of medicine to reduce morbidity and mortality. Non-adherence to prescribed medicine can result in many obstacles, including poor blood pressure control, pathological changes and signs and symptoms associated with worsening cardiac function, hospitalisation and mortality (Albert, 2008:55). Despite advances in treating patients with cardiac failure and after myocardial infarction, treatment regimens are only beneficial if patients adhere to their prescribed therapy.

Delamater (2006:71) stated that diabetes is a challenging disease to manage successfully. It has further been acknowledged that non-adherence rates for chronic disease regimens and for lifestyle changes are about 50.00%. Substantial regimen adherence obstacles were prevalent in patients with diabetes as a group. These obstacles include social, healthcare provider and

medical system demographic, psychological, social, and disease-and treatment related factors (Delamater, 2006:76).

2.9.2 Methods to determine refill persistence

Persistence analysis must include a pre-specified limit on the number of days allowed between refills, considered the “permissible gap” (Cramer *et al.*, 2007:3).

Van Wijk *et al.* (2006:12) reported on a study done in the Netherlands that compared *three different methods* of calculating a 1-year refill persistence rate and associations between patient characteristics and 1-year persistence. These methods were (Van Wijk *et al.*, 2006:12):

The first method was based on a defined maximum number of days that the patient has been between the theoretic end date of a prescription and the start date of the next one to be classified as a continuous user.

The second method was based on a defined maximum fraction of the theoretic duration of the prescription after which the treatment gap occurs that a patient is allowed to have, and thus be classified as continuous user.

The third method was based on a combination of the first two methods. The maximum number of days a patient is allowed to have between two prescriptions, then to be classified as a continuous user. This was based on both a defined maximum number of days between two prescriptions and a defined maximum fraction of the theoretic duration of the prescription after which the treatment gap occurs, whichever is the lowest number of days.

Further, a specific value of 90 days for a maximum allowed treatment gap was chosen, because the Netherlands health insurance companies only compensate pharmacies for prescriptions with a maximum length of 90 days.

Other commonly used maximum allowed treatment option gaps include (Van Wijk *et al.*, 2006:12):

- Method 1: 30 days (comparable to 0.33 times the theoretical duration);
- Method 2: 45 days (comparable to 0.5 times the theoretical duration);
- Method 3: 90 days which is comparable to one times the theoretical duration of a prescription and;
- Method 4: 180 days; this is comparable to two times the theoretical duration of a prescription.

Van Wijk *et al.* (2006:17) conclude that different definitions of calculating 1-year persistence lead to different percentages of persistent patients and can also influence the association between patient characteristics and 1-year persistence. The use of method 2 or method 3 seems to be the most reasonable definition if persistence is to be studied. Results of studies on persistence with chronic medicine must be interpreted with great caution while assessing these studies.

A study was done by Dezii (2000a:2) in the United States to confirm a hypothesis that a greater percentage of patients receiving a single pill combining an ACE inhibitor with a diuretic would persist with therapy than patients receiving both medicine as separate pills. The method included prescription data that were obtained from a large commercial pharmacy benefit manager. Patients were regarded as being persistent if they renewed their prescription within three times the number of days supplied by the previous prescription. Patients were followed for one year from the date of the initial prescription. It was concluded from this study that the simplification of the medicine regimen by using combination therapy in a single pill for hypertension results in significant increases in persistence with prescribed therapy.

2.9.3 Methods to determine adherence

Other methods to determine adherence, except for MPR include (refer to Chapter 1, section 1.10.2.5):

“Proportion of days covered (PCD)”. The PCD can be determined by the following formulas (Adapted from Grymonpre *et al.*, 1998:749-754; Nau, 2011):

Electronic prescription claims data adherence:

$$\text{Adherence (PCD) (\%)} = \frac{\text{Number of days in period "covered" by medicine}}{\text{Number of days in the period}} \times 100$$

Nau (2011) further contributes by stating that PCD provides a more conservative estimate of adherence compared to MPR when patients are switching medicine or using dual-therapy in a class.

Pill count adherence:

$$\text{Adherence (\%)} = \frac{\text{Quantity dispensed} - \text{Quantity remaining}}{\text{Prescribed number of tablets} \times \text{Number of days between dispensing date and interview}} \times 100$$

Self-report adherence:

$$\text{Adherence (\%)} = \frac{\text{Number of tablets taken per day as reported by client}}{\text{Prescribed number of tablets per day as indicated on the label}} \times 100$$

Manual prescription claims data adherence:

$$\text{Adherence (\%)} = \frac{\text{Sum of quantity dispensed overall interval}}{\text{Sum of prescribed number of tablets per day as on label x Number of days in interval between first and last fill}} \times 100$$

2.9.4 Strategies to enhance medicine adherence

These strategies to enhance medicine adherence include the following:

- Patient involvement (Dezii, 2000b:10);
- Emphasize patient self-management of disease or illness. Taking ownership of one's condition results in increased motivation to understand the illness or treatment plan (Winnick *et al.*, 2005:e722);
- Involve the family of the patient to promote compliance (Rosner, 2006:558);
- Use the simplest effective regimen available. Single-dose or few-dose regimens leave little opportunity for failed compliance (Dezii, 2000b:11; Winnick *et al.*, 2005:e722);
- Routine compliance pill counts (Dezii, 2000b:11);
- Telephone reminders (Dezii, 2000b:11; Rosner, 2006:558);
- Selecting medicine to minimize adverse effects (Dezii, 2000b:11).

2.9.5 Barriers to adherence

Therapy-related factors (i.e. those that can be altered by a medicine change) include (Albert, 2008:58):

- Failure to initiate therapy during hospitalisation: In-hospital initiation of medicine has a dramatic effect on long-term treatment rates and patient's adherence.
- Lack of knowledge by the patient i.e. the purpose of the treatment is not clear, or the patient is not educated on his/her disease condition (Bester & Hammann, 2008:18)

- Complexity of medicine regimen such as polypharmacy and frequent dosing: The important factor is the prevalence of co-morbidities, which leads to treatment regimens that are particularly complex. Among the older population, the occurrence of co-morbid conditions is high. Therefore, the risk of poor adherence is higher among persons with three or more co-morbid conditions. A common example is the combination of type 2 diabetes, hypertension and hyperlipidaemia (Ockene *et al.*, 2002:632).
- Forgetfulness (Bester & Hammann, 2008:18);
- Medicine cost: cost remains an important obstacle to medicine adherence as well as refill policies. A lack of coverage, high co-payments*, and frequent refill requirements* are all powerful adherence disincentives (Ockene *et al.*, 2002:632).

**Co-payments and its influencing factors as well as factors pertaining to medicine refill are discussed in more detail in sections 2.5.1.2 and 2.9.*

- Adverse effects (lack of knowledge about possible adverse effects).

A common reason for non-compliance after the prescription has been filled includes adverse effects. Weight gain is a common adverse effect associated with atypical antipsychotics, and adverse effects associated with some antihypertensive medicine include impotence and dizziness. Adverse effects can also arise if a patient fails to take a medicine as instructed (Dezii, 2000b:8). Adverse effects due to drug-drug and drug-food interactions also can result in non-compliance, as well as polypharmacy, increasing the risk of medicine interactions.

2.9.5.1 Obstacles with chronic diseases and adherence

Some examples of adherence obstacles with CDL conditions include:

Chronic obstructive pulmonary disease (COPD)

Poor adherence to medicine therapy and disease management programs has been identified as the major factor resulting in emergency hospitalisation among COPD patients (George *et al.*, 2005:3199). However, a decrease in the number of hospitalisations and length of stay in hospital among patients with chronic respiratory ailments was due to better medicine adherence (George *et al.*, 2005:3199). Several factors predispose COPD patients to non-adherence, which makes the management of COPD complex as the patient needs to make lifestyle changes along with optimal medicine adherence (George *et al.*, 2005:3199). Rand (2005:98) reports that, as with asthma, COPD non-adherence with therapy is widespread and estimations are that almost half

of the prescription medicine dispensed each year for these conditions is not taken as prescribed. In addition, the evidence base for adherence to therapy in COPD patients is very limited. The limited data available suggest that, as in other chronic diseases, adherence is often poor with a negative influence on outcomes (Rand, 2005:100).

Hypertension

Uncontrolled hypertension is one of the most powerful contributors to cardiovascular disease, resulting in a fourfold risk of coronary artery disease and sevenfold risk of stroke as compared to normotensive patients. Thus, the majority of patients diagnosed with hypertension do not take their medicine as prescribed (Cramer, 1998:1563). Therefore, adherence to recommended medicine is a major contributor to adequate blood pressure control. (Bourgault *et al.*, 2005:608).

Bipolar disorder

The costs of bipolar disorder to the patient and healthcare community are high, and it is important in finding ways to decrease unnecessary financial and personal costs involved (Lage & Hassan, 2009). A retrospective cohort study was done by Lage and Hassan (2009) to examine the association between adherence to antipsychotics and risk of hospitalisations and emergency room visits among patients with bipolar disorder. Data were obtained from the Pharmetrics database in the United States. The period of this study, was from 1 January 2000 to 31 December 2006, and contained data from over 75 different managed care organisations that included more than 55 million individuals (Lage & Hassan, 2009). This study revealed that more than half of the 7 769 patients with bipolar took their antipsychotic medicine less than half of the time, and the majority of patients (78.70%) were taking their medicine less than 75.00% of the time. Lage and Hassan (2009) conclude from this study that these results are consistent with previous research indicating low levels of adherence to antipsychotics and mood stabilizers among patients with bipolar disorder.

Cardiac failure

Van der Wal *et al.* (2005:5) report that, because of the improvement of the pharmacological and non-pharmacological treatment of cardiac failure (heart failure) (HF) patients, the HF patients' related therapeutic regimen is becoming more complicated. In addition, eleven retrospective studies have reported the worsening HF and the relationship with noncompliance. In nine of these studies, the most commonly identified cause of worsening HF was noncompliance with medicine and diet (Van der Wal *et al.*, 2005:6). In 21.00% to 64.00% of patients, noncompliance was the

precipitating factor of HF exacerbation, sometimes leading to hospitalisation (Van der Wal *et al.*, 2005:6).

Evidence-based interventions to improve compliance in patients with HF are scarce (Van der Wal *et al.*, 2005:15). As medicine is the cornerstone of the treatment of HF in patients nowadays, noncompliance with medicine and other lifestyle recommendations is a major obstacle in patients with HF (Van der Wal *et al.*, 2005:15).

2.9.5.1.1 Possible adverse outcomes related to non-adherence with medicine regimens

Adverse outcomes include (Iuga & McGuire, 2014:37; Rosner, 2006:558):

- Added discomfort to the patient;
- Adverse effects on the patient's health;
- Worsening or aggravation of the illness;
- Decreased quality of life;
- Increased utilisation of services, such as additional diagnostic testing, and;
- Increased costs to the patient and the health system.

2.10 Chapter summary

This Chapter analysed and described the difference in burden and treatment of the different CDL conditions and their co-morbidities. The different aspects that influence their treatment cost were also discussed.

Chapter 3 will contain the research results of the empirical investigation as well as the discussion thereof.

CHAPTER 3:

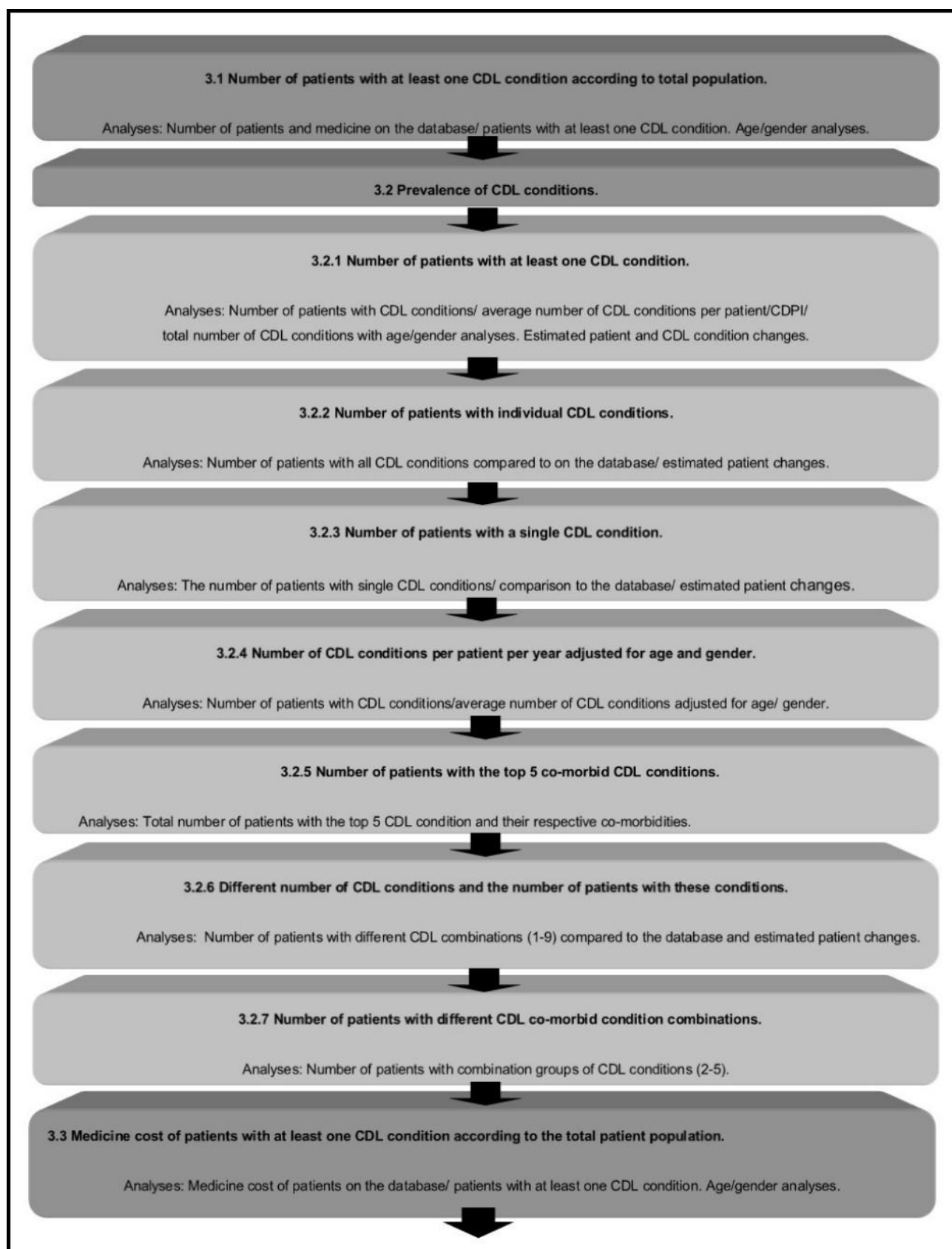
STUDY RESULTS AND DISCUSSION

In this Chapter the results of the empirical investigation are discussed. The results are presented according to the specific annual study periods from 2008 until 2012.

The results discussed will be divided into two main sections namely *frequency/prevalence* and *cost*. Each of these sections will further contain a sub-section for presentation of results. The presentation of the results is illustrated in Figure 3.1.

3.1 Number of patients with at least one CDL condition according to total population.

Data in this section contain total patient population on the database for the entire study period as well as the patient population with at least one CDL condition with associated medicines. Data were further analysed according to age and gender. Table 3.1 summarises and Figure 3.2 and 3.3 illustrate the CDL conditions.



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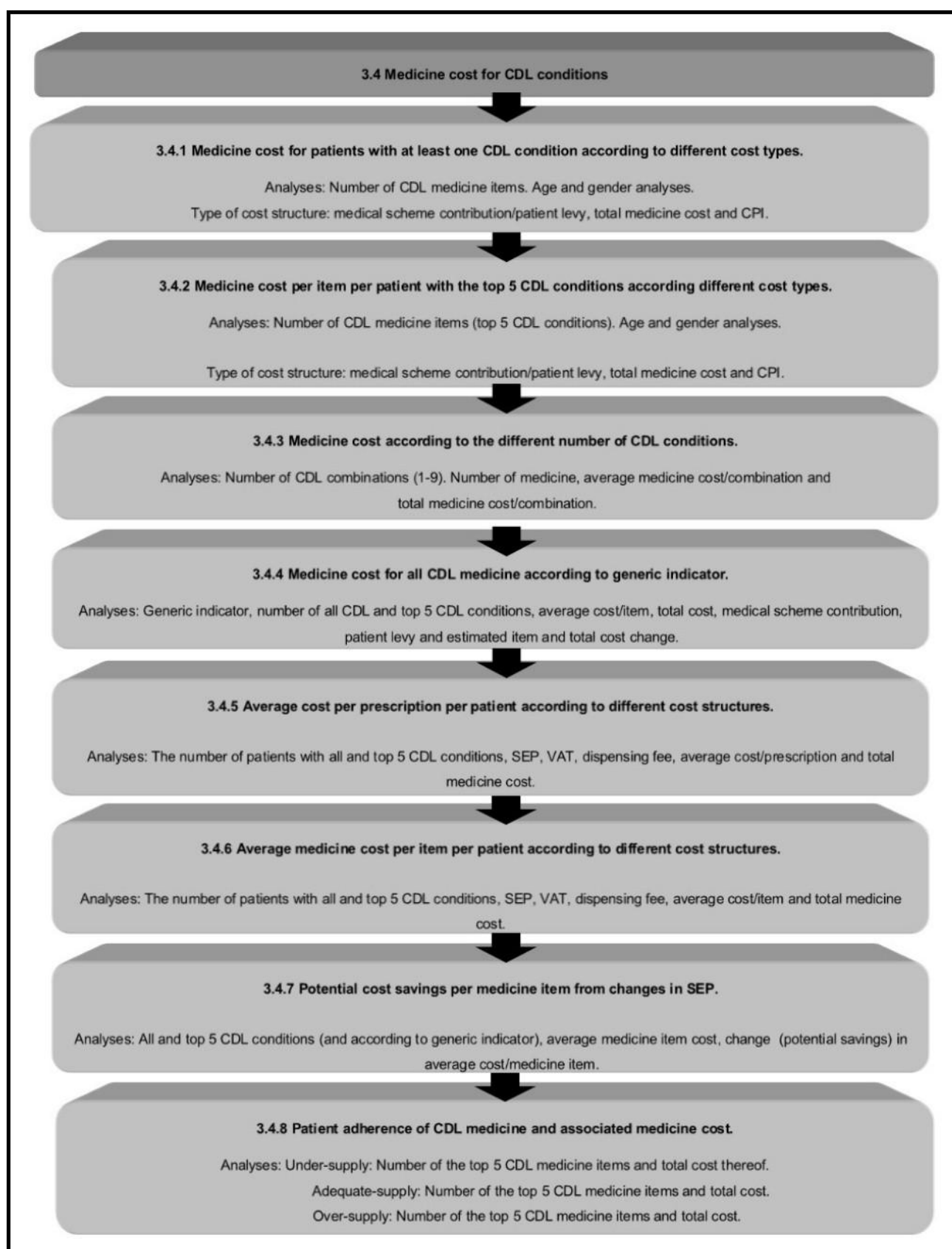


Figure 3.1: Overview of the presentation of the results.

Table 3.1: Number of patients on the database compared to patients with CDL conditions.

Description			Year 2008	Year 2009	Year 2010	Year 2011	Year 2012
Number of patients on the database (N)	Gender	Female	538 254	712 305	661 007	578 593	545 068
		Male	436 243	595 223	559 282	499 237	484 627
	Age group (years)	0 > age ≤ 12	124 440	192 387	175 664	156 805	146 296
		12 > age ≤ 50	524 962	705 064	640 480	557 250	523 587
		50 > age ≤ 60	154 659	191 661	182 559	160 018	156 430
		60 > age ≤ 70	89 570	115 114	114 697	102 425	102 047
	age > 70	80 866	103 302	106 889	101 336	101 339	
Total		974 497	1 307 528	1 220 289	1 077 834	1 029 699	
Number of patients with at least one CDL condition (n)	Gender	Female	125 548 (23.33%)	142 690 (20.03%)	140 133 (21.20%)	129 192 (22.33%)	146 678 (26.91%)
		Male	88 731 (20.34%)	112 244 (18.86%)	111 062 (19.86%)	104 159 (20.86%)	122 007 (25.18%)
	Age group (years)	0 > age ≤ 12	3 611 (2.90%)	4511 (2.34%)	4 273 (2.43%)	4165 (2.66%)	4 088 (2.79%)
		12 > age ≤ 50	49 519 (9.43%)	60 697 (8.61%)	57 516 (8.98%)	52 628 (9.44%)	56 479 (10.79%)
		50 > age ≤ 60	52 040 (33.65%)	61 735 (32.21%)	60 167 (32.96%)	54 364 (33.97%)	62 851 (40.18%)
		60 > age ≤ 70	51 215 (57.18%)	60 026 (52.14%)	59 716 (52.06%)	54 988 (53.69%)	66 388 (65.06%)
	age > 70	57 894 (71.59%)	67 965 (65.79%)	69 523 (65.04%)	67 206 (66.32%)	78 879 (77.84%)	
Total		214 279 (21.99%)	254 934 (19.49%)	251 195 (20.58%)	233 351 (21.65%)	268 685 (26.09%)	
Number of medicine items on the database (N)	Gender	Female	9 893 928	12 834 715	12 103 038*	10 327 159*	9 237 012*
		Male	6 545 325	8 814 276	8 424 739*	7 439 420*	7 172 238*
	Age group (years)	0 > age ≤ 12	1 085 511	1 727 830	1 552 825	1 303 782	1 209 684
		12 > age ≤ 50	6 416 499	8 347 338	7 604 671	6 378 677	5 906 537
		50 > age ≤ 60	3 288 346	4 153 722	3 945 088	3 384 147	3 280 626
		60 > age ≤ 70	2 585 064	3 418 324	3 366 712	2 945 546	2 876 437
	age > 70	3 063 833	4 001 777	4 058 470	3 754 442	3 136 008	
Total		16 439 253	21 648 991	20 527 766	17 766 594	16 409 292	
Number of CDL condition medicine items (n)	Gender	Female	1 376 575 (13.91%)	1 804 555 (14.06%)	1 728 965 (14.29%)	1 735 386 (16.80%)	1 551 209 (16.79%)
		Male	1 174 733 (17.95%)	1 526 551 (17.32%)	1 480 315 (17.58%)	1 515 603 (20.37%)	1 513 911 (21.11%)
	Age group (years)	0 > age ≤ 12	20 380 (1.88%)	43 014 (2.49%)	39 469 (2.54%)	40 356 (3.09%)	34 964 (2.89%)
		12 > age ≤ 50	445 947 (6.95%)	578 377 (6.93%)	541 606 (7.12%)	554 426 (8.69%)	520 912 (8.82%)
		50 > age ≤ 60	589 949 (17.94%)	746 537 (17.97%)	710 961 (18.02%)	712 964 (21.07%)	712 071 (21.71%)
		60 > age ≤ 70	646 249 (25.00%)	837 411 (24.50%)	807 093 (23.97%)	817 432 (27.75%)	822 188 (28.58%)
	age > 70	848 783 (27.00%)	1 125 767 (28.13%)	1 110 151 (27.35%)	1 124 811 (29.96%)	974 985 (31.09%)	
Total		2 551 308 (15.52%)	3 331 106 (15.39%)	3 209 280 (15.63%)	3 249 989 (18.29%)	3 065 120 (18.68%)	

Note: All percentages in Table 3.1 are expressed as a percentage of the equivalent group on the total database.* Unidentified patients with regard to gender include: (2010) - (n = 11), (2011) - (n = 15) and (2012) - (n = 42).

Table 3.1 presents the number of patients on the database and the number of patients with at least one CDL condition. The prevalence of the patients with at least one CDL condition increased overall from 21.99% (n = 214 279) of the total number of patients on the database in 2008, up to 26.09% (n = 268 685) in 2012.

- Female patients with at least one CDL condition increased from 23.33% (2008) to 26.91% (2012), whereas male patients had an overall increase of 20.34% (2008) to 25.18% (2012).

The prevalence of patients with at least one CDL condition according to age group increased as contribution to the total database except in the age group 0 > age ≤ 12 years.

- Age group: 0 > age ≤ 12 years: decreased from 2.90% (2008) to 2.79% (2012).
- Age group: 12 > age ≤ 50 years: increased from 9.43% (2008) to 10.79% (2012);
- Age group: 50 > age ≤ 60 years: increased from 33.65% (2008) to 40.18% (2012);
- Age group: 60 > age ≤ 70 years: increased from 57.18% (2008) to 65.06% (2012), and age;
- Age group: > 70 years: increased from 71.59% in 2008 to 77.84% in 2012.

The prevalence of CDL medicine items attributed to an overall increase of the total number of all medicine on the database:

- From 15.52% (n = 2 551 308) in 2008 to 18.68% (n = 3 065 120) in 2012.

The contribution of CDL medicine items to the prevalence of medicine on the database for different genders:

- Male patients: increased from 17.95% (2008) to 21.11% (2012).
- Female patients: increased from 13.91% (2008) to 16.79% (2012).

The prevalence of CDL medicine items increased in all age group with 0 > age ≤ 12 years from 1.88% (2008) to 2.89% (2012). The other age groups: 12 > age ≤ 50 years increased from 6.95% (2008) to 8.82% (2012); 50 > age ≤ 60 years increased from 17.94% (2008) to 21.71% (2012); 60 > age ≤ 70 years increased from 25.00% (2008) to 28.58% (2012) and age group > 70 years increased from 27.00% (2008) to 31.09% (2012).

Therefore, the prevalence of patients with at least one CDL condition and prevalence of CDL medicine with regard to the total on the database increased from 2008 until 2012.

3.2 Prevalence of CDL conditions.

The main section, 3.2 will contain different sub-sections as listed below:

- ❖ 3.2.1 Number of patients with at least one CDL condition.
- ❖ 3.2.2 Number of patients with individual CDL conditions.
- ❖ 3.2.3 Number of patients with a single CDL condition.
- ❖ 3.2.4 Number of CDL conditions per patient per year adjusted for age and gender.
- ❖ 3.2.5 Number of patients with the top 5 co-morbid CDL conditions.
- ❖ 3.2.6 Different number of CDL conditions and the number of patients with these conditions.
- ❖ 3.2.7 Number of patients with different CDL co-morbid condition combinations.

3.2.1 Number of patients with at least one CDL condition.

This section will contain a summary and data analyses of the number of patients with at least one CDL condition. The number of patients and CDL conditions will be discussed according to age and gender. Statistical and practical significant difference in average number of CDL conditions per patients will also be analysed. The change in number of patients and CDL conditions will be used to determine the change between 2008 and 2012 and estimated annual change of these two groups. The results will be summarized in Tables 3.2, 3.3, 3.4 and illustrated in Figure, 3.2, 3.3 and 3.4. In addition, the average number of medicine items per patient per year according to age and gender will be discussed. The chronic disease-prevalence index (CDPI) will be used to determine whether the number of CDL medicine items is relatively low or high per patient per year. These results are summarised in Table 3.5.

Table 3.2: Number of patients with at least one CDL condition according to age and gender from 2008 until 2012.

Year	Description		Number of patients		Mean (number of CDL conditions/patient) (n)	Standard deviation (±)	Confidence interval (95%CI)	Number of CDL conditions		Gender (2008-2012)		Age group (years)(2008-2012)	
			(n)	%*				(N)	% [#]	p-value	Cramer's V	p-value	Cramer's V
2008	Gender	Female	125 548	58.59	1.54	0.83	1.53-1.54	193 182	57.26	<i>p</i> < 0.0001	<i>Cramer's V</i> = 0.0263	<i>p</i> < 0.0001	<i>Cramer's V</i> = 0.0158
		Male	88 731	41.41	1.63	0.87	1.62-1.63	144 200	42.74				
	Age group (years)	0 > age ≤ 12	3 611	1.69	1.01	0.11	1.01-1.02	3 654	1.08				
		12 > age ≤ 50	49 519	23.11	1.27	0.57	1.27-1.28	63 090	18.70				
		50 > age ≤ 60	52 040	24.29	1.50	0.75	1.49-1.50	77 881	23.08				
		60 > age ≤ 70	51 215	23.90	1.67	0.88	1.66-1.67	85 375	25.31				
		age >70	57 894	27.02	1.85	1.00	1.85-1.86	107 382	32.00				
		Total	214 279	100.00	1.57	0.85	1.57-1.58	337 382	100.00				
2009	Gender	Female	142 690	55.97	1.67	0.90	1.67-1.68	238 440	55.84				
		Male	112 244	44.03	1.68	0.90	1.67-1.68	188 596	44.16				
	Age group (years)	0 > age ≤ 12	4 511	1.77	1.02	0.14	1.01-1.02	4 582	1.07				
		12 > age ≤ 50	60 697	23.81	1.34	0.64	1.33-1.34	81 183	19.01				
		50 > age ≤ 60	61 735	24.22	1.61	0.83	1.60-1.61	99 196	23.23				
		60 > age ≤ 70	60 026	23.55	1.80	0.93	1.80-1.81	108 259	25.35				
		age >70	67 965	26.66	1.97	1.03	1.96-1.98	133 816	31.34				
		Total	254 934	100.00	1.68	0.90	1.67-1.68	427 036	100.00				
2010	Gender	Female	140 133	55.79	1.68	0.90	1.68-1.69	235 631	55.65				
		Male	111 062	44.21	1.69	0.90	1.69-1.70	187 760	44.35				
	Age group (years)	0 > age ≤ 12	4 273	1.70	1.01	0.14	1.01-1.02	4 334	1.02				
		12 > age ≤ 50	57 516	22.90	1.34	0.64	1.33-1.34	76 844	18.15				
		50 > age ≤ 60	60 167	23.77	1.61	0.83	1.61-1.62	97 032	22.92				
		60 > age ≤ 70	59 716	23.95	1.81	0.93	1.80-1.81	107 860	25.48				
		age >70	69 523	27.68	1.98	1.02	1.97-1.98	137 321	32.43				
		Total	251 195	100.00	1.69	0.90	1.68-1.69	423 391	100.00				
2011	Gender	Female	129 192	55.36	1.71	0.93	1.71-1.72	221 462	55.22				
		Male	104 159	44.64	1.72	0.93	1.72-1.73	179 574	44.78				
	Age group (years)	0 > age ≤ 12	4 165	1.78	1.01	0.13	1.01-1.02	4 220	1.05				
		12 > age ≤ 50	52 628	22.55	1.35	0.65	1.34-1.35	70 812	17.66				
		50 > age ≤ 60	54 364	23.30	1.64	0.85	1.63-1.65	89 066	22.21				
		60 > age ≤ 70	54 988	23.56	1.85	0.96	1.84-1.86	101 848	25.40				
		age >70	67 206	28.80	2.01	1.04	2.00-2.02	135 090	33.69				
		Total	233 351	100.00	1.72	0.93	1.71-1.72	401 036	100.00				
2012	Gender	Female	146 678	54.59	1.76	0.96	1.76-1.77	258 263	54.18				
		Male	122 007	45.41	1.79	0.98	1.79-1.80	218 455	45.82				
	Age group (years)	0 > age ≤ 12	4 088	1.52	1.01	0.11	1.01-1.02	4 137	0.87				
		12 > age ≤ 50	56 479	21.02	1.37	0.68	1.36-1.38	77 362	16.23				
		50 > age ≤ 60	62 851	23.39	1.68	0.88	1.67-1.68	105 427	22.12				
		60 > age ≤ 70	66 388	24.71	1.91	1.00	1.90-1.92	126 797	26.60				
		age >70	78 879	29.36	2.07	1.07	2.06-2.07	162 995	34.19				
		Total	268 685	100.00	1.77	0.97	1.77-1.78	476 718	100.00				

%* = $\frac{\text{Number of patients}}{\text{Total number of patients with CDL conditions for that year}} \times 100$

%[#] = $\frac{\text{Number of CDL conditions}}{\text{Total number of CDL conditions for that year}} \times 100$

Table 3.3: Change in number of patients and CDL conditions according to age and gender (2008 vs 2012).

Description		Year 2008		Year 2012		Patient change [†] (2008 vs 2012) (n)	CDL condition change [‡] (2008 vs 2012)(N)	Estimated annual patient change [*] (n)	Estimated annual CDL condition change [#] (N)
		Number of patients (n)	Number of CDL conditions (N)	Number of patients (n)	Number of CDL conditions (N)				
Gender	Female	125 548	193 182	146 678	258 263	↑ 21 130 (16.83%)	↑ 65 081 (33.69%)	↑ 5 283 (4.21%)	↑ 16 270 (8.42%)
	Male	88 731	144 200	122 007	218 455	↑ 33 276 (37.50%)	↑ 74 255 (51.49%)	↑ 8 319 (9.38%)	↑ 18 564 (12.87%)
Age (years)	0 > age ≤ 12	3 611	3 654	4 088	4 137	↑ 477 (13.21%)	↑ 483 (13.22%)	↑ 119 (3.30%)	↑ 121 (3.31%)
	12 > age ≤ 50	49 519	63 090	56 479	77 362	↑ 6 960 (14.06%)	↑ 14 272 (22.62%)	↑ 1 740 (3.52%)	↑ 3 568 (5.66%)
	50 > age ≤ 60	52 040	77 881	62 851	105 427	↑ 10 811 (17.20%)	↑ 27 546 (35.37%)	↑ 2 703 (4.30%)	↑ 6 887 (8.84%)
	60 > age ≤ 70	51 215	85 375	66 388	126 797	↑ 15 173 (29.63%)	↑ 41 422 (48.52%)	↑ 3 793 (7.41%)	↑ 10 356 (12.13%)
	age >70	57 894	107 382	78 879	162 995	↑ 20 985 (36.25%)	↑ 55 613 (51.79%)	↑ 5 246 (9.06%)	↑ 13 903 (12.95%)

^{*} Estimated annual patient change = $\frac{\text{Patient change (2008 vs 2012)}}{4^{\&}}$

[#] Estimated annual CDL condition change = $\frac{\text{CDL condition change (2008 vs 2012)}}{4^{\&}}$

[†] Patient change (2008 vs 2012) = $\frac{\text{Number of patients (2008)} - \text{(2012)}}{\text{Number of patients (2008)}} \times 100$

[‡] CDL condition change (2008 vs 2012) = $\frac{\text{CDL conditions (2008)} - \text{(2012)}}{\text{CDL conditions (2008)}} \times 100$

[&] Annual change between 2 study years (2008-2009, 2009-2010, 2010-2011 and 2011-2012)

Table 3.4: Statistical and practical significant difference in the average number of patients with CDL conditions according to age and gender from 2008 until 2012 (as indicated in Table 3.2).

Year	Description comparison		Mean (number of CDL conditions/patient) (n)	Standard deviation ($\pm$)	Confidence interval (95%CI)	p-value	d-value *
2008	Gender	Female and	1.54	0.83	1.53-1.54	< 0.05	0.10
		Male	1.63	0.87	1.62-1.63		
2009	Gender	Female and	1.67	0.90	1.67-1.68	< 0.05	0.01
		Male	1.68	0.90	1.67-1.68		
2010	Gender	Female and	1.68	0.90	1.68-1.69	< 0.05	0.01
		Male	1.69	0.90	1.69-1.70		
2011	Gender	Female and	1.71	0.93	1.71-1.72	< 0.05	0.01
		Male	1.72	0.93	1.72-1.73		
2012	Gender	Female and	1.76	0.96	1.76-1.77	< 0.05	0.03
		Male	1.79	0.98	1.79-1.80		
2008	Age group (years)	0 > age $\leq$ 12 and	1.01	0.11	1.01-1.02	< 0.05	0.46
		12 > age $\leq$ 50	1.27	0.57	1.27-1.28		
		12 > age $\leq$ 50 and	1.27	0.57	1.27-1.28	< 0.05	0.31
		50 > age $\leq$ 60	1.50	0.75	1.49-1.50		
		50 > age $\leq$ 60 and	1.50	0.75	1.49-1.50	< 0.05	0.19
		60 > age $\leq$ 70	1.67	0.88	1.66-1.67		
		60 > age $\leq$ 70 and	1.67	0.88	1.66-1.67	< 0.05	0.18
		age > 70	1.85	1.00	1.85-1.86		
2009	Age group (years)	0 > age $\leq$ 12 and	1.02	0.14	1.01-1.02	< 0.05	0.50
		12 > age $\leq$ 50	1.34	0.64	1.33-1.34		
		12 > age $\leq$ 50 and	1.34	0.64	1.33-1.34	< 0.05	0.33
		50 > age $\leq$ 60	1.61	0.83	1.60-1.61		
		50 > age $\leq$ 60 and	1.61	0.83	1.60-1.61	< 0.05	0.20
		60 > age $\leq$ 70	1.80	0.93	1.80-1.81		
		60 > age $\leq$ 70 and	1.80	0.93	1.80-1.81	< 0.05	0.17
		age > 70	1.97	1.03	1.96-1.98		
2010	Age group (years)	0 > age $\leq$ 12 and	1.01	0.14	1.01-1.02	< 0.05	0.52
		12 > age $\leq$ 50	1.34	0.64	1.33-1.34		
		12 > age $\leq$ 50 and	1.34	0.64	1.33-1.34	< 0.05	0.33
		50 > age $\leq$ 60	1.61	0.83	1.61-1.62		
		50 > age $\leq$ 60 and	1.61	0.83	1.61-1.62	< 0.05	0.22
		60 > age $\leq$ 70	1.81	0.93	1.80-1.81		
		60 > age $\leq$ 70 and	1.81	0.93	1.80-1.81	< 0.05	0.17
		age > 70	1.98	1.02	1.97-1.98		

*Mean variance analyses between gender groups: t-test was conducted (also refer to Chapter 1, section 1.11.2.2).

*Mean variance analyses between age groups: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Year	Description comparison		Mean (number of CDL conditions/patient) (n)	Standard deviation ($\pm$)	Confidence interval (95%CI)	p-value	d-value *
2011	Age group (years)	0 > age $\leq$ 12 and	1.01	0.13	1.01-1.02	< 0.05	0.52
		12 > age $\leq$ 50	1.35	0.65	1.34-1.35		
		12 > age $\leq$ 50 and	1.35	0.65	1.34-1.35	< 0.05	0.34
		50 > age $\leq$ 60	1.64	0.85	1.63-1.65		
		50 > age $\leq$ 60 and	1.64	0.85	1.63-1.65	< 0.05	0.22
		60 > age $\leq$ 70	1.85	0.96	1.84-1.86		
		60 > age $\leq$ 70 and	1.85	0.96	1.84-1.86	< 0.05	0.15
		age > 70	2.01	1.04	2.00-2.02		
2012	Age group (years)	0 > age $\leq$ 12 and	1.01	0.11	1.01-1.02	< 0.05	0.53
		12 > age $\leq$ 50	1.37	0.68	1.36-1.38		
		12 > age $\leq$ 50 and	1.37	0.68	1.36-1.38	< 0.05	0.35
		50 > age $\leq$ 60	1.68	0.88	1.67-1.68		
		50 > age $\leq$ 60 and	1.68	0.88	1.67-1.68	< 0.05	0.23
		60 > age $\leq$ 70	1.91	1.00	1.90-1.92		
		60 > age $\leq$ 70 and	1.91	1.00	1.90-1.92	< 0.05	0.15
		age > 70	2.07	1.07	2.06-2.07		

*Mean variance analyses between gender groups: t-test was conducted (also refer to Chapter 1, section 1.11.2.2).

*Mean variance analyses between age groups: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table 3.2 recorded that there was an overall increase from 2008 until 2012 of 25.39% (n = 54 406) in the prevalence of patients with at least one CDL condition. The increase in the prevalence of chronic conditions can be confirmed by a study that was done by Abegunde *et al.* (2007:1929), which projected the burden of chronic diseases in 23 countries. The countries included Russia, Egypt, Ukraine, Democratic Republic of the Congo, Nigeria, Ethiopia, South Africa, Burma, Bangladesh, India, Pakistan, Turkey, Indonesia, Iran, Brazil, Vietnam, China, Poland, Philippines, Thailand, Argentina, Mexico and Columbia (Abegunde *et al.*, 2007:1930). This study projected that deaths associated with all chronic diseases may increase from 61.00% of the total disease burden in 2005 to 71.00% in 2030. Also, deaths from cardiovascular disease and diabetes may increase from 33.00% to 36.00% of the total disease burden, and chronic respiratory disease, which includes asthma, would increase from 8.00% in 2005 to 12.00% in 2030 (Abegunde *et al.*, 2007:1931).

Table 3.2 further reveal that the prevalence of CDL conditions also increased overall with 41.30% (n = 139 336) between 2008 and 2012 with the highest increase between 2008 and 2009 of 26.57% (n = 89 654). Possible reasons for the overall increase in patients might be that either

more patients were diagnosed with a CDL condition or more patients with an existing CDL condition registered their condition as a chronic condition with their respective medical schemes.

The total average number of CDL conditions per patient increased with a statistically significant difference ($p < 0.05$) from (refer to Table 3.2):

- 2008 - 1.57 ± 0.85 (95%CI:1.57-1.58);
- 2009 - 1.68 ± 0.90 (95%CI:1.67-1.68);
- 2010 - 1.69 ± 0.90 (95%CI:1.68-1.69);
- 2011 - 1.72 ± 0.93 (95%CI:1.71-1.72); until
- 2012 - 1.77 ± 0.97 (95%CI:1.77-1.78).

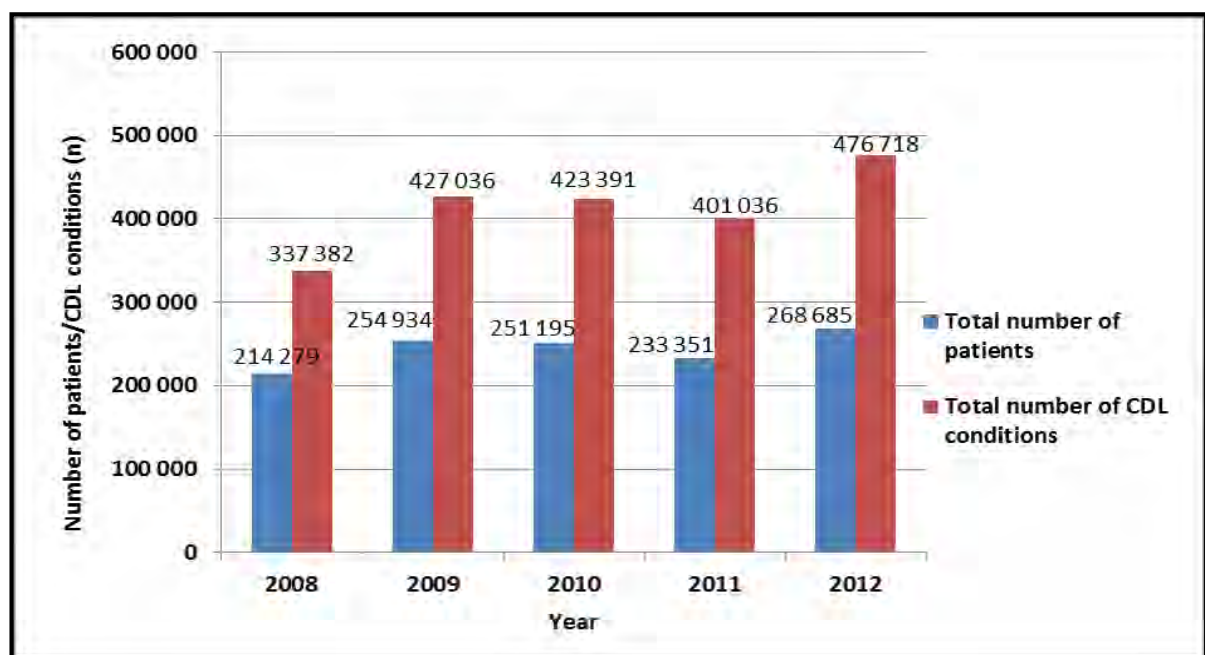


Figure 3.2: Number of patients with at least one CDL condition from 2008 until 2012.

Female versus male patients (refer to Table 3.2)

- Female patients accounted for the majority of patients with at least one CDL condition in each year from 2008 until 2012. The highest increase was between 2011 and 2012, an increase of 13.53% (n = 17 468).
- Male patients also had an overall increase from 2008 until 2012, with the highest increase between 2008 and 2009 of 26.50% (n = 23 513).

There was no practical significant association between gender groups and their number of respective CDL conditions per year for the study period (*Cramer's V* = 0.0263; *p* < 0.0001) (refer to Table 3.2). The number of male patients and their associated CDL conditions had higher increases between 2008 and 2012 than female patients.

The highest estimated annual increase in the prevalence of patients and CDL conditions according to gender were for male patients, with 9.38% (n = 8 319) and 12.87% (n = 18 564) respectively (refer to Table 3.3).

The average number of CDL conditions per female patients versus male patients, increased from:

- 2008 - 1.54 ± 0.83 (95%CI:1.53-1.54) versus 1.63 ± 0.87 (95%CI:1.62-1.63) to
- 2012 - 1.76 ± 0.96 (95%CI:1.76-1.77) versus 1.79 ± 0.98 (95%CI:1.79-1.80).

The difference in average number of CDL conditions per patient between male and female patients was of no large practical significance (*d* < 0.8; *p* < 0.05) (refer to Table 3.4). The increase in the number of patients from 2008 until 2012 could be also attributed to an increase in medical scheme beneficiaries as reported by the PBM Company used in this study (refer to Chapter 2, section 2.3.3.1). The higher number of non-communicable diseases in female patients was also found in other studies done in South Africa as found by Phaswana-Mafuya *et al.* (2013:3) (refer to Chapter 2, section 2.6.4) and Germany (refer to Chapter 2, section 2.6.5). In another study in the United States, Paez *et al.* (2009:18) determined the number of self-reported chronic conditions to represent 292 million (143 million male and 149 million female) Americans. They also found that female patients had more co-morbid chronic conditions than male patients, with two conditions (9.40% male patients versus 12.00% female patients) and three or more conditions (10.70% male patients versus 15.80% female patients).

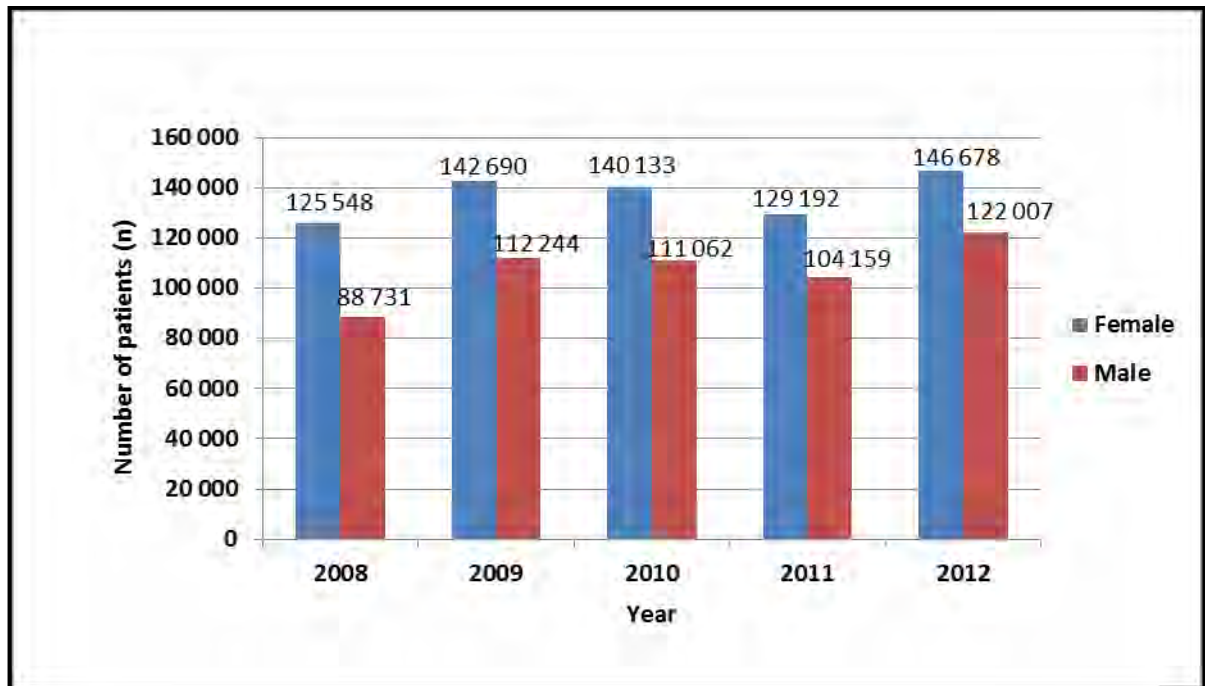


Figure 3.3: Number of patients with at least one CDL condition according to gender from 2008 until 2012.

Age groups (refer to Table 3.2)

All age groups had an overall increase in the number of patients with at least one CDL condition from 2008 until 2012. No practical significant association between age groups and the number of their respective CDL conditions was found (*Cramer's V* = 0.0158; *p* < 0.0001). The average number of CDL conditions per patient changed during the study period with:

- Age group: 0 > age ≤ 12 years : 2008 - 1.01 ± 0.11 (95%CI:1.01-1.02) to 2012 - 1.01 ± 0.11 (95%CI:1.01-1.02);
- Age group: 12 > age ≤ 50 years: 2008 - 1.27 ± 0.57 (95%CI:1.27-1.28) to 2012 - 1.37 ± 0.68 (95%CI:1.36-1.38);
- Age group: 50 > age ≤ 60 years: 2008 - 1.50 ± 0.75 (95%CI:1.49-1.50) to 2012 - 1.68 ± 0.88 (95%CI:1.67-1.68);
- Age group: 60 > age ≤ 70 years: 2008 1.67 ± 0.88 (95%CI:1.66-1.67) to 2012 - 1.91 ± 1.00 (95%CI:1.90-1.92); and

- Age group: 70 > age years: 2008 - 1.85 ± 1.00 (95%CI:1.85-1.86) to 2012 - 2.07 ± 1.97 (95%CI:2.06-2.07).

These differences in average number of CDL conditions per patient per year between the age groups were of statistical significance ($p < 0.05$), but not of large practical significance ($d < 0.8$) (refer to Table 3.4). All age groups had their highest number of patients in 2012, except for age groups 0 to 12 and 12 to 50 years. Age group > 70 years had the highest number of patients of all the age groups with CDL conditions from 2008 until 2012. The largest increase in the prevalence of patients between 2008 and 2012 was for age group > 70 years (36.25%; $n = 20\ 985$) and for CDL conditions (age group > 70 years; 51.79%; $n = 55\ 613$). Age group > 70 years thus had the highest estimated annual patient increase of 9.06% ($n = 5\ 246$) and estimated increase in prevalence of CDL conditions of 12.95% ($n = 13\ 903$) (refer to Table 3.3).

Above results confirmed the findings by Paez *et al.* (2009:18) which found that the prevalence of co-morbid chronic conditions increases with increasing age. This study found that when comparing patients of age 0 to 19 years with patients ≥ 80 years 3.70% of patients (0 to 19 years) versus 20.20% (≥ 80 years) had two conditions, and 1.20% (0 to 19 years) versus 54.20% (≥ 80 years) in patients with three or more conditions (Paez *et al.*, 2009:18). This confirms that the elderly, who are the most rapidly growing population in the majority of western countries, have an increased number of chronic diseases and disabilities (Nobili *et al.*, 2011:28). A century ago, one in twenty people were aged 65 years and older, in 2011 the proportion was one in six and by 2050, the proportion will be one in four with chronic diseases (Nobili *et al.*, 2011:29). The study by Phaswana-Mafuya *et al.* (2013:3) also found that the higher age groups had a higher prevalence of non-communicable diseases (refer to Chapter 2, section 2.6.4).

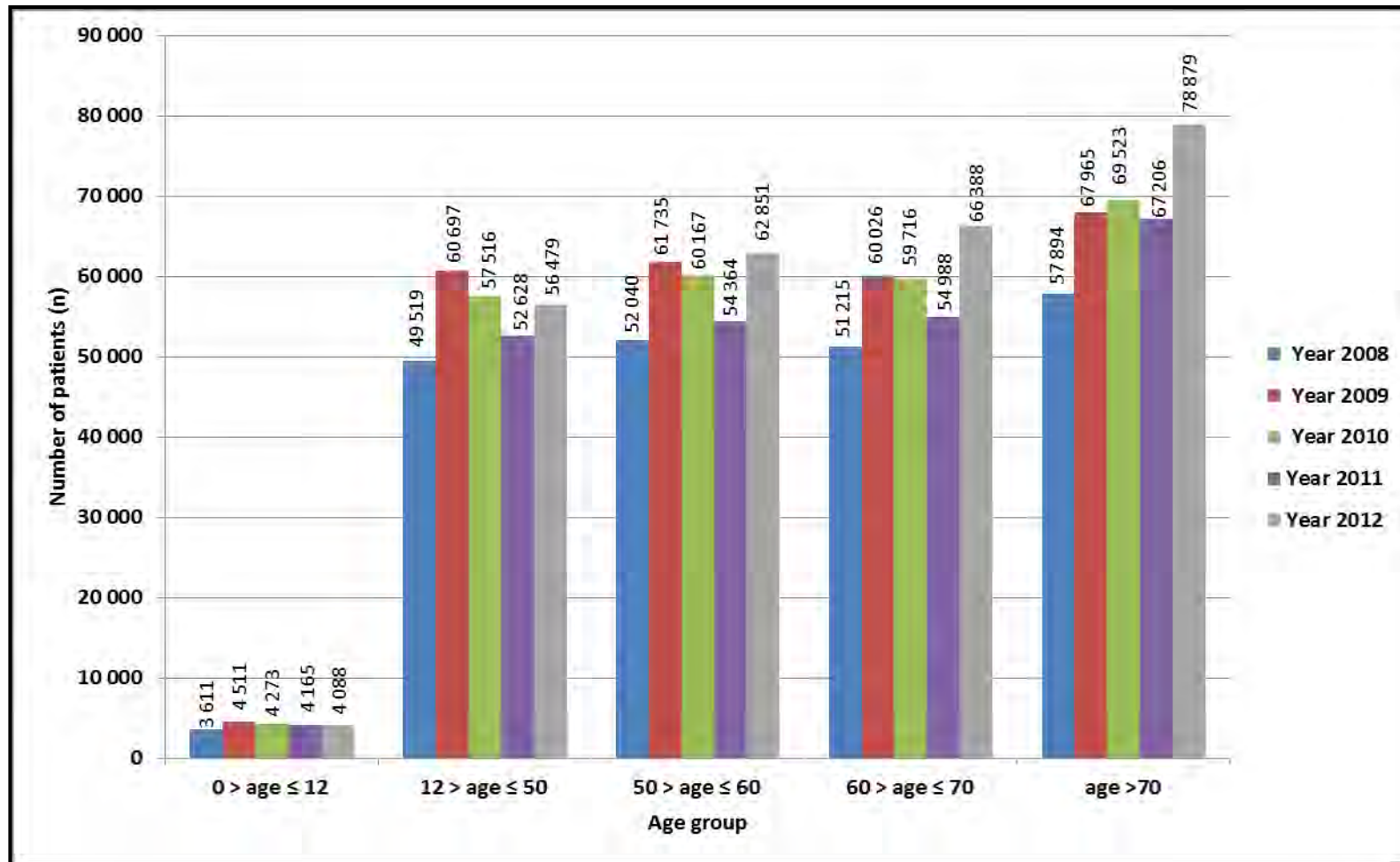


Figure 3.4: Number of patients with at least one CDL condition according to age from 2008 until 2012.

Table 3.5: Number of patients with a CDL condition and associated CDL medicine according to age and gender from 2008 until 2012.

Year	Description		Number of patients		Number of CDL medicine items		Mean ^{&} (number of CDL medicine items/patient/year) (n)	CDPI
			(n)	%*	(n)	% [#]		
2008	Gender	Female	125 548	58.59	1 376 575	53.95	10.96	0.92
		Male	88 731	41.41	1 174 733	46.05	13.24	1.11
	Age group (years)	0 > age ≤ 12	3 611	1.69	20 380	0.80	5.64	0.47
		12 > age ≤ 50	49 519	23.11	445 947	17.48	9.01	0.76
		50 > age ≤ 60	52 040	24.29	589 949	23.12	11.34	0.95
		60 > age ≤ 70	51 215	23.90	646 249	25.33	12.62	1.06
		age >70	57 894	27.02	848 783	33.27	14.66	1.23
		Total	214 279	100.00	2 551 308	100.00	11.91	
2009	Gender	Female	142 690	55.97	1 804 555	54.17	12.65	0.97
		Male	112 244	44.03	1 526 551	45.83	13.60	1.03
	Age group (years)	0 > age ≤ 12	4 511	1.77	43 014	1.29	9.54	0.73
		12 > age ≤ 50	60 697	23.81	578 377	17.36	9.58	0.73
		50 > age ≤ 60	61 735	24.22	746 537	22.41	12.09	0.93
		60 > age ≤ 70	60 026	23.55	837 411	25.14	13.95	1.07
		age >70	67 965	26.66	1 125 767	33.80	16.56	1.27
		Total	254 934	100.00	3 331 106	100.00	13.07	
2010	Gender	Female	140 133	55.79	1 728 965	53.87	12.34	0.97
		Male	111 062	44.21	1 480 315	46.13	13.33	1.04
	Age group (years)	0 > age ≤ 12	4 273	1.70	39 469	1.23	9.24	0.72
		12 > age ≤ 50	57 516	22.90	541 606	16.88	9.42	0.74
		50 > age ≤ 60	60 167	23.77	710 961	22.15	11.82	0.93
		60 > age ≤ 70	59 716	23.95	807 093	25.15	13.52	1.05
		age >70	69 523	27.68	1 110 151	34.59	15.97	1.25
		Total	251 195	100.00	3 209 989	100.00	12.78	
2011	Gender	Female	129 192	55.36	1 734 386	53.37	13.42	0.96
		Male	104 159	44.64	1 515 603	46.63	14.55	1.04
	Age group (years)	0 > age ≤ 12	4 165	1.78	40 356	1.24	9.69	0.70
		12 > age ≤ 50	52 628	22.55	554 426	17.06	10.53	0.76
		50 > age ≤ 60	54 364	23.30	712 964	21.94	13.11	0.94
		60 > age ≤ 70	54 988	23.56	817 432	25.15	14.87	1.07
		age >70	67 206	28.80	1 124 811	34.61	16.74	1.20
		Total	233 351	100.00	3 249 989	100.00	13.93	
2012	Gender	Female	146 678	54.59	1 551 209	50.61	10.58	0.93
		Male	122 007	45.41	1 513 911	49.39	12.41	1.09
	Age group (years)	0 > age ≤ 12	4 088	1.52	34 964	1.14	8.55	0.75
		12 > age ≤ 50	56 479	21.02	520 912	16.99	9.22	0.81
		50 > age ≤ 60	62 851	23.39	712 071	23.23	11.33	0.99
		60 > age ≤ 70	66 388	24.71	822 188	26.82	12.38	1.09
		age >70	78 879	29.36	974 985	31.81	12.36	1.08
		Total	268 685	100.00	3 065 120	100.00	11.41	

%* = $\frac{\text{Number of patients}}{\text{Total number of patients with CDL conditions for that year}} \times 100$

%[#] = $\frac{\text{Number of CDL medicine items}}{\text{Total number of CDL medicine items for that year}} \times 100$

[&] = $\frac{\text{Number of patients}}{\text{Number of CDL medicine items}}$

Table 3.5 presents that the chronic disease-prevalence index (CDPI) was consistently higher for male than female patients, due to the higher prevalence of chronic disease medicine in relation to the prevalence of patients. However, male patients had a CDPI > 1, and therefore, having a moderately to high number of medicine items per patient (as determined in Chapter 1, section 1.10.2.4). Male patients further had their highest CDPI during 2008 and female patients during 2009 and 2010.

All age groups had an overall increase in CDPI from 2008 to 2012, except for age group > 70 years. This resulted in an overall annual increase in average number of CDL medicine items per patient. All age groups recorded their highest CDPI during 2012, with:

- Age group: 0 > age ≤ 12 years, a CDPI of 0.75;
- Age group: 12 > age ≤ 50 years, a CDPI of 0.81;
- Age group: 50 > age ≤ 60 years, a CDPI of 0.99; and
- Age group: 60 > age ≤ 70 years with CDPI of 1.09.
- Age group: > 70 years, was the only group with the highest CDPI of 1.27 during 2009.

Therefore the overall increase in the number of patients with single and co-morbid CDL chronic conditions may be attributed to an aging population, patients registering for CDL conditions combined with population growth in South Africa. This will result in an increase in the use of healthcare resources (refer to Chapter 1, section 1.2). This might also result in the increase in non-communicable disease death rates as predicted by the United Nations (2012) in Chapter 2, section 2.6.5.

3.2.2 Number of patients with individual CDL conditions.

Patients with 26 individual CDL conditions are summarised and discussed in Tables 3.6 and 3.7. These patients had CDL conditions either as a single CDL condition or in combination. Patients with a CDL condition as a contribution to the total number of patients on the database are also summarised below. The prevalence change in number of patients and estimated annual change are also included in this section.

Table 3.6: Number of patients with the individual CDL conditions as a contribution to the total database from 2008 until 2012.

Type of CDL condition	Year 2008		Year 2009		Year 2010		Year 2011		Year 2012	
	Number of CDL patients (n)	(%)*	Number of CDL patients (n)	(%)*	Number of CDL patients (n)	(%)*	Number of CDL patients (n)	(%)*	Number of CDL patients (n)	(%)*
Addison's disease	157	0.02	172	0.01	165	0.01	164	0.02	177	0.02
Coronary artery disease	8 763	0.90	11 786	0.90	9 533	0.78	10 203	0.95	14 227	1.38
Asthma	22 020	2.26	26 589	2.03	26 285	2.15	26 157	2.43	27 943	2.71
Cardiac failure	9 412	0.97	13 528	1.03	12 930	1.06	11 220	1.04	16 594	1.61
Cardiomyopathy	3 179	0.33	4 288	0.33	3 569	0.29	3 047	0.28	3 427	0.33
Chronic renal disease	193	0.02	307	0.02	293	0.02	284	0.03	651	0.06
Hyperlipidaemia	64 832	6.65	86 075	6.58	86 120	7.06	50 813	4.71	100 322	9.74
Hypertension	127 314	13.07	163 372	12.49	162 314	13.30	152 259	14.13	176 845	17.17
Hypothyroidism	39 606	4.06	39 562	3.03	40 066	3.28	37 600	3.49	43 894	4.26
Multiple sclerosis	115	0.01	885	0.07	837	0.07	591	0.06	640	0.06
Parkinson's disease	1 790	0.18	2 254	0.17	2 293	0.19	2 164	0.20	2 459	0.24
Chronic obstructive pulmonary disease	2 097	0.22	2 926	0.22	2 726	0.22	2 409	0.22	2 736	0.27
Crohn's disease	162	0.02	388	0.03	384	0.03	359	0.03	422	0.04
Diabetes insipidus	34	0.00	38	0.00	38	0.00	35	0.00	37	0
Diabetes mellitus type 1	4 332	0.44	4 338	0.33	4 324	0.35	5 004	0.46	5 112	0.5
Diabetes mellitus type 2	31 511	3.23	41 892	3.20	43 043	3.53	41 805	3.88	48 631	4.72
Dysrhythmia	6 061	0.62	7 884	0.60	8 007	0.66	7 996	0.74	9 573	0.93
Epilepsy	6 853	0.70	9 150	0.70	8 790	0.72	8 006	0.74	9 312	0.9
Glaucoma	5 646	0.58	7 147	0.55	7 300	0.60	6 978	0.65	8 533	0.83
Haemophilia A	22	0.00	33	0.00	35	0.00	41	0.00	42	0
Haemophilia B	1	0.00	1	0.00	1	0.00	2	0.00	4	0.00
Rheumatoid arthritis	2 285	0.23	3 065	0.23	30 417	2.49	2 993	0.28	3 688	0.36
Schizophrenia	693	0.07	890	0.07	866	0.07	790	0.07	920	0.09
Bronchiectasis	70	0.01	78	0.01	53	0.00	51	0.01	32	0
Systemic lupus erythematosus	128	0.01	178	0.01	180	0.02	177	0.02	220	0.02
Ulcerative colitis	106	0.01	210	0.02	192	0.02	188	0.02	277	0.03
Total	337 382	34.62	427 036	32.66	423 391	34.70	401 036	37.21	476 718	46.30

* % = $\frac{\text{Number of CDL patients}}{\text{Number of patients on the database}} \times 100$

Table 3.7: Number of patients with the individual CDL conditions from 2008 until 2012.

Type of CDL condition	Year 2008		Year 2009		Year 2010		Year 2011		Year 2012		Change (2008 vs 2012) [#] (n)	Estimated annual change ^{&} (n)
	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]		
Addison's disease	157	0.05	172	0.04	165	0.04	164	0.04	177	0.04	↑ 20 (12.74%)	↑ 5 (3.19%)
Coronary artery disease	8 763	2.60	11 786	2.76	9 533	2.25	10 203	2.54	14 227	2.98	↑ 5 464 (62.35%)	↑ 1 366 (15.59%)
Asthma	22 020	6.53	26 589	6.23	26 285	6.21	26 157	6.52	27 943	5.86	↑ 5 923 (26.90%)	↑ 1 481 (6.73%)
Cardiac failure	9 412	2.79	13 528	3.17	12 930	3.05	11 220	2.80	16 594	3.48	↑ 7 182 (76.31%)	↑ 1 796 (19.08%)
Cardiomyopathy	3 179	0.94	4 288	1.00	3 569	0.84	3 047	0.76	3 427	0.72	↑ 248 (7.80%)	↑ 62 (1.95%)
Chronic renal disease	193	0.06	307	0.07	293	0.07	284	0.07	651	0.14	↑ 458 (237.31%)	↑ 115 (59.33%)
Hyperlipidaemia	64 832	19.22	86 075	20.16	86 120	20.34	50 813	12.67	100 322	21.04	↑ 35 490 (54.74%)	↑ 8 873 (13.69%)
Hypertension	127 314	37.74	163 372	38.26	162 314	38.34	152 259	37.97	176 845	37.1	↑ 49 531 (38.90%)	↑ 12 383 (9.73%)
Hypothyroidism	39 606	11.74	39 562	9.26	40 066	9.46	37 600	9.38	43 894	9.21	↑ 4 288 (10.83%)	↑ 1 072 (2.71%)
Multiple sclerosis	115	0.03	885	0.21	837	0.20	591	0.15	640	0.13	↑ 525 (456.52%)	↑ 131 (114.13%)
Parkinson's disease	1 790	0.53	2 254	0.53	2 293	0.54	2 164	0.54	2 459	0.52	↑ 669 (37.37%)	↑ 167 (9.34%)
Chronic obstructive pulmonary disease	2 097	0.62	2 926	0.69	2 726	0.64	2 409	0.60	2 736	0.57	↑ 639 (30.47%)	↑ 160 (7.62%)
Crohn's disease	162	0.05	388	0.09	384	0.09	359	0.09	422	0.09	↑ 260 (160.49%)	↑ 65 (40.12%)
Diabetes insipidus	34	0.01	38	0.00	38	0.01	35	0.01	37	0.01	↑ 3 (8.82%)	↑ 1 (2.21%)
Diabetes mellitus type 1	4 332	1.28	4 338	1.02	4 324	1.02	5 004	1.25	5 112	1.07	↑ 780 (18.01%)	↑ 195 (4.50%)
Diabetes mellitus type 2	31 511	9.34	41 892	9.81	43 043	10.17	41 805	10.42	48 631	10.20	↑ 17 120 (54.33%)	↑ 4 280 (13.58%)
Dysrhythmia	6 061	1.80	7 884	1.85	8 007	1.89	7 996	1.99	9 573	2.01	↑ 3 512 (57.94%)	↑ 878 (14.49%)
Epilepsy	6 853	2.03	9 150	2.14	8 790	2.08	8 006	2.00	9 312	1.95	↑ 2 459 (39.69%)	↑ 615 (9.92%)
Glaucoma	5 646	1.67	7 147	1.67	7 300	1.72	6 978	1.74	8 533	1.79	↑ 2 887 (51.13%)	↑ 722 (12.78%)
Haemophilia A	22	0.01	33	0.01	35	0.01	41	0.01	42	0.01	↑ 20 (90.91%)	↑ 5 (22.73%)
Haemophilia B	1	0.00	1	0.00	1	0.00	2	0.00	4	0.00	↑ 3 (300.00%)	↑ 1 (75.00%)
Rheumatoid arthritis	2 285	0.68	3 065	0.72	30 417	7.18	2 993	0.75	3 688	0.77	↑ 1 403 (61.40%)	↑ 351 (15.35%)
Schizophrenia	693	0.21	890	0.21	866	0.21	790	0.20	920	0.19	↑ 227 (32.76%)	↑ 57 (8.19%)
Bronchiectasis	70	0.02	78	0.02	53	0.01	51	0.01	32	0.01	↓ 38 (54.29%)	↓ 10 (13.57%)
Systemic lupus erythematosus	128	0.04	178	0.04	180	0.04	177	0.04	220	0.05	↑ 92 (71.88%)	↑ 23 (17.97%)
Ulcerative colitis	106	0.03	210	0.05	192	0.05	188	0.05	277	0.06	↑ 171 (161.32%)	↑ 43 (40.33%)
Total	337 382	100.00	427 036	100.00	423 391	100.00	401 036	100.00	476 718	100.00	↑ 139 336 (41.30%)	↑ 34 834 (10.33%)

[†] % = $\frac{\text{Number of CDL patients}}{\text{Total number of patients with CDL conditions for that year}} \times 100$

^{*} Estimated annual change = $\frac{\text{Change (2008 vs 2012)}}{4^{\&}}$

[#] Change (2008 vs 2012) = $\frac{\text{Number of CDL patients (2008)} - \text{(2012)}}{\text{Number of CDL patients (2008)}} \times 100$

[&] Annual change between 2 study years (2008-2009, 2009-2010, 2010-2011 and 2011-2012)

Table 3.6 shows that the prevalence of patients with CDL conditions as a contribution to the database increased overall from 34.62% to 46.30% between 2008 and 2012. Of all the CDL conditions, hypertension had the highest contribution to the total database during each of the study years, followed by hyperlipidaemia.

According to Table 3.7, all CDL conditions had a patient increase of 41.30% (n = 139 336) between 2008 and 2012, with an estimated annual increase of 10.33% (n = 34 834). All individual CDL conditions except bronchiectasis had an overall increase in the number of patients from 2008 until 2012, hypertension had the highest increase (n = 49 531), followed by hyperlipidaemia (n = 35 490) and then diabetes mellitus type 2 (n = 17 120). Bronchiectasis had an overall decrease of 38 patients, and diabetes insipidus had the lowest patient increase (n = 3) between 2008 and 2012. The reduction in patients with bronchiectasis may be attributed to increased immunization and antimicrobial use for this CDL condition (refer to Chapter 2, section 2.7.2.4). Another reason may be that patients may have co-morbid airway diseases (Athanasio, 2012:1335). These co-morbidities include bronchiectasis with COPD, as both these CDL conditions share symptoms such as susceptibility to recurrent exacerbations by persistent or new infections, and coughing with sputum production (Bilton & Jones, 2011:7; Hurst *et al.*, 2015:310) (refer to Chapter 2, sections 2.7.2.4 and 2.7.2.6). Also, bronchiectasis may be considered a risk factor for asthma exacerbations and *Mycobacterium tuberculosis* a cause of bronchiectasis (Kang *et al*, 2014:213). Due to possible co-morbidities for patients with bronchiectasis, misdiagnosis and under-reporting may be the result of the decrease of patients between 2008 and 2012.

3.2.3 Number of patients with a single CDL condition.

Data in this section contain patients with a single CDL conditions as a contribution to all patients on the database. The number of patients with a single CDL condition, and the change between 2008 and 2012, as well as the estimated annual change, will be analysed. The results are summarised in Table 3.8 and Table 3.9.

The top 5 CDL conditions determined in this section in Table 3.9 and section 3.2.2, Table 3.7 will be the CDL conditions analysed in other sections in this chapter where different aspects of prevalence and medicine cost are analysed.

Table 3.8: Number of patients with a single CDL condition as a contribution to the total database from 2008 until 2012.

Type of CDL condition	Year 2008		Year 2009		Year 2010		Year 2011		Year 2012	
	Number of CDL patients (n)	% *	Number of CDL patients (n)	% *	Number of CDL patients (n)	% *	Number of CDL patients (n)	% *	Number of CDL patients (n)	% *
Hypertension	57 627	5.91	70 058	5.36	69 193	5.67	62 909	5.84	69 248	6.73
Hypothyroidism	24 558	2.52	11 824	0.90	11 899	0.98	10 658	0.99	11 724	1.14
Hyperlipidaemia	15 239	1.56	18 385	1.41	17 778	1.46	15 002	1.39	18 216	1.77
Asthma	12 139	1.25	14 559	1.11	14 107	1.16	13 586	1.26	13 803	1.34
Diabetes Mellitus Type 2	6 158	0.63	7 425	0.57	7 097	0.58	6 393	0.59	7 133	0.69
Epilepsy	3 770	0.39	4 991	0.38	4 635	0.38	4 101	0.38	4 665	0.45
Diabetes Mellitus Type 1	2 912	0.30	2 199	0.17	1 744	0.14	1 952	0.18	1 656	0.16
Glaucoma	1 622	0.17	1 967	0.15	1 987	0.16	1 817	0.17	2 185	0.21
Cardiac failure	1 271	0.13	2 402	0.18	2 277	0.19	1 861	0.17	2 227	0.22
Rheumatoid arthritis	872	0.09	1 109	0.09	1 108	0.09	1 042	0.10	1 257	0.12
Dysthyrthmia	759	0.08	902	0.07	900	0.07	809	0.08	846	0.08
Cardiomyopathy	606	0.06	474	0.04	416	0.03	349	0.03	270	0.03
Coronary artery disease	588	0.06	781	0.06	641	0.05	991	0.09	562	0.06
Parkinson's disease	531	0.05	645	0.05	642	0.05	568	0.05	598	0.06
Chronic obstructive pulmonary disease	421	0.04	578	0.04	538	0.04	451	0.04	504	0.05
Schizophrenia	367	0.04	489	0.04	460	0.04	424	0.04	482	0.05
Crohn's disease	100	0.01	239	0.02	232	0.02	218	0.02	237	0.02
Multiple sclerosis	63	0.01	315	0.02	293	0.02	198	0.02	171	0.02
Ulcerative colitis	42	0.00	92	0.01	77	0.01	71	0.01	84	0.01
Addison's disease	40	0.00	42	0.00	36	0.00	37	0.00	38	0.00
Systemic lupus erythematosus	38	0.00	51	0.00	59	0.01	49	0.01	65	0.01
Bronchiectasis	36	0.00	36	0.00	30	0.00	21	0.00	4	0.00
Haemophilia A	20	0.00	27	0.00	31	0.00	35	0.00	30	0.00
Diabetes insipidus	10	0.00	7	0.00	10	0.00	8	0.00	8	0.00
Chronic renal disease	9	0.00	36	0.00	33	0.00	29	0.00	82	0.01
Haemophilia B	1	0.00	1	0.00	1	0.00	1	0.00	2	0.00
Total	129 799	13.32	139 634	10.68	136 224	11.16	123 580	11.47	136 097	13.22

* % = $\frac{\text{Number of CDL patients}}{\text{Number of patients on the database}} \times 100$

Table 3.9: Number of patients with a single CDL condition from 2008 until 2012.

Type of CDL condition	Year 2008		Year 2009		Year 2010		Year 2011		Year 2012		Change (2008 vs 2012) [#] (n)	Estimated annual change [*] (n)
	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]	Number of CDL patients (n)	% [†]		
Hypertension	57 627	44.40	70 058	50.17	69 193	50.79	62 909	50.91	69 248	50.88	↑ 11 621 (20.17%)	↑ 2 905 (5.04%)
Hypothyroidism	24 558	18.92	11 824	8.47	11 899	8.73	10 658	8.62	11 724	8.61	↓ 12 834 (52.26%)	↓ 3 209 (13.07%)
Hyperlipidaemia	15 239	11.74	18 385	13.17	17 778	13.05	15 002	12.14	18 216	13.38	↑ 2 977 (12.12%)	↑ 744 (3.03%)
Asthma	12 139	9.35	14 559	10.43	14 107	10.36	13 586	10.99	13 803	10.14	↑ 1 664 (13.71%)	↑ 416 (3.43%)
Diabetes Mellitus Type 2	6 158	4.74	7 425	5.32	7 097	5.21	6 393	5.17	7 133	5.24	↑ 975 (15.83%)	↑ 244 (3.96%)
Epilepsy	3 770	2.90	4 991	3.57	4 635	3.40	4 101	3.32	4 665	3.43	↑ 895 (23.74%)	↑ 224 (5.94%)
Diabetes Mellitus Type 1	2 912	2.24	2 199	1.57	1 744	1.28	1 952	1.58	1 656	1.22	↓ 1 256 (43.13%)	↓ 314 (10.78%)
Glaucoma	1 622	1.25	1 967	1.41	1 987	1.46	1 817	1.47	2 185	1.61	↑ 563 (34.71%)	↑ 141 (8.68%)
Cardiac failure	1 271	0.98	2 402	1.72	2 277	1.67	1 861	1.51	2 227	1.64	↑ 956 (75.22%)	↑ 239 (18.81%)
Rheumatoid arthritis	872	0.67	1 109	0.79	1 108	0.81	1 042	0.84	1 257	0.92	↑ 385 (44.15%)	↑ 96 (11.04%)
Dysthyrthmia	759	0.58	902	0.65	900	0.66	809	0.65	846	0.62	↑ 87 (11.46%)	↑ 22 (2.87%)
Cardiomyopathy	606	0.47	474	0.34	416	0.31	349	0.28	270	0.2	↓ 336 (55.45%)	↓ 84 (13.86%)
Coronary artery disease	588	0.45	781	0.56	641	0.47	991	0.80	562	0.37	↓ 26 (4.42%)	↓ 7 (1.11%)
Parkinson's disease	531	0.41	645	0.46	642	0.47	568	0.46	598	0.44	↑ 67 (12.62%)	↑ 17 (3.16%)
Chronic obstructive pulmonary disease	421	0.32	578	0.41	538	0.39	451	0.36	504	0.37	↑ 83 (19.72%)	↑ 21 (4.93%)
Schizophrenia	367	0.28	489	0.35	460	0.34	424	0.34	482	0.35	↑ 115 (31.36%)	↑ 29 (7.84%)
Crohn's disease	100	0.08	239	0.17	232	0.17	218	0.18	237	0.17	↑ 137 (137.00%)	↑ 34 (34.25%)
Multiple sclerosis	63	0.05	315	0.23	293	0.22	198	0.16	171	0.13	↑ 108 (171.43%)	↑ 27 (42.86%)
Ulcerative colitis	42	0.03	92	0.07	77	0.06	71	0.06	84	0.06	↑ 42 (100.00%)	↑ 11 (25.00%)
Addison's disease	40	0.03	42	0.03	36	0.03	37	0.03	38	0.03	↓ 2 (5.00%)	↓ 1 (1.25%)
Systemic lupus erythematosus	38	0.03	51	0.04	59	0.04	49	0.04	65	0.05	↑ 27 (71.05%)	↑ 7 (17.76%)
Bronchiectasis	36	0.03	36	0.03	30	0.02	21	0.02	4	0.00	↓ 32 (88.89%)	↓ 8 (22.22%)
Haemophilia A	20	0.02	27	0.02	31	0.02	35	0.03	30	0.02	↑ 10 (50.00%)	↑ 3 (12.50%)
Diabetes insipidus	10	0.01	7	0.01	10	0.01	8	0.01	8	0.01	↓ 2 (20.00%)	↓ 1 (5.00%)
Chronic renal disease	9	0.01	36	0.03	33	0.02	29	0.02	82	0.06	↑ 73 (811.11%)	↑ 18 (202.78%)
Haemophilia B	1	0.00	1	0.00	1	0.00	1	0.00	2	0.00	↑ 1 (100.00%)	↑ 1 (25.00%)
Total	129 799	100.00	139 634	100.00	136 224	100.00	123 580	100.00	136 097	100.00	↑ 6 298 (4.85%)	↑ 1 575 (1.21%)

[†] % = $\frac{\text{Number of CDL patients}}{\text{Total number of CDL patients for that year}} \times 100$

^{*} Estimated annual change = $\frac{\text{Change (2008 vs 2012)}}{4\&}$

[#] Change (2008 vs 2012) = $\frac{\text{Number of CDL patients (2008) - (2012)}}{\text{Number of CDL patients (2008)}} \times 100$

& Annual change between 2 study years (2008-2009, 2009-2010, 2010-2011 and 2011-2012)

Table 3.8 reveals that the contribution of patients with a single CDL condition to the database stayed relatively constant between 13.32% (2008) and 13.22% (2012), although the number of patients increased (n = 6 298).

Hypertensive patients had the highest contribution to all patients on the database throughout the study period from 5.91% (2008) to 6.73% (2012). In addition, the CDL condition with the highest increase in number of patients was hypertension with 11 621, and the highest prevalence increase was for chronic renal disease with 811.11%, with a small increase (73) in the number of patients.

Patients with the top 5 single CDL conditions were in the top 5 constantly throughout the study period, with hypertension having the highest number of patients: 57 627 from 2008 to 69 248 in 2012. This is consistent with a study done in 2001 which revealed that hypertension was the most common CDL condition (McLeod *et al.*, 2002:19) (refer to Chapter 2, section 2.6.4), and the highest prevalence of the chronic conditions as reported by the Medical Research Council (2009) (refer to Chapter 1, section 1.2).

The other CDL conditions in the top 5 were patients with hypothyroidism with the highest number of patients at 24 558 (2008), hyperlipidaemia with 18 385 (2009) and asthma 14 559 (2009) and diabetes mellitus type 2 with 7 425 patients (2009). Hypothyroidism is part of the top 5 conditions, probably due to the increase in iodine deficiency disorders in Africa as reported in Chapter 2, section 2.7.2.19.

According to Table 3.9, all patients with single CDL conditions had an overall increase of 4.85% (n = 6 298) between 2008 and 2012, with an estimated annual increase of 1.21% (n = 1 575). Patients with single CDL conditions with an overall decrease between 2008 and 2012 were hypothyroidism (n = 12 834; 52.26%), diabetes mellitus type 1 (n = 1 256; 43.13%), cardiomyopathy (n = 336; 55.45%), coronary artery disease (n = 26; 4.42%), Addison's disease (n = 2; 5.00%), bronchiectasis (n = 32; 88.89%) and diabetes insipidus (n = 2; 20.00%).

Patients with CDL conditions with the highest decrease in number of patients was for hypothyroidism with 12 834 (52.26%), and the highest prevalence decrease was for cardiomyopathy with 55.45% (n = 336). Chronic renal disease, however, is the CDL condition with the highest estimated annual prevalence increase of 202.78%. This high increase might be attributed to the increase in the CDL conditions that contribute as risk factors to the development of chronic renal disease as well as an increase in possible registration of chronic renal disease as a chronic condition (refer to Table 3.9 and Chapter 2, section 2.7.2.8 and Figures 2.6 and 2.7).

The top 5 CDL conditions had a total combined prevalence of 89.15% (2008), 87.56% (2009), 88.14% (2010), 87.83% (2011) and 88.25% in 2012. To elaborate on these findings, Ornstein *et al.* (2013:519) report the following basic epidemiological data on co-morbidity from a study done in the United States in 2011: The study included 667 379 patients, and found that hypertension and hyperlipidaemia were the most prevalent chronic diseases with 33.51% (n = 223 653) and 32.97% (n = 220 053) as found in Table 3.6 from 2009 until 2012. Westaway (2010:35) confirmed the findings of the high prevalence of one or more CDL conditions in South Africa from a study that was done in 710 participants from Pretoria by self-reporting of chronic conditions. Of the participants, 25.00% had hypertension alone, 8.00% had hypertension and diabetes mellitus and 5.00% had diabetes mellitus alone. These were the most prevalent reported conditions. However, self-reports may lead to under-reporting of hypertension and other chronic conditions (Westaway, 2010:35).

The results from section 3.2.2 and 3.2.3 conclude that almost all patients with CDL conditions increased throughout the study period and will probably increase after 2012. The increase in top 5 CDL conditions coincides with the data from a study which revealed that the same top 5 conditions may remain in the top 5 as estimated from 1994 until 2025 under the NHI (McLeod, 2009b:7). These estimated increases for the top 5 CDL conditions include (McLeod, 2009b:7):

- Hypertension: 1 388 731 (1994) to 2 593 482 (2025);
- Asthma: 624 993 (1994) to 816 733 (2025);
- Hyperlipidaemia: 615 850 (1994) to 1 137 312 (2025);
- Diabetes mellitus type 2: 310 861 (1994) to 559 928 (2025); and
- Hypothyroidism: 283 965 (1994) to 537 987 (2025).

If these results from (McLeod, 2009b:7) and the results from Tables 3.7 and 3.9 are used, the following estimated annual increases from 2008 and 2012 between the two studies can be compared. Table 3.7 contains the CDL conditions as single or as a co-morbidity, and Table 3.9 only as single CDL conditions. The comparison includes:

- Hypertension: 2.80% (n = 38 863) (McLeod, 2009b:7) *versus* 9.73% (n = 12 383) (Table 3.7) *versus* 5.04% (n = 2 905) (Table 3.9);
- Asthma: 0.98% (n = 6 187) (McLeod, 2009b:7) *versus* 6.73% (n = 1 481) (Table 3.7) *versus* 3.43% (n = 416) (Table 3.9);

- Hyperlipidaemia: 2.73% (n = 16 821) (McLeod, 2009b:7) *versus* 13.69% (n = 8873) (Table 3.7) *versus* 3.03% (n = 744) (Table 3.9);
- Diabetes mellitus type 2: 2.58% (n = 8 034) (McLeod, 2009b:7) *versus* 13.58% (n = 4 280) (Table 3.7) *versus* 3.96% (n = 244) (Table 3.9);
- Hypothyroidism: 2.88% (n = 8 194) (McLeod, 2009b:7) *versus* 2.71% (n = 1 072) (Table 3.7) *versus* 13.07% (n = 3 209) (Table 3.9).

This comparison confirms that the study by McLeod revealed larger estimated annual increases in the number of patients on a year-to-year basis with any of the top 5 CDL conditions.

Furthermore, the prevalence of these top 5 CDL conditions may be responsible for the cardiovascular and respiratory disease burden in South Africa as confirmed in Chapter 1, section 1.2.

3.2.4 Number of CDL conditions per patient per year adjusted for age and gender.

In this section the average number of CDL conditions per patient per year will be analysed. The data were adjusted for age and gender differences so that the same patients were included in 2008 and 2012. This will also take patients into consideration that either entered or left the medical scheme for any reason during the study period. Data from this section are summarised in Table 3.10. Detailed results for the top 5 CDL conditions are presented in *Appendix B* and Figure 3.5.

Table 3.10: Number of all CDL conditions per patient per year adjusted for age and gender from 2008 until 2012.

Type of CDL condition	Total number of CDL patients* (2008-2012) (n)	Year [#]	Mean (number of CDL conditions/patient)* (n)	Standard error	Confidence interval (95%CI)*	p-value	d-value
All CDL conditions	1 222 444	2008	1.57	0.00	1.57-1.58	0.00	0.11
		2009	1.68	0.00	1.67-1.68		
		2010	1.69	0.00	1.68-1.69		
		2011	1.72	0.00	1.72-1.72		
		2012	1.77	0.00	1.77-1.78		

* Data were derived from Table 3.2.

Data were analysed by using linear mixed-effect modelling (MIXED): refer to Chapter 1, section 1.11.2.4.

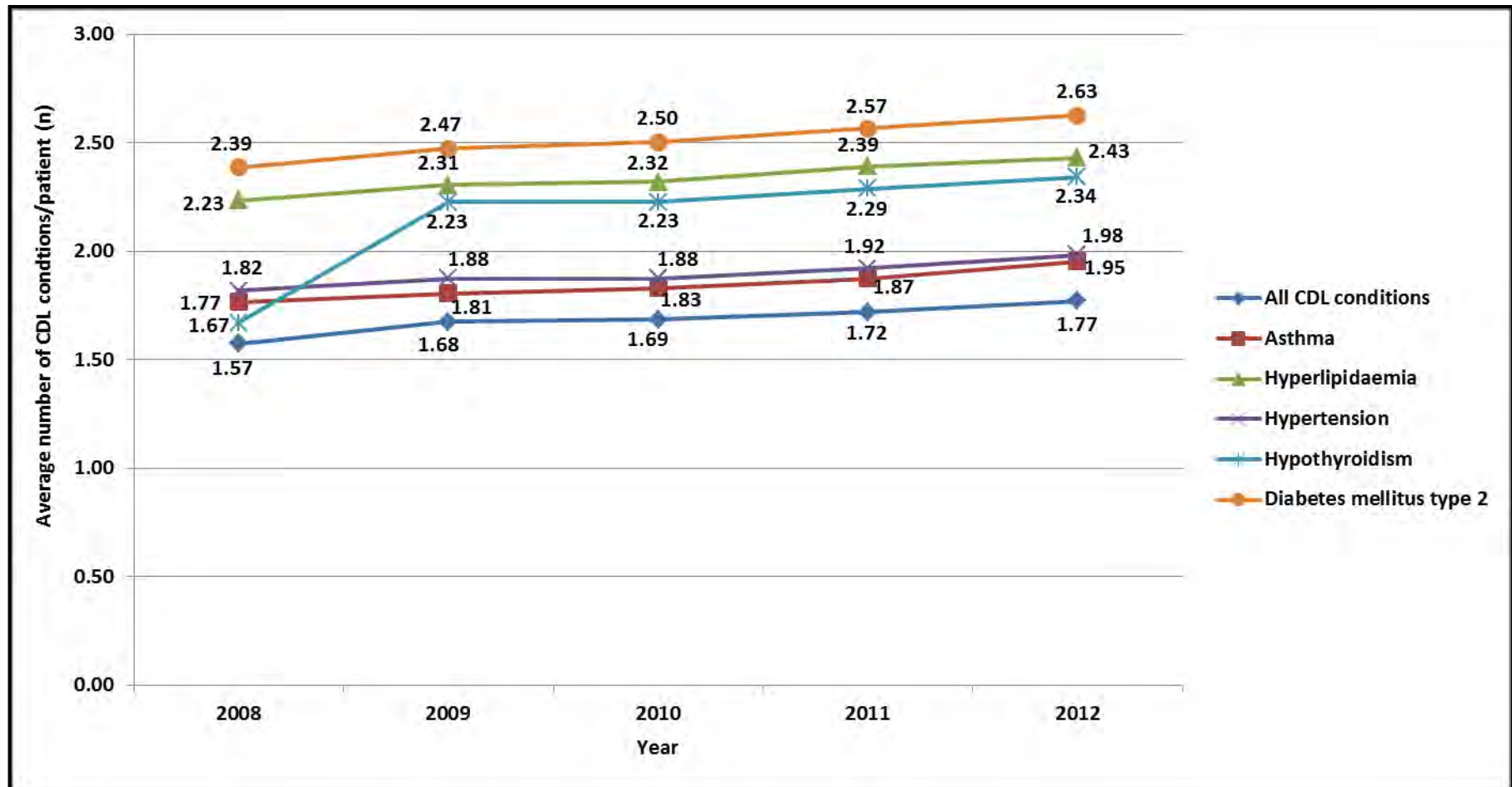


Figure 3.5: Average number of CDL conditions/patient adjusted for age and gender from 2008 until 2012.

Table 3.10 shows that patients with any of the CDL conditions in 2008 had an increase of 0.20 CDL conditions, with an average from 1.57 ± 0.00 (95%CI:1.57-1.58) (2008) to 1.77 ± 0.00 (95%CI:1.77-1.78) (2012). This difference in the increase in the average number of CDL conditions per patient per year between 2008 and 2012 is of statistical significance ($p < 0.05$), but no large practical significance ($d < 0.8$).

All of the CDL conditions had the following increases in average number of CDL conditions per patient per year from 2008 to 2012 (refer to *Appendix B*):

- Asthma: increased by 0.18;
- Hyperlipidaemia: increased by 0.20;
- Hypertension: increased by 0.16;
- Hypothyroidism: increased by 0.67; and
- Diabetes mellitus type 2: increased by 0.24.

The high average number of co-morbid CDL conditions per patient per year for diabetes mellitus type 2 and hyperlipidaemia might be attributed to these conditions also being prevalent in coronary artery disease (refer to Chapter 2, section 2.7.2.7 and Chapter 3, section 3.2.7). A study done in the Netherlands from 1985 to 2007 confirmed that patients with a single CDL condition developed on average at least one co-morbid CDL condition within 5 years. This study determined incidence and prevalence density rates of chronic co-morbid diseases and disease clusters (Luijks *et al.*, 2012:1). Data were obtained from the Continuous Morbidity Registration (CMR), a practice based network (Luijks *et al.*, 2012:2). The study included 714 adult patients with newly diagnosed type 2 diabetes mellitus. The study found that after 1 year of diabetes mellitus type 2 diagnoses, 263 patients had developed ≥ 1 co-morbid chronic condition and 81 patients had developed ≥ 3 co-morbid conditions. After 5 years, 160 patients had developed ≥ 1 co-morbid chronic condition and 91 patients had developed ≥ 3 comorbid chronic conditions. Cardiovascular disease was the most common group with 122 patients having a cardiovascular disease as co-morbid condition after 1 year (Luijks *et al.*, 2012:5).

Average number of co-morbidities with hypothyroidism had an overall increase from 1.67 ± 0.01 (95%CI:1.66-1.68) (2008) to 2.34 ± 0.01 (95%CI:2.33-2.35) (2012). This high increase might be attributed to the association between hypothyroidism and cardiovascular disease. This association included changes in thyroid hormone and might be as a result from chronic congestive cardiac failure, acute myocardial infarction, a rise in diastolic blood pressure and elevated rise in serum lipid levels (Mayer *et al.*, 2006:502; Klein & Danzi, 2007:1725-1729). To confirm this statement, the co-morbidities associated with hypothyroidism include hypertension, hyperlipidaemia and congestive cardiac failure (refer to Chapter 3, section 3.2.7).

The increase in the average number of CDL conditions for patients with hypertension may also be due to the possibility of hypertension being a risk factor for the development of coronary artery disease and chronic renal disease (refer to Chapter 2, sections 2.6.6.4, 2.7.2.7 and 2.7.2.8). Hyperlipidaemia is also a risk factor for coronary artery disease and may therefore be a reason for the increased CDL conditions in these patients (refer to Chapter 2, sections 2.6.6.5 and 2.7.2.7). Therefore, a single patient with any of the CDL conditions had an increase in CDL conditions during the study period.

3.2.5 Number of patients with the top 5 co-morbid CDL conditions

Data discussed in this section contain patients from the database for the entire study period with the top 5 CDL conditions. These top 5 conditions were determined through the number of the top 5 CDL conditions as a single condition and are then discussed with their respective CDL co-morbidities. Tables 3.11 and 3.12 summarise these top 5 CDL conditions.

Table 3.11: Number of patients with the top 5 co-morbid CDL conditions from 2008 until 2012.

Year	Type of CDL condition	Number of CDL patients (n)	Mean (co-morbid CDL conditions/ patient) (n)	Standard deviation (±)	Confidence interval (95%CI)	Number of co-morbid CDL conditions (N)	Change (Number of CDL patients) * (2008 vs 2012)(%)	Change (Number of co-morbid CDL conditions) # (2008 vs 2012) (%)
2008	Asthma	22 020	0.77	1.05	0.85-0.78	16 860	↑ 26.90	↑ 58.10
2009		26 589	0.81	1.10	0.79-0.82	21 444		
2010		26 285	0.83	1.11	0.82-0.84	21 842		
2011		26 157	0.87	1.14	0.86-0.89	22 853		
2012		27 943	0.95	1.19	0.94-0.97	26 656		
2008	Diabetes mellitus type 2	31 511	1.39	1.03	1.37-1.40	43 679	↑ 54.33	↑ 81.01
2009		41 892	1.47	1.06	1.46-1.48	61 701		
2010		43 043	1.50	1.04	1.49-1.51	64 667		
2011		41 805	1.57	1.06	1.56-1.58	65 475		
2012		48 631	1.63	1.09	1.62-1.64	79 062		
2008	Hyperlipidaemia	64 832	1.23	0.98	1.23-1.24	79 923	↑ 54.74	↑ 79.56
2009		86 075	1.31	1.01	1.30-1.31	112 364		
2010		86 120	1.32	0.99	1.31-1.33	113 721		
2011		80 513	1.39	1.01	1.38-1.40	111 973		
2012		100 322	1.43	1.04	1.42-1.44	143 510		
2008	Hypertension	127 314	0.82	0.93	0.81-0.82	104 189	↑ 38.91	↑ 66.78
2009		163 372	0.88	0.96	0.87-0.88	143 029		
2010		162 314	0.88	0.96	0.88-0.89	143 076		
2011		152 259	0.92	0.98	0.92-0.93	140 299		
2012		176 845	0.98	1.02	0.98-0.99	173 765		
2008	Hypothyroidism	39 606	0.67	1.03	0.66-0.68	26 579	↑ 10.83	↑ 121.58
2009		39 562	1.23	1.10	1.22-1.24	48 510		
2010		40 066	1.23	1.10	1.22-1.24	49 361		
2011		37 600	1.29	1.13	1.28-1.30	48 420		
2012		43 894	1.34	1.15	1.33-1.35	58 894		

* Change (number of CDL patients) (2008 vs 2012) = $\frac{\text{Number of CDL patients (2008)} - \text{(2012)}}{\text{Number of CDL patients (2008)}} \times 100$

Change (co-morbid CDL conditions) (2008 vs 2012) = $\frac{\text{Number of co-morbid CDL conditions (2008)} - \text{(2012)}}{\text{Number of co-morbid CDL conditions (2008)}} \times 100$

Table 3.12: Statistical and practical significance of the average number of co-morbid CDL conditions per patient from 2008 until 2012.

Type of CDL condition	Description comparison (year)	Mean (co-morbid CDL conditions/ patient) (n)	Standard deviation ($\pm$)	Confidence interval (95%CI)	<i>p</i> -value	(<i>d</i> -value)*
Asthma	2008 to	0.77	1.05	0.85-0.78	< 0.05	0.04
	2009	0.81	1.10	0.79-0.82		
	2009 to	0.81	1.10	0.79-0.82	> 0.05	0.02
	2010	0.83	1.11	0.82-0.84		
	2010 to	0.83	1.11	0.82-0.84	< 0.05	0.04
	2011	0.87	1.14	0.86-0.89		
	2011 to	0.87	1.14	0.86-0.89	< 0.05	0.07
	2012	0.95	1.19	0.94-0.97		
Diabetes mellitus type 2	2008 to	1.39	1.03	1.37-1.40	< 0.05	0.08
	2009	1.47	1.06	1.46-1.48		
	2009 to	1.47	1.06	1.46-1.48	< 0.05	0.03
	2010	1.50	1.04	1.49-1.51		
	2010 to	1.50	1.04	1.49-1.51	< 0.05	0.07
	2011	1.57	1.06	1.56-1.58		
	2011 to	1.57	1.06	1.56-1.58	< 0.05	0.06
	2012	1.63	1.09	1.62-1.64		
Hyperlipidaemia	2008 to	1.23	0.98	1.23-1.24	< 0.05	0.08
	2009	1.31	1.01	1.30-1.31		
	2009 to	1.31	1.01	1.30-1.31	< 0.05	0.01
	2010	1.32	0.99	1.31-1.33		
	2010 to	1.32	0.99	1.31-1.33	< 0.05	0.07
	2011	1.39	1.01	1.38-1.40		
	2011 to	1.39	1.01	1.38-1.40	< 0.05	0.04
	2012	1.43	1.04	1.42-1.44		

* = Mean variance analyses between study years: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Type of CDL condition	Description comparison (year)	Mean (co-morbid CDL conditions/ patient) (n)	Standard deviation ($\pm$)	Confidence interval (95%CI)	p-value	(d-value)*
Hypertension	2008 to 2009	0.82	0.93	0.81-0.82	< 0.05	0.06
	2009 to 2010	0.88	0.96	0.87-0.88		
	2009 to 2010	0.88	0.96	0.87-0.88	> 0.05	0.00
	2010 to 2011	0.88	0.96	0.88-0.89		
	2011 to 2012	0.92	0.98	0.92-0.93	< 0.05	0.04
	2011 to 2012	0.92	0.98	0.92-0.93		
	2012	0.98	1.02	0.98-0.99	< 0.05	0.06
Hypothyroidism	2008 to 2009	0.67	1.03	0.66-0.68	> 0.05	0.51
	2009 to 2010	1.23	1.10	1.22-1.24		
	2009 to 2010	1.23	1.10	1.22-1.24	> 0.05	0.00
	2010 to 2011	1.23	1.10	1.22-1.24		
	2011 to 2012	1.23	1.10	1.22-1.24	< 0.05	0.06
	2011 to 2012	1.29	1.13	1.28-1.30		
	2012	1.29	1.13	1.28-1.30	< 0.05	0.04

* = Mean variance analyses between study years: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

The top 5 CDL conditions in Table 3.11 and 3.12 shows that the total number of patients with co-morbid CDL conditions as well as the number of co-morbid conditions increased from 2008 until 2012. All of these conditions had their highest respective number of patients and CDL conditions in 2012, with the average number of chronic conditions per patient per year increased from 2008 until 2012 for all these conditions. All of the top 5 CDL conditions had differences of statistical significance in the average number of co-morbidities per patient throughout the study year, except for asthma and hypertension between 2009 and 2010, and also for hypothyroidism between 2008 and 2009 including 2009 and 2010, where it stayed relatively unchanged. None of the top 5 conditions displayed an increase of large practical significance in the number of co-morbid CDL conditions per patient throughout the study period.

The prevalence of patients with asthma with co-morbidities increased overall by 26.90% (n = 5 923) between 2008 and 2012. Co-morbidities with asthma increased on a year-to-year basis from 2008 to 2012 by 27.19% (n = 4 584), 1.86% (n = 398), 4.63% (n = 1 011) and 16.64% (n = 3 803), with an overall increase of 58.10% (n = 9 796) between 2008 and 2012.

Diabetes mellitus type 2 had a patient prevalence increase of 32.94% (n = 10 381) from 2008 to 2009, a further increase between 2009 and 2010 with 2.75% (n = 1 151), then a decrease of 2.88% (n = 1 238) from 2010 to 2011 and an increase of 16.39% (n = 6 826) between 2011 and 2012. Patients with diabetes mellitus type 2 had co-morbidity increases of 41.26% (n = 18 022), 4.81% (n = 2 966), 1.25% (n = 808) and 20.75% (n = 13 587) from 2011 to 2012.

This resulted in an overall increase in prevalence of patients with diabetes mellitus type 2 of 54.33% (n = 17 120) and 81.01% (n = 35 383) in co-morbid conditions.

Patients with hyperlipidaemia increased by 24.68% (n = 21 243) from 2008 to 2009, increased further by 0.025% (n = 45) from 2009 to 2010, then decreased by 6.51% (n = 5 967) from 2010 to 2011 and then increased again by 19.75% (n = 19 809) from 2011 to 2012. Co-morbidities of patient with hyperlipidaemia increase by 28.87% (n = 32 441) from 2008 to 2009, 1.19% (n = 1 357) from 2009 to 2010, then decreased by 1.54% (n = 1 748) from 2010 to 2011 and then increased again by 21.98% (n = 31 537) from 2011 to 2012.

The overall increase in patients with hyperlipidaemia was 54.74% (n = 35 490) and 79.56% (n = 63 587) in co-morbid conditions between 2008 and 2012.

The prevalence of hypertensive patients increased by 22.07% (n = 36 058) between 2008 and 2009, then decreased by 0.65% (n = 1058) between 2009 and 2010, then further decreased by 6.20% (n = 10 055) from 2010 to 2011, but increase again by 13.90% (n = 24 586). Hypertensive co-morbidities increased by 27.16% (n = 38 840) from 2008 to 2009 and again by 0.03% (n = 47) to 2010. A decrease of 1.94% (n = 2 777) followed to 2011 and an increase of 19.26% (n = 33 466) from 2011 to 2012.

The prevalence of hypertensive patients increased overall with 38.91% (n = 49 531) between 2008 and 2012, while co-morbid conditions increased by 66.78% (n = 69 576).

Patients with hypothyroidism were the only CDL condition in the top 5 with a reduction in patient prevalence from 2008 to 2009 with 0.11% (n = 44), whereas all the other conditions increased between 2008 and 2009. The prevalence of patients with hypothyroidism also increased by 1.26% (n = 504) from 2009 to 2010, then decreased again by 6.16% (n = 2 466) from 2010 to 2011, but then increased again by 14.34% (n = 6 294) from 2011 to 2012. An increase in the prevalence of hypothyroidism co-morbidities of 45.21% (n = 21 931) occurred between 2008 and 2009, a further increase of 1.72% (n = 851) from 2009 to 2010, then a decrease of 1.91% (n = 941) from 2010 to 2011 and then an increase of 17.79% (n = 10 474) to 2012.

Patient prevalence of patients with hypothyroidism increased overall with 10.83% (n = 4 288) and co-morbid conditions increased by 121.58% (n = 32 315) between 2008 and 2012.

Diabetes mellitus type 2 had the highest average number of co-morbid conditions per patient during each of the study years, with 2012 being the highest (n = 1.63) and the lowest average number of co-morbid CDL conditions per patient by asthma during the each study year, except 2008 with hypothyroidism (n = 0.67). The increase in diabetes was confirmed that there is a worldwide increase in the prevalence of patients with diabetes (refer to Chapter 2, sections 2.6.6.3 and 2.7.2.11). Diabetes is also an important co-morbidity with depression as reported by Brown *et al.* (2005:1063) and O'Connor *et al.* (2009:328) in Chapter 2, section 2.6.5.

The overall change in the prevalence of patients with hyperlipidaemia had the highest overall increase in prevalence between 2008 and 2012 of 54.74% (n = 35 490). The highest prevalence of co-morbid conditions was for hypothyroidism with 121.58% (n = 32 315).

All of the top 5 CDL conditions thus increased in patient prevalence as well as their respective number of co-morbidities. The high prevalence of hypertension as a co-morbid disease illustrates was also found by McLeod *et al.* (2002:31). This statement can further be illustrated by Table 3.15, whereby hypertension and hyperlipidaemia were prevalent in most of the co-morbidities. The result of these increased co-morbidities may further lead to decreased medicine adherence among patients with co-morbid conditions as stated in Chapter 2, section 2.9.5.

3.2.6 Different number of CDL conditions and the number of patients with these conditions.

Data analysed in this section will consist of patients with at least one CDL condition as well as number of different CDL conditions for each study year. The data will be summarised as a contribution of the number of patients in each number of CDL conditions to the total number of patients on the database (Table 3.13). The prevalence of patients with different combinations of CDL conditions will be summarised in Tables 3.13 and 3.14. Changes in the number of patients between 2008 and 2012 and the estimated annual change in the number of patients are also tabled and discussed below:

Table 3.13: Number patients with the different number of CDL conditions as a percentage of the total number of patients on the database from 2008 until 2012.

Number of different CDL conditions	Year 2008		Year 2009		Year 2010		Year 2011		Year 2012	
	Number of CDL patients		Number of CDL patients		Number of CDL patients		Number of CDL patients		Number of CDL patients	
	(n)	% *	(n)	% *	(n)	% *	(n)	% *	(n)	% *
1	129 799	13.32	139 634	10.68	136 224	11.16	123 580	11.47	136 097	13.22
2	55 468	5.69	73 259	5.60	72 144	5.91	66 976	6.21	78 163	7.59
3	21 470	2.20	30 582	2.34	31 409	2.57	30 905	2.87	38 205	3.71
4	5 824	0.60	8 810	0.67	8 973	0.74	9 258	0.86	12 292	1.20
5	1 408	0.14	2 089	0.16	1 986	0.16	2 113	0.20	3 177	0.31
6	274	0.03	477	0.04	389	0.03	453	0.04	644	0.06
7	31	0.00	73	0.01	64	0.01	56	0.01	96	0.01
8	5	0.00	10	0.00	6	0.00	8	0.00	8	0.00
9	0	0.00	0	0.00	0	0.00	2	0.00	3	0.00
Total	214 279	21.99	254 934	19.50	251 195	20.59	233 351	21.65	268 685	26.09

* % = $\frac{\text{Number of patients with a specific number of CDL conditions}}{\text{Number of patients on the database}} \times 100$

Table 3.14: Number patients with the different number of CDL conditions as a percentage of the total number of patients with CDL conditions from 2008 until 2012.

Number of different CDL conditions	Year		Year		Year		Year		Year		Year 2008-2012		Patient change (2008 vs 2012) [#] (n)	Estimated annual patient change [*] (n)
	2008		2009		2010		2011		2012		Number of different CDL conditions (1-9)			
	Number of CDL patients		Number of CDL patients		Number of CDL patients		Number of CDL patients		Number of CDL patients					
	(n)	% [†]	(n)	% [†]	(n)	% [†]	(n)	% [†]	(n)	% [†]	<i>p</i> -value	Cramer's V		
1	129 799	60.57	139 634	54.77	136 224	54.23	123 580	52.96	136 097	50.65	<i>p</i> < 0.0001	Cramer's V = 0.0363	↑ 6 298 (4.86%)	↑ 1 575 (1.22%)
2	55 468	25.89	73 259	28.74	72 144	28.72	66 976	28.70	78 163	29.09			↑ 22 695 (40.92%)	↑ 5 674 (10.23%)
3	21 470	10.02	30 582	12.00	31 409	12.50	30 905	13.24	38 205	14.22			↑ 16 735 (77.95%)	↑ 4 184 (19.49%)
4	5 824	2.72	8 810	3.46	8 973	3.57	9 258	3.97	12 292	4.57			↑ 6 468 (111.06%)	↑ 1 617 (27.77%)
5	1 408	0.66	2 089	0.82	1 986	0.79	2 113	0.91	3 177	1.18			↑ 1 769 (125.64%)	↑ 443 (31.41%)
6	274	0.13	477	0.19	389	0.15	453	0.19	644	0.24			↑ 370 (135.04%)	↑ 93 (33.76%)
7	31	0.00	73	0.03	64	0.03	56	0.02	96	0.04			↑ 65 (209.68%)	↑ 16 (52.42%)
8	5	0.00	10	0.00	6	0.00	8	0.00	8	0.00			↑ 3 (60.00%)	↑ 1 (15.00%)
9	0	0.00	0	0.00	0	0.00	2	0.00	3	0.00			↑ 3 (↑ 1; 50.00%, 2011-2012)	↑ 1 (50.00%)
Total	214 279	100.00	254 934	100.00	251 195	100.00	233 351	100.00	268 685	100.00			↑ 54 406 (25.39%)	↑ 13 602 (6.35%)

[†] % = $\frac{\text{Number of patients with a specific number of CDL conditions}}{\text{Total number of CDL patients for that year}} \times 100$

[#] Patient change (2008 vs 2012) = $\frac{\text{Number of CDL patients (2008)} - \text{(2012)}}{\text{Number of CDL patients (2008)}} \times 100$

Estimated annual patient change = $\frac{\text{Patient change (2008 vs 2012)}}{4^{\&}}$

[&] Annual change between 2 study years (2008-2009, 2009-2010, 2010-2011 and 2011-2012)

The data from Tables 3.13 and 3.14 recorded that 54.43% (n = 665 334) of patients had only one CDL condition, 28.31% (n = 346 010) had two CDL conditions, 12.48% (n = 152 571) had three CDL conditions and 4.79% (n = 58 529) had more than three CDL conditions during the five year study period. There was also no practical significant association between the number of patients per year and the number of CDL conditions (*Cramer's V* = 0.0363; $p < 0.0001$).

The prevalence of patients with a single CDL condition increased by 4.86% (n = 6 298) from 2008 (n = 129 799) to 2012 (n = 136 097).

The number of patients with co-morbid CDL conditions thus totalled 557 110 for the entire study period, which resulted in an increase of 56.95% (n = 48 108) from 84 480 (2008) to 132 588 (2012). All of the co-morbid combinations had overall increases between 2008 until 2012. The largest increases in patients with co-morbid CDL conditions were from 2008 until 2009 for the following combination groups:

- Two CDL conditions with n = 17 791;
- Three CDL conditions with n = 9 112;
- Six CDL conditions with n = 203;
- Seven CDL conditions n = 42; and
- Eight CDL conditions n = 5.

The largest increases for the following combination groups occurred from 2011 until 2012 with:

- Four CDL conditions with n = 3 034; and
- Five CDL conditions with n = 1 064.

In 2011, the first patient claimed medicine for nine CDL conditions (n = 2) and then increased further to 2012. The same study in section 3.2.3 by Ornstein *et al.* (2013:521) reported that, as in Table 3.14, the number of patients decreased with the addition of CDL conditions. However, patients with a single CDL condition ranged from 60.57% to 50.65% over a five year period, whereas only 20.10% (n = 134 136) of patients from the United States study had a single CDL condition (Ornstein *et al.*, 2013:521).

The highest increase in the number of patients occurred in the group with two CDL conditions (n = 22 695) between 2008 and 2012, and therefore having the highest estimated annual increase

of 5 674 patients. Patients in the group with seven conditions had the highest prevalence increase of 209.68% (n = 65), with an estimated annual increase of 52.42% (n = 16). Other groups also with a higher than 100.00% increase between 2008 and 2012 were:

- Four CDL conditions with 111.06% (n = 6 468);
- Five CDL conditions with 125.64% (n = 1 769); and
- Six CDL conditions with 135.04% (n = 370).

This section illustrates that there was an increase in the number of patients with all numbers of co-morbid CDL conditions between 2008 and 2012. This confirms the estimation (refer to Chapter 2, Table 2.5) that may result in greater medical cost and disability as stated by Michaud and Wolfe (2007:886) and Wolff *et al.* (2002:2269) in Chapter 2, sections 2.6.1 and 2.6.4. High medicine cost due to co-morbidity with regard to single CDL conditions can be confirmed in section 3.4.3. The increase in co-morbid conditions in South Africa is further confirmed as found in the United States, Eastern and Central European Union countries as well as Australia (Gemmill, 2008; Holden *et al.*, 2011; Vogeli *et al.*, 2007:391) (refer to Chapter 1, section 1.2).

A study was also done in six middle-income countries that included China, Ghana, Mexico, India, South Africa and Russia (Lee *et al.*, 2015:3). The goal of this study was to assess the impact of NCD multi-morbidity on healthcare utilisation and out-of-pocket expenditures in these countries. Data for this study were collected from cross-sectional data from adults > 18 years (n = 39 213) in the WHO Study on Global Ageing and Adult Health (SAGE) from 2007 until 2010 (Lee *et al.*, 2015:4). The results found that multi-morbidity increased with age and in South Africa (n = 3 243) patients. The following association was made between NCDs and healthcare utilisation: For all six countries, the number of healthcare visits for outpatients increased from 2.66 (single NCD) versus 4.15 (multi-morbidity NCD) and the number of hospitalisation days increased from 0.15 (single NCD) versus 0.25 (multi-morbidity NCD). For South Africa the number of healthcare visits for outpatients increased from 2.63 (single NCD) versus 5.74 (multi-morbidity NCD) and the number of hospitalisation days increased from 0.10 (single NCD) versus 0.20 (multi-morbidity NCD) (Lee *et al.*, 2015:7). This study concluded that NCD multi-morbidity resulted in greater healthcare utilisation and associated financial burden for citizens of these selected countries (Lee *et al.*, 2015:10).

An increase in co-morbid conditions may also lead to medicine adherence problems, because of an increase in medicine and cost to treat these conditions and side-effect possibilities as listed in Chapter 2, section 2.9.5.

3.2.7 Number of patients with different CDL co-morbid condition combinations.

The number of patients with 2 to 5 CDL combination groups will be discussed and analysed. The data in each of these groups will further be analysed, only according to the top 5 CDL combinations in each group. The data are summarized in Table 3.15 below.

Table 3.15: Number of patients with the different combinations of CDL conditions from 2008 until 2012.

Year 2008				Year 2009		
Total number of different CDL conditions	Type of CDL combination*	Number of patients		Type of CDL combination*	Number of patients	
		n	% #		n	% #
2	Hyperlipidaemia + HTN	20 140	36.31	Hyperlipidaemia + HTN	25 366	34.64
	HTN + DM2	9 059	16.33	HTN + DM2	10 856	14.82
	HTN + Hypothyroidism	4 397	7.93	HTN + Hypothyroidism	8 281	11.31
	HTN + Asthma	3 216	5.80	HTN + Asthma	3 507	4.79
	Hyperlipidaemia + DM2	2 105	3.80	Hyperlipidaemia + DM2	2 813	3.84
3	Hyperlipidaemia + HTN + DM2	5 734	26.71	Hyperlipidaemia + HTN + DM2	8 117	26.57
	Hyperlipidaemia + HTN + Hypothyroidism	2 312	10.77	Hyperlipidaemia + HTN + Hypothyroidism	4 272	13.98
	Hyperlipidaemia + HTN + CAD	1 754	8.17	Hyperlipidaemia + HTN + CAD	1 873	6.13
	Hyperlipidaemia + HTN + Asthma	1 086	5.06	Hyperlipidaemia + HTN + Asthma	1 251	4.09
	Hyperlipidaemia + HTN + CF	787	3.67	Hypothyroidism + DM2 + HTN	1 004	3.29
4	Asthma + DM2 + HTN + Hyperlipidaemia	277	4.76	Asthma + DM2 + HTN + Hyperlipidaemia	380	4.35
	Hypothyroidism + Hyperlipidaemia + HTN + CAD	236	4.06	Hypothyroidism + Hyperlipidaemia + CAD + HTN	305	3.49
	Glaucoma + DM2 + HTN + Hyperlipidaemia	186	3.20	Glaucoma + DM2 + HTN + Hyperlipidaemia	242	2.77
	Hyperlipidaemia + CF + CAD + HTN	185	3.18	Hyperlipidaemia + CF + CAD + HTN	242	2.77
5	Hypothyroidism + DM2 + CAD + HTN + Hyperlipidaemia	47	3.36	Hypothyroidism + DM2 + CAD + HTN + Hyperlipidaemia	83	4.21
	DM1 + Hypothyroidism + Hyperlipidaemia + HTN + DM2	35	2.51	DM1 + Hypothyroidism + Hyperlipidaemia + HTN + DM2	38	1.93
	Hypothyroidism + CF + Dysrhythmia + HTN + Hyperlipidaemia	27	1.93	Hypothyroidism + CF + Dysrhythmia + HTN + Hyperlipidaemia	36	1.83
	Glaucoma + CAD + Hyperlipidaemia + HTN + DM2	23	1.65	Dysrhythmia + CAD + Hyperlipidaemia + HTN + Hypothyroidism	30	1.52

* HTN-hypertension, DM1- diabetes mellitus type 1, DM2-diabetes mellitus type 2, CAD-coronary artery disease, CF-cardiac failure.

% = $\frac{\text{Number of patients with each combination}}{\text{Total number of patients for each number of CDL conditions.}} \times 100$

Year 2010				Year 2011		
Total number of different CDL conditions	Type of CDL combination*	Number of patients		Type of CDL combination*	Number of patients	
		n	% #		n	% #
2	Hyperlipidaemia + HTN	24 954	34.60	Hyperlipidaemia + HTN	22 628	33.80
	HTN + DM2	10 692	14.83	HTN + DM2	9 954	14.87
	HTN + Hypothyroidism	8 461	11.73	HTN + Hypothyroidism	7 846	11.72
	HTN + Asthma	3 477	4.82	HTN + Asthma	3 675	5.49
	Hyperlipidaemia + DM2	3 134	4.35	Hyperlipidaemia + DM2	2 903	4.34
3	Hyperlipidaemia + HTN + DM2	9 276	29.56	Hyperlipidaemia + HTN + DM2	9 201	29.80
	Hyperlipidaemia + HTN + Hypothyroidism	4 368	13.92	Hyperlipidaemia + HTN + Hypothyroidism	4 133	13.39
	Hyperlipidaema + HTN + CAD	1 527	4.87	Hyperlipidaemia + HTN + CAD	1 707	5.53
	Hyperlipidaemia + HTN + Asthma	1 293	4.12	Hyperlipidaemia + HTN + Asthma	1 349	4.37
	Hypothyroidism + DM2 + HTN	1 072	3.42	Hypothyroidism + DM2 + HTN	1 024	3.32
4	Hypothyroidism + DM2 + HTN + Hyperlipidaemia	1 368	15.35	Hypothyroidism + DM2 + Hyperlipidaemia + HTN	1 406	15.29
	Asthma + DM2 + HTN + Hyerlipidaemia	411	4.61	Asthma + DM2 + HTN + Hyperlipidaemia	489	5.32
	Glaucoma + DM2 + HTN + Hyperlipidaemia	293	3.29	Hypothyroidism + Hyperlipidaemia + CAD + HTN	317	3.45
	Hypothyroidism + Hyperlipidaemia + CAD + HTN	265	2.97	Glaucoma + DM2 + HTN + Hyperlipidaemia	275	2.99
	Hypothytoidism + Dysrhythmia + Hyperlipidaemia + HTN	216	2.42	DM2 + DM1 + Hyperlipidaemia + HTN	265	2.88
5	Hypothyroidism + DM2 + Asthma + HTN + Hyperlidaemia	108	5.88	Hypothyroidism + DM2 + Asthma + HTN + Hyperlidaemia	125	6.35
	Hypothyroidism + DM2 + CAD + HTN + Hyperlipidaemia	53	2.89	Hypothyroidism + DM2 + CAD + HTN + Hyperlipidaemia	81	4.11
	DM1 + Hypothyroidism + Hyperlipidaemia + HTN +DM2	49	2.67	DM1 + Hypothyroidism + Hyperlipidaemia + HTN +DM2	61	3.10
	Hypothyroidism + CF + Dysrhythmia + HTN + Hyperlipidaemia	43	2.34	Hypothyroidism + CF + Dysrhythmia + HTN + Hyperlipidaemia	42	2.13
	Cardiomyopathy + CAD + Hyperlipidaemia + HTN + CF	25	1.36	Dysrhythmia + CAD + Hyperlipidaemia + HTN + DM2	37	1.88

* HTN-hypertension, DM1-diabetes mellitus type 1, DM2-diabetes mellitus type 2, CAD-coronary artery disease, CF-cardiac failure.

% = $\frac{\text{Number of patients with each combination}}{\text{Total number of patients for each number of CDL conditions.}} \times 100$

Year 2012			
Total number of different CDL conditions	Type of CDL combination*	Number of patients	
		n	% #
2	Hyperlipidaemia + HTN	27 167	34.77
	HTN + DM2	10 834	13.87
	HTN + Hypothyroidism	8 993	11.51
	HTN + Asthma	3 849	4.93
	Hyperlipidaemia + DM2	3 522	4.51
3	Hyperlipidaemia + HTN + DM2	10 847	28.43
	Hyperlipidaemia + HTN + Hypothyroidism	5 019	13.15
	Hyperlipidaemia + HTN + CAD	2 579	6.76
	Hyperlipidaemia + HTN + Asthma	1 605	4.21
	Hyperlipidaemia + HTN + CF	1 470	3.85
4	Hypothyroidism + DM2 + Hyperlipidaemia + HTN	1 660	13.60
	Asthma + DM2 + HTN + Hyperlipidaemia	594	4.87
	Hypothyroidism + Hyperlipidaemia + CAD + HTN	426	3.49
	Hyperlipidaemia + CF + CAD + HTN	379	3.10
	Glaucoma + DM2 + HTN + Hyperlipidaemia	363	2.97
5	Hypothyroidism + DM2 + Asthma + HTN + Hyperlipidaemia	154	5.21
	Hypothyroidism + DM2 + CAD + HTN + Hyperlipidaemia	110	3.72
	DM1 + Hypothyroidism + Hyperlipidaemia + HTN + DM2	69	2.34
	Hypothyroidism + CF + Dysrhythmia + HTN + Hyperlipidaemia	52	1.76
	Dysrhythmia + CAD + Hyperlipidaemia + HTN + DM2	50	1.69

* HTN-hypertension, DM1- diabetes mellitus type1, DM2-diabetes mellitus type 2, CAD-coronary artery disease, CF-cardiac failure.

% = $\frac{\text{Number of patients with each different number of CDL conditions}}{\text{Total number of patients for each number of CDL conditions}} \times 100$

Two CDL conditions

Table 3.15 reveals that all of the combinations prevalent in 2008 were also prevalent in 2009, 2010, 2011 and 2012. Hypertension was prevalent in 4 of the top 5 combinations and all of the combinations in the top 5 had overall increases to 2012. Although hyperlipidaemia with hypertension had the highest increase of 7 027 patients between 2008 and 2012, hypertension with hypothyroidism had the highest prevalence increase of 104.52% (n = 4 596). The lowest increase in the number of patients was for hypertension with asthma (n = 633), whereas the lowest increase was 19.59% (n = 1 775) for hypertension with diabetes mellitus type 2. The latter combination had the second highest prevalence and patients with this combination had a higher risk of coronary artery disease, macrovascular complications, including stroke, congestive cardiac failure and peripheral vascular disease (Bretzel, 2007:S35; Dokken, 2008:160).

Three CDL conditions

Combinations of three CDL conditions from 2008 to 2012, had a relatively high number of patients with hyperlipidaemia in the top 5 combinations in 2008 and 2012 and the top 4 in 2009, 2010 and 2011. Hypertension was prevalent in all of the top 5 combinations throughout the study period. This might be attributed to hypertension being a risk factor for stroke, coronary artery disease, chronic kidney disease, cardiac failure, peripheral artery disease and advanced retinopathy (Rosendorff *et al.*, 2007:2762; Seedat & Rayner, 2012:64) (also refer to Chapter 2, sections 2.6.6.4, 2.7.2.7 and 2.7.2.8). The large prevalence of hypertension in combination confirmed the results from the study by Mcleod *et al.* (2002:31) in Chapter 2, section 2.6.4., that hypertension was prevalent in 8 of the top 9 combinations.

The combination with the highest prevalence throughout the study period was for hyperlipidaemia with hypertension and diabetes mellitus type 2. It was confirmed that there is an approximately two-fold higher incidence of hypertension in patients with diabetes when compared to age-matched patients without diabetes (Kengne *et al.*, 2005:3597). Patients with hypertension are also more likely to develop diabetes when compared to normotensive patients (Kengne *et al.*, 2005:3597).

All of the combinations showed an overall increase in number of patients from 2008 to 2012, with hyperlipidaemia with hypertension and diabetes mellitus type 2 having the largest increase of 5 113 patients. In the majority of patients where diabetes mellitus type 2 was present, hyperlipidaemia was also present. This can be confirmed by Amod *et al.* (2012:S58) who state that patients with diabetes have a higher incidence of lipid abnormalities an important contributor to vascular disease. The most frequent lipid disturbances (abnormalities) in type 2 diabetes are decreased HDL cholesterol and increased serum triglycerides (Amod *et al.*, 2012:S58). In addition, hypertension is a common co-morbidity in patients with type 2 diabetes, and may affect the majority of patients with type 2 diabetes, This may then result in micro and macro-vascular disease as a modifiable risk factor (Amod *et al.*, 2012:S61).

The combination of hypertension with hyperlipidaemia and diabetes mellitus type 2 may further contribute to the development of metabolic syndrome. According to the International Diabetes Federation (2006:10), metabolic syndrome can be defined as central obesity (body mass index (BMI) > 30 kg/m² with ethnicity specific values) together with two or more of the following:

- Raised plasma triglycerides (≥ 1.7 mmol/L; 150 mg/dL) or specific treatment for the lipid abnormality (International Diabetes Federation, 2006:10);

- Reduced HDL-cholesterol (< 1.03 mmol/L, 40 mg/dL for males; < 1.29 mmol/L, 50 mg/dL for females) or specific treatment for the lipid abnormality (International Diabetes Federation, 2006:10);
- Raised fasting plasma glucose (Fasting plasma glucose (FPG) ≥ 100 mg/dL (5.6 mmol/L). If FPG > 100 mg/dL (5.6 mmol/L), an oral glucose tolerance test is recommended, although not necessary to define the presence of the syndrome) or specific treatment for diabetes mellitus type 2 (International Diabetes Federation, 2006:10);
- Raised blood pressure (systolic blood pressure (BP) ≥ 130 mmHg or diastolic BP ≥ 85 mmHg or specific treatment for hypertension (International Diabetes Federation, 2006:10).

In patients with three CDL conditions, coronary artery disease and/or cardiac failure was also prevalent in the top 5 combinations throughout the study period. This might be as a result of the high number of patients with hypertension and hyperlipidaemia in this group.

Four CDL conditions

In patients with a combination of four CDL conditions, asthma with diabetes mellitus type 2 with hyperlipidaemia and hypertension had the highest number of patients from 2008 to 2009. This combination had the highest number and prevalence increase of 114.44% ($n = 317$) between 2008 and 2012. The combination of hypothyroidism with diabetes mellitus type 2, hyperlipidaemia and hypertension remained the combination with the highest number of patients from 2010 until 2012 with four CDL conditions.

Five CDL conditions

Conditions prevalent in five CDL condition combinations were all prevalent in the top 5 conditions as determined in section 3.2.2, Table 3.7, where hypothyroidism with diabetes mellitus type 2, asthma, hypertension and hyperlipidaemia had the highest number of patients throughout the study period including the highest increase of 42.59% ($n = 46$).

In addition, certain CDL conditions were only prevalent with certain other combinations for all combination groups. These include:

- Where asthma was prevalent in all combinations throughout all study years, hypertension was always present, and
- Glaucoma was always present with hypertension, hyperlipidaemia and diabetes mellitus type 2.

To confirm the combination with glaucoma above, risk factors for primary open-angle glaucoma include: diabetes and hypertension (Terebuh & Terebuh, 1999:735). The fact that glaucoma was present with hypertension, hyperlipidaemia and diabetes mellitus type 2 can be confirmed by a study done in Canada in 2006 among 258 patients (Canadian Glaucoma Study Group, 2006:572). This study found that 29.10% of glaucoma patients had hypertension, 15.90% had cardiovascular disease and 9.30% had diabetes (Canadian Glaucoma Study Group, 2006:572).

- Dysrhythmia was always present with hypertension and hyperlipidaemia;
- Diabetes mellitus type 2 was always present with hypertension;
- Cardiac failure was present with hypertension and hyperlipidaemia; and
- Hypothyroidism with hypertension.

Confirming the coexistence of hypothyroidism and hypertension, a study was done in Multan by comparing 189 patients (58 male and 131 female patients) with 100 control patients (30 male and 70 female patients) (Afzal *et al.*, 2009:7). The results showed that 11.10% and 27.20% of female patients with hypothyroidism had systolic and diastolic hypertension respectively. For male patients, 15.70% and 21.0% of whom had hypothyroidism also had systolic and diastolic hypertension respectively (Afzal *et al.*, 2009:7). These results concluded that male and female patients with overt hypothyroidism had a higher incidence of systemic hypertension with narrow pulse pressure (Afzal *et al.*, 2009:7).

Although not summarised in Table 3.15, certain other CDL conditions are more prevalent in certain combinations which could lead to an increase in morbidity and mortality.

Vogeli *et al.* (2007:392) report that individuals with epilepsy were more likely to have heart disease and stroke than the general population. Co-morbidities with an association between COPD and other chronic conditions include dyslipidaemia, cardiac disease, diabetes mellitus, hypertension and psychological disorders such as depression, as reported by Chatila *et al.* (2008:549) and Van den Bemt *et al.* (2009:108) in Chapter 2, section 2.6.5. Cardiovascular disease co-morbidity, including hypertension, myocardial infarction, cardiac failure, stroke and peripheral vascular disease has also shown an increased association in patients with inflammatory arthritis including rheumatoid arthritis (Michaud & Wolfe, 2007:890; Ursum *et al.*, 2013:4). To further emphasize the co-existence of CDL conditions (especially hypertension, diabetes mellitus type 2 and asthma) even in primary health facilities in South Africa, a study was done in primary health facilities. This study was conducted in 2010 in the Western Cape, North West, Northern Cape and Limpopo

provinces (Lalkhen & Mash, 2015:135). This study included 18 856 patient consultations (Lalkhen & Mash, 2015:135). The results found that hypertension, diabetes mellitus type 2 and asthma had the following CDL co-morbidities (Lalkhen & Mash, 2015:136):

- Hypertension (n = 3 219): Diabetes mellitus type 2 (n = 587;18.2%), asthma (n = 116;3.6%), COPD (n = 67;2.1%), epilepsy (n = 55;1.7%), lipid disorders (n = 54;1.7%) and heart failure (n = 48;1.5%);
- Diabetes mellitus type 2: (n = 946): Hypertension (n = 597;63.1%), lipid disorders (n = 14;1.5%), schizophrenia (n = 8;0.8%) and epilepsy (n = 5;0.5%);
- Asthma (n = 485): Hypertension (n = 139;28.7%), diabetes mellitus type 2 (n = 26;5.4%) and epilepsy (n = 6;12.%).

It was concluded that all of the NCD conditions included in the study, all the conditions (n = 5 793), 1 972 patients (34.0%) had one additional condition, 617 patients (10.7%) had two co-morbidities, 211 (3.6%) had three co-morbidities and 6 patients (0.1%) had four co-morbidities. Hypertension was the most prevalent condition with the most co-morbidities of all the conditions included in the study (Lalkhen & Mash, 2015:137).

3.3 Medicine cost of patients with at least one CDL condition according to the total patient population.

Data in this section contain total direct medicine cost of the patients with at least one CDL condition. Data will further be stratified according to age and gender (refer to Table 3.16).

Table 3.16: Medicine cost of patients with CDL conditions compared to the total medicine cost of the database from 2008 until 2012.

	Description		Year 2008	Year 2009	Year 2010	Year 2011	Year 2012
Total cost of medicine items on the database (R)	Gender	Female	1 057 274 453.63	1 460 708 720.03	1 429 235 328.40*	1 143 593 475.00*	1 004 583 004.00*
		Male	728 596 560.22	1 048 502 049.85	1 030 990 482.26*	867 189 285.10*	835 780 568.90*
	Age group (years)	0 > age ≤ 12	70 776 260.18	124 562 041.27	115 846 802.78	84 889 814.15	83 264 059.60
		12 > age ≤ 50	590 645 996.89	813 366 061.99	777 041 409.19	602 939 920.06	571 037 514.94
		50 > age ≤ 60	380 433 225.13	516 133 514.47	501 293 384.29	408 306 029.71	386 259 430.49
		60 > age ≤ 70	342 790 861.99	491 464 982.08	489 802 362.66	408 975 427.42	390 596 230.90
		age > 70	401 224 669.66	563 684 170.07	576 240 806.61	505 671 884.95	409 207 672.24
	Total		1 785 871 013.85	2 509 210 769.88	2 460 224 765.53	2 010 783 076.29	1 840 364 908.17
Total cost of CDL condition medicine items (R)	Gender	Female	172 599 818.00 (16.33%)	243 389 361.00 (16.66%)	243 302 216.00 (17.02%)	236 993 978.00 (20.72%)	213 237 859.00 (21.27%)
		Male	161 835 732.00 (22.21%)	225 512 854.00 (21.51%)	228 335 693.00 (22.14%)	228 109 523.00 (26.30%)	226 494 292.00 (27.10%)
	Age group (years)	0 > age ≤ 12	3 612 678.20 (5.10%)	9 811 562.97 (7.88%)	9 676 406.80 (8.35%)	9 590 846.08 (11.30%)	8 554 937.24 (10.27%)
		12 > age ≤ 50	702 162 08.39 (11.89%)	103 873 166.00 (12.77%)	104 920 865.00 (13.50%)	108 840 066.00 (18.05%)	102 980 530.00 (18.03%)
		50 > age ≤ 60	75 835 287.14 (19.93%)	103 045 096.00 (19.97%)	101 186 025.00 (20.18%)	98 988 085.02 (24.24%)	99 648 760.62 (25.80%)
		60 > age ≤ 70	82 324 867.10 (24.02%)	112 596 369.00 (22.91%)	113 545 944.00 (23.18%)	110 339 268.00 (26.98%)	110 716 272.00 (28.35%)
		age > 70	102 446 509.00 (25.53%)	139 576 021.00 (24.76%)	142 308 669.00 (24.70%)	137 345 236.00 (27.16%)	117 831 652.00 (28.80%)
	Total		334 435 550.00 (18.73%)	468 902 215.00 (18.68%)	471 637 910.00 (19.17%)	465 103 501.00 (23.13%)	439 732 152.00 (23.89%)

Note: All percentages in Table 3.16 are expressed as a percentage of the equivalent group on the total database.

* Unidentified patients with regard to gender include: (2010) - (n = 11; R1 045.66), (2011) - (n = 15; R316.05) and (2012) - (n = 42; R1 334.97).

Table 3.16 reveal that the total CDL medicine cost increased overall from 18.73% in 2008 to 23.89% of the total medicine cost on the database in 2012.

Table 3.16 depicts that female patients with at least one CDL condition contributed more to the total medicine cost than male patients from 2008 to 2011. The total medicine cost of female patients with at least one CDL condition represented 16.33% in 2008 and increased to 21.27% in 2012, in comparison to male patients with 22.21% in 2008 that increased to 27.10% in 2012.

The percentage that the medicine cost of CDL medicine represented to the total medicine cost on the database increased as follows for the different age groups:

- Age group: $0 > \text{age} \leq 12$ years: increased from 5.10% (2008) to 10.27% (2012).
- Age group: $12 > \text{age} \leq 50$ years: increased from 11.89% (2008) to 18.03% (2012);
- Age group: $50 > \text{age} \leq 60$ years: increased from 19.93% (2008) to 25.80% (2012);
- Age group: $60 > \text{age} \leq 70$ years: increased from 24.02% (2008) to 28.35% (2012); and
- Age group: $\text{age} > 70$ years: increased from 25.53% (2008) to 28.80% (2012).

The total medicine cost contribution further showed a trend in all the study years, an increase in the cost contribution percentage with increased age.

3.4 Medicine cost for CDL conditions

The main section, 3.4 will contain different sub-sections as listed below:

- 3.4.1. Medicine cost for patients with at least one CDL condition according to different cost types^{*}.
- 3.4.2. Medicine cost per item per patient with the top 5 CDL conditions according to different cost types.
- 3.4.3. Medicine cost according to the different number of CDL conditions.
- 3.4.4. Medicine cost for all CDL medicine according to different generic indicators.

^{*} Refer to Chapter 1, section 1.10.2.2

- 3.4.5. Average cost per prescription per patient according to different cost structures[#].
- 3.4.6. Average medicine cost per item per patient according to different cost structures.
- 3.4.7. Potential cost savings per medicine item from changes in SEP.
- 3.4.8. Patient adherence of CDL medicine and associated medicine cost.

3.4.1 Medicine cost for patients with at least one CDL condition according to different cost types.

In this section, the total and average medicine cost per item of patients with at least one CDL condition stratified according to age and gender will be analysed and discussed. The medicine cost for all CDL condition items will further be analysed (refer to Tables 3.17 to 3.21). The cost will be presented as the average and total medicine cost per item, and the cost-prevalence index (CPI)* from 2008 until 2012.

The medicine cost aspects will be further analysed according to medical scheme contribution claimed, patient levy claimed as well as the total medicine cost per item.

[#] Refer to Chapter 1, section 1.10.2.2

^{*} Refer to list of abbreviations and chapter 1.

Table 3.17: Medicine cost for all CDL condition items according to different cost types for 2008.

Year	Description		Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)	
				Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2008	Gender	Female	1 376 575	Medical scheme contribution	103.83	185.77	103.53-104.15	142 934 214.00	0.96	
				Patient levy	21.55	79.45	21.42-21.69	29 665 604.18		
				Total cost	125.38	204.54	125.05-125.73	172 599 818.00		
		Male	1 174 733	Medical scheme contribution	115.68	305.85	115.13-116.24	135 891 544.00	1.05	
				Patient levy	22.09	54.33	21.99-22.19	25 944 187.71		
				Total cost	137.76	312.44	137.20-138.33	161 835 732.00		
	Age group (years)	0 > age ≤ 12	20 380	Medical scheme contribution	158.19	255.44	154.69-161.70	3 223 876.01	1.35	
				Patient levy	19.08	42.89	18.49-19.67	388 802.19		
				Total cost	177.27	259.59	173.71-180.83	3 612 678.20		
		12 > age ≤ 50	445 947	Medical scheme contribution	134.86	474.58	133.47-136.26	60 141 907.83	1.20	
				Patient levy	22.59	72.55	22.38-22.81	10 074 300.56		
				Total cost	157.45	482.16	156.04-158.87	70 216 208.39		
		50 > age ≤ 60	589 949	Medical scheme contribution	106.91	187.70	106.43-107.39	63 070 320.65	0.98	
				Patient levy	21.64	111.70	21.36-21.93	12 764 966.49		
				Total cost	128.55	220.55	127.99-129.11	75 835 287.14		
		60 > age ≤ 70	646 249	Medical scheme contribution	105.55	182.39	105.10-105.99	68 208 726.66	0.97	
				Patient levy	21.84	42.14	21.74-21.95	14 116 140.44		
				Total cost	127.39	189.31	126.93-127.85	82 324 867.10		
		age >70	848 783	Medical scheme contribution	99.18	123.74	98.92-99.45	84 180 926.75	0.92	
				Patient levy	21.52	38.60	21.44-21.61	18 265 582.21		
				Total cost	120.70	132.95	120.42-120.98	102 446 509.00		
		Total		2 551 308	Medical scheme contribution	109.29	248.45	108.99-109.60	278 825 758.00	
					Patient levy	21.80	69.03	21.72-21.89	55 609 791.89	
					Total cost	131.08	259.92	130.77-131.41	334 435 550.00	

Table 3.18: Medicine cost for all CDL condition items according to different cost types for 2009.

Year	Description		Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)		
				Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)			
2009	Gender	Female	1 804 555	Medical scheme contribution	111.69	342.13	111.19-112.19	201 543 742.00	0.95		
				Patient levy	23.19	52.01	23.12-23.27	41 845 619.33			
				Total cost	134.88	348.80	134.37-135.39	243 389 361.00			
		Male	1 526 551	Medical scheme contribution	123.37	383.13	122.77-123.98	188 329 764.00	1.04		
				Patient levy	24.36	79.86	24.23-24.49	37 183 089.71			
				Total cost	147.73	393.69	147.11-148.36	225 512 854.00			
	Age group (years)	0 > age ≤ 12	43 014	Medical scheme contribution	193.16	402.94	189.35-196.97	8 308 450.97	1.62		
				Patient levy	34.94	64.55	34.34-35.56	1 503 112.00			
				Total cost	228.10	405.76	224.27-231.94	9 811 562.97			
		12 > age ≤ 50	578 377	Medical scheme contribution	154.47	642.37	152.82-156.13	89 341 152.90	1.28		
				Patient levy	25.13	77.06	24.93-25.33	14 532 012.92			
				Total cost	179.59	649.22	177.93-181.27	103 873 166.00			
		50 > age ≤ 60	746 537	Medical scheme contribution	114.32	304.84	113.64-115.02	85 346 145.17	0.98		
				Patient levy	23.71	93.26	23.50-23.92	17 698 951.14			
				Total cost	138.03	323.76	137.30-138.77	103 045 096.00			
		60 > age ≤ 70	837 411	Medical scheme contribution	111.11	341.84	110.39-111.85	93 048 524.59	0.96		
				Patient levy	23.34	49.01	23.24-23.45	19 547 844.90			
				Total cost	134.46	346.57	133.72-135.20	112 596 369.00			
		age >70	1 125 767	Medical scheme contribution	101.11	137.11	100.86-101.37	113 829 233.00	0.88		
				Patient levy	22.87	47.04	22.79-22.96	25 746 788.08			
				Total cost	123.98	149.12	123.71-124.26	139 576 021.00			
		Total			3 331 106	Medical scheme contribution	117.04	361.54	116.66-117.43	389 873 506.00	
						Patient levy	23.72	66.24	23.66-23.80	79 028 709.04	
						Total cost	140.76	370.10	140.37-141.14	468 902 215.00	

Table 3.19: Medicine cost for all CDL condition items according to different cost types for 2010.

Year	Description		Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)	
				Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2010	Gender	Female	1 728 965	Medical scheme contribution	116.72	359.36	116.19-114.26	201 804 505.00	0.96	
				Patient levy	24.00	56.12	23.92-24.09	41 497 711.11		
				Total cost	140.72	367.90	140.18-141.27	243 302 216.00		
		Male	1 480 315	Medical scheme contribution	129.18	472.07	128.42-129.94	191 223 993.00	1.05	
				Patient levy	25.07	101.10	24.91-24.24	37 111 700.26		
				Total cost	154.25	486.15	153.47-155.04	228 335 693.00		
	Age group (years)	0 > age ≤ 12	39 469	Medical scheme contribution	209.48	558.42	203.97-214.99	8 267 868.51	1.67	
				Patient levy	35.69	65.04	35.05-36.33	1 408 538.29		
				Total cost	245.16	560.36	239.64-250.70	9 676 406.80		
		12 > age ≤ 50	541 606	Medical scheme contribution	167.17	777.65	165.10-169.24	90 538 369.57	1.32	
				Patient levy	26.56	131.13	26.21-26.91	14 382 495.50		
				Total cost	193.72	793.76	191.61-195.84	104 920 865.00		
		50 > age ≤ 60	710 961	Medical scheme contribution	118.67	293.47	117.99-119.36	84 370 906.01	0.97	
				Patient levy	23.65	61.19	23.51-23.80	16 815 118.61		
				Total cost	142.32	304.47	141.62-143.03	101 186 025.00		
		60 > age ≤ 70	807 093	Medical scheme contribution	116.28	400.08	115.42-117.16	93 852 038.88	0.96	
				Patient levy	24.40	86.45	24.22-24.59	19 693 904.78		
				Total cost	140.69	412.33	139.79-141.59	113 545 944.00		
		age >70	1 110 151	Medical scheme contribution	104.49	138.37	104.24-104.75	115 999 315.00	0.87	
				Patient levy	23.70	46.45	23.62-23.79	26 309 354.19		
				Total cost	128.19	150.87	127.91-128.47	142 308 669.00		
		Total		3 209 280	Medical scheme contribution	122.47	415.22	122.02-122.92	393 028 498.00	
					Patient levy	24.49	80.07	24.41-24.59	78 609 411.37	
					Total cost	146.96	426.59	146.50-147.43	471 637 910.00	

Table 3.20: Medicine cost for all CDL condition items according to different cost types for 2011.

Year	Description		Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)		
				Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)			
2011	Gender	Female	1 734 386	Medical scheme contribution	114.85	358.02	114.32-115.39	199 196 788.00	0.96		
				Patient levy	21.04	42.66	20.98-21.10	36 483 458.43			
				Total cost	136.64	364.48	136.11-137.19	236 993 978.00			
		Male	1 515 603	Medical scheme contribution	127.04	442.54	126.34-127.74	192 535 860.00	1.05		
				Patient levy	21.96	77.13	21.84-22.09	33 282 324.87			
				Total cost	150.51	454.15	149.79-151.23	228 109 523.00			
	Age group (years)	0 > age ≤ 12	40 356	Medical scheme contribution	210.92	708.81	204.01-217.84	8 511 835.04	1.66		
				Patient levy	26.74	67.10	26.09-27.40	1 079 011.04			
				Total cost	237.66	712.89	230.70-244.62	9 590 846.08			
		12 > age ≤ 50	554 426	Medical scheme contribution	172.97	762.65	170.96-174.98	95 897 834.16	1.37		
				Patient levy	23.17	115.94	22.87-23.48	12 847 168.30			
				Total cost	196.31	777.06	194.27-198.36	108 840 066.00			
		50 > age ≤ 60	712 964	Medical scheme contribution	116.59	280.76	115.94-117.25	83 125 750.89	0.97		
				Patient levy	21.03	48.58	20.92-21.14	14 990 452.58			
				Total cost	138.84	293.12	138.16-139.52	98 988 085.02			
		60 > age ≤ 70	817 432	Medical scheme contribution	112.66	339.02	111.93-113.40	92 092 570.81	0.94		
				Patient levy	21.16	40.10	21.08-21.25	17 298 075.20			
				Total cost	134.98	343.49	134.24-135.73	110 339 268.00			
		age >70	1 124 811	Medical scheme contribution	99.67	145.91	99.40-99.94	112 104 657.00	0.85		
				Patient levy	20.94	36.98	20.87-21.01	23 551 076.18			
				Total cost	122.11	156.84	121.82-122.40	137 345 236.00			
		Total			3 249 989	Medical scheme contribution	120.53	399.71	120.10-120.97	391 732 648.00	
						Patient levy	21.47	61.20	21.40-21.54	69 765 783.30	
						Total cost	143.11	408.81	142.67-143.56	465 103 501.00	

Table 3.21: Medicine cost for all CDL condition items according different cost types for 2012.

Year	Description		Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)		
				Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)			
2012	Gender	Female	1 551 209	Medical scheme contribution	117.06	383.45	116.46-117.67	181 583 242.00	0.96		
				Patient levy	20.41	60.28	20.32-20.51	31 654 617.30			
				Total cost	137.47	394.46	136.85-138.09	213 237 859.00			
		Male	1 513 911	Medical scheme contribution	128.27	554.26	127.39-129.16	194 187 689.00	1.04		
				Patient levy	21.34	55.76	21.26-21.43	32 306 602.95			
				Total cost	149.61	560.78	148.72-150.51	226 494 292.00			
	Age group (years)	0 > age ≤ 12	34 964	Medical scheme contribution	214.36	1 101.78	202.82-225.91	7 494 930.98	1.71		
				Patient levy	30.32	71.93	29.57-31.08	1 060 006.26			
				Total cost	244.68	1 105.26	233.10-256.27	8 554 937.24			
		12 > age ≤ 50	520 912	Medical scheme contribution	174.91	921.95	172.41-177.42	91 112 625.47	1.38		
				Patient levy	22.78	89.80	22.54-23.03	11 867 904.49			
				Total cost	197.69	934.01	195.16-200.23	102 980 530.00			
		50 > age ≤ 60	712 071	Medical scheme contribution	118.98	338.66	118.20-119.77	84 720 813.28	0.98		
				Patient levy	20.96	56.12	20.84-21.10	14 927 947.34			
				Total cost	139.94	348.58	139.14-140.76	99 648 760.62			
		60 > age ≤ 70	822 188	Medical scheme contribution	113.51	322.68	112.81-114.21	93 325 016.68	0.94		
				Patient levy	21.15	53.22	21.04-21.27	17 391 255.38			
				Total cost	134.66	330.10	133.95-135.38	110 716 272.00			
		age >70	974 985	Medical scheme contribution	101.66	198.82	101.27-102.06	99 117 545.05	0.84		
				Patient levy	19.19	37.68	19.12-19.27	18 714 106.78			
				Total cost	120.85	207.19	120.45-121.27	117 831 652.00			
		Total			3 065 120	Medical scheme contribution	122.60	475.58	122.07-123.13	375 770 931.00	
						Patient levy	20.87	58.10	20.81-20.94	63 961 220.25	
						Total cost	143.46	483.84	142.93-144.01	439 732 152.00	

Tables 3.17 to 3.21 recorded that 2009 had the highest number of medicine items claimed for both genders as well as all age groups for the study period, with a total number of 3 331 106 medicine claimed. There was an overall increase in the prevalence of all CDL medicine items of 20.14% (n = 513 812) from 2 551 308 (2008) to 3 065 120 (2012). The highest average medicine cost per item claimed was during 2010 (R146.96 ± R426.59) (95%CI:R146.50-R147.43). Thereafter, the total average cost per item decreased slightly to 2012.

Total medicine cost had an overall increase of 31.49% (R105 296 602.00) between 2008 and 2012, the total medical scheme contribution paid increased by 34.77% (R96 945 173.00) and the total patient levy paid increased by 15.02% (R8 351 468.36) between 2008 and 2012. To confirm the total medicine cost increase, it was estimated that the amount spent on medicine worldwide increased from \$605 billion in 2006 and increased with \$234 billion between 2008 and 2012 from \$731 billion in 2007 to \$965 billion in 2012 (IMS Institute of Healthcare Informatics, 2011:4; IMS Institute of Healthcare Informatics, 2013:5). Thereafter it was estimated to increase further by \$205 billion to \$235 billion (2013 to 2017) to \$1 170 billion to \$1 200 billion by 2017 (IMS Institute of Healthcare Informatics, 2013:5). Spending on medicine by pharmerging countries* that include South Africa, as a contribution to the worldwide spending, was 14.00% (\$92.12 billion) in 2006 and increased to 20.00% (\$191.20 billion) in 2011 (IMS Institute of Healthcare Informatics, 2012:5). This contribution was further estimated to increase to \$360 billion in 2016 (IMS Institute of Healthcare Informatics, 2012:5).

The average medicine cost per item increased from R131.08 ± R259.92 (95%CI:R130.77-R131.41) (2008) to R143.86 ± R483.84 (95%CI:R142.93-R144.01)(2012), which might be attributed to the amendment of the SEP and/or dispensing fee (refer to Chapter 2, section 2.5.1.6 and 2.5.1.6.1). The increase in average medicine cost per item might also be attributed to medical inflation or with an increase in the number of beneficiaries with registered CDL conditions (refer to Chapter 2, sections 2.3.2.2.1 and 2.3.3.1).

From 2008 until 2012, the average patient levy per item remained between 15.00% and 17.00% of the average total medicine item cost for each study year and totalled R346 974 915.60, with the total average levy per item decreasing from R21.80 ± R69.03 (95%CI:R21.72-R69.03) (2008) to R20.87 ± R58.10 (95%CI:R20.81-R20.94) (2012). This large total levy amount of R346 974 915.60 may be due to several reasons, such as not using formulary medicine, not claiming medicine from designated service providers and refusal to use generic medicine. However, investigating these reasons fall outside the scope of this study.

* Refer to Chapter 2, section 2.5.2.1.5

Gender groups

From 2008 until 2012, female patients consistently claimed more (above 51%) of medicine items for CDL conditions than male patients. Medicine items increased by 12.68% (n = 174 634) and 28.87% (n = 33 178) from 2008 to 2012 for female and male patients respectively.

The average cost per medicine item changed as follows:

- Female patients: increased from R125.38 ± R204.54 (95%CI:R125.05-R125.73) (2008) to R137.47 ± R394.46 (95%CI:R136.85-R138.09) (2012);
- Male patients: increased from R137.76 ± R312.44 (95%CI:R137.20-R138.33) (2008) to R149.61 ± R560.78 (95%CI:R148.72-R150.51) (2012).

The average cost per medicine item was consistently higher for male than female patients for the same period, with the highest average cost per medicine item (R154.25 ± R486.15) (95%CI:R153.47-R155.04) in 2010. The higher average cost per medicine item for male patients might be attributed to CDL conditions such as haemophilia A and B with a highest cost per medicine item per patient (refer to *Appendix C*). The total number of medicine items claimed for the entire study period for haemophilia A was 1309 for male patients with the highest average cost per item of R26 897.92 ± R23 957.47 (95%CI:R24 287.56-R29 508.28) during 2012, compared to female patients (n = 5) with the highest average cost per item (R12 102.20 ± R1.61) (95%CI:R12 087.71-R12 116.69) also during 2012. Haemophilia B had 42 male patients with the highest average cost per medicine item during 2012 (R9 124.96 ± R9 819.59) (95%CI:R3 455.30-R14 794.62) and no female patients present with this CDL condition during the entire study period. The higher number of male patients with haemophilia A and B than females were also noted by Linker (2007:538), Mahlangu and Gilham (2007:1297) as well as Stonebraker *et al.* (2010:24) in Chapter 2, section 2.7.2.15. The statement that medicine therapy for all CDL conditions was relatively more expensive for male than female patients can be confirmed by the CPI, which revealed that male patients had a higher CPI throughout the study period than female patients, with an average of 1.05 for the study period compared to 0.96 for female patients. The higher overall cost per medicine item for all CDL conditions may possibly further be attributed to the top 5 CDL conditions that had a higher average cost per medicine item for male patients in 64.00% (n = 16) of the combined study periods* (refer to *Appendix D*).

* Combined study periods = 25 (Top 5 CDL conditions, each for 5 years)

Age groups

The prevalence of CDL medicine between 2008 and 2012 for the different age groups increased as follows:

- 0 > age ≤ 12 years: increased by 71.56% (n = 14 584);
- 12 > age ≤ 50 years: increased by 16.81% (n = 74 965);
- 50 > age ≤ 60 years: increased by 20.70% (n = 122 122);
- 60 > age ≤ 70 years: increased by 27.22% (n = 175 939); and
- > 70 years: increased by 14.87% (n = 126 202) between 2008 until 2012.

The average medicine cost per item between 2008 and 2012 increased as follows in the different age groups:

- 0 > age ≤ 12 years: increased from R177.27 ± R259.59 (95%CI:R173.71-R180.83) (CPI:1.35) (2008) to R244.68 ± R1 105.26 (95%CI:R233.10-R256.27) (CPI:1.71) (2012);
- 12 > age ≤ 50 years: increased from R157.45 ± R482.16 (95%CI:R156.04-R158.87) (CPI:1.20) (2008) to R197.69 ± R934.01 (95%CI:R195.16-R200.23) (CPI:1.38) (2012).
- 50 > age ≤ 60 years: increased from R128.55 ± R220.55 (95%CI:R127.99-R129.11) (CPI:0.98) (2008) and R139.94 ± R348.58 (95%CI:R139.14-R140.76) (CPI:0.98) (2012).
- 60 > age ≤ 70 years: increased from R127.39 ± R189.31 (95%CI:R126.93-R127.85) (CPI:0.97) (2008) to R134.66 ± R330.10 (95%CI:R133.95-R135.38) (CPI:0.94) (2012).
- > 70 years: a slight increase from R120.70 ± R132.95 (95%CI:R120.42-R120.98) (CPI:0.92) (2008) to R120.85 ± R207.19 (95%CI:R120.45-R121.27) (CPI:0.84) (2012).

The oldest age group (> 70 years) had the highest number of medicine items claimed of all the age groups in each year, which might be attributed to this age group having the highest number of patients (refer to Tables 3.1 and 3.2). The youngest age group (0 > age ≤ 12 years) had the highest average cost per item claimed of all the age groups in all study years, with 2010 being the highest (R245.16 ± R560.36) (95%CI:R239.64-R250.70). This age group also had the lowest number of patients and CDL medicine items claimed throughout the entire study period (refer to Table 3.1).

The medicine cost was the most expensive for age group $0 > \text{age} \leq 12$ years, with a higher CPI than all the other age groups throughout the study period. The average CPI over the study period for this age group was 1.60, followed by age group $12 > \text{age} \leq 50$ years (CPI = 1.31), age group $50 > \text{age} \leq 60$ years (CPI = 0.98), and age group $60 > \text{age} \leq 70$ years with 0.95. The group with the lowest average CPI was > 70 years with 0.87, indicating the relatively least expensive medicine treatment for this group of patients.

Thus, female patients and patients > 70 years claimed more medicine items, but male patients claimed more expensive medicine items. Age group $0 > \text{age} \leq 12$ years showed the highest increase in the number of medicine items and used more expensive medicine items to treat their CDL conditions, thus the higher CPI. However, there are other factors that may also influence changes in medicine cost. Some of these factors may include the SEP, dispensing fee, VAT and generic substitution and are also discussed throughout this chapter.

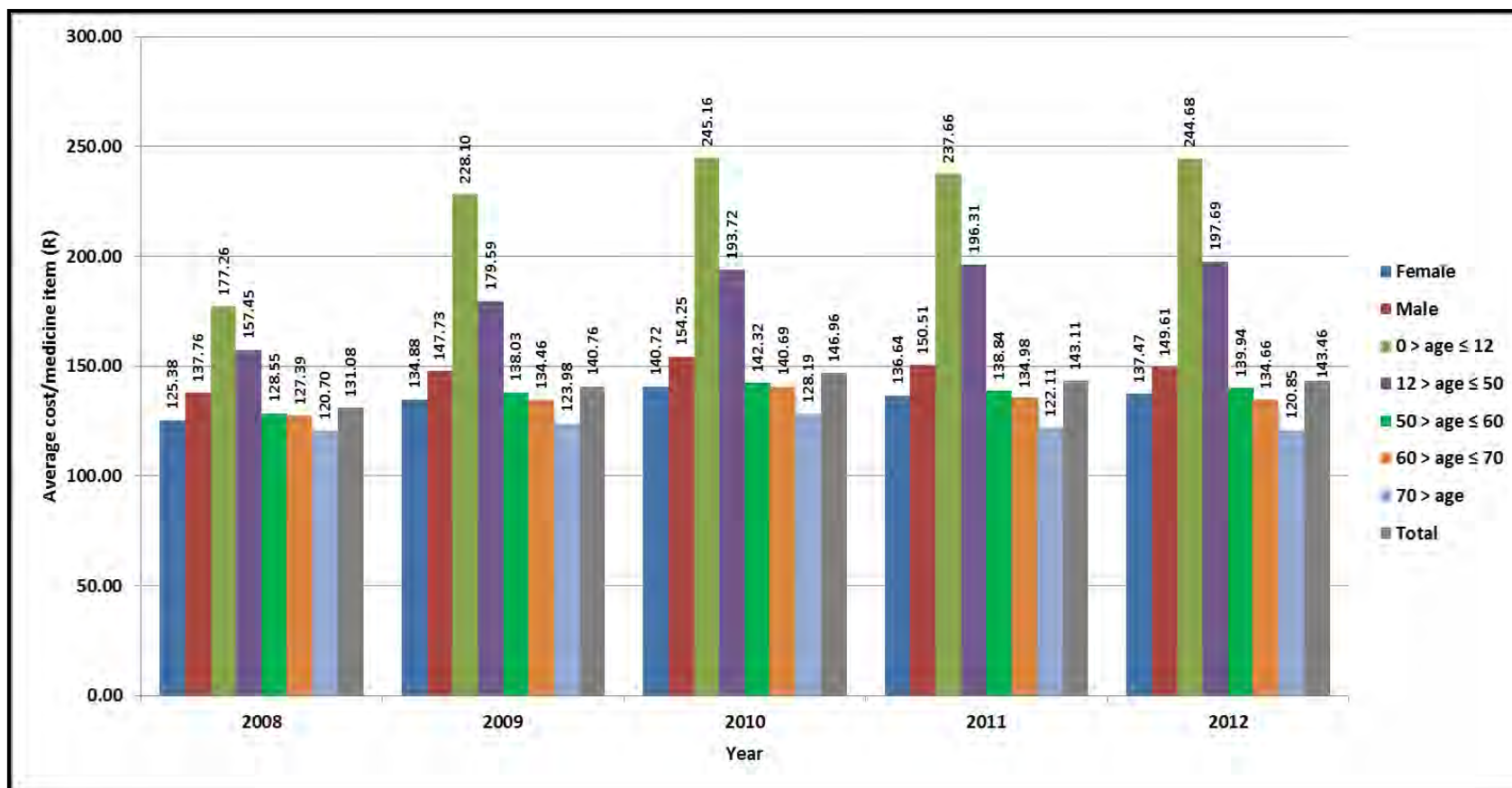


Figure 3.6: Average medicine cost for all CDL conditions from 2008 until 2012.

3.4.2 Medicine cost per item per patient with the top 5 CDL conditions according to different cost types.

This section will contain the number of medicine items per patient for the top 5 CDL conditions according to age and gender. Medicine cost will also be analysed in terms of total medicine cost, medical scheme contribution paid as well as the patient levy for each of these conditions. The CPI will also be determined as a measurement of how expensive the medicine treatment for these conditions was. The results for the top 5 conditions are summarised below in Tables 3.22 to 3.26, and discussed. Data according to age and gender are tabled in *Appendix D*.

Table 3.22: Medicine cost for patients with asthma according to different cost types from 2008 until 2012.

Type of CDL condition	Year	Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)
			Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
Asthma	2008	170 266	Medical scheme contribution	148.19	126.20	147.59-148.79	25 231 711.66	1.33
			Patient levy	26.18	51.47	25.94-26.43	4 458 283.41	
			Total cost	174.37	139.06	173.72-175.04	29 689 995.07	
	2009	275 752	Medical scheme contribution	167.69	143.45	167.16-168.23	46 242 088.99	1.44
			Patient levy	35.59	70.74	35.33-35.86	9 814 996.74	
			Total cost	203.29	160.35	202.69-203.89	56 057 085.73	
	2010	266 517	Medical scheme contribution	177.71	149.62	177.15-178.28	47 362 677.47	1.46
			Patient levy	37.63	70.83	37.37-37.91	10 030 049.78	
			Total cost	215.34	167.09	214.71-215.98	57 392 727.25	
	2011	287 719	Medical scheme contribution	177.48	134.10	177.00-177.98	51 064 854.44	1.43
			Patient levy	27.60	48.98	27.43-27.78	7 941 524.81	
			Total cost	205.08	150.68	204.54-205.64	59 006 379.25	
	2012	250 619	Medical scheme contribution	176.50	132.27	175.99-177.02	44 234 832.50	1.42
			Patient levy	27.51	50.69	27.31-27.71	6 894 380.42	
			Total cost	204.01	148.27	203.44-204.60	51 129 212.92	

Table 3.23: Medicine cost for patients with diabetes mellitus type 2 according to different cost types from 2008 until 2012.

Type of CDL condition	Year	Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)
			Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
Diabetes mellitus type 2	2008	400 499	Medical scheme contribution	135.58	209.79	134.94-136.24	54 300 572.68	1.12
			Patient levy	11.80	34.82	11.70-11.91	4 726 261.08	
			Total cost	147.38	215.57	146.72-148.05	59 026 833.76	
	2009	546 554	Medical scheme contribution	146.47	227.81	145.87-147.08	80 054 790.40	1.14
			Patient levy	13.40	40.63	13.30-13.51	7 323 567.81	
			Total cost	159.87	237.53	159.25-160.51	87 378 358.21	
	2010	571 088	Medical scheme contribution	155.92	245.08	155.29-156.56	89 044 324.10	1.16
			Patient levy	14.89	42.31	14.78-15.00	8 501 035.49	
			Total cost	170.81	255.88	170.15-171.47	97 545 359.59	
	2011	561 918	Medical scheme contribution	161.08	254.80	160.42-161.75	90 513 175.38	1.22
			Patient levy	13.70	37.85	13.60-13.80	7 697 173.97	
			Total cost	174.78	263.84	174.09-175.47	98 210 349.35	
	2012	550 477	Medical scheme contribution	161.81	255.49	161.13-162.48	89 070 252.07	1.22
			Patient levy	12.97	36.34	12.88-13.07	7 140 024.01	
			Total cost	174.78	263.32	174.08-175.48	96 210 276.08	

Table 3.24: Medicine cost for patients with hyperlipidaemia according to different cost types from 2008 until 2012.

Type of CDL condition	Year	Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)
			Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
Hyperlipidaemia	2008	585 706	Medical scheme contribution	134.33	56.54	134.19-134.48	78 680 638.43	1.19
			Patient levy	21.86	38.01	21.77-21.96	12 805 061.67	
			Total cost	156.20	65.28	156.03-156.37	91 485 700.10	
	2009	39 861	Medical scheme contribution	216.95	111.84	215.85-218.05	8 647 784.77	1.83
			Patient levy	40.46	83.83	39.64-41.28	1 612 650.12	
			Total cost	257.41	123.06	256.20-258.62	10 260 434.89	
	2010	37 409	Medical scheme contribution	229.77	109.81	228.66-230.88	8 595 384.69	1.85
			Patient levy	42.03	82.49	41.20-42.87	1 572 355.53	
			Total cost	271.80	119.34	270.59-273.01	10 167 740.22	
	2011	748 947	Medical scheme contribution	93.96	78.21	93.78-94.14	70 369 011.96	0.85
			Patient levy	20.98	38.95	20.89-21.07	15 709 535.42	
			Total cost	114.93	94.75	114.72-115.15	86 078 547.38	
	2012	728 985	Medical scheme contribution	94.41	80.13	94.23-94.59	68 820 617.91	0.81
			Patient levy	21.59	39.62	21.51-21.69	15 741 405.38	
			Total cost	116.00	96.81	115.78-116.23	84 562 023.29	

Table 3.25: Medicine cost for patients with hypertension according to different cost types from 2008 until 2012.

Type of CDL condition	Year	Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)
			Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
Hypertension	2008	1 653 034	Medical scheme contribution	85.52	59.67	85.43-85.62	141 370 204.00	0.81
			Patient levy	21.23	33.10	21.18-21.29	35 095 956.65	
			Total cost	106.75	71.29	106.65-106.87	176 466 160.00	
	2009	2 199 968	Medical scheme contribution	92.04	63.68	91.96-92.13	202 493 401.00	0.82
			Patient levy	23.14	37.66	23.09-23.19	50 899 629.75	
			Total cost	115.18	76.70	115.08-115.29	253 393 031.00	
	2010	2 183 996	Medical scheme contribution	93.08	63.34	93.00-93.17	203 289 851.00	0.79
			Patient levy	23.58	38.97	23.53-23.63	51 494 014.81	
			Total cost	116.66	77.91	116.56-116.77	254 783 866.00	
	2011	2 107 443	Medical scheme contribution	89.47	59.98	89.39-89.55	188 545 454.00	0.77
			Patient levy	21.28	34.00	21.24-21.33	44 841 399.47	
			Total cost	110.74	74.41	110.65-110.85	233 386 854.00	
	2012	1 941 630	Medical scheme contribution	89.15	59.35	89.07-89.24	173 096 371.00	0.77
			Patient levy	20.57	34.28	20.53-20.62	39 944 083.45	
			Total cost	109.72	73.18	109.62-109.83	213 040 455.00	

Table 3.26: Medicine cost for patients with hypothyroidism according to different cost types from 2008 until 2012.

Type of CDL condition	Year	Number of CDL medicine items (n)	Item cost (R)					Cost-prevalence index (CPI)
			Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
Hypothyroidism	2008	298 254	Medical scheme contribution	36.69	16.87	36.63-36.76	10 944 421.66	0.30
			Patient levy	2.65	5.73	2.62-2.67	788 964.67	
			Total cost	39.34	17.20	39.28-39.40	11 733 386.33	
	2009	35 389	Medical scheme contribution	39.29	19.40	39.09-39.50	1 390 594.84	0.30
			Patient levy	3.61	6.33	3.54-3.67	127 623.67	
			Total cost	42.90	20.04	42.69-43.11	1 518 218.51	
	2010	34 756	Medical scheme contribution	41.25	26.60	40.97-41.53	1 433 764.14	0.31
			Patient levy	3.14	18.13	2.95-3.34	109 305.64	
			Total cost	44.40	31.87	44.06-44.73	1 543 069.78	
	2011	35 479	Medical scheme contribution	40.64	17.91	40.46-40.83	1 442 041.95	0.30
			Patient levy	2.05	4.13	2.01-2.10	72 866.80	
			Total cost	42.70	18.35	42.51-42.89	1 514 908.75	
	2012	38 012	Medical scheme contribution	41.32	20.77	41.12-41.53	1 570 838.16	0.30
			Patient levy	1.64	4.68	1.59-1.69	62 392.44	
			Total cost	42.97	22.61	42.74-43.19	1 633 230.60	

Asthma

Table 3.22 shows that the prevalence of medicine items for asthma increased by 47.19% (n = 80 353) between 2008 and 2012, with the highest increase of 61.95% (n = 105 486) between 2008 and 2009. The increase in asthma medicine might include that globally 5% to 10% of children with asthma will still have symptoms by age 21 years (Braman, 2006:7S). Asthma in the elderly might also be under-estimated, and asthma symptoms in the elderly often overlap with chronic conditions such as COPD and cardiovascular disease (Braman, 2006:7S).

The cost for asthma medicine totalled R253 275 400.22 for the entire study period and increased overall from 2008 to 2012, of which 84.55% (R214 136 165.00) was for the amount paid for by the medical scheme and 15.45% (R39 139 235.16) by patient levies. In each of the study years, the medical scheme contribution attributed to the majority of the total medicine cost, with:

- 84.98% (R25 231 711.66) for 2008;
- 82.49% (R46 242 088.99) for 2009;
- 82.52% (R47 362 677.47) for 2010;
- 86.54% (R51 064 854.44) for 2011; and
- 86.52% (R44 234 832.50) for 2012.

The CPI for asthma ranged between 1.33 and 1.46, with 2010 being the highest with 1.46. This indicated that the cost of medicine per patient for asthma therapy was relatively expensive throughout the study period.

Furthermore, the total patient levy per medicine item (co-payment) as a percentage of the total medicine cost for asthma decreased overall from 15.02% (2008) until 13.48% (2012), but the total levy increased by 54.64% (R2 436 097.01) from 2008 until 2012. Thus, there was an overall decrease in the percentage of the total medicine cost paid for by patients as levies.

The total average cost per medicine item for asthma treatment increased from R174.37 ± R139.06 (95%CI:R173.72-R175.04) (2008) to R215.34 ± R167.09 (95%CI:R214.71-R215.98) in 2010, where-after the average cost per item decreased to R204.01 ± R148.27 (2012) (95%CI:R203.44-R204.60). The decrease might be attributed to the amendment of the SEP in 2010. Of the top 5 CDL conditions, asthma had the second highest average cost per medicine item of R215.34 ± R167.09 (95%CI:R214.71-R215.98) after hyperlipidaemia.

Diabetes mellitus type 2

The prevalence of medicine in patients with diabetes mellitus type 2 in Table 3.23 increased overall by 27.46% (n = 149 978) between 2008 and 2012, with the highest increase occurring between 2008 and 2009 with 36.47% (n = 146 055). The total number of medicine items for diabetes mellitus type 2 patients were the second highest of the top 5 CDL conditions totalling 2 630 536 for the entire study period.

The medicine cost for all medicine for diabetes mellitus type 2 totalled R438 371 176.99 for the entire study period and increased overall from 2008 to 2012. Ninety one point nine three per cent (91.93%) (R402 983 114.63) of this amount was paid for by the medical scheme and 8.07% (R35 388 062.88) was for patient levies. In each of the study years, the medical scheme contribution attributed to the greater part of the total medicine cost:

- 91.99% (R54 300 572.68) for 2008;
- 91.62% (R80 054 790.40) for 2009;
- 91.29% (R89 044 324.10) for 2010;
- 92.17% (R90 513 175.38) for 2011; and
- 92.58% (R89 070 252.07) for 2012.

The CPI ranged between 1.12 to 1.22, with 2011 and 2012 being the highest with 1.22. This indicated that the medicine treatment cost per patient per diabetes mellitus type 2 treatments were relatively expensive throughout the study period.

The total average cost per medicine item for diabetes mellitus type 2 increased from R147.38 ± R215.57 (95%CI:R146.72-R148.05) (2008) to R174.78 ± R263.32 (95%CI:R174.08-R175.48) (2012), irrespective of the changes in SEP during the study period. This was the only top 5 CDL condition with a continuous increase in the average medicine cost per item per patient.

The total patient levy per item (co-payment) as a percentage of the total medicine cost for diabetes mellitus type 2 had an overall decrease from 2008 until 2012. The total average patient levy per medicine item for diabetes mellitus type 2 increased from 2008 to 2012.

Hyperlipidaemia

Data from Table 3.24 showed that the prevalence of medicine in patients with hyperlipidaemia increased by 24.46% (n = 143 279) between 2008 and 2012. The total number of medicine items per patient totalled 2 140 908 for the entire study period. Hyperlipidaemia had the third highest number of medicine items claimed from all of the top 5 CDL conditions for all study years, with 2011 being the highest (n = 748 947).

Of all the top 5 CDL conditions, hyperlipidaemia had the second highest total direct medicine cost for the study period with R282 554 445.88, where 55.36% (R156 432 800.33) was paid for by medical schemes and 44.64% (R126 121 645.55) by patient levies. The cost-prevalence index (CPI) ranged between 0.81 and 1.85, with 2010 being the highest 1.85, indicating that hyperlipidaemia treatment was relatively expensive from 2008 to 2010. The total average cost per medicine item for hyperlipidaemia decreased from R156.00 ± R65.28 (95%CI:R156.03-R156.37) (2008) to R116.00 ± R96.81 (95%CI:R115.78-R116.23) (2012), with the highest average cost per medicine item of the top 5 conditions during 2010 (R271.80 ± R119.34) (95%CI:R270.59-R273.01).

For hyperlipidaemia in each of the study years, the medical scheme contribution contributed to the majority of the total medicine costs with:

- 86.00% (R78 680 638.43) for 2008;
- 84.28% (R8 647 784.77) for 2009;
- 84.54% (R8 595 384.69) for 2010;
- 81.75% (R70 369 011.96) for 2011; and
- 81.38% (R68 820 617.91) for 2012.

The total patient levy per item (co-payment) for hyperlipidaemia medicine as a percentage of the total medicine cost increased overall from 2008 until 2012.

Hypertension

Hypertension had the highest number of medicine items claimed for all of the top 5 CDL conditions over the study period, with 2009 being the highest (n = 2 199 968) as summarised in Table 3.25. The prevalence of medicine for hypertensive patients increased overall by 17.46% (n = 288 596) between 2008 and 2012. The total number of medicine items for hypertensive patients totalled 10 086 071 for the entire study period.

Hypertension therefore also had the highest total direct medicine cost for the total study period with a total of all top 5 conditions with R1 131 070 366.00, where 80.35% (R908 795 281.00) was paid for by medical schemes and 19.65% (R222 275 085.00) in patient levies. From 2008 to 2012, hypertension had a CPI between 0.77 and 0.82, with 2009 being the highest (0.82), indicating that medicine treatment was relatively inexpensive throughout the entire study period.

In each study year, the medical scheme contribution attributed to the majority of the total medicine cost which were:

- 80.11% (R141 370 204.00) for 2008;
- 79.12% (R202 493 401.00) for 2009;
- 79.79% (R203 289 851.00) for 2010;
- 80.79% (R188 545 454.00) for 2011, and;
- 81.25% (R173 096 371.00) for 2012.

Furthermore, the total patient levy per item (co-payment) as a percentage of the total medicine cost decreased overall from 2008 until 2012 for hypertension treatment.

The total average cost per hypertensive medicine item increased overall from R106.75 ± R71.29 (95%CI:R106.65-R106.87) (2008) to R109.72 ± R73.18 (95%CI:R109.62-R109.83) (2012). The average cost per medicine item for hypertension decreased between 2010 and 2012. The decrease might be attributed to the amendment of the SEP in 2010.

Hypothyroidism

Table 3.26 depicts that the smallest number of medicine items claimed for all of the top 5 CDL conditions was for hypothyroidism for all of the study years (n = 441 890).

The prevalence of medicine items for hypothyroidism decreased overall by 87.26% (n = 260 242) between 2008 and 2012. Of all the top 5 CDL conditions, hypothyroidism had the lowest total direct medicine item cost for the study period with R17 942 813.97, where 93.53% (R16 781 660.75) was paid for by medical schemes and 6.47% (R1 161 153.22) in patient levies. The reason for the relative low percentage paid as patient levies, might be attributed to the fact that hypothyroidism had the lowest average cost per medicine item, and therefore the medicine items was more affordable for these patients. This CDL condition therefore had the lowest overall total medicine cost paid as patient levies. A CPI between 0.30 and 0.31 occurred between 2008 and

2012, with 2009 being the highest (0.31), indicating that the treatment therapy was relatively inexpensive throughout the entire study period.

The medical scheme contribution attributed to the majority of the total medicine cost included:

- 80.11% (R141 370 204.00) for 2008;
- 79.12% (R202 493 401.00) for 2009;
- 79.79% (R203 289 851.00) for 2010;
- 80.79% (R188 545 454.00) for 2011; and
- 81.25% (R173 096 371.00) for 2012.

The total levy per item (co-payment) for hypothyroidism, as a percentage of the total medicine cost decreased overall from 6.72% (R788 964.67) 2008 to 3.82% (R62 392.44) 2012.

Asthma and diabetes mellitus type 2 medicine items were more expensive, according to the CPI, compared to the other CDL conditions in the top 5. The total levy per medicine item (co-payment) for the top 5 CDL conditions as a percentage of the total medicine cost decreased from 2008 until 2012. This might be as a result of formulary medicine used, generic substitution taking place or designated service providers were used more frequently from 2008 until 2012 (also refer to Chapter 2, section 2.5.1.2). However, out-of-pocket expenditure in South Africa increased from 2000 to 2009 as stated by the World Health Organization (2012b) (refer to Chapter 1, section 1.2), as was found in this study from 2008 (R55 609 791.89) until 2012 (R63 961 220.25). Lower co-payments if attributed to generic medicine substitution were in line with other countries who also reported on having lower co-payments for generic medicine when compared to original medicine (refer to Chapter 2, Tables 2.2 and 2.3 as well as section 2.5.2.1.5).

Gender groups (refer to Appendix D)

Asthma

Female patients with asthma claimed more medicine items than male patients in each of the study years, with 2011 being the highest (n = 161 908). Overall female patients with asthma had an increase in medicine items of 43.67% (n = 42 129) between 2008 and 2012.

Male patients had a higher overall prevalence increase of 51.80% (n = 38 224) in the number of medicine items claimed for asthma than female patients between 2008 and 2012, with the highest increase from 2008 to 2009 with 62.48% (n = 46 108).

Female as well as male patients had an overall increase in the total average cost per medicine item for asthma medicine from R176.32 ± R139.11 (95%CI:R175.45-R177.21) (2008) to R204.88 ± R149.63 (95%CI:R204.10-R205.67) (2012) and R171.83 ± R138.95 (95%CI:R170.83-R172.83) (2008) to R202.94 ± R146.58 (95%CI:R202.08-R203.80) (2012) respectively. Female patients had a higher total average cost per medicine item than male patients for the entire study period. Female patients also had a consistently higher average patient levy per medicine item than male patients for asthma medicine for the entire study period.

Diabetes mellitus type 2

Male patients claimed more diabetes mellitus type 2 medicine items in each of the study years than female patients with 2012 being the highest (n = 327 988). Male patients further had a bigger increase in the number of medicine items per patient of 44.82% (n = 101 502) than female patients, with 27.85% (n = 48 476) between 2008 and 2012.

Female and male patients had overall increases in the total average cost per medicine item of anti-diabetic type 2 medicine from R143.79 ± R212.62 (95%CI:R142.80-R144.80) (2008) to R166.39 ± R250.18 (95%CI:R165.36-R167.44) (2012) and R150.14 ± R217.76 (95%CI:R149.25-R151.04) (2008) to R180.46 ± R271.73 (95%CI:R179.54-R181.40) (2012) respectively. Male patients had a higher average medicine cost per anti-diabetic type 2 medicine items than female patients for the entire study period. The average patient levy per medicine item was also higher for male than for female patients for the entire study period.

Hyperlipidaemia

Medicine items for male patients with hyperlipidaemia had a higher increase of 29.24% (n = 90 321) than female patients, with 19.13% (n = 52 958) between 2008 and 2012. Male patients with hyperlipidaemia claimed more medicine items in each of the study years with 2012 being the highest (n = 399 240).

Female and male patients had overall decreases in the average cost per medicine item from R151.77 ± R62.71 (95%CI:R151.54-R152.01) (2008) to R108.88 ± R92.56 (95%CI:R108.57-R109.20) (2012) and R160.16 ± R67.25 (95%CI:R159.93-R160.41) (2008) to R121.88 ± R99.80 (95%CI:R121.57-R122.19) (2012) respectively. Male patients had a higher average total medicine cost per item than female patients for 2008, 2011 and 2012. The average patient levy per medicine item was also higher for male patients than female patients during 2008, 2011 and 2012.

Hypertension

Female patients claimed more hypertension medicine items for each study year, with 2009 being the highest for both female and male patients with 1 241 393 and 958 575 respectively. Female patients with hypertension had an increase of 9.40% (n = 88 774) between 2008 and 2012. Male patients however, had a higher overall prevalence increase in the number of medicine items claimed than female patients, of 30.81% (n = 218 211) between 2008 and 2012.

Female hypertensive patients had an overall increase in the total average medicine cost per item from R103.62 ± R70.27 (95%CI:R103.62-R70.27) (2008) to R106.79 ± R71.72 (95%CI:R106.66-R106.94) (2012) compared to male patients with R110.93 ± R72.41 (95%CI:R110.76-R111.10) (2008) to R113.06 ± R74.65 (95%CI:R112.91-R113.21) (2012). Male patients had a consistently higher average total medicine cost per item than female patients from 2008 until 2012. The average patient levy per medicine item was also higher for male patients than female patients from 2008 until 2012.

Hypothyroidism

Female patients claimed more medicine items for hypothyroidism each study year with 2008 being the highest (n = 262 343). The number of medicine items claimed for female patients were:

- 7.31 times more than those for male patients in 2008;
- 5.12 times more than those for male patients in 2009;
- 4.98 times more than those for male patients in 2010;
- 4.95 times more than those for male patients in 2011; and
- 5.02 times more than those for male patients in 2012.

Overall, female patients with hypothyroidism had a decrease of 87.92% (n = 230 641) between 2008 and 2012. Male patients further had a higher overall prevalence decrease in medicine items per patient of 82.43% (n = 29 601) between 2008 and 2012.

Female and male patients had an overall increase in the total average cost per medicine item from R39.10 ± R16.85 (95%CI:R39.04-R39.17) (2008) to R42.64 ± R23.03 (95%CI:R42.39-R42.90) (2012) and R41.07 ± R19.49 (95%CI:R40.87-R41.28) (2008) to R44.59 ± R20.24 (95%CI:R44.09-R45.09) (2012) respectively. Male patients had a higher average total medicine cost per item than female patients for 2008, 2011 and 2012. The average patient levy per

medicine item was also higher for female patients than male patients from 2008, 2009, 2010 and 2012.

Age groups (refer to Appendix D)

Asthma

0 > age ≤ 12 years: The prevalence of medicine items for patients in this group had an overall increase of 89.04% (n = 135 06) between 2008 and 2012. This age group also had the least number of medicine items of all the other age groups for the entire study period. This age group had an overall increase in the total average cost per medicine item from R149.99 ± R125.67 (95%CI:R148.00-R152.00) (2008) to R180.10 ± R131.17 (95%CI:R178.58-R181.62) (2012). This age group had an increase in total medicine cost percentage that contributed 7.66% (R2 275 116.09) to the total asthma cost in 2008 to 10.10% (R5 164 144.78) in 2012. This group also had an overall increase in average levy cost per medicine item from R19.48 ± R40.25 (95%CI:R18.85-R20.13) (2008) to R31.57 ± R54.24 (95%CI:R30.95-R32.21) (2012).

12 > age ≤ 50 years: This age group had an overall increase in prevalence of medicine items with 29.57% (n = 16 811) between 2008 and 2012. The highest prevalence of medicine per patient of all the age groups was found in this age group throughout the entire study period, as a contribution to the prevalence of patients for asthma of 33.39% (n = 56 845) in 2008, 31.77% (n = 87 620) in 2009, 30.74% (n = 81 933) in 2010, 29.93% (n = 86 116) in 2011 and 29.39% (n = 73 656) in 2012. The total medicine cost as a contribution to the total asthma cost was also the highest of all the age groups throughout the study period, with 17.72% (R9 578 924.55) in 2008, 31.28% (R17 534 960.11) in 2009, 30.57% (R17 545 303.51) in 2010, 30.08% (R17 746 648.41) in 2011 and 29.61% (R15 137 898.12) in 2012. The total average cost per medicine item per patient increased from R168.51 ± R137.67 (95%CI:R167.38-R169.65) (2008) to R205.52 ± R149.93 (95%CI:R204.44-R206.61) (2012).

50 > age ≤ 60 years: The total medicine item prevalence in this group increased by 46.18% (n = 14 449) between 2008 and 2012. The total medicine prevalence contributed 18.37% (n = 31 286) in 2008 to the prevalence of medicine and 18.25% (n = 45 735) in 2012. The total medicine cost in this group increased as a contribution to the total medicine cost of 17.72% (R5 261 018.82) in 2008 to 18.23% (R9 323 093.52) in 2012. The total average cost per medicine item also increased from R168.16 ± R142.69 (95%CI:R166.58-R169.74) in 2008 to R203.85 ± R153.78 (95%CI:R202.44-R205.26) in 2012.

60 > age ≤ 70 years: The total medicine item prevalence in this group increased by 57.24% (n = 17 842) between 2008 and 2012. The total medicine prevalence contributed 18.31% (n = 31

171) in 2008 to the prevalence of medicine and 19.55% (n = 49 013) in 2012. The medicine cost in this group increased as a contribution to the total medicine cost of 18.94% (R5 623 417.99) in 2008 to 19.98% (R10 213 406.06) in 2012. The total average cost per medicine item increased from R180.41 ± R139.39 (95%CI:R178.86-R181.96) in 2008 to R208.38 ± R148.54 (95%CI:R207.07-R209.70) in 2012.

Age >70 years: This age group had the second highest prevalence of medicine items throughout the entire study period with an increase of 49.57% (n = 17 745) between 2008 and 2012. The total average cost per medicine item increased from R194.20 ± R140.41 (95%CI:R192.75-R195.66) in 2008 to R210.88 ± R148.32 (95%CI:R209.63-R212.14) in 2012. This age group further had the highest average patient levy per item per patient of all the age groups except for 2012.

Diabetes mellitus type 2

0 > age ≤ 12 years: Antidiabetic medicine items in this age group had an overall decrease of 27.21% (n = 40) between 2008 and 2012. This age group also had the least number of medicine items per patient for diabetes mellitus type 2 of all the other age groups for the entire study period. This age group had the highest total average cost per item for all study. There was an overall decrease in the total average cost per medicine item from R366.49 ± R163.90 (95%CI:R339.78-R393.21) (2008) to R317.07 ± R168.37 (95%CI:R284.80-R349.34) (2012). This group also had an overall increase in average levy cost per item from R12.54 ± R32.87 (95%CI:R7.19-R17.91) (2008) to R37.06 ± R78.56 (95%CI:R22.01-R52.12) (2012).

12 > age ≤ 50 years: This age group had an overall increase in prevalence of medicine items of 16.86% (n = 15 151) between 2008 and 2012. The total average cost per medicine item increased from R160.87 ± R232.40 (95%CI:R159.35-R162.39) (2008) to R197.54 ± R279.06 (95%CI:R195.85-R199.23) (2012).

50 > age ≤ 60 years: The prevalence of medicine in this group increased by 35.39% (n = 43 270) between 2008 and 2012. The prevalence of medicine items in this age group contributed 18.37% (n = 31 286) in 2008 to the prevalence of medicine for diabetes mellitus type 2 and 18.25% (n = 45 735) in 2012. The highest prevalence of medicine of all age groups were found in this age group throughout the entire study period as a contribution to the total number of medicine items for diabetes mellitus type 2 of 30.52% (n = 122 252) in 2008, 29.91% (n = 163 501) in 2009, 29.79% (n = 170 150) in 2010, 29.32% (n = 164 781) in 2011 and 30.07% (n = 165 522) in 2012. The total medicine cost as a contribution to the total diabetes mellitus type 2 cost was also the highest of all the age groups throughout the study period, with:

- 32.17% (R18 986 705.33) in 2008;
- 31.48% (R27 503 746.52) in 2009;
- 31.54% (R30 765 517.22) in 2010;
- 31.29% (R30 727 254.79) in 2011; and
- 31.62% (R30 419 395.83) in 2012.

The total average cost per medicine item per patient also increased overall from R155.31 ± R225.09 (95%CI:R154.05-R156.57) in 2008 to R183.78 ± R278.17 (95%CI:R182.44-R185.12) in 2012.

60 > age ≤ 70 years: The prevalence of medicine items in this group increased by 52.10% (n = 53 884) between 2008 and 2012. The prevalence of medicine contributed 25.83% (n = 103 429) in 2008 to the prevalence of medicine per patient and 28.58% (n = 157 313) in 2012. The total average cost per medicine item also increased from R148.69 ± R218.01 (95%CI:R147.37-R150.03) in 2008 to R178.84 ± R264.84 (95%CI:R177.53-R180.15) in 2012. The total medicine cost in this group increased as a contribution to the total medicine cost of 26.05% (R15 379 192.09) in 2008 to 29.24% (R28 133 135.64) in 2012.

Age >70 years: This age group had the second highest medicine item prevalence for diabetes mellitus type 2 throughout the entire study period with an increase of 44.46% (n = 37 713) between 2008 and 2012. The total average cost per medicine item increased from R119.70 ± R173.33 (95%CI:R118.54-R120.87) in 2008 to R137.78 ± R219.56 (95%CI:R136.55-R139.01) in 2012. This age group further had the lowest average total medicine cost per item of all the age groups from 2008 until 2012.

Hyperlipidaemia

0 > age ≤ 12 years: Medicine item prevalence in this group had an overall decrease of 6.06% (n = 4) between 2008 and 2012. This age group also had the lowest number of medicine items than all the other age groups for hyperlipidaemia from 2008 until 2012 (refer to Appendix D). This age group had the highest total average cost per item for all study years except for 2009, with 2010 being the highest with R416.09 ± R0.00 (95%CI:R0-R0). There was an overall decrease in the total average cost per medicine item from R168.35 ± R81.05 (95%CI:R148.43-R188.28) in 2008 to R132.17 ± R92.59 (95%CI:R108.66-R155.68) in 2012.

12 > age ≤ 50 years: This age group had an overall increase in prevalence of medicine of 10.37% (n = 7 728) between 2008 and 2012, with 2011 also having the most medicine (n = 86 302). The total average cost per medicine item per patient decreased from R166.76 ± R73.34 (95%CI:R166.24-R167.29) (2008) to R130.69 ± R107.30 (95%CI:R129.96-R131.42) (2012), where 2010 had the highest average cost per item of R275.29 ± R117.04 (95%CI:R272.65-R277.94). In addition, this group also had the second highest average cost per item per patient from 2008 until 2012.

50 > age ≤ 60 years: Medicine item prevalence in this group increased by 18.59% (n = 26 437) between 2008 and 2012. The total medicine prevalence per patient contributed 24.29% (n = 142 249) in 2008 to the prevalence of medicine for hyperlipidaemia and 23.14% (n = 168 686) in 2012. The total medicine cost as a contribution made by this group to the total cost for hyperlipidaemia was 25.26% (R23 109 414.42) in 2008, 30.63% (R3 142 951.94) in 2009, 30.17% (R3 067 265.99) in 2010, 24.91% (R21 440 861.76) in 2011 and 25.08% (R21 208 224.08) in 2012. The total average cost per medicine item had an overall decrease from R162.46 ± R67.91 (95%CI:R162.11-R162.81) in 2008 to R125.73 ± R103.02 (95%CI:R125.24-R126.22) in 2012.

60 > age ≤ 70 years: There was an increase of 26.83% (n = 48 945) between 2008 and 2012 in the prevalence of medicine items in this group. This age group had the second highest number of medicine items of all the age groups for the entire study period. The prevalence of medicine contributed 31.15% (n = 182 435) in 2008 to the prevalence of medicine and 31.74% (n = 231 380) in 2012. The total average cost per medicine item decreased overall from R155.89 ± R65.33 (95%CI:R155.60-R156.20) in 2008 to R118.18 ± R97.94 (95%CI:R117.78-R118.58) in 2012. The total medicine cost in this group increased as a contribution to the total medicine cost of 31.09% (R28 440 582.90) in 2008 to 32.34% (R27 343 665.97) in 2012.

Age >70 years: The highest prevalence of medicine items in this age group was during 2008, 2011 and 2012, with a 32.27% increase (n = 60 173) between 2008 and 2012. The highest number of medicine items was during 2011 (n = 266 274). The total average cost per medicine item decreased from R147.49 ± R58.23 (95%CI:R147.23-R147.76) in 2008 to R102.40 ± R85.32 (95%CI:R102.07-R102.75) in 2012, where 2010 had the highest average cost per item per patient of R266.50 ± R123.11 (95%CI:R263.75-R269.25).

Hypertension

0 > age ≤ 12 years: The prevalence of medicine items in this group had an overall decrease of 33.09% (n = 46) between 2008 and 2012. This age group also had the least number of medicine items than all the other age groups for the entire study period. The lowest total average cost per

item for all study years, except for 2012 was observed in this age group. There was an overall increase in the total average cost per medicine item from R86.27 ± R70.59 (95%CI:R47.44-R98.12) in 2008 to R110.92 ± R93.93 (95%CI:R91.71-R130.14) in 2012. This age group also had the highest increase in average levy per medicine item among all the age groups R10.42 ± R23.13 (95%CI:R6.55-R14.30) (2008) to R38.39 ± R77.11 (95%CI:R22.51-R54.28) (2012).

12 > age ≤ 50 years: This age group had an overall increase in medicine item prevalence of 11.78% (n = 27 970) between 2008 and 2012, where 2009 had the most medicine per patient (n = 312 167). The total average cost per item per patient increased from R104.02 ± R69.57 (95%CI:R103.74-R104.30) (2008) to R107.34 ± R71.18 (95%CI:R107.07-R107.61) (2012).

50 > age ≤ 60 years: The prevalence in this group's medicine increased by 19.04% (n = 75 627) between 2008 and 2012, with the highest during 2009 (n = 523 455). The prevalence of medicine per patient contributed 24.05% (n = 397 620) in 2008 to the prevalence of medicine per patient and 24.37% (n = 473 247) in 2012. The total medicine cost as a contribution of the total hypertension cost was 23.82% (R42 023 575.53) in 2008, 23.73% (R60 138 224.57) in 2009, 23.29% (R59 331 417.96) in 2010, 22.78% (R53 154 089.83) in 2011 and 24.43% (R52 051 146.83) in 2012. The total average cost per item also increased overall from R105.69 ± R70.82 (95%CI:R105.47-R105.91) in 2008 to R109.99 ± R73.07 (95%CI:R109.78-R110.20) in 2012.

60 > age ≤ 70 years: The prevalence of medicine items in this group increased by 24.33% (n = 107 873) between 2008 and 2012. The prevalence of medicine items contributed 26.83% (n = 443 453) in 2008 to the prevalence of medicine items and 28.40% (n = 551 326) in 2012. The total average cost per item also increased from R108.03 ± R71.63 (95%CI:R107.83-R108.25) in 2008 to R112.80 ± R73.90 (95%CI:R112.61-R113.00) in 2012. The total average medicine item cost was the highest in this age group of all the other age groups from 2008 until 2012. The total medicine cost in this group increased as a contribution to the total medicine cost of 27.15% (R47 908 243.75) in 2008 to 29.19% (R62 191 371.43) in 2012.

Age >70 years: This age group had the second highest prevalence of medicine items throughout the entire study period with an increase of 13.43% (n = 77 172) between 2008 and 2012. The medicine prevalence per patient contributed to 34.74% (n = 574 446) (2008), 35.05% (n = 771 156) (2009), 35.78% (n = 781 535) (2010), 37.04% (n = 780 664) (2011) and 33.56% (n = 651 618) in 2012. The overall total average cost per item stayed relatively constant from R107.64 ± R72.00 (95%CI:R107.45-R107.83) in 2008 to R107.89 ± R73.34 (95%CI:R107.72-R108.08) in 2012, with 2010 having the highest average cost per item per patient with R116.80 ± R79.26.

Hypothyroidism

0 > age ≤ 12 years: The number of patients in this group had least number of medicine items throughout the entire study period. There was an overall decrease of medicine (n = 148) between 2008 and 2012. This age group also had the least number of medicine items of all the other age groups for the entire study period. No patients during 2011 and 2012 might be due to either a reduction of patients in this age group, or these patients did not register hypothyroidism as chronic condition. This age group had an increase in total medicine cost that contributed 0.03% (R4 125.14) to the total condition cost in 2008 to 0.00% in 2012. This group therefore had an increase in average levy cost per medicine item from R27.87 ± R9.95 (95%CI:R26.26-R29.49) (2008) to R42.67 ± R9.15 (95%CI:R36.85-R48.48) in 2010.

12 > age ≤ 50 years: The prevalence of medicine had a decrease of 95.93% (n = 50 541) between 2008 and 2012. The total average cost per medicine item per patient increased from R42.03 ± R20.33 (95%CI:R41.86-R42.21) (2008) to R46.56 ± R55.76 (95%CI:R44.19-R48.92) (2012). In addition, this age group had the highest average cost per item of all age groups for 2008, 2009, 2011 and 2012. The total medicine cost percentage as a contribution to the total medicine cost for hypothyroidism was higher in 2008 (18.87%; R2 214 498.00) to 2012 (6.11%; R99 860.67).

50 > age ≤ 60 years: Medicine prevalence in this group had an overall decrease of 91.44% (n = 63 326) between 2008 and 2012. The prevalence of medicine per patient contributed 23.22% in 2008 to the prevalence of medicine, and 15.60% in 2012. The total medicine cost as a contribution to the total medicine cost for hypothyroidism was 23.93% (R2 808 098.61) in 2008 and then declined to 16.66% (R272 094.57) in 2012. The total average cost per medicine item also increased overall from R40.55 ± R18.92 (95%CI:R40.41-R40.69) in 2008 to R45.90 ± R23.17 (95%CI:R45.31-R46.49) in 2012.

60 > age ≤ 70 years: The prevalence of medicine in this age group decreased by 84.55% (n = 69 740) between 2008 and 2012, with the highest during 2010 as with the previous age group (n = 82 482). The prevalence of medicine contributed 27.66% in 2008 to the prevalence of medicine and 33.52% in 2012. The total average cost per medicine item also increased from R39.07 ± R16.75 (95%CI:R38.96-R39.19) in 2008 to R43.77 ± R19.64 (95%CI:R43.43-R44.11) in 2012. The total medicine cost in this group increased as a contribution to the total medicine cost of 27.47% (R3 222 916.99) in 2008 to 34.15% (R557 752.54) in 2012.

Age >70 years: This age group had the highest prevalence of medicine throughout the entire study period, irrespective of an overall decrease of 81.64% (n = 76 487) between 2008 and 2012. The highest number of medicine items was during 2008 (n = 93 684). The total average cost per

medicine item increased from R37.19 ± R13.68 (95%CI:R37.10-R37.27) in 2008 to R40.91 ± R16.18 (95%CI:R40.67-R41.15) in 2012, with 2010 having the highest average cost per item per patient with R42.37 ± R14.74 (95%CI:R42.15-R42.59).

Hypertension and hypothyroidism were the only chronic conditions in the top 5 where the number of medicine items increased as the age group increased for all study years from 2008 until 2012.

3.4.3 Medicine cost according to the different number of CDL conditions.

This section will contain the analyses of the different number of CDL conditions as well as the number of medicine items for each number of conditions. The average and total medicine cost for each combination will also be analysed. The data discussed will be summarised in Table 3.27.

Table 3.27: Medicine cost of CDL items for different number of CDL conditions from 2008 until 2012.

Year	Total number of CDL conditions	Item cost (R)				
		Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total cost(R)
2008	1	1 171 014	135.00	333.49	134.40-135.61	158 087 152.00
	2	819 393	124.29	160.34	123.95-124.64	101 844 800.00
	3	396 847	132.15	213.38	131.49-132.82	52 443 407.40
	4	128 172	135.04	133.53	134.31-135.78	17 308 359.00
	5	30 260	133.85	136.81	132.31-135.39	4 050 179.70
	6	4 854	122.36	116.36	119.09-125.64	593 925.02
	7	565	130.54	144.16	118.63-142.45	73 753.64
	8	203	167.36	176.13	142.98-191.74	33 973.35
	9	0	0.00	0.00	0.00	0.00
	Total	2 551 308	131.08	259.92	130.77-131.41	334 435 550.00
2009	1	1 405 152	149.08	450.06	148.34-149.83	209 485 614.00
	2	1 089 570	131.46	316.32	130.87-132.06	143 237 318.00
	3	574 007	138.54	295.15	137.78-139.30	79 520 203.67
	4	195 128	139.00	191.85	138.15-139.85	27 122 501.02
	5	53 512	142.46	294.22	139.97-144.96	7 623 225.36
	6	11 841	139.70	220.34	135.73-143.67	1 654 174.62
	7	1 719	132.60	166.14	124.75-140.47	227 942.96
	8	177	176.47	193.92	147.71-205.24	31 235.06
	9	0	0.00	0.00	0.00	0.00
	Total	3 331 106	140.76	370.10	140.37-141.14	468 902 215.00
2010	1	1 361 345	156.11	514.58	155.25-156.98	212 523 199.00
	2	1 052 460	136.34	349.66	135.67-137.01	143 490 457.00
	3	561 303	143.50	287.20	142.75-144.26	80 547 013.07
	4	177 547	150.09	508.32	147.73-152.46	26 647 804.36
	5	45 922	146.03	196.96	144.23-147.83	6 705 790.91
	6	8 657	166.78	267.20	161.16-172.42	1 443 836.79
	7	1 895	135.45	159.04	128.29-142.62	256 686.01
	8	151	153.13	182.21	123.83-182.43	23 121.93
	9	0	0.00	0.00	0.00	0.00
	Total	3 209 280	146.96	426.59	146.50-147.43	471 637 910.00

Year	Total number of CDL conditions	Item cost (R)				
		Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost(R)
2011	1	1 440 982	151.81	496.50	151.00-162.62	218 752 168.00
	2	1 036 101	131.92	342.48	131.26-132.58	136 681 187.00
	3	551 192	138.86	299.36	138.08-139.66	76 540 117.05
	4	171 395	147.92	273.77	146.63-149.22	25 352 657.31
	5	41 005	156.95	296.34	154.09-159.83	6 435 856.17
	6	8 005	145.19	183.82	141.16-149.22	1 162 221.13
	7	1 074	123.38	163.05	113.63-133.15	132 514.95
	8	235	199.06	162.82	178.14-219.99	46 779.02
	9	0	0.00	0.00	0.00	0.00
	Total	3 249 989	143.11	408.81	142.67-143.56	465 103 501.00
2012	1	1 321 568	155.03	625.44	153.96-156.10	204 877 422.00
	2	951 932	132.47	384.88	131.70-133.25	126 102 997.00
	3	543 464	134.87	262.37	134.18-135.57	73 298 409.57
	4	186 087	141.78	315.08	140.36-143.22	26 384 228.14
	5	50 721	146.80	242.31	144.70-148.91	7 445 946.15
	6	10 024	143.98	189.02	140.28-147.69	1 443 266.18
	7	1 130	128.44	174.94	118.24-138.66	145 142.17
	8	193	178.76	152.09	157.17-200.35	34 499.94
	9	1	240.08	0.00	0.00	240.08
	Total	3 065 120	143.46	483.84	142.93-144.01	439 732 152.00

The results in Table 3.27 show that the prevalence of single CDL conditions medicine items: 45.90% (2008), 42.18% (2009), 42.42% (2010), 44.34% (2011) and 43.12% (2012). These results revealed that medicine for single CDL conditions represented less than 50.00% of all CDL conditions' medicine items throughout the study period. The lowest prevalence occurred during 2009 and 2010, resulting in more than 50.00% of all medicines that were claimed for patients with at least two CDL conditions. Co-morbid CDL conditions also had a higher share of the total medicine item cost in Table 3.27 with 52.72% (R176 348 398.00) (2008), 55.32% (R259 416 601.00) (2009), 54.94% (R259 114 711.00) (2010), 52.97% (R246 351 333.00) (2011) and 53.41% (R234 854 730.00) (2012).

The total cost of medicine items for the different number of CDL conditions changed as follows between 2008 and 2012:

- *One CDL condition*: increase of 29.60% (R46 790 270.00);
- *Two CDL conditions*: increased by 23.82% (R24 258 197.00);
- *Three CDL conditions*: increased by 39.77% (R20 855 002.57);

- *Four CDL conditions:* increased by 52.44% (R9 075 869.14);
- *Five CDL conditions:* increased by 83.84% (R3 395 766.45);
- *Six CDL conditions:* increased by 143.01% (R849 341.16);
- *Seven CDL conditions:* increased by 96.79% (R71 388.53);
- *Eight CDL conditions:* increased by 2.76% (R926.59); and
- *Nine CDL conditions:* increased overall by 100.00% (R240.08).

The prevalence of medicine items for the different number of CDL conditions changed as follows between 2008 and 2012:

- *One CDL condition:* an increase of 12.86% (n = 150 554);
- *Two CDL conditions:* increased by 16.17% (n = 132 539);
- *Three CDL conditions:* increased by 36.94% (n = 146 617);
- *Four CDL conditions:* increased by 45.18% (n = 57 915);
- *Five CDL conditions:* increased by 67.61% (n = 20 461);
- *Six CDL conditions:* increased by 106.51% (n = 5 170);
- *Seven CDL conditions:* increased by 100.00% (n = 565).
- *Eight CDL conditions:* decreased by 25.62% (n = 10); and
- *Nine CDL conditions:* increase overall by 100.00% (n = 1).

Medicine for a combination of seven conditions was the only category that experienced more increases than decreases on a year-to-year basis.

Medicine items for CDL conditions in combinations of five, six and seven CDL conditions all increased between 2011 and 2012, confirming the increase in medicine items claimed for more co-morbid conditions.

The prevalence of CDL medicine used in co-morbid CDL conditions had an overall increase of 26.32% (n = 363 258) from 2008 (n = 1 380 294) to 2012 (n = 1 743 552). Average medicine cost per medicine item was also predominantly higher for most of the study period as the number of co-morbid CDL condition combinations increased. The total medicine cost increase of co-morbid CDL condition medicine between 2008 and 2012 totalled R58 506 332.00. It can thus be concluded that, as found in the study by McLeod *et al.* (2002:19) in 2001, the majority of the medicine was due to co-morbidities and the increases as predicted in Table 2.5 (McLeod *et al.*, 2002:19).

This confirms that patients with multiple CDL conditions may use more medicine at an increased cost. This increase in CDL conditions and associated risk factors may further lead to increased direct medicine cost and indirect costs (such as loss of productivity) (refer to Chapter 2, sections 2.6.5 and 2.6.6). Where the average cost per medicine item was less with more co-morbidities, it may have a larger impact on treatment cost, mortality, morbidity and healthcare resources, as more CDL conditions are involved, according to Michaud and Wolfe (2007:886) (refer to Chapter 2, section 2.6.1). This increase in co-morbidities was also found in another South African study by McLeod (2009b:1) and reported in the United States by Vogeli *et al.* (2007:391) (refer to Chapter 1, section 1.2).

3.4.4 Medicine cost for all CDL medicine according to generic indicator

In this section the number of medicine items and their cost for all CDL conditions and the top 5 CDL conditions will be discussed according to different generic indicators between 2008 and 2012. The total cost of generic medicine items with regard to the original equivalents will be analysed. This will be done to determine the possible cost savings if the original medicine items were substituted with a generic equivalent. Detailed results relevant to this section will be summarised in Tables 3.28 to 3.32, *Appendix E*. Figure 3.7 will present a portion of these results.

Refer to Chapter 1, Table 1.7 for classification of the generic indicators used in this study.

Table 3.28: Medicine cost of all CDL items according to generic indicator (2008 vs 2012).

Generic indicator*	Year 2008		Year 2012		Item change (2008 vs 2012) † (n)	Total cost change (2008 vs 2012) ‡ (R)	Estimated annual change # (items) (n)	Estimated annual change & (Total cost) (R)
	Number of all CDL medicine items @ (n)	Total cost † (R)	Number of all CDL medicine items @ (n)	Total cost † (R)				
M	0	0.00	5 738	2 999 404.15	↑ 5738 (100.00%)	↑ 2 999 404.15 (100.00%)	↑ 1 435 (25.00%)	↑ 749 851.04 (25.00%)
N	617 863	149 621 345.00	488 882	170 339 594.00	↓ 128 981 (20.87%)	↑ 20 718 249.00 (13.85%)	↓ 32 245 (5.22%)	↑ 5 179 562.25 (3.46%)
O	385 081	50 688 491.37	500 038	69 487 016.26	↑ 114 957 (29.85%)	↑ 18 798 524.89 (37.09%)	↑ 28 739 (7.46%)	↑ 4 699 631.22 (9.27%)
Y	1 548 364	134 125 713.00	2 070 462	196 906 138.00	↑ 522 098 (33.72%)	↑ 62 780 425.00 (46.81%)	↑ 130 525 (8.43%)	↑ 15 695 106.25 (11.70%)

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

@ Data derived from Table 3.30

† Data derived from Table 3.30

† Item change (2008 vs 2012) = $\frac{\text{Number of CDL medicine items (2008)} - \text{(2012)}}{\text{Number of CDL medicine items (2008)}} \times 100$

‡ Total cost change (2008 vs 2012) = $\frac{\text{Total cost (2008)} - \text{(2012)}}{\text{Total cost (2008)}} \times 100$

Estimated annual change (items) = $\frac{\text{Item change (2008 vs 2012)}}{4^\ddagger}$

& Estimated annual change (total cost) = $\frac{\text{Total cost change (2008 vs 2012)}}{4^\ddagger}$

‡ Annual change between 2 study years (2008-2009, 2009-2010, 2010-2011 and 2011-2012)

Table 3.29: All generic indicator medicine as percentage of all CDL medicine from 2008 until 2012.

Year	Generic indicator*	Number of CDL medicine items (n)	Total number of CDL medicine items (N)	Percentage of all CDL items (%)
2008	M	0	2 551 308	0
	N	617 863		24.22
	O	385 081		15.09
	Y	1 548 364		60.69
2009	M	1 748	3 331 106	0.05
	N	827 432		24.84
	O	558 631		16.77
	Y	1 943 295		58.34
2010	M	3 043	3 209 280	0.09
	N	673 446		20.98
	O	573 161		17.86
	Y	1 959 630		61.06
2011	M	3 423	3 249 989	0.11
	N	559 163		17.21
	O	567 023		17.45
	Y	2 120 380		65.24
2012	M	5 738	3 065 120	0.19
	N	488 882		15.95
	O	500 038		16.31
	Y	2 070 462		67.55

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table 3.30: Total cost of all CDL medicine items according to generic indicator from 2008 until 2012.

Year	Generic indicator*	Cost	Number of CDL medicine items (n)	Item cost (R)			
				Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
2008	M	Total cost all CDL items	0	0.00	0.00	0.00	0.00
	N		617 863	242.16	494.29	240.93-243.40	149 621 345.00
	O		385 081	131.06	103.03	131.31-131.96	50 688 491.37
	Y		1 548 364	86.62	65.43	86.53-86.73	134 125 713.00
2009	M		1 748	665.85	327.76	650.47-681.23	1 163 898.20
	N		827 432	261.65	712.31	260.12-263.19	216 494 809.00
	O		558 631	137.12	119.53	136.81-137.44	76 599 357.33
	Y		1 943 295	89.87	74.11	89.77-89.98	174 644 150.00
2010	M		3 043	644.40	321.68	632.97-655.83	1 960 895.26
	N		673 446	302.54	893.77	300.41-304.68	203 742 438.00
	O		573 161	145.61	140.89	145.25-145.98	83 459 181.13
	Y		1 959 630	93.12	77.08	93.01-93.23	182 475 395.00
2011	M		3 423	501.69	226.02	494.12-509.27	1 717 275.49
	N		559 163	317.96	940.02	315.50-320.43	177 790 675.00
	O		567 023	151.24	148.57	150.86-151.63	85 757 383.78
	Y		2 120 380	94.25	80.49	94.14-94.36	199 838 166.00
2012	M		5 738	522.73	222.79	516.96-528.50	2 999 404.15
	N		488 882	348.43	1169.83	345.15-351.71	170 339 594.00
	O		500 038	138.96	137.14	138.59-139.35	69 487 016.26
	Y		2 070 462	95.10	78.06	95.00-95.21	196 906 138.00

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table 3.31: Medical scheme contribution of all CDL medicine items according to generic indicator from 2008 until 2012.

Year	Generic indicator*	Cost	Number of CDL medicine items (n)	Item cost (R)			
				Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
2008	M	Medical scheme contribution all CDL items	0	0.00	0.00	0.00	0.00
	N		617 863	204.30	478.90	203.11-205.50	126 232 342.00
	O		385 081	95.93	84.85	95.66-96.20	36 941 524.96
	Y		1 548 364	74.69	59.66	74.60-74.79	115 651 891.00
2009	M		1 748	631.22	314.99	616.44-646.00	1 103 370.17
	N		827 432	223.09	702.54	221.58-224.61	184 595 565.00
	O		558 631	97.78	94.91	97.53-98.03	54 623 877.10
	Y		1 943 295	76.96	67.01	76.86-77.05	149 550 694.00
2010	M		3 043	619.05	312.24	607.95-630.15	1 883 773.59
	N		673 446	261.88	877.31	259.78-263.97	176 359 556.00
	O		573 161	101.58	114.98	101.28-101.88	58 223 065.80
	Y		1 959 630	79.89	69.42	79.80-79.99	156 562 103.00
2011	M		3 423	497.36	222.01	489.92-504.80	1 702 476.24
	N		559 163	285.12	928.24	282.69-287.56	159 431 153.00
	O		567 023	106.62	119.25	106.31-106.93	60 455 161.88
	Y		2 120 380	80.24	68.81	80.15-80.33	170 143 857.00
2012	M		5 738	510.01	220.76	504.30-515.73	2 926 463.68
	N		488 882	310.48	1 157.17	307.23-313.72	151 786 683.00
	O		500 038	100.60	110.66	100.29-100.90	50 302 650.92
	Y		2 070 462	82.47	71.29	82.37-82.57	170 755 134.00

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table 3.32: Patient levy of all CDL medicine items according to generic indicator from 2008 until 2012

Year	Generic indicator*	Cost	Number of CDL medicine items (n)	Item cost (R)			
				Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total cost (R)
2008	M	Patient levy all CDL items	0	0.00	0.00	0.00	0.00
	N		617 863	37.85	127.80	37.54-37.17	23 389 002.77
	O		385 081	35.70	48.21	35.55-35.85	13 746 966.41
	Y		1 548 364	11.93	22.54	11.90-11.97	18 473 822.71
2009	M		1 748	34.63	98.05	30.03-39.23	60 528.03
	N		827 432	38.55	114.33	38.31-38.80	31 899 244.75
	O		558 631	39.34	58.82	39.18-39.49	21 975 480.23
	Y		1 943 295	12.91	25.93	12.88-12.95	25 093 456.03
2010	M		3 043	25.34	80.04	22.50-28.19	77 121.67
	N		673 446	40.66	154.92	40.29-41.03	27 382 881.86
	O		573 161	44.03	64.79	43.86-44.20	25 236 115.33
	Y		1 959 630	13.22	26.21	13.19-13.26	25 913 292.51
2011	M		3 423	13.76	48.36	12.14-15.38	47 088.50
	N		559 163	35.94	123.03	35.62-36.26	20 096 488.10
	O		567 023	39.82	61.27	39.66-39.98	22 579 865.10
	Y		2 120 380	12.75	22.79	12.72-12.78	27 042 341.60
2012	M		5 738	12.71	48.20	11.46-13.96	72 940.47
	N		488 882	37.95	118.95	37.62-38.28	18 552 910.33
	O		500 038	38.37	60.62	38.20-38.53	19 184 365.34
	Y		2 070 462	12.63	23.46	12.60-12.66	26 151 004.11

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Tables 3.28 to 3.32 record that original medicine items (group-N) as a contribution to the total number of CDL medicine decreased from 24.22% (n = 617 863) (2008) to 15.95% (n = 488 882) (2012). This concludes, that fewer original medicine without generic equivalents were dispensed and claimed, resulting in an increased drive to promote the use of generic medicine.

There was a further increase (n = 5 738) in the number of original medicine items (group-M) with a total medicine cost of R299 940 415.00 from 2008 to 2012. Where original medicine items were claimed (group-O), the medicine item prevalence increased by 29.85% (n = 114 957) from 385 081 (2008) to 500 038 (2012). The total medicine item cost of these items increased by R18 798 524.89 between 2008 and 2012.

Where original medicine items were claimed (group-N), a 20.88% (n = 128 981) decrease in medicine item prevalence was observed between 2008 and 2012. However, there was an increase in the total medicine item cost increase owing to the high average cost per medicine item between 2008 (R242.16 ± R494.29) (95%CI:R240.93-R243.40) and 2012 (R348.43 ± R1 169.83) (95%CI:R345.15-R351.71). The highest average cost per medicine item for all the medicine description groups occurred where the original medicine items (group-M) were claimed in each study year. This reveals that patent rights might play an important role in higher medicine prices, due to research and development. Patent rights are exclusive rights granted to an inventor for their intellectual property holder (Tomlinson & Rutter, 2014). No one is allowed to, use, import, and market or sell these patented products other than the patent or right-holder (Tomlinson & Rutter, 2014). Thus, generic medicine is further manufactured on the bases that the patent is no longer under protection. The public policy option available to the state, however, allows working on the patent before expiry, therefore allowing the development of generic medicine (SA, 2013a:16).

The total medical scheme contribution cost of medicine items as a contribution to the total medicine cost for original medicine (group-M) increased to 97.57% from 2008 to 2012. Original medicine (group-N) increased from 84.37% to 88.85%, whereas, the original (group-O) had a slight decrease from 72.88% (2008) to 72.39% (2012) and the generic medicine (group-Y) as a contribution to the total medicine cost increased from 86.23% to 86.72%.

The total medical scheme contribution cost of medicine items for original medicine (group-N) increased overall by 20.24% (R25 554 341.00), whereas the original medicine (group-O) increased by 36.17% (R13 361 125.96) and the generic medicine (group-Y) increased by 47.65% (R55 103 243.00) from 2008 until 2012. This concludes that the majority of medicine cost claimed,

was by medical scheme contribution. The minority of the total medicine cost was paid by patents as levies, resulting in possible patient saving.

The total patient levy observed showed that, as a total, all medicine description groups had an overall increase in average cost per item from 2008 until 2012. For the generic medicine (group-Y), the average cost per item increased from R11.93 ± R22.54 (95%CI:R11.90-R11.97) (2008) to R12.63 ± R23.46 (95%CI:R12.60-R12.66) (2012).

Hyperlipidaemia and diabetes mellitus type 2 were the only two CDL conditions of the top 5 with an overall decrease in average levy per medicine item (group-Y) from 2008 to 2012 with R12.06 ± R21.42 (95%CI:R11.99-R12.12) to R10.28 ± R19.93 (95%CI:R10.23-R10.33) and R6.10 ± R17.59 (95%CI:R6.02-R6.18) to R5.91 ± R17.55 (95%CI:R5.84-R5.97) respectively. The average cost per generic medicine item was consistently lower than for any of the original medicine claimed throughout the study period. Lower co-payments for generic medicine with regard to original medicine claimed were in line with EU and other countries that also reported on having lower co-payments for generic medicine when compared to original medicine as cost saving strategy and reduction of expenditure (IMS Health, 2010:10) (also refer to Chapter 2, section 2.5.2.1.5 and Table 2.2). These data confirmed the increase in the drive of generic medicine use and possible cost savings available in the South African private health sector (refer to Chapter 2, section 2.5.1.5.2 and 2.5.2.1.5). However, asthma was the only CDL condition within the top 5 CDL conditions with an increase in average patient levy per medicine item (group-O) from R39.71 ± R63.12 (95%CI:R38.54-R40.87) (2008) to R69.10 ± R77.57 (95%CI:R68.27-R69.94) (2012). This might be attributed to the overall increase in the number of original medicine provided from 11 246 (2008) to 33 151 (2012) (group-O) (refer to *Appendix E*).

Generic medicine items (group-Y) had an overall increase between 2008 and 2012 of 33.72% (n = 522 098) and a total medicine cost increase of 46.81% (R62 780 425.00), with an estimated increase thereafter (refer to Table 3.28). This estimated generic medicine increase worldwide and in South Africa can be confirmed by Chapter 2, sections 2.5.1.5.2 and 2.5.2.1.5.

The average cost per generic equivalent for all CDL conditions provided increased from R86.62 ± R65.43 (95%CI:R86.53-R86.73) (2008) to R95.10 ± R78.06 (95%CI:R95.00-R95.21) in 2012. Asthma was also the only top 5 CDL condition with an increase in average generic medicine patient levy for from R10.04 ± R30.01 (95%CI:R9.82-R10.26) (2008) to R16.47 ± R35.94 (95%CI:R16.28-R16.66) (2012). The average cost per medicine item was lower for generic medicine than any of the original medicine claimed, as stated in Chapter 2, section 2.5.1.5.2, where the cost of the generic equivalent should be lower than the original equivalent before

substitution. This increase in average cost per generic item (group-Y) was consistent with the average cost per item for all generic medicine from the database for all medicine items with R77.00 (2008) to R92.00 (2012) as reported by Badenhorst *et al.* (2013:11) as well as Bester and Badenhorst (2009:13). The average medicine item cost of the CDL conditions was higher than for the database.

The increase in the number of generic medicines claimed throughout the study period might be attributed to the following (Badenhorst *et al.*, 2011a:10):

- Managed care initiatives such as applying generic reference pricing and formularies (refer to Chapter 2, section 2.5.1.4) to promote generic medicine use, as well as prior authorisation of medicine;
- Greater awareness of the availability and use of generic medicine by providers and patients;
- An increased number of generic medicine becoming available on the market due to the loss of original medicine losing their patents (also refer to Chapter 2, section 2.5.1.5.2); and
- Mandatory generic substitution at pharmacy level (refer to Chapter 2, section 2.5.1.5.2).

The increase in the number of generic medicine claimed may also result in a cost containment strategy, such as a lower average cost per medicine item and lower patient levies.

All of the top 5 CDL conditions had overall increases in the number of generic medicine items claimed from 2008 until 2012. The highest proportion of generic medicine (group-Y) claimed were for hypertension with 72.18% (n = 1 117 663) of the total number of medicine items in 2012. The CDL condition with the least number of generic medicine claimed within the top 5 conditions was in 2011 for hypothyroidism with 0.06% (n = 1 310).

Prevalence of generic medicine items (group-Y) compared to original medicine items (no generic medicine available) (group-N) between 2008 and 2012:

- Hypertension: increased by 34.43% (n = 384 827), generic medicine (group-Y);
- Hypertension: decreased by 44.16% (n = 155 290), original medicine (group-N);
- Hyperlipidaemia: increased by 27.99% (n = 114 552), generic medicine (group-Y);
- Hyperlipidaemia: increased by 53.33% (n = 59 330), original medicine (group-N);

- Diabetes mellitus type 2: increased by 51.34% (n = 94 453), generic medicine (group-Y);
- Diabetes mellitus type 2: increased by 16.60% (n = 16 042), original medicine (group-N);
- Asthma: increased by 104.37% (n = 71 709), generic medicine (group-Y);
- Asthma: decreased by 14.68% (n = 13 261), original medicine (group-N);
- Hypothyroidism: increased by 100.00% (n = 1 294), generic medicine (group-Y); and
- Hypothyroidism: decreased by 99.11% (n = 295 610), original medicine (group-N).

It can therefore be concluded that within the top 5 conditions, the overall generic medicine available and claimed increased, while original medicine without generic medicine (group-N) decreased except for hyperlipidaemia and diabetes mellitus type 2.

The prevalence of generic medicine claimed (group-Y) as a contribution to the total number of medicine items from 2008 to 2012 included:

- All CDL conditions: 62.59% (n = 9 642 131; R887 989 562.00);
- Hypertension: 71.85% (n = 7 246 874; R638 910 434.10);
- Hyperlipidaemia: 70.93% (n = 1 518 499; R138 344 428.91);
- Diabetes mellitus type 2: 46.32% (n = 1 218 535; R72 194 403.14);
- Asthma: 43.27% (n = 541 209; R58 586 882.92); and
- Hypothyroidism: 0.69% (n = 3 054; R110 855.34).

The highest average medicine cost per generic item claimed during the study period was for hyperlipidaemia during 2010 (R191.62 ± R53.83) (95%CI:R190.86-R192.38).

Furthermore, the number and cost of original medicine for all CDL conditions claimed for each study year and therefore not substituted (where the patent expired and not expired) were:

- 2008: n = 385 081 (R50 688 491.37);
- 2009: n = 560 379 (R77 763 255.53);
- 2010: n = 576 204 (R85 420 076.39);

- 2011: n = 570 446 (R87 474 659.27); and
- 2012: n = 505 776 (R72 486 420.41).

This was a combined total of 2 597 886 CDL medicine items for the study period with a value of R373 832 902.80. Possible reasons for this high number of medicine not substituted and thus not contributing to cost savings may include a specific generic product not being available, the patient refusing generic substitution or the treating doctor refusing generic equivalents (also refer to Chapter 2, section 2.5.1.5.2).

The total number of medicine available in the top 5 CDL conditions for generic substitution and not substituted (group-M and group-O) were from 2008 to 2012:

- Hypertension: (n = 1 271 459; R209 731 497.38);
- Hyperlipidaemia: (n = 140 559; R26 382 743.52);
- Diabetes mellitus type 2: (n = 811 770; R65 173 842.92);
- Asthma: (n = 126 875; R27 226 367.31); and
- Hypothyroidism: (n = 105 379; R4 597 453.83) that were available, and could have contributed to cost savings.

It was demonstrated in 2006 by Perry (2006:12) that in 11 European countries that if just 10 active ingredients for medicine were substituted for generic equivalents, public pharmaceutical expenditure would be reduced by 27.00% to 48.00% in countries such as Denmark, Belgium, Italy, France, Portugal and the Netherlands. The high number of generic medicine items claimed compared to original medicine showed the importance of generic substitution in potential cost savings, as 80.60% of the countries in Table 2.2 used generic substitutions to reduce pharmaceutical expenditure in some or other way. Another cost containment strategy possibly relevant to the increase in the number of generic medicine dispensed and the lower average levy for generic medicine was the use of algorithms (refer to *Appendix A*) and formularies, which were also used other countries (refer to Chapter 2, section 2.5.1.4, section 2.5.2.1.6 and Table 2.2).

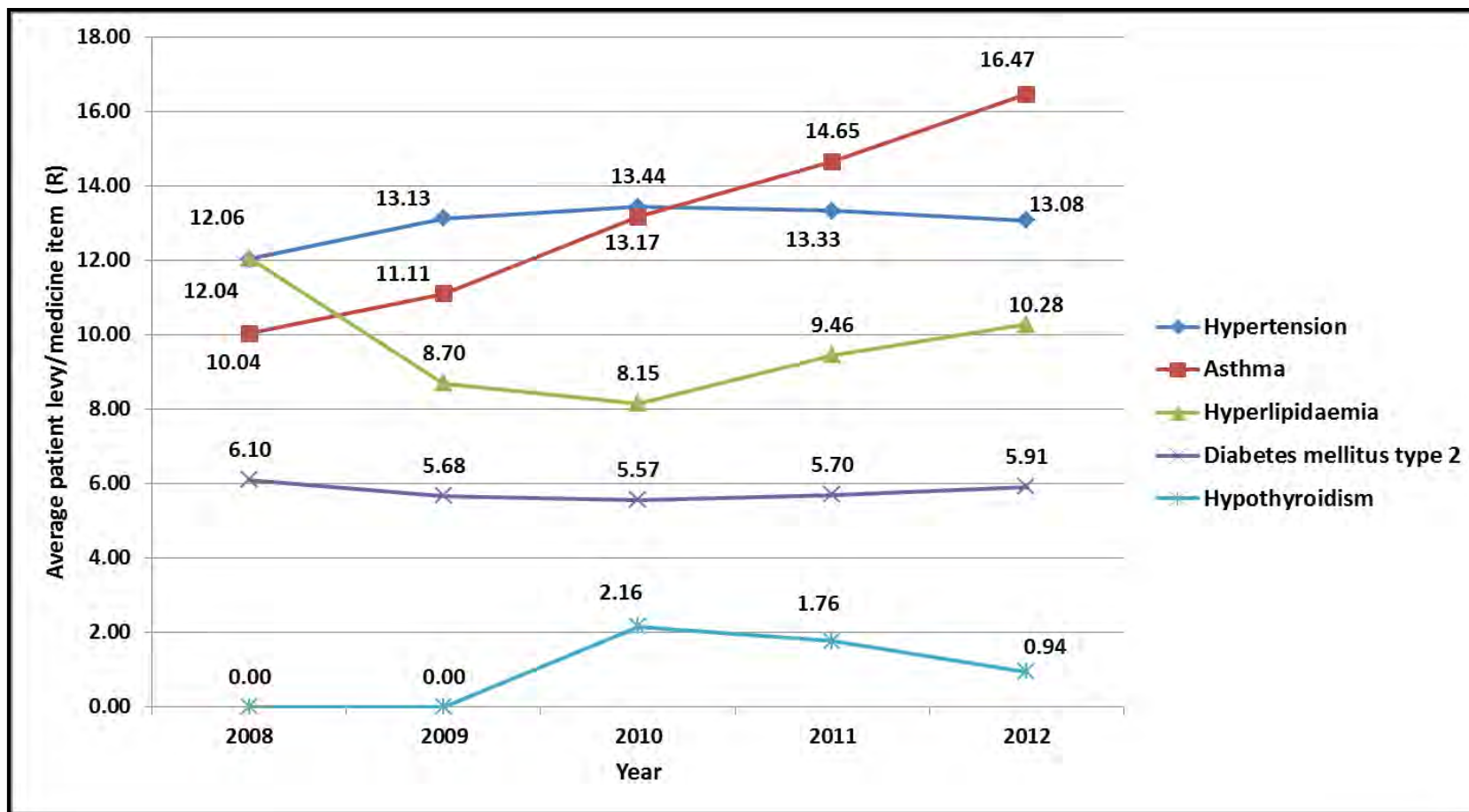


Figure 3.7: Average patient levy per generic medicine item for the top 5 CDL conditions from 2008 until 2012.

3.4.4.1 Statistical and practical significance of medicine cost for CDL conditions according to generic indicator.

In this section the statistical and practical significant differences in the average cost per medicine item of all 26 and top 5 CDL conditions will be discussed. The results will be analysed according to the total medicine cost, medical scheme contribution paid as well as the patient levy for each of the study years. The results for the total will be summarised in Tables 3.33 to 3.41 as well as *Appendix F*. The results summarised in table 3.36 to 3.41 were calculated from data in tables 3.33 to 3.35.

Table 3.33: Statistical and practical significant difference between the total average cost per medicine item for all CDL conditions according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value ¹
All CDL conditions	Total CDL medicine item cost	2008	Group-M and	0.00	0.00	0.00	_ #	-
			Group-N	242.16	494.29	240.93-243.40		
			Group-N and	242.16	494.29	240.93-243.40	< 0.05	0.25
			Group-O	131.06	103.03	131.31-131.96		
			Group-O and	131.06	103.03	131.31-131.96	< 0.05	0.43
			Group-Y	86.62	65.43	86.53-86.73		
			Group-N and	242.16	494.29	240.93-243.40	< 0.05	0.31
			Group-Y	86.62	65.43	86.53-86.73		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-Y	86.62	65.43	86.53-86.73		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-O	131.06	103.03	131.31-131.96		
		2009	Group-M and	665.85	327.76	650.47-681.23	< 0.05	0.57
			Group-N	261.65	712.31	260.12-263.19		
			Group-N and	261.65	712.31	260.12-263.19	< 0.05	0.17
			Group-O	137.12	119.53	136.81-137.44		
			Group-O and	137.12	119.53	136.81-137.44	< 0.05	0.40
			Group-Y	89.87	74.11	89.77-89.98		
			Group-N and	261.65	712.31	260.12-263.19	< 0.05	0.24
			Group-Y	89.87	74.11	89.77-89.98		
			Group-M and	665.85	327.76	650.47-681.23	< 0.05	1.75
			Group-Y	89.87	74.11	89.77-89.98		
			Group-M and	665.85	327.76	650.47-681.23	< 0.05	1.61
			Group-O	137.12	119.53	136.81-137.44		
		2010	Group-M and	644.40	321.68	632.97-655.83	< 0.05	0.40
			Group-N	302.54	893.77	300.41-304.68		
			Group-N and	302.54	893.77	300.41-304.68	< 0.05	0.18
			Group-O	145.61	140.89	145.25-145.98		
			Group-O and	145.61	140.89	145.25-145.98	< 0.05	0.37
			Group-Y	93.12	77.08	93.01-93.23		
			Group-N and	302.54	893.77	300.41-304.68	< 0.05	0.23
			Group-Y	93.12	77.08	93.01-93.23		
			Group-M and	644.40	321.68	632.97-655.83	< 0.05	1.71
			Group-Y	93.12	77.08	93.01-93.23		
			Group-M and	644.40	321.68	632.97-655.83	< 0.05	1.55
			Group-O	145.61	140.89	145.25-145.98		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

¹ Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
All CDL conditions	Total CDL medicine item cost	2011	Group-M and	501.69	226.02	494.12-509.27	< 0.05	0.20
			Group-N	317.96	940.02	315.50-320.43		
			Group-N and	317.96	940.02	315.50-320.43	< 0.05	0.18
			Group-O	151.24	148.57	150.86-151.63		
			Group-O and	151.24	148.57	150.86-151.63	< 0.05	0.38
			Group-Y	94.25	80.49	94.14-94.36		
			Group-M and	317.96	940.02	315.50-320.43	< 0.05	0.24
			Group-Y	94.25	80.49	94.14-94.36		
			Group-M and	501.69	226.02	494.12-509.27	< 0.05	1.80
			Group-Y	94.25	80.49	94.14-94.36		
			Group-M and	501.69	226.02	494.12-509.27	< 0.05	1.55
			Group-O	151.24	148.57	150.86-151.63		
		2012	Group-M and	522.73	222.79	516.96-528.50	< 0.05	0.15
			Group-N	348.43	1169.83	345.15-351.71		
			Group-N and	348.43	1169.83	345.15-351.71	< 0.05	0.18
			Group-O	138.96	137.14	138.59-139.35		
			Group-O and	138.96	137.14	138.59-139.35	< 0.05	0.32
			Group-Y	95.10	78.06	95.00-95.21		
			Group-N and	348.43	1169.83	345.15-351.71	< 0.05	0.22
			Group-Y	95.10	78.06	95.00-95.21		
			Group-M and	522.73	222.79	516.96-528.50	< 0.05	1.92
			Group-Y	95.10	78.06	95.00-95.21		
			Group-M and	522.73	222.79	516.96-528.50	< 0.05	1.72
			Group-O	138.96	137.14	138.59-139.35		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table 3.34: Statistical and practical significant difference between the average medical scheme contribution per medicine item for all CDL conditions according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value ¹
All CDL conditions	Medical scheme contribution	2008	Group-M and	0	0.00	0.00	_ #	-
			Group-N	204.30	478.90	203.11-205.50		
			Group-N and	204.30	478.90	203.11-205.50	< 0.05	0.22
			Group-O	95.93	84.85	95.66-96.20		
			Group-O and	95.93	84.85	95.66-96.20	< 0.05	0.25
			Group-Y	74.69	59.66	74.60-74.79		
			Group-N and	204.30	478.90	203.11-205.50	< 0.05	0.27
			Group-Y	74.69	59.66	74.60-74.79		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-Y	74.69	59.66	74.60-74.79		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-O	95.93	84.85	95.66-96.20		
		2009	Group-M and	631.22	314.99	616.44-646.00	< 0.05	0.58
			Group-N	223.09	702.54	221.58-224.61		
			Group-N and	223.09	702.54	221.58-224.61	< 0.05	0.18
			Group-O	97.78	94.91	97.53-98.03		
			Group-O and	97.78	94.91	97.53-98.03	< 0.05	0.22
			Group-Y	76.96	67.01	76.86-77.05		
			Group-N and	223.09	702.54	221.58-224.61	< 0.05	0.21
			Group-Y	76.96	67.01	76.86-77.05		
			Group-M and	631.22	314.99	616.44-646.00	< 0.05	1.76
			Group-Y	76.96	67.01	76.86-77.05		
			Group-M and	631.22	314.99	616.44-646.00	< 0.05	1.69
			Group-O	97.78	94.91	97.53-98.03		
		2010	Group-M and	619.05	312.24	607.95-630.15	< 0.05	0.41
			Group-N	261.88	877.31	259.78-263.97		
			Group-N and	261.88	877.31	259.78-263.97	< 0.05	0.18
			Group-O	101.58	114.98	101.28-101.88		
			Group-O and	101.58	114.98	101.28-101.88	< 0.05	0.19
			Group-Y	79.89	69.42	79.80-79.99		
			Group-N and	261.88	877.31	259.78-263.97	< 0.05	0.21
			Group-Y	79.89	69.42	79.80-79.99		
			Group-M and	619.05	312.24	607.95-630.15	< 0.05	1.73
			Group-Y	79.89	69.42	79.80-79.99		
			Group-M and	619.05	312.24	607.95-630.15	< 0.05	1.66
			Group-O	101.58	114.98	101.28-101.88		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

¹ Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
All CDL conditions	Medical scheme contribution	2011	Group-M and	497.36	222.01	489.92-504.80	< 0.05	0.23
			Group-N	285.12	928.24	282.69-287.56		
			Group-N and	285.12	928.24	282.69-287.56	< 0.05	0.19
			Group-O	106.62	119.25	106.31-106.93		
			Group-O and	106.62	119.25	106.31-106.93	< 0.05	0.22
			Group-Y	80.24	68.81	80.15-80.33		
			Group-N and	285.12	928.24	282.69-287.56	< 0.05	0.22
			Group-Y	80.24	68.81	80.15-80.33		
			Group-M and	497.36	222.01	489.92-504.80	< 0.05	1.88
			Group-Y	80.24	68.81	80.15-80.33		
			Group-M and	497.36	222.01	489.92-504.80	< 0.05	1.76
			Group-O	106.62	119.25	106.31-106.93		
		2012	Group-M and	510.01	220.76	504.30-515.73	< 0.05	0.17
			Group-N	310.48	1 157.17	307.23-313.72		
			Group-N and	310.48	1 157.17	307.23-313.72	< 0.05	0.18
			Group-O	100.60	110.66	100.29-100.90		
			Group-O and	100.60	110.66	100.29-100.90	< 0.05	0.16
			Group-Y	82.47	71.29	82.37-82.57		
			Group-N and	310.48	1 157.17	307.23-313.72	< 0.05	0.20
			Group-Y	82.47	71.29	82.37-82.57		
			Group-M and	510.01	220.76	504.30-515.73	< 0.05	1.94
			Group-Y	82.47	71.29	82.37-82.57		
			Group-M and	510.01	220.76	504.30-515.73	< 0.05	1.85
			Group-O	100.60	110.66	100.29-100.90		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table 3.35: Statistical and practical significant difference between the average patient levy per medicine item for all CDL conditions according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
All CDL conditions	Patient levy	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	37.85	127.80	37.54-37.17		
			Group-N and	37.85	127.80	37.54-37.17	< 0.05	0.02
			Group-O	35.70	48.21	35.55-35.85		
			Group-O and	35.70	48.21	35.55-35.85	< 0.05	0.49
			Group-Y	11.93	22.54	11.90-11.97		
			Group-N and	37.85	127.80	37.54-37.17	< 0.05	0.20
			Group-Y	11.93	22.54	11.90-11.97		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	11.93	22.54	11.90-11.97		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	35.70	48.21	35.55-35.85		
		2009	Group-M and	34.63	98.05	30.03-39.23	_ &	0.03
			Group-N	38.55	114.33	38.31-38.80		
			Group-N and	38.55	114.33	38.31-38.80	< 0.05	0.01
			Group-O	39.34	58.82	39.18-39.49		
			Group-O and	39.34	58.82	39.18-39.49	< 0.05	0.45
			Group-Y	12.91	25.93	12.88-12.95		
			Group-N and	38.55	114.33	38.31-38.80	< 0.05	0.22
			Group-Y	12.91	25.93	12.88-12.95		
			Group-M and	34.63	98.05	30.03-39.23	< 0.05	0.22
			Group-Y	12.91	25.93	12.88-12.95		
			Group-M and	34.63	98.05	30.03-39.23	< 0.05	0.05
			Group-O	39.34	58.82	39.18-39.49		
		2010	Group-M and	25.34	80.04	22.50-28.19	< 0.05	0.10
			Group-N	40.66	154.92	40.29-41.03		
			Group-N and	40.66	154.92	40.29-41.03	< 0.05	0.02
			Group-O	44.03	64.79	43.86-44.20		
			Group-O and	44.03	64.79	43.86-44.20	< 0.05	0.48
			Group-Y	13.22	26.21	13.19-13.26		
			Group-N and	40.66	154.92	40.29-41.03	< 0.05	0.18
			Group-Y	13.22	26.21	13.19-13.26		
			Group-M and	25.34	80.04	22.50-28.19	< 0.05	0.15
			Group-Y	13.22	26.21	13.19-13.26		
			Group-M and	25.34	80.04	22.50-28.19	< 0.05	0.23
			Group-O	44.03	64.79	43.86-44.20		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
All CDL conditions	Patient levy	2011	Group-M and	13.76	48.36	12.14-15.38	< 0.05	0.18
			Group-N	35.94	123.03	35.62-36.26		
			Group-N and	35.94	123.03	35.62-36.26	< 0.05	0.03
			Group-O	39.82	61.27	39.66-39.98		
			Group-O and	39.82	61.27	39.66-39.98	< 0.05	0.44
			Group-Y	12.75	22.79	12.72-12.78		
			Group-N and	35.94	123.03	35.62-36.26	< 0.05	0.19
			Group-Y	12.75	22.79	12.72-12.78		
			Group-M and	13.76	48.36	12.14-15.38	_ &	0.02
			Group-Y	12.75	22.79	12.72-12.78		
		2012	Group-M and	13.76	48.36	12.14-15.38	< 0.05	0.42
			Group-O	39.82	61.27	39.66-39.98		
			Group-M and	12.71	48.20	11.46-13.96	< 0.05	0.21
			Group-N	37.95	118.95	37.62-38.28		
			Group-N and	37.95	118.95	37.62-38.28	< 0.05	0.01
			Group-O	38.37	60.62	38.20-38.53		
			Group-O and	38.37	60.62	38.20-38.53	< 0.05	0.43
			Group-Y	12.63	23.46	12.60-12.66		
			Group-N and	37.95	118.95	37.62-38.28	< 0.05	0.21
			Group-Y	12.63	23.46	12.60-12.66		
			Group-M and	12.71	48.20	11.46-13.96	_ &	0.00
			Group-Y	12.63	23.46	12.60-12.66		
			Group-M and	12.71	48.20	11.46-13.96	< 0.05	0.42
			Group-O	38.37	60.62	38.20-38.53		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Tables 3.36 to 3.41 will contain a summary of the most practical significant differences between the average cost per medicine item according to the different generic indicators from Tables 3.33 to 3.35 and *Appendix F*.

Table 3.36: Most practical significant differences between the average cost per medicine item according to generic indicator for all CDL conditions from 2008 until 2012.

CDL condition	Cost	Year	Generic indicator comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	d-value
All CDL conditions	Total medicine cost	2008	Group-O and	131.06	103.03	131.31-131.96	0.43
			Group-Y	86.62	65.43	86.53-86.73	
		2009	Group-M and	665.85	327.76	650.47-681.23	1.75
			Group-Y	89.87	74.11	89.77-89.98	
		2010	Group-M and	644.40	321.68	632.97-655.83	1.71
			Group-Y	93.12	77.08	93.01-93.23	
		2011	Group-M and	501.69	226.02	494.12-509.27	1.80
			Group-Y	94.25	80.49	94.14-94.36	
		2012	Group-M and	522.73	222.79	516.96-528.50	1.92
			Group-Y	95.10	78.06	95.00-95.21	
	Medical scheme contribution	2008	Group-N and	204.30	478.90	203.11-205.50	0.27
			Group-Y	74.69	59.66	74.60-74.79	
		2009	Group-M and	631.22	314.99	616.44-646.00	1.76
			Group-Y	76.96	67.01	76.86-77.05	
		2010	Group-M and	619.05	312.24	607.95-630.15	1.73
			Group-Y	79.89	69.42	79.80-79.99	
		2011	Group-M and	497.36	222.01	489.92-504.80	1.88
			Group-Y	80.24	68.81	80.15-80.33	
		2012	Group-M and	510.01	220.76	504.30-515.73	1.94
			Group-Y	82.47	71.29	82.37-82.57	
	Patient levy	2008	Group-O and	35.70	48.21	35.55-35.85	0.49
			Group-Y	11.93	22.54	11.90-11.97	
		2009	Group-O and	39.34	58.82	39.18-39.49	0.45
			Group-Y	12.91	25.93	12.88-12.95	
		2010	Group-O and	44.03	64.79	43.86-44.20	0.48
			Group-Y	13.22	26.21	13.19-13.26	
		2011	Group-O and	39.82	61.27	39.66-39.98	0.44
			Group-Y	12.75	22.79	12.72-12.78	
		2012	Group-O and	38.37	60.62	38.20-38.53	0.43
			Group-Y	12.63	23.46	12.60-12.66	

Table 3.37: Most practical significant differences between the average cost per medicine item according to generic indicator for asthma from 2008 until 2012.

CDL condition	Cost	Year	Generic indicator comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	d-value
Asthma	Total medicine cost	2008	Group-N and	267.18	117.39	266.41-267.95	1.74
			Group-Y	63.10	60.09	62.65-63.55	
		2009	Group-N and	299.32	131.53	298.68-299.96	1.82
			Group-Y	60.24	68.71	59.81-60.67	
		2010	Group-N and	309.17	133.52	308.49-309.86	1.78
			Group-Y	71.04	91.66	70.46-71.62	
		2011	Group-N and	272.32	146.49	271.44-273.20	0.92
			Group-Y	137.37	122.99	136.72-138.02	
		2012	Group-N and	264.90	151.54	263.83-265.97	0.69
			Group-Y	161.04	129.61	160.37-161.72	
	Medical scheme contribution	2008	Group-N and	230.39	113.74	229.65-231.14	1.56
			Group-Y	53.06	50.21	52.68-53.43	
		2009	Group-N and	249.67	127.72	249.04-250.29	1.57
			Group-Y	49.13	56.89	48.77-49.49	
		2010	Group-N and	260.56	133.05	259.89-261.24	1.52
			Group-Y	57.87	72.50	57.41-58.33	
		2011	Group-N and	239.40	136.52	238.58-240.22	0.85
			Group-Y	122.71	112.38	122.12-123.31	
		2012	Group-N and	235.16	140.63	234.17-236.15	0.64
			Group-Y	144.57	119.72	143.95-145.20	
	Patient levy	2008	Group-O and	39.71	63.12	38.54-40.87	0.47
			Group-Y	10.04	30.01	9.82-10.26	
		2009	Group-N and	49.65	81.53	49.25-50.05	0.47
			Group-Y	11.11	34.96	10.89-11.33	
		2010	Group-O and	70.98	95.77	69.72-72.24	0.60
			Group-Y	13.17	49.46	12.86-13.48	
		2011	Group-O and	55.22	71.68	54.55-55.89	0.57
			Group-Y	14.65	32.01	14.48-14.82	
		2012	Group-O and	69.10	77.57	68.27-69.94	0.68
			Group-Y	16.47	35.94	16.28-16.66	

Table 3.38: Most practical significant differences between the average cost per medicine item according to generic indicator for diabetes mellitus type 2 from 2008 until 2012.

CDL condition	Cost	Year	Generic indicator comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	d-value
Diabetes mellitus type 2	Total medicine cost	2008	Group-N and	425.35	291.21	423.51-427.19	1.26
			Group-O	58.31	45.69	58.06-58.58	
		2008	Group-N and	425.35	291.21	423.51-427.19	1.26
			Group-Y	59.46	42.24	59.27-59.65	
		2009	Group-M and	671.36	322.45	659.78-682.96	1.90
			Group-Y	59.28	45.81	59.10-59.47	
		2010	Group-M and	657.54	348.48	649.25-665.84	1.72
			Group-Y	59.55	47.85	59.37-59.74	
		2011	Group-M and	510.98	226.70	504.30-517.67	1.99
			Group-Y	58.88	45.71	58.71-59.05	
		2012	Group-M and	536.39	238.69	531.45-541.32	1.99
			Group-Y	59.16	44.95	59.00-59.33	
	Medical scheme contribution	2008	Group-N and	399.87	293.51	398.02-401.72	1.20
			Group-O	48.79	35.33	48.59-48.99	
		2009	Group-M and	645.93	317.99	634.50-657.36	1.87
			Group-O	51.57	33.53	51.41-51.74	
		2010	Group-M and	635.95	338.23	627.89-644.00	1.72
			Group-Y	53.98	41.21	53.82-54.14	
		2010	Group-M and	635.95	338.23	627.89-644.00	1.72
			Group-O	54.20	35.91	54.03-54.36	
		2011	Group-M and	499.13	225.52	492.48-505.78	1.98
			Group-Y	53.18	37.38	53.04-53.32	
		2011	Group-M and	499.13	225.52	492.48-505.78	1.98
			Group-O	54.48	32.84	54.33-54.64	
		2012	Group-M and	524.98	237.44	520.07-529.89	1.99
			Group-Y	53.25	36.79	53.12-53.39	
	Patient levy	2008	Group-N and	25.47	59.32	25.10-25.85	0.33
			Group-Y	6.10	17.59	6.02-6.18	
		2009	Group-N and	29.86	67.44	29.50-30.21	0.36
			Group-Y	5.68	19.84	5.60-5.76	
		2010	Group-N and	33.95	74.36	33.55-34.35	0.38
			Group-Y	5.57	18.14	5.50-5.64	
		2011	Group-O and	14.12	21.11	14.02-14.22	0.40
			Group-Y	5.70	17.07	5.63-5.76	
		2012	Group-O and	14.86	21.60	14.75-14.97	0.41
			Group-Y	5.91	17.55	5.84-5.97	

Table 3.39: Most practical significant differences between the average cost per medicine item according to generic indicator for hyperlipidaemia from 2008 until 2012.

CDL condition	Cost	Year	Generic indicator comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	d-value
Hyperlipidaemia	Total medicine cost	2008	Group-N and	229.75	76.45	229.30-230.20	1.31
			Group-Y	128.89	35.74	128.79-129.01	
		2009	Group-O and	374.33	99.34	367.91-380.77	1.98
			Group-Y	177.62	57.40	176.87-178.38	
		2010	Group-O and	408.91	123.04	400.61-417.21	1.77
			Group-Y	191.62	53.83	190.86-192.38	
		2011	Group-N and	237.57	92.70	237.13-238.02	1.77
			Group-Y	73.10	48.51	72.97-73.23	
		2012	Group-N and	238.72	98.51	238.22-239.19	1.68
			Group-Y	72.86	48.02	72.74-73.00	
	Medical scheme contribution	2008	Group-N and	187.92	78.49	187.46-188.38	0.91
			Group-Y	116.84	35.25	116.73-116.94	
		2009	Group-N and	279.12	132.83	277.11-281.13	0.83
			Group-Y	168.92	58.29	168.15-169.68	
		2010	Group-N and	280.07	129.31	278.13-282.01	0.75
			Group-Y	183.46	56.21	182.68-184.25	
		2011	Group-N and	190.95	88.17	190.53-191.38	1.44
			Group-Y	63.64	42.76	63.53-63.75	
		2012	Group-N and	190.46	93.09	190.02-190.90	1.37
			Group-Y	62.58	41.77	62.47-62.70	
	Patient levy	2008	Group-O and	49.37	49.33	48.99-49.75	0.76
			Group-Y	12.06	21.42	11.99-12.12	
		2009	Group-O and	128.19	105.87	121.34-135.05	1.13
			Group-Y	8.70	24.22	8.38-9.02	
		2010	Group-O and	125.46	109.77	118.06-132.86	1.06
			Group-Y	8.15	23.54	7.82-8.48	
		2011	Group-O and	72.20	76.61	71.44-72.96	0.82
			Group-Y	9.46	19.07	9.41-9.51	
		2012	Group-N and	48.26	53.39	48.00-48.51	0.71
			Group-Y	10.28	19.93	10.23-10.33	

Table 3.40: Most practical significant differences between the average cost per medicine item according to generic indicator for hypertension from 2008 until 2012.

CDL condition	Cost	Year	Generic indicator comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	d-value
Hypertension	Total medicine cost	2008	Group-N and	173.02	74.04	172.78-173.27	1.26
			Group-Y	79.18	52.11	79.09-79.28	
		2009	Group-N and	177.44	78.69	177.20-177.68	1.15
			Group-Y	87.14	55.54	87.06-87.23	
		2010	Group-N and	179.12	83.74	178.85-179.40	1.06
			Group-Y	90.77	57.28	90.68-90.86	
		2011	Group-N and	182.49	93.15	182.12-182.87	0.99
			Group-Y	90.05	56.22	89.96-90.14	
		2012	Group-N and	192.70	96.02	192.28-193.13	1.06
			Group-Y	91.22	55.29	91.13-91.31	
	Medical scheme contribution	2008	Group-N and	135.83	70.18	135.60-136.06	0.98
			Group-Y	67.14	44.87	67.06-67.23	
		2009	Group-N and	139.44	74.87	139.21-139.66	0.87
			Group-Y	74.01	47.99	73.94-74.09	
		2010	Group-N and	141.71	77.93	141.45-141.96	0.83
			Group-Y	77.33	49.54	77.25-77.40	
		2011	Group-N and	145.23	84.56	144.89-145.56	0.81
			Group-Y	76.72	48.20	76.64-76.79	
		2012	Group-N and	150.60	88.30	150.21-150.99	0.82
			Group-Y	78.14	47.91	78.06-78.21	
	Patient levy	2008	Group-O and	46.60	43.22	46.40-46.80	0.80
			Group-Y	12.04	20.96	12.00-12.08	
		2009	Group-O and	55.78	55.49	55.57-55.99	0.77
			Group-Y	13.13	23.25	13.09-13.17	
		2010	Group-O and	62.36	59.23	62.14-62.58	0.83
			Group-Y	13.44	23.76	13.40-13.48	
		2011	Group-O and	50.33	53.99	50.13-50.52	0.68
			Group-Y	13.33	21.81	13.30-13.36	
		2012	Group-O and	49.53	55.18	49.31-49.75	0.66
			Group-Y	13.08	22.31	13.04-13.12	

Table 3.41: Most practical significant differences between the average cost per medicine item according to generic indicator for hypothyroidism from 2008 until 2012.

CDL condition	Cost	Year	Generic indicator comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	d-value
Hypothyroidism	Total medicine cost	2008	None	–	–	–	None
				–	–	–	
		2009	Group-N and	42.83	20.74	42.59-43.07	0.28
			Group-Y	57.12	51.54	24.90-139.13	
		2010	Group-O and	43.99	17.43	43.80-44.18	0.25
			Group-Y	38.92	20.07	37.06-40.80	
		2011	Group-N and	36.16	24.71	35.16-37.17	0.29
			Group-O	43.33	17.71	43.14-43.53	
		2012	Group-O and	43.66	18.63	43.46-43.86	0.59
			Group-Y	32.61	13.61	31.87-33.35	
	Medical scheme contribution	2008	None	–	–	–	None
				–	–	–	
		2009	Group-N and	39.26	19.86	39.02-39.49	0.35
			Group-Y	57.12	51.54	24.90-139.13	
		2010	Group-O and	41.20	17.41	41.01-41.39	0.22
			Group-Y	36.77	20.60	34.85-38.69	
		2011	Group-N and	33.49	21.17	32.63-34.35	0.37
			Group-O	41.31	17.53	41.11-41.50	
		2012	Group-O and	42.03	18.37	41.83-42.22	0.56
			Group-Y	31.66	13.56	30.92-32.40	
	Patient levy	2008	None	–	–	–	None
				–	–	–	
		2009	Group-N and	3.57	6.23	3.50-3.64	0.03
			Group-O	3.75	6.73	3.60-3.91	
		2010	Group-O and	2.79	6.34	2.72-2.85	0.10
			Group-Y	2.16	6.29	1.57-2.74	
		2010	Group-N and	9.21	71.08	6.08-12.34	0.10
			Group-Y	2.16	6.29	1.57-2.74	
		2011	Group-N and	2.67	6.12	2.42-2.92	0.15
			Group-Y	1.76	3.58	1.57-1.96	
		2012	Group-O and	1.63	3.44	1.59-1.66	0.20
			Group-Y	0.94	2.44	0.81-1.08	

Tables 3.36 to 3.41 show that the group with the largest practical significant difference in average cost per item was for generic medicine (group-Y), when compared to all the other generic indicator groups. The CDL condition with the largest overall average practical significant difference was diabetes mellitus type 2 for both total average cost and medical scheme contribution claimed. The CDL condition with the largest practical significance difference in average cost per item for patient levy claimed was for hyperlipidaemia. Furthermore, this concludes that with regard to patient levy claimed for all CDL conditions and the top 5 conditions separately, the difference between original medicine items (even when a generic was available) and generic item claimed shows the potential

cost savings by choosing and claiming a generic medicine over the original medicine where applicable.

3.4.5 Average cost per prescription per patient according to different cost structures.

In this section the cost per prescription for the top 5 CDL conditions will be analysed as determined in section 3.2.2, Table 3.7. This cost structure analysed will be divided into the SEP, dispensing fee and value-added tax (VAT) as summarised in Table 3.42 and *Appendix G*. This division will then be used to determine the change in each of the factors over the study period, as well as the influence of the change in SEP on the medicine cost. Although VAT is included as a component of the medicine cost in this section, it will not be discussed as it will contribute 14.00% of the total medicine cost (refer to Chapter 2, section 2.5.1.6.1).

Table 3.42: Cost per prescription for all CDL conditions according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost/prescription (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
All CDL conditions	2008	179 038	Single exit price (SEP)	17.21	54.33	16.96-17.46	3 081 718.73
			Dispensing fee	42.85	46.17	42.64-43.01	7 672 188.78
			Value-added-tax (VAT)	6.98	7.52	6.94-7.01	1 248 960.96
	2009	216 546	Single exit price (SEP)	22.27	85.94	21.91-22.63	4 822 953.96
			Dispensing fee	44.66	57.79	44.41-44.90	9 670 276.55
			Value-added-tax (VAT)	7.27	9.41	7.23-7.31	1 574 231.07
	2010	212 719	Single exit price (SEP)	24.30	97.57	23.89-24.72	5 169 232.08
			Dispensing fee	45.15	63.16	44.88-45.42	9 604 010.14
			Value-added-tax (VAT)	7.35	10.28	7.31-7.39	1 563 443.51
	2011	215 225	Single exit price (SEP)	25.24	100.38	24.81-25.66	5 446 616.63
			Dispensing fee	40.73	82.33	40.38-41.07	8 765 171.45
			Value-added-tax (VAT)	6.63	13.40	6.57-6.69	1 426 888.38
	2012	209 147	Single exit price (SEP)	24.91	101.75	24.47-25.35	5 209 889.19
			Dispensing fee	42.38	64.11	42.10-42.65	8 862 706.94
			Value-added-tax (VAT)	6.90	10.44	6.85-6.94	1 442 766.25

The average SEP per prescription containing at least one CDL condition as summarised in Table 3.42, increased from R17.21 ± R54.33 (95%CI:R16.96-R17.46) (2008) to R24.91 ± R101.75 (95%CI:R24.47-R25.35) (2012) with a constant increase from 2008 to 2011. In contrast the dispensing fee per prescription stayed relatively constant between R42.85 ± R46.17 (95%CI:R42.64-R43.01) (2008) to R42.38 ± R64.11 (95%CI:R42.10-R42.65) (2012). The average dispensing fee per prescription for all CDL conditions was consistently higher than the SEP during each study year.

There was a statically significant difference in average SEP per prescription between all study years, except between 2010 and 2012 as well as 2011 and 2012, with no practical significant difference between any of the study years. A statistically significant difference in average dispensing fee was observed between all study years ($p < 0.05$), except between 2009 and 2010 as well between 2008 and 2012, with no large practical significant difference ($d < 0.8$). The higher dispensing fee contributed 63.92% (R7 672 188.78) (2008), 60.19% (R9 670 276.55) (2009), 58.79% (R9 604 010.14) (2010), 56.04% (R8 765 171.45) (2011) and 57.12% (R8 862 706.94) during 2012 to the total prescription cost for each study year. The importance of comparing the SEP and dispensing fee was to determine how both of these cost structures influence the total medicine cost claimed by the medical scheme. The World Health Organization and Health Action International (2011:47) add by stating regulation of mark-ups without regulation of retail selling price or manufacturer selling price (such as the SEP) may unlikely result in reduced medicine prices (refer to Chapter 2, section 2.5.1.6.1). The introduction of a SEP has possible unintended consequences. This may result in reduced access to medicine due to possible higher dispensing fees to compensate for lower SEP's and therefore compromising South Africa's healthcare system and access to medicine (Free Market Foundation, 2006) (refer to Chapter 2, section 2.5.1.6.1).

Hypertension

Prescriptions containing medicine for hypertension had an overall increase in average SEP from R5.94 ± R18.06 (95%CI:R5.84-R6.05) (2008) to R8.98 ± R55.12 (95%CI:R8.69-R9.26) (2012). The dispensing fee also had an overall increase from R40.85 ± R30.60 (95%CI:R40.68-R41.02) (2008) to R41.07 ± R37.48 (95%CI:R40.87-R41.26) (2012), and the average dispensing fee per prescription was consistently higher than the average SEP for hypertension.

Hypothyroidism

Prescriptions for patients with hypothyroidism had an overall reduction in average SEP per prescription as well as the average dispensing fee per prescription from 2008 to 2012 with R12.64 ± R38.81 (95%CI:R10.67-R14.62) to R6.29 ± R40.49 (95%CI:R5.05-R7.54) and R56.01 ± R41.97 (95%CI:R53.87-R58.15) to R27.43 ± R30.03 (95%CI:R26.51-R28.36) respectively. The dispensing fee per prescription for hypothyroidism however, was consistently higher than the SEP.

Asthma

Patient prescriptions containing medicine for asthma had an overall increase in average SEP from R85.43 ± R103.86 (95%CI:R83.99-R86.87) (2008) to R111.93 ± R130.54 (95%CI:R110.24-R113.61) (2012). The average dispensing fee also had an overall increase from R42.76 ± R31.84 (95%CI:R42.32-R43.20) (2008) to R43.30 ± R54.40 (95%CI:R42.60-R44.00) (2012).

Hyperlipidaemia

Prescriptions with medicine for the treatment of hyperlipidaemia had an overall increase in average SEP from R7.29 ± R18.20 (95%CI:R7.14-R7.43) (2008) to R10.49 ± R48.86 (95%CI:R10.14-R10.83) (2012), in contrast the average dispensing fee per prescription which was higher throughout the study period than the SEP, decreased from R47.85 ± R35.15 (95%CI:R47.57-R48.12) (2008) to R43.24 ± R42.32 (95%CI:R42.94-R43.54) (2012).

Diabetes mellitus type 2

Appendix G summarises that prescriptions containing medicine for diabetes mellitus type 2 had an overall increase in average SEP per prescription from R14.29 ± R32.55 (95%CI:R13.92-R14.66) (2008) to R19.02 ± R46.35 (95%CI:R18.56-R19.49) (2012). The average dispensing fee per prescription also increased overall from R49.54 ± R38.94 (95%CI:R49.10-R49.98) (2008) to R51.11 ± R47.48 (95%CI:R50.64-R51.58) (2012).

It can be concluded that during the entire study period that the average SEP per prescription increased and the average dispensing fee per prescription decreased for all CDL conditions. The top 5 CDL conditions also had an overall increase in the average SEP per prescription, except for hypothyroidism. However, there was an overall increase in the average dispensing fee per prescription for the top 5 conditions, except for hypothyroidism and hyperlipidaemia. Prescriptions containing medicine for asthma had the highest average SEP per prescription of the top 5 CDL conditions during:

- 2008 with R85.43 ± R103.86 (95%CI:R83.99-R86.87);

- 2009 with R100.89 ± R114.63 (95%CI:R99.49-R102.29);
- 2010 with R107.34 ± R124.50 (95%CI:R105.81-R108.87);
- 2011 with R115.75 ± R120.49 (95%CI:R114.26-R117.23); and
- 2012 with R111.93 ± R130.54 (95%CI:R110.24-R113.61).

In addition, hypothyroidism had the highest average dispensing fee per prescription during 2008 with R56.01 ± R41.97 (95%CI:R53.87-R58.15) and diabetes mellitus type 2 had the highest average dispensing fee per prescription for 2009 with R51.10 ± R48.30 (95%CI:R50.63-R51.57), 2010 with R52.01 ± R48.52 (95%CI:R51.54-R52.48), 2011 with R50.54 ± R103.47 (95%CI:R49.51-R51.57) and 2012 with R51.11 ± R47.48 (95%CI:R50.64-R51.58). The average dispensing fee per prescription was higher than the SEP throughout the study period for hypertension, diabetes mellitus type 2, hyperlipidaemia and hypothyroidism. These CDL conditions contributed 90.56% (R50 105 310.12) of the total dispensing fee for the top 5 conditions (R70 337 352.94).

Asthma, was the only CDL condition in the top 5 with a higher average SEP per prescription than dispensing fee for the entire study period and contributed 49.11% (R12 523 719.01) of the total SEP of the top 5 CDL conditions (R25 501 873.73). This may be attributed to the higher SEP per medicine item than dispensing fee for asthma throughout the study period (refer to *Appendix H* and section 3.4.6).

3.4.6 Average medicine cost per item per patient according to different cost structures.

In this section the cost per medicine item for patients with the top 5 CDL conditions (as determined in section 3.2.2, Table 3.7) will be analysed. This cost structure analysed will also be divided into the SEP, dispensing fee and VAT as summarised in Table 3.43, *Appendix H* and illustrated in Figures 3.8 and 3.9. This division will then be used to determine the change in each of the factors over the study period as well as the influence of the change in SEP on the medicine cost. In this section, VAT will not be discussed for the same reason as in noted in section 3.4.5.

Table 3.43: Medicine cost per item for all CDL conditions according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost /item (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
All CDL conditions	2008	179 038	Single exit price (SEP)	12.98	43.67	12.78-13.18	2 324 084.73
			Dispensing fee	30.00	32.90	29.85-30.15	5 371 550.48
			Value-added-tax (VAT)	4.88	5.36	4.86-4.91	874 438.45
	2009	216 546	Single exit price (SEP)	16.18	74.20	15.87-16.49	3 502 841.37
			Dispensing fee	29.93	42.72	29.75-30.11	6 478 788.10
			Value-added-tax (VAT)	4.87	6.95	4.84-4.90	1 054 686.43
	2010	212 719	Single exit price (SEP)	17.57	77.55	17.24-17.90	3 737 183.57
			Dispensing fee	30.38	48.14	30.17-30.58	6 461 963.76
			Value-added-tax (VAT)	4.95	7.84	4.91-4.98	1 051 947.59
	2011	215 225	Single exit price (SEP)	17.78	78.73	17.45-18.11	3 837 324.62
			Dispensing fee	27.20	53.69	26.97-27.43	5 853 975.00
			Value-added-tax (VAT)	4.43	8.74	4.39-4.46	952 972.68
	2012	209 147	Single exit price (SEP)	17.66	85.75	17.29-18.02	3 692 776.99
			Dispensing fee	28.14	50.21	27.93-28.36	5 885 575.78
			Value-added-tax (VAT)	4.58	8.17	4.55-4.62	958 116.99

Table 3.43, concludes that the SEP per item increased from R12.98 ± R43.67 (95%CI:R12.78-R13.18) (2008) to R17.57 ± R77.55 (95%CI:R17.24-R17.90) (2010) for all CDL conditions. Thereafter, the SEP remained relatively constant from 2010 to 2012 with R17.66 ± R85.75 (95%CI:R17.29-R18.02). This revealed that the changed in SEP between 2010 and 2012 did not affected the SEP for all CDL conditions. The average dispensing fee for all CDL conditions was also consistently higher than the SEP for all CDL conditions throughout the study period. This higher dispensing fee resulted a contribution to the total cost of 62.68% (R5 371 550.48) (2008), 58.70% (R6 478 788.10) (2009), 57.43% (R6 461 963.76) (2010), 55.00% (R5 853 975.00) (2011) and 55.86% (R5 885 575.78) for 2012 for each study year respectively.

It can be concluded from *Appendix H* that there was an increase in the average SEP per medicine item for a patient with hypertension from R3.72 ± R10.51 (95%CI:R3.66-R3.78) (2008) to R5.47 ± R45.82 (95%CI:R5.23-R5.71) (2012). The dispensing fee claimed however stayed relatively constant for the entire study period from R27.34 ± R15.60 (95%CI:R27.25-R27.43) (2008) to R26.35 ± R22.79 (95%CI:R26.24-R26.48) (2012). This fee contributed a large percentage to the total medicine cost for each study year, comprising of between 73% and 77% of the total medicine cost.

Hypothyroidism

For hypothyroidism it was concluded that the SEP had the largest decrease in average cost per patient between from R7.99 ± R27.15 (95%CI:R6.61-R9.38) (2008) to R2.71 ± R25.77 (95%CI:1.90-R3.53) (2009), although the number of patients more than doubled. The average cost of the SEP thereafter had an overall increase to R3.42 ± R21.11 (95%CI:R2.77-R4.07) (2012). The dispensing fee had a decreased from R32.90 ± R21.44 (95%CI:R31.81-R34.00) (2008) to R16.47 ± R12.95 (95%CI:R16.08-R16.88) (2012) and had a share of between 72.00% and 76.00% of the total medicine cost for the entire study period.

Asthma

Asthma had an overall increase average SEP cost from R68.06 ± R86.35 (95%CI:R66.86-R69.26) (2008) to R80.35 ± R108.15 (95%CI:R78.95-R81.75) (2012) with the largest increase between 2008 and 2009. The average SEP cost was also higher than the dispensing fee which had a slight decrease from R31.09 ± R21.49 (95%CI:R30.80-R31.39) to R28.64 ± R39.01 (95%CI:R28.14-R29.15) (2012). The SEP contributed between 66.00% and 73.00% of the total medicine cost for each study year. Asthma, with a high SEP may be attributed to the possible higher cost of asthma medicine such as inhalers.

Hyperlipidaemia

The data for hyperlipidaemia from *Appendix H* conclude that there was an overall increase in SEP from R4.58 ± R10.46 (95%CI:R4.51-R4.67) (2008) to R6.09 ± R37.30 (95%CI:R5.83-R6.35) (2012) with the highest in 2010 with R9.44 ± R45.16 (95%CI:R9.10-R9.80). There was an overall decrease in dispensing fee from R32.42 ± R16.11 (95%CI:R32.30-R32.55) (2008) to R26.50 ± R22.61 (95%CI:R26.34-R26.66) (2012) and contributing between 68.00% and 77.00% of the total medicine cost for each year.

Diabetes mellitus type 2

Diabetes mellitus type 2 had on overall increase from R8.17 ± R19.13 (95%CI:R7.96-R8.39) (2008) to R10.01 ± R27.02 (95%CI:R9.74-R10.28) (2012) with a constant increase between 2008 and 2010. The dispensing fee had a slight overall decrease from R28.18 ± R17.83 (95%CI:R27.98-R28.39) (2008) to R27.00 ± R20.10 (95%CI:R26.80-R27.20) (2012) and contributed between 65.00% and 69.00% of the total medicine cost.

It can be concluded that all CDL conditions had an overall increase in SEP between 2008 and 2012, and a decrease in dispensing fee. In addition, all of the top 5 CDL conditions had an overall increase in average SEP, except for hypothyroidism. All of the top 5 conditions had an overall decrease in dispensing fee per item. Four of the top 5 conditions (hypothyroidism, diabetes mellitus type 2, hypertension and hyperlipidaemia) had an overall higher average dispensing fee than SEP, that totalled of R35 229 151.13 (90.81%) of the total dispensing fee cost of R38 793 800.66 for the top 5 CDL conditions for the entire study period.

Asthma had a consistently higher average SEP than dispensing fee from 2008 until 2012, with a total medicine cost of R9 266 898.08 (54.37%) of the total SEP cost for the top 5 CDL conditions of R17 045 574.59. Asthma had the highest total SEP claimed for the entire study period with R9 266 898.08 and hypertension had the highest total dispensing fee claimed of R19 699 955.15. Hypothyroidism had the lowest total SEP and dispensing fee for the entire study period with R59 533.63 and R292 708.78 respectively.

Thus, of the top 5 CDL conditions it can be concluded that overall the average SEP and dispensing fee did not show a large increase or decrease throughout the study period, but did increase overall even with a change in pricing regulations (refer to Chapter 2, section 2.5.1.6.1). This resulted in no difference of any large practical significance for any condition that could have resulted in possible significant cost savings from the change in SEP.

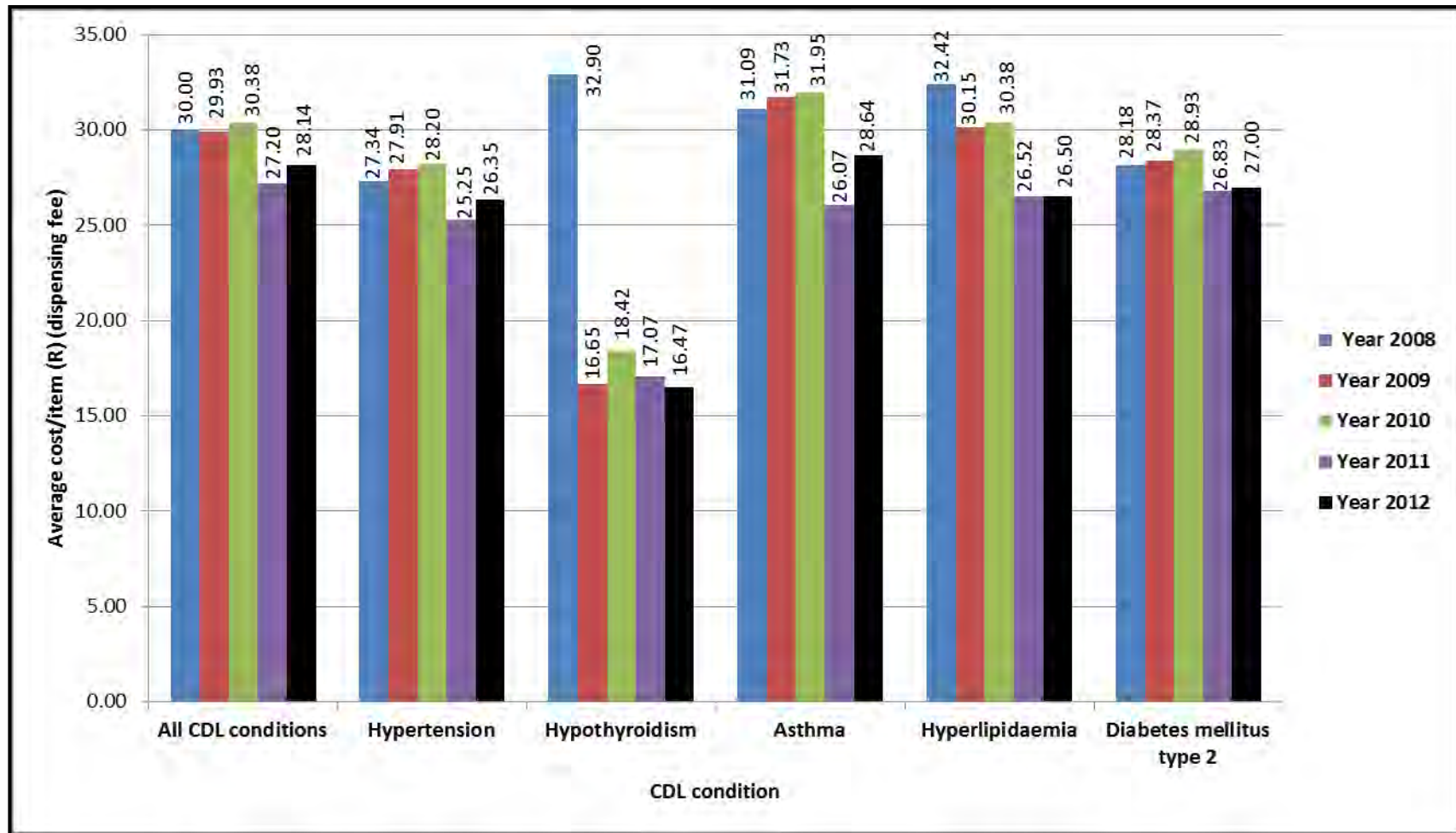


Figure 3.8: Average dispensing fee per medicine item of all CDL and the top 5 CDL conditions from 2008 until 2012.

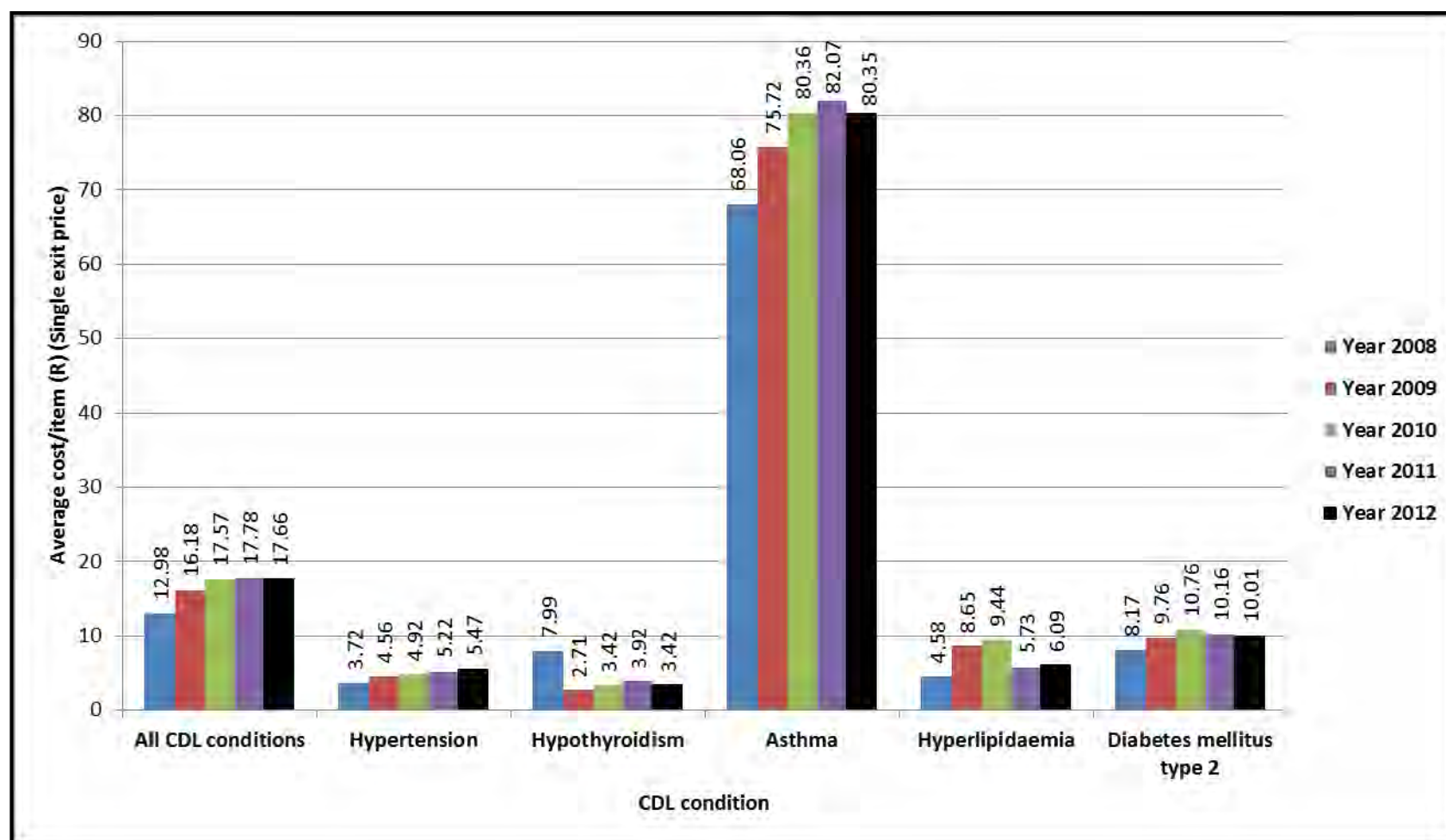


Figure 3.9: Average SEP per medicine item of all CDL and the top 5 CDL conditions from 2008 until 2012.

3.4.7 Potential cost savings per medicine item from changes in SEP

The changes in the average cost for the total number of medicine items as well as generic indicator medicine items according to time of SEP amendments for the entire study period are summarised in Table 3.44 below (also refer to Chapter 2, section 2.5.1.6.1). The percentage change (↓) indicated a reduction in average cost per medicine item and might have resulted in possible cost saving potential. A percentage change indicated by (↑) indicated an increase in the average cost per medicine item, and thus not resulting in possible cost savings at the time of SEP amendments during the study period.

The mean, standard deviation and confidence interval in Table 3.44 were derived from Tables 3.19 to 3.21 and 3.30 as well as *Appendix D* and *Appendix E*.

Table 3.44: Potential cost savings at time of change in the SEP between 2010 and 2012.

Year	Type of CDL condition	Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Average cost change (%) (2010-2011) [#]	Average cost change (%) (2011-2012) ^{&}
2010	All CDL conditions	Total medicine cost	146.96	426.59	146.50-147.43	↓ 2.62	↑ 0.24
2011			143.11	408.81	142.67-143.56		
2012			143.46	483.84	142.93-144.01		
2010	Hypertension	Total medicine cost	116.66	77.91	116.56-116.77	↓ 5.08	↓ 0.92
2011			110.74	74.41	110.65-110.85		
2012			109.72	73.18	109.62-109.83		
2010	Asthma	Total medicine cost	215.34	167.09	214.71-215.81	↓ 4.77	↓ 0.52
2011			205.08	150.68	204.54-205.64		
2012			204.01	148.27	203.44-204.60		
2010	Hyperlipidaemia	Total medicine cost	271.80	119.34	270.59-273.01	↓ 57.72	↑ 0.92
2011			114.93	94.75	114.72-115.15		
2012			116.00	96.81	115.78-116.23		
2010	Diabetes mellitus type 2	Total medicine cost	170.81	225.88	170.15-171.47	↑ 2.32	0.00
2011			174.78	263.84	174.09-175.47		
2012			174.78	263.32	174.08-175.48		
2010	Hypothyroidism	Total medicine cost	44.40	31.87	44.06-44.73	↓ 3.83	↑ 0.63
2011			42.70	18.35	42.51-42.89		
2012			42.97	22.61	42.74-43.19		

[#] Average cost change (2010-2011) = $\frac{\text{average cost/item (2010)} - \text{average cost/item (2011)}}{\text{average cost/item (2010)}} \times 100$

[&] Average cost change (2011-2012) = $\frac{\text{average cost/item (2011)} - \text{average cost/item (2012)}}{\text{average cost/item (2011)}} \times 100$

Year	Type of CDL condition	Type of cost	Generic indicator*	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Average cost change (%) (2010-2011) [#]	Average cost change (%) (2011-2012) ^{&}
2010	All CDL conditions	Total medicine cost	M	644.40	321.68	632.97-655.83	↓ 22.15	↑ 4.20
2011				501.69	226.02	494.12-509.27		
2012				522.73	222.79	516.96-528.50		
2010			N	302.54	893.77	300.14-304.68	↑ 5.10	↑ 9.58
2011				317.96	940.02	315.50-320.68		
2012				348.43	1 169.83	345.15-351.71		
2010			O	145.61	140.89	145.25-145.98	↑ 3.87	↓ 8.12
2011				151.24	148.57	150.86-151.63		
2012				138.96	137.14	138.59-139.35		
2010			Y	93.12	77.08	93.01-93.23	↑ 1.21	↑ 0.90
2011				94.25	80.49	94.14-94.36		
2012				95.10	78.06	95.00-95.21		
2010	Hypertension	Total medicine cost	M	0.00	0.00	0.00-0.00	-	-
2011				0.00	0.00	0.00-0.00		
2012				0.00	0.00	0.00-0.00		
2010			N	179.12	83.74	178.85-179.40	↑ 1.88	↑ 5.60
2011				182.49	93.15	182.12-182.87		
2012				192.70	96.02	192.28-193.13		
2010			O	180.61	86.95	180.29-180.93	↓ 10.15	↓ 3.16
2011				162.27	80.64	161.99-162.57		
2012				157.14	80.64	156.82-157.46		
2010			Y	90.77	57.28	90.68-90.86	↓ 0.79	↑ 1.30
2011				90.05	56.22	89.96-90.14		
2012				91.22	55.29	91.13-91.31		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

[#] Average cost change (2010-2011) = $\frac{\text{average cost/item (2010)} - \text{average cost/item (2011)}}{\text{average cost/item (2010)}} \times 100$

[&] Average cost change (2011-2012) = $\frac{\text{average cost/item (2011)} - \text{average cost/item (2012)}}{\text{average cost/item (2011)}} \times 100$

Year	Type of CDL condition	Type of cost	Generic indicator*	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Average cost change (%) (2010-2011) [#]	Average cost change (%) (2011-2012) ^{&}
2010	Asthma	Total medicine cost	M	0.00	0.00	0.00-0.00	–	–
2011				0.00	0.00	0.00-0.00		
2012				0.00	0.00	0.00-0.00		
2010			N	309.17	133.52	308.49-309.86	↓ 11.92	↓ 2.72
2011				272.32	146.49	271.44-273.20		
2012				264.90	151.54	263.83-265.97		
2010			O	218.89	175.50	216.59-221.20	↑ 15.94	↓ 3.66
2011				253.79	147.48	252.41-255.17		
2012				244.51	153.63	242.86-246.17		
2010			Y	71.04	91.66	70.46-71.62	↑ 93.37	↑ 17.23
2011				137.37	122.99	136.72-138.02		
2012				161.04	129.61	160.37-161.72		
2010	Hyperlipidamia	Total medicine cost	M	0.00	0.00	0.00-0.00	–	–
2011				0.00	0.00	0.00-0.00		
2012				0.00	0.00	0.00-0.00		
2010			N	356.71	108.06	355.09-358.34	↓ 33.40	↑ 0.48
2011				237.57	92.70	237.13-238.02		
2012				238.72	98.51	238.22-239.19		
2010			O	408.91	123.04	400.61-417.21	↓ 57.13	↓ 6.39
2011				175.32	103.87	174.29-176.35		
2012				164.11	99.97	163.06-165.17		
2010			Y	191.62	53.83	190.86-192.38	↓ 61.85	↓ 0.33
2011				73.10	48.51	72.97-73.23		
2012				72.86	48.02	72.74-73.00		

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

[#] Average cost change (2010-2011) = $\frac{\text{average cost/item (2010)} - \text{average cost/item (2011)}}{\text{average cost/item (2010)}} \times 100$

[&] Average cost change (2011-2012) = $\frac{\text{average cost/item (2011)} - \text{average cost/item (2012)}}{\text{average cost/item (2011)}} \times 100$

Year	Type of CDL condition	Type of cost	Generic indicator*	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Average cost change (%) (2010-2011) [#]	Average cost change (%) (2011-2012) ^{&}
2010	Diabetes mellitus type 2	Total medicine cost	M	657.54	348.48	649.25-665.84	↓ 22.29	↑ 4.97
2011				510.98	226.70	504.30-517.67		
2012				536.39	238.69	531.45-541.32		
2010			N	498.40	334.61	496.60-500.21	↑ 15.94	↓ 0.79
2011				577.86	327.99	576.00-579.73		
2012				573.27	331.33	571.34-575.21		
2010			O	67.82	46.22	67.61-68.04	↑ 1.16	↑ 0.12
2011				68.61	43.69	68.40-68.82		
2012				68.69	40.49	68.49-68.90		
2010			Y	59.55	47.85	59.37-59.74	↓ 1.13	↑ 0.41
2011				58.88	45.71	58.71-59.05		
2012				59.16	44.95	59.00-59.33		
2010	Hypothyroidism	Total medicine cost	M	0.00	0.00	0.00-0.00	-	-
2011				0.00	0.00	0.00-0.00		
2012				0.00	0.00	0.00-0.00		
2010			N	52.25	112.56	47.31-57.21	↓ 30.79	↑ 8.27
2011				36.16	24.71	35.16-37.17		
2012				39.15	52.08	37.17-41.14		
2010			O	43.99	17.43	43.80-44.18	↓ 1.50	↑ 0.76
2011				43.33	17.71	43.14-43.53		
2012				43.66	18.63	43.36-43.86		
2010			Y	38.92	20.07	37.06-40.80	↑ 0.18	↓ 16.36
2011				38.99	17.76	38.03-39.95		
2012				32.61	13.61	31.87-33.35		

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

[#] Average cost change (2010-2011) = $\frac{\text{average cost/item (2010)} - \text{average cost/item (2011)}}{\text{average cost/item (2010)}} \times 100$

[&] Average cost change (2011-2012) = $\frac{\text{average cost/item (2011)} - \text{average cost/item (2012)}}{\text{average cost/item (2011)}} \times 100$

The SEP was introduced in 2004 as stated in Chapter 2, section 2.5.1.6.1, where after changes and amendments took place and published in 2010 and 2012. All CDL conditions and the top 5 CDL conditions had decreases and increases between 2010 and 2012 as summarised above.

Table 3.44 shows that for all CDL conditions, the only generic indicators group-N and group-Y had increases of the average cost per item across both SEP changes. The other two groups had alternating increases and decreases for this period.

The overall changes for the different generic indicator groups are summarised below in Tables 3.45 to 3.48:

Table 3.45: Overall potential cost savings of all and the top 5 CDL conditions between 2010 and 2012.

Year	Type of CDL condition	Type of cost	Average cost change (%) (2010-2012) *
2010	All CDL conditions	Total medicine cost	↓ 2.38
2011			
2012			
2010	Hypertension	Total medicine cost	↓ 6.00
2011			
2012			
2010	Asthma	Total medicine cost	↓ 5.29
2011			
2012			
2010	Hyperlipidaemia	Total medicine cost	↓ 56.80
2011			
2012			
2010	Diabetes mellitus type 2	Total medicine cost	↑ 2.32
2011			
2012			
2010	Hypothyroidism	Total medicine cost	↓ 3.20
2011			
2012			

* Average cost change (2010-2012) = average cost change (2010-2011) +/- average cost change (2011-2012).

Table 3.46: Overall potential cost savings of all CDL conditions and hypertension according to generic indicator between 2010 and 2012.

Year	Type of CDL condition	Type of cost	Generic indicator*	Average cost change (%) (2010-2012) [#]
2010	All CDL conditions	Total medicine cost	M	↓ 17.95
2011				
2012				
2010			N	↑ 14.68
2011				
2012				
2010			O	↓ 4.25
2011				
2012				
2010			Y	↑ 2.11
2011				
2012				
2010	Hypertension	Total medicine cost	M	-
2011				
2012				
2010			N	↑ 7.48
2011				
2012				
2010			O	↓ 13.31
2011				
2012				
2010			Y	↑ 0.51
2011				
2012				

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

[#] Average cost change (2010-2012) = average cost change (2010-2011) +/- average cost change (2011-2012).

Table 3.47: Overall potential cost savings of asthma and hyperlipidaemia according to generic indicator between 2010 and 2012.

Year	Type of CDL condition	Type of cost	Generic indicator*	Average cost change (%) (2010-2012) [#]
2010	Asthma	Total medicine cost	M	–
2011				
2012				
2010			N	↓ 14.64
2011				
2012				
2010			O	↑ 12.28
2011				
2012				
2010			Y	↑ 110.60
2011				
2012				
2010	Hyperlipidamia	Total medicine cost	M	–
2011				
2012				
2010			N	↑ 32.92
2011				
2012				
2010			O	↑ 50.74
2011				
2012				
2010			Y	↓ 62.18
2011				
2012				

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

[#] Average cost change (2010-2012) = average cost change (2010-2011) +/- average cost change (2011-2012).

Table 3.48: Overall potential cost savings of diabetes mellitus type 2 and hypothyroidism according to generic indicator from 2010 and 2012.

Year	Type of CDL condition	Type of cost	Generic indicator*	Average cost change (%) (2010-2012) [#]
2010	Diabetes mellitus type 2	Total medicine cost	M	↓ 17.32
2011				
2012				
2010			N	↑ 15.15
2011				
2012				
2010			O	↑ 1.28
2011				
2012				
2010			Y	↓ 0.72
2011				
2012				
2010	Hypothyroidism	Total medicine cost	M	-
2011				
2012				
2010			N	↓ 22.52
2011				
2012				
2010			O	↓ 0.74
2011				
2012				
2010			Y	↓ 16.18
2011				
2012				

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

[#] Average cost change (2010-2012) = average cost change (2010-2011) +/- average cost change (2011-2012).

This section shows that although two changes in SEP occurred, there was a reduction in total average medicine item cost for all CDL conditions as well as for 4 of the top 5 CDL conditions. Changes in the average cost per medicine item due to the SEP at the time of SEP change can possibly be excluded from the reasons for changes in average cost per medicine item, as the average SEP cost per item stayed relatively constant between 2010 and 2012 (refer to Table 3.43). Another reason for the overall reduction in average cost per medicine item may be

attributed to generic substitution, with the increased utilisation and reduced average cost per medicine item (refer to Tables 3.30 to 3.32).

The overall increase in average cost per medicine item where generic medicine items were provided (group-Y) did not result in a reduction in number of medicine items claimed as more generic medicine items were claimed for the entire study period as for any of the other groups where original medicine items were provided (refer to Table 3.30). The average cost per item for generic medicine was still lower than any of the other generic indicator groups irrespective of the two changes in SEP.

3.4.8 Patient adherence of CDL medicine and associated medicine cost.

This section will include an analysis of patient medicine that was under-, adequately and over-supplied, and the incurred medicine item cost thereof for the entire study period. Data in Table 3.49 are combined for the top 5 CDL conditions as a total for the entire study period. By using MPR (refer to Chapter 1, section 1.10.2.5), patient adherence and the associated medicine cost for under-, adequate and over-supply of the top 5 CDL medicine items were determined. There may be a strong association between non-adherence and cost as stated by Rademan (2008:2) in Chapter 2, section 2.9.1 (also refer to Chapter 2, section and 2.9.5).

The medicine item cost in the under-supplied group in this section refers to the cost of the medicine items not yet paid for by either the medical scheme or the patient.

Table 3.49: Medicine supply type of the number of items for the top 5 CDL conditions.

Type of CDL condition	Supply type	Number of CDL medicine items (n) [#]	% [*]	Total CDL medicine item cost (R)	% [*]
Hypertension	< 80% (under-supply)	203 234	31.50	163 735 614.00	20.96
	≥ 80% ≤ 110% (adequate-supply)	373 759	57.93	617 532 906.00	79.04
	> 110% (over-supply)	68 146	10.56	15 142 955.05	1.94
Hypothyroidism	< 80% (under-supply)	5 696	53.23	5 437 687.21	67.60
	≥ 80% ≤ 110% (adequate-supply)	4 691	43.84	2 579 915.16	32.07
	> 110% (over-supply)	313	2.93	26 969.37	0.34
Hyperlipidaemia	< 80% (under-supply)	57 678	27.09	41 564 745.11	18.61
	≥ 80% ≤ 110% (adequate-supply)	131 677	61.84	176 172 818.00	78.86
	> 110% (over-supply)	23 569	11.07	5 666 457.51	2.54
Diabetes mellitus type 2	< 80% (under-supply)	68 775	39.19	323 340 442.00	65.74
	≥ 80% ≤ 110% (adequate-supply)	84 596	48.21	162 074 835.00	32.95
	> 110% (over-supply)	22 107	12.60	6 407 759.72	1.30
Asthma	< 80% (under-supply)	92 800	74.61	387 797 665.00	84.88
	≥ 80% ≤ 110% (adequate-supply)	24 191	19.45	65 840 601.53	14.41
	> 110% (over-supply)	7 386	5.94	3 217 117.23	0.70

[#] Inclusion criteria: At least 2 prescriptions containing medicine items for the appropriate CDL conditions had to be claimed between 2008 and 2012.

^{*} Percentages may not add up to 100% as a result of rounding to 2 decimals.

Medicine item supply as summarised in Table 3.49, shows that of the top 5 CDL conditions, only 3 CDL conditions had a higher percentage of items in the adequate-supply group than the percentage of medicine items in either the under-or over-supply groups. These 3 CDL conditions included hypertension, hyperlipidaemia and diabetes mellitus type 2. The CDL condition with the highest prevalence of medicine items (adequate supply) was for hyperlipidaemia 61.84% (n = 131 677) followed by hypertension 57.93% (n = 373 759). In addition, there was no practical significant association between the number of CDL medicine items and the supply groups (under, adequate and over-supply groups) (*Cramer's V* = 0.2211; *p* < 0.0001).

Hypertension was the CDL condition with the highest number of medicine items in the under-supplied group over the 5 years (n = 203 234) as well as over-supplied medicine items (n = 68 146) when compared to the other CDL conditions in the top 5. This under-supply may be attributed to the fact that hypertension had the most number of patients as well as the most number of medicine items claimed (refer to Tables 3.7 and 3.8 as well as *Appendix D*). Further reasons may include that hypertension presents with asymptomatic symptoms as stated by Sutters (2007:436), and that patients may miss medicine doses as required. In addition, hypertension was prevalent in most of the CDL combinations throughout the study period (refer to Table 3.15). The result of the increased number of patients thereof may have led to increased medicine cost, increased adverse effects and complexity of medicine regimen such as polypharmacy and frequent dosing as stated by Dezii (2000b:8) and Ockene *et al.* (2002:632) in Chapter 2, section 2.9.5. Therefore, the risk of poor adherence is higher among persons with three or more co-morbid conditions (Ockene *et al.*, 2002:632). Also, the majority of patients diagnosed with hypertension do not take their medicine as prescribed as stated by Cramer (1998:1563) in Chapter 2, section 2.9.5.1. Therefore, adherence to recommended medicine is a major contributor to adequate blood pressure control. (Bourgault *et al.*, 2005:608). Pittman *et al.* (2010:568) confirmed that reduced compliance may result in increased healthcare costs in determining the relationship between hospitalisations, emergency department visits, costs of care and adherence to antihypertensive medicine between 2007 and 2008. This study done in the United States included 625 620 patients diagnosed with hypertension. Adherence was determined by calculating MPR and ratio of total days medicine supplied to total days in a period (Pittman *et al.*, 2010:569). This study found and concluded that adherent patients with hypertension had lower total healthcare costs and decreased risk of cardiovascular-related hospitalisations and emergency department visits (Pittman *et al.*, 2010:571).

The CDL condition with lowest prevalence of adequately-supplied medicine items was for asthma with 19.45% (n = 24 191). Asthma was also the CDL condition with the highest prevalence of medicine items in the under-supplied group with 74.61%. The second highest number of medicine

items in the under-supplied group was also for asthma with 92 800, 12.56 times more when compared to over-supplied medicine items with 7 386. The high number of patients receiving an under-supply of asthma medicine items might be attributed to improper inhaler technique used in chronic respiratory ailments such as COPD and asthma (refer to Chapter 2, section 2.9.5). This may lead to increased health care utilisation subsequent to failed therapy, such as an increase in the number of hospitalisations and length of stay in hospital among patients with chronic respiratory ailments as confirmed by Kreling, (2000) and George *et al.* (2005:3199) in Chapter 1, section 1.2 and Chapter 2, section 2.9.5.1. Therefore, proper inhaler technique is essential for adequate adherence, and less than optimal technique can decrease medicine delivery and thus reduce efficacy (Rifaat *et al.*, 2013:372). A study was done at the King Abdulaziz Medical City-King Fahad National Guard Hospital and the King Khalid University Hospital in Riyadh, Saudi-Arabia, to determine and evaluate inhaler technique in emergency department visits among patients with asthma. This study was conducted between August 2010 and March 2011 (AL-Jahdali *et al.*, 2013:2). The study included adult patients, ≥ 18 years with asthma who visited the emergency department during the study period. The results found that among the 450 patients, 203 (45%) of these patients presented with improper asthma inhaler device use (AL-Jahdali *et al.*, 2013:2). In addition, the improper use of these inhaler devices was associated with irregular clinic follow-ups, lack of education of asthma medicine, uncontrolled asthma resulting in three or more emergency department visits. This lack of proper education was confirmed by Bester and Hamman (2008:18) (refer to Chapter 2, section 2.9.5), and the increased emergency department visits may result in increased costs, as confirmed by Ockene *et al.* (2002:632) (refer to Chapter 2, section 2.9.5) as well as by Price *et al.* (2013:42). Another reason for the high number of medicine items under-supplied for asthma may be owing to the higher average SEP per medicine item than dispensing fee, when compared to the other CDL conditions in the top 5 (refer to *Appendix H*). Possible co-morbid airway diseases with asthma such as bronchiectasis and COPD may also have resulted in the high percentage of medicine items in the under-supplied group as reported in section 3.2.2 (Athanazio, 2012:1335; Bilton & Jones, 2011:7; Hurst *et al.*, 2015:310; Kang *et al.*, 2014:213).

All of the top 5 conditions had more medicine items in the under-supplied group than the over-supplied group. Hypothyroidism had the second highest prevalence of medicine items in the under-supplied group with 53.23% (n = 5 696). This number of medicine items was 18.20 times more compared to medicine items in the over-supplied group (n = 313). One reason for the high under-supply in hypothyroidism may be attributed to lifelong, daily administration of thyroxine which can lead to patient non-compliance (Rangan *et al.*, 2007:e1) (also refer to Chapter 2, section 2.9.5). This non-compliance is the most common cause of lack of thyroxine treatment

response (Rangan *et al.*, 2007:e1). Another reason for non-compliance may be that hypothyroidism, especially in sub-clinical hypothyroidism can be nearly asymptomatic or present minimal symptoms, even when profound (Bar *et al.*, 2007:430; Braverman, 1999:95), as found in other CDL conditions by Choudhry (2009:365) below.

The medicine items in the under-supplied group for the top 5 CDL conditions were 3.52 times more (n = 306 662) than medicine items in the over-supplied group. The total cost of CDL medicine items in the under-supplied group (R921 876 153.32) was 30.26 times higher (R891 414 894.44) when compared to over-supplied medicine items (R30 461 258.88). The consequences of this under-supply (non-adherence) include worsening of the current condition, obtaining possible co-morbidities and thus increasing treatment costs and *vice versa* (refer to Chapter 2, sections 2.9.5.1 and 2.9.5.1.1 as well as sections 3.2.7 and 3.4.3). Fleming (2008:S16) confirmed that even small gaps in therapy, such as those created by a missed prescription fill, may reduce the benefits of regular therapy. Also, even though non-adherence reduces therapy costs, it may result in reduced clinical effectiveness as stated by Hiligsmann *et al.* (2012:161) in Chapter 2, section 2.9.1. However, non-adherence due to over-supply can lead to increased cost by the patient and/or healthcare system over medicine not necessarily needed as R30 461 258.88 that could have been saved (refer to Chapter 2, section 2.9.5.1).

The greatest effect of under-supply of the top 5 CDL conditions on medicine item cost was demonstrated by diabetes mellitus type 2, where 39.19% (n = 68 775) of medicine items equalled 65.74% (R323 340 442.00) of the total medicine item cost for that CDL condition and not yet paid for by either the medical scheme or the patient.

Non-adherence, on the other hand, can occur and be owing to side-effects as well as the misunderstanding of the importance of taking chronic medicine for asymptomatic conditions such as hyperlipidaemia, especially with complex treatment regimens (Choudhry, 2009:365). The results thereof may be important in terms of increased cost sharing (co-payments) by patients (Choudhry, 2009:366). In addition, the South African Heart Association and the Lipid and Atherosclerosis Society of Southern Africa found that statin therapy, if used at maximum doses, can lower LDL-C (low-density lipoprotein cholesterol) (Klug *et al.*, 2012:181). For every mmol/l the LDL-C is reduced, there is a 20.00% reduction in all-cause morbidity, 23.00% reduction in major cardiac events, 17.00% reduction in stroke and 10.00% reduction in mortality. Therefore, the number of medicine items under-supplied for hyperlipidaemia (n = 57 678) with a total medicine cost of R41 564 745.11, and might incur additional cost such as hospitalisation and indirect medical cost due to insufficient reduction in LDL-C (refer to Chapter 2, section 2.9.5.1.1). Pittman *et al.* (2011:1662) also found that medicine adherence is associated with reduced

medical cost in a study done in the United States between 2007 and 2009 with 381 422 patients. The objective of this study was to evaluate adherence to statins for hyperlipidaemia for 12 months and the associated effect on healthcare costs (Pittman *et al.*, 2011:1662). Adherence was determined by calculating MPR, and it was concluded that in the adherent patients, greater statin medicine cost resulted in lower medical and healthcare costs (Pittman *et al.*, 2011:1665).

The combination of hypertension, hyperlipidaemia and diabetes mellitus type 2 are all risk factors for coronary artery disease (refer to *Appendix A* and Chapter 2, section 2.7.2.7), with 329 687 medicine items under-supplied, that totalled R528 640 801.11. All of these risk factors are to a large extent preventable and proper control thereof can prevent further co-morbidities and incurred direct and indirect medical costs.

In addition, although the majority of patients claimed an adequate supply of medicine items (adherent), these patients contributed 84.94% (n = 992 673) to the total number of medicine items in the top 5 (n = 1 168 618) and 51.82% (R1 024 201 075.69) of the total medicine item cost of the top 5 CDL conditions (R1 976 538 487.89). The same type of trend was reported on by Briesacher *et al.* (2008:440) in a study in the United States to determine the adherence of chronic diseases, including hypertension, hypothyroidism, seizure disorders and diabetes mellitus type 2. This study was conducted from medicine claims data from between 2001 until 2004 (n = 706 032 patients). This study found that the MPR of all these chronic diseases were > 50% for the study period.

Furthermore, the MPR may not directly be attributed to medicine item cost such as patient levies, as the CDL conditions with the lowest adherence (under-supply) did not have the highest average levy cost, a contrast as stated in Chapter 1, section 1.2. Therefore, other reasons except direct medicine item cost may be attributed to non-adherence in this study such as the disease being asymptomatic and especially co-morbidity as stated above by Choudhry (2009:365). An increased risk of non-compliance due to co-morbidity may result from a possible increased number of medicine items dispensed (Ito, 2013:127). In contrast, efficacy to compliance may be compromised due to cost that may also drive the decision to create formularies, restrict availability and access to medicines, ignoring the importance of palatability and frequency of dosing (Winnick *et al.*, 2005:e721).

Thus, in all of the top 5 CDL conditions, the majority of medicine items claimed were of adequate supply (adherent). Of the medicine items not adequately supplied (non-adherent), the majority were under-supplied and may result in complications and increased utilisation of healthcare resources, due to many possible adherence barriers. Medicine items over-supplied also resulted

in possible unnecessary cost, due to possible adherence barriers. To reduce barriers resulting in non-adherence, patients and health providers should be educated to identify adherence barriers and enhance medicine adherence for the treatment of CDL conditions (refer to Chapter 2, section 2.9.4). The discussion and analyses of these adherence barriers fall outside the scope of this study, except of medicine item cost.

3.5 Chapter summary

This chapter contained the analyses and results of the empirical investigation, where prevalence and especially medicine cost of the different CDL conditions and their co-morbidities were discussed. Chapter 4 will contain the conclusion, recommendations and limitations of this study.

CHAPTER 4:

CONCLUSIONS, LIMITATIONS AND RECOMMENDATIONS

4.1 Introduction

In this chapter the conclusions based on the results of the *literature study* and the *empirical investigation* as well as recommendations derived from this study will be presented. The limitations encountered during the study will also be included in this chapter. Four specific research objectives were set for the literature study and five for the empirical study (refer to chapter 1, section 1.4).

4.2 Conclusions

4.2.1 Conclusions based on the literature study

The following conclusions are based on the *specific research objectives* of the *literature study*:

Specific research objective 1 was to outline the general background of South African private and public health sectors.

This objective was discussed in Chapter 2, section 2.3.

The South African private and public health sectors had the following in common to achieve adequate health services in both these sectors, and included:

South Africa strives toward a health system that is cost-effective and optimises the utilisation of private and public sector resources. Regulations include the National Health Act (61 of 2003) and the NDP, both of which are applicable in the public and private health sectors to ensure an adequate and reliable supply of safe and cost-effective medicine through certain interventions (refer to Chapter 2, section 2.3.1.5.1). The public and private health sector of South Africa further contain aspects of medicine pricing structures including negotiating and rationalising medicine prices through tender pricing and procurement as well as the cost saving option of generic medicine.

Public sector health funding serves the majority of the South African population and generally consists of general tax funds. In contrast, private health funding consists of funding through medical scheme contributions. In addition, the medical scheme industry in South Africa is regulated by the Council for Medical Schemes which acts as a regulatory authority, administers and enforces the Medical Schemes Act (131 of 1998).

The total number of medical scheme beneficiaries increased by approximately 31.70% (n = 2 120 000) between 2004 and 2013 (Council for Medical Schemes, 2014:146). Medical scheme income and expenditure for health services therefore also consistently increased from 2008 until 2012 (Council for Medical Schemes, 2010d:43; Council for Medical Schemes, 2011:34; Council for Medical Schemes, 2013; Council for Medical Schemes, 2014:158) (refer to Chapter 2, section 2.3.3.1).

Specific research objective 2 was to briefly describe the medicine pricing systems, including principles of managed health care in South Africa as well as internationally.

This objective was discussed in Chapter 2, sections 2.3.2.2, 2.4 and 2.5.

The demand for lower-cost medicine is an ever-increasing trend worldwide, and in a cost conscious environment; pressure to select the least expensive medicine is exerted on prescribers and dispensers by governments, consumers and medical schemes (Kanfer, 2007:10). Therefore, as a result medicine pricing systems were introduced, including managed care principles. Within the South African context managed care principles attempt to contain costs while striving to deliver quality health care that includes PMBs and the CDL. The CDL was introduced whereby medical schemes identify and pay for the diagnosis and treatment of the 27 most prevalent chronic medical conditions, and has been governed by the Council for Medical Schemes from 1 January 2004.

Medicine pricing structures further included the transparent pricing system with the implementation of the SEP, co-payments incurred by medical scheme members as a result of generic substitution, non-formulary medicine and the use of DSPs as well as the implementation of the NHI. These structures will be summarised below.

The introduction of the SEP for medicine was to ensure that South Africans have access to affordable, good quality medicine (Free Market Foundation, 2006). The regulations came into effect in 2 August 2004 with annual adjustments to the SEP as specified (Osman, 2004) (refer to chapter 2, section 2.5.1.6.1). Furthermore, generic substitution regulations in South Africa came into effect on 2 May 2003 (Mestern, 2003) (refer to chapter 2, section 2.5.1.5.2). As a result,

generic medicine in South Africa increased by R734 million (11.70%) versus R317 million (2.70%) of original medicine items (NAPM, 2013). This coincides with the results from this study that revealed that generic medicine increased by greater amounts and percentage when compared with original medicine provided. Thus, generic medicine items increased by R62 780 425.00 (46.81%) versus R42 516 178.04 (21.23%) for original medicine items, from 2008 until 2012 (refer to Chapter 3, Table 3.28). Other countries including the European Union also implement generic substitution as a cost-containment strategy (refer to Chapter 2, Table 2.2). The Medical Schemes Act (131 of 1998) confirmed that a formulary medicine includes a medicine that is clinically appropriate and effective for the treatment of a specific PMB condition suffered by a medical scheme member. The CDL algorithms are currently used as benchmark for formulary treatment of these conditions (refer to Appendix A). Different types of formulary lists are also used in other countries (refer to Chapter 2, Table 2.2). A DSP refers to health providers that to provide its members of the medical schemes with diagnosis and treatment of PMB conditions (Medikredit, 2004:54) (refer to Chapter 2, section 2.5.1.3). Choosing not to use the DSP may result in co-payment by the patient (refer to Chapter 2, Figure 2.1). In addition, accessible and equal health care to the South African population as stated by the NDP and National Health Act (61 of 2003), irrespective of employment status, led to the development of the NHI (refer to Chapter 2, section 2.5.1.7). The development and implementation within the first five years included the strengthening of the public sector, with the implementation of a new central NHI fund in 2014/2015 and is on-going (Matsoso & Fryatt, 2013:22).

Specific research objective 3 was to determine the prevalence of patients with chronic diseases and associated treatment cost in South Africa, and internationally.

This objective was discussed in Chapter 2, sections 2.6 and 2.9.

To emphasize the growing health and financial burden of chronic disease, it is predicted that globally, deaths from non-communicable diseases (NCD) will increase by 77.00% between 1990 and 2020, and that most of these deaths will occur in the developing regions of the world (Medical Research Council, 2009).

In South Africa the burden of non-communicable disease due will probably increase with an increase in ageing population and population growth from 2.28 million (1985) to 5.13 million (2025) (McLeod, 2009b:7). This increase may further result in associated chronic disease and CDL risk factors resulting in possible co-morbidity (refer to Chapter 2, Table 2.5).

****A section of the empirical study was included in this conclusion to further demonstrate the prevalence of chronic disease and the associate cost in South Africa.****

This study found that the prevalence of patients with at least one CDL condition had an increase of from 21.99% (n = 214 279) to 26.09% (n = 268 685) with a medicine cost increase of 31.49% (R105 296 602.00) when compared to the number of patients on the database from 2008 until 2012 (refer to Chapter 3, Tables 3.1 and 3.16). Thus, there was an increase in co-morbid CDL conditions from 2008 until 2012 (refer to Chapter 3, section 3.2.6).

Therefore, it is imperative to ensure adherence to chronic disease and CDL medicine treatment to reduce further treatment cost, such as medicine co-payments (levies) as well as mortality and morbidity.

Specific research objective 4 of this study was to outline the prevalence of patients and approved medicine treatment included in the algorithms of the 27 CDL conditions in South Africa as well as internationally.

This objective was discussed in Chapter 2, section 2.7 and Table 3.7 and Appendix C.

Prevalence and treatment of these 27 CDL conditions from literature to illustrate the prevalence of the CDL conditions in South Africa were applicable internationally and discussed in chapter 2, section 2.7.2. Also refer to Appendix A for the benchmark treatment algorithms for the treatment of CDL conditions as determined by the Medical Schemes Act.

****Although the data from Table 3.7 were not part of the literature study, they were included to illustrate the number of patients with CDL conditions in the section of the private health sector included in this study.****

The following CDL conditions with their respective prevalence increases as found in this study from 2008 until 2012. The only CDL condition with a decrease was for bronchiectasis (also refer to Chapter 3, Table 3.7):

Hypertension increased (n = 49 531;38.90%), hyperlipidaemia increased (n = 35 490;54.74%), coronary artery disease increased (n = 5 464;62.35%), cardiac failure increased (n = 7 182;76.31%), asthma increased (n = 5 923;26.90%), bronchiectasis decreased (n = 38;54.29%), cardiomyopathy increased (n = 248;7.80%), chronic obstructive pulmonary disease increased (n = 639;30.47%), chronic renal disease increased (n = 458;237.31%), Crohn's disease increased (n = 260;160.49%), diabetes insipidus increased (n = 3;8.82%), diabetes mellitus type 1 increased (n = 780;18.01%), diabetes mellitus type 2 increased (n = 17 120;54.33%), dysrhythmia increased (n = 3 512;57.94%), epilepsy increased (n = 2 459;39.69%), glaucoma increased (n = 2 887;51.13%), haemophilia A increased

(n = 20;90.91%), haemophilia B increased (n = 3;300.00%), hypothyroidism increased (n = 4 288;10.83%), Addison's disease increased (n = 20;12.74%), multiple sclerosis increased (n = 525;456.52%), Parkinson's disease increased (n = 669;37.37%), rheumatoid arthritis increased (n = 1 403;61.40%), schizophrenia increased (n = 227;32.76%), systemic lupus erythematosus increased (n = 92;71.88%), ulcerative colitis increased (n = 171;161.32%) and total for all CDL patients increased (n = 139 336;41.30%) with a further estimated annual increase beyond 2012 as listed in Table 3.7.

Bipolar mood disorder was discussed in the literature study, and excluded from the empirical investigation, due to an approved formal treatment algorithm only becoming available in 2009. Therefore, only 26 CDL conditions and not 27 were analysed in the empirical investigation (refer to Chapter 1, section 1.10.1.4, Chapter 2, section 2.7.2.3 and Appendix A).

4.2.2 Conclusions based on the empirical investigation

The following conclusions are based on the specific objectives of the empirical investigation.

Both research objectives 5 and 6 will be discussed in this section.

***Specific research objective 5** of this study was to investigate the prevalence of patients with the 26 CDL conditions and their associated medicine cost in a section of the South African private health sector.*

***Specific research objective 6** of this study was to investigate possible changes in prevalence of patients with different co-morbid CDL conditions.*

4.2.2.1 Number of patients with at least one CDL condition according to total population.

The results were discussed in Chapter 3, section 3.1 and summarised in Table 3.1.

The database consisted of 974 497 patients in 2008, with an increase to 1 029 699 patients in 2012. The total number of patients with at least one CDL condition as a contribution to the database increased as stated in research objective 3 from 214 279 (21.99%) in 2008 to 268 685 (26.09%) in 2012.

The prevalence of female and male patients as well as gender groups changed overall as follows:

Female versus male patients with at least one CDL condition increased from 23.33% (2008) to 26.91% (2012) versus 20.34% (2008) to 25.18% (2012).

- Age group: 0 > age ≤ 12 years: decreased from 2.90% (2008) to 2.79% (2012).
- Age group: 12 > age ≤ 50 years: increased from 9.43% (2008) to 10.79% (2012);
- Age group: 50 > age ≤ 60 years: increased from 33.65% (2008) to 40.18% (2012);
- Age group: 60 > age ≤ 70 years: increased from 57.18% (2008) to 65.06% (2012); and
- Age group: > 70 years: increased from 71.59% in 2008 to 77.84% in 2012.

The prevalence of CDL medicine as a contribution to the total number of medicine items on the database increased from 15.52% (n = 2 551 308) in 2008 to 18.68% (n = 3 065 120) in 2012. This included female versus male patients with increases of 13.91% (2008) to 16.79% (2012) versus 17.95% (2008) to 21.11% (2012) respectively for both genders.

The prevalence of CDL medicine items increased as follows:

- Age group: 0 > age ≤ 12 years: from 1.88% (2008) to 2.89% (2012).
- Age group: 12 > age ≤ 50 years: from 6.95% (2008) to 8.82% (2012);
- Age group: 50 > age ≤ 60 years: from 17.94% (2008) to 21.71% (2012);
- Age group: 60 > age ≤ 70 years: from 25.00% (2008) to 28.58% (2012); and
- Age group: > 70 years: from 27.00% (2008) to 31.09% (2012).

Therefore, the prevalence of patients with at least one CDL condition and prevalence of CDL medicine with regard to the total on the database increased consistently from 2008 until 2012. These findings, however, were in contrast by 2012 with the 10 point plan from 2009 until 2014 to reduce non-communicable diseases including cancer, chronic respiratory disease, diabetes and cardiovascular disease with their associated risk factors (National Planning Commission, 2011:298).

4.2.2.2 Number of patients and all CDL conditions from 2008 until 2012.

Chapter 3, section 3.2.1 contained the data analyses used in this section. The data were summarised in Tables 3.2, 3.3, 3.4 and 3.5.

The prevalence of patients with at least one CDL condition increased overall with 25.39% (n = 54 406) from 2008 until 2012. The increase in the prevalence of chronic conditions was also noted in other studies in Chapter 3, section 3.2.1. The prevalence of CDL conditions also increased overall with 41.30% (n = 139 336) between 2008 and 2012. The total average number of CDL conditions per patient increased from 1.57 ± 0.85 (95%CI:1.57-1.58) in 2008 to 1.77 ± 0.97 (95%CI:1.77-1.78) in 2012 ($p < 0.05$).

Female patients accounted for the majority of patients with at least one CDL condition in each year from 2008 until 2012. The number of male patients and their associated CDL conditions had higher increases between 2008 and 2012 than female patients.

The average number of CDL conditions for female versus male patients increased from:

- 2008 - 1.54 ± 0.83 (95%CI:1.53-1.54) versus 1.63 ± 0.87 (95%CI:1.62-1.63) to
- 2012 - 1.76 ± 0.96 (95%CI:1.76-1.77) versus 1.79 ± 0.98 (95%CI:1.79-1.80).

The average number of CDL conditions per patient changed from 2008 until 2012 with:

- Age group: $0 > \text{age} \leq 12$ years : 2008 - 1.01 ± 0.11 (95%CI:1.01-1.02) to 2012 - 1.01 ± 0.11 (95%CI:1.01-1.02);
- Age group: $12 > \text{age} \leq 50$ years: 2008 - 1.27 ± 0.57 (95%CI:1.27-1.28) to 2012 - 1.37 ± 0.68 (95%CI:1.36-1.38);
- Age group: $50 > \text{age} \leq 60$ years: 2008 - 1.50 ± 0.75 (95%CI:1.49-1.50) to 2012 - 1.68 ± 0.88 (95%CI:1.67-1.68);
- Age group: $60 > \text{age} \leq 70$ years: 2008 1.67 ± 0.88 (95%CI:1.66-1.67) to 2012 - 1.91 ± 1.00 (95%CI:1.90-1.92); and
- Age group: $70 > \text{age}$ years: 2008 - 1.85 ± 1.00 (95%CI:1.85-1.86) to 2012 - 2.07 ± 1.97 (95%CI:2.06-2.07).

Age group > 70 years had the highest number of patients of all the age groups with CDL conditions from 2008 until 2012. The largest increase in the prevalence of patients between 2008 and 2012 was for age group > 70 years (36.25%; n = 20 985) and for CDL conditions (group > 70 years; 51.79%; n = 55 613). These results confirmed the findings by Paez *et al.* (2009:18) as above, which also found that the prevalence of co-morbid chronic conditions increase with increasing age. The chronic disease-prevalence index (CDPI) was consistently higher for male than female patients, due to the higher prevalence of chronic disease medicine in relation to the prevalence of patients. However, male patients consistently had a CDPI > 1, and all age groups had an overall increase in CDPI from 2008 to 2012, except for age group > 70 years.

Therefore the overall increase in the number of patients with single and co-morbid CDL chronic conditions may be attributed to an aging population, patients registering their CDL condition as a chronic condition with their respective medical scheme with population growth in South Africa. This may result in an increase in the use of healthcare resources (refer to Chapter 1, section 1.2). Furthermore, this might also result in the increase in non-communicable disease death rates as predicted the United Nations (2012) in Chapter 2, section 2.6.5.

4.2.2.3 Number of patients with individual CDL conditions from 2008 until 2012.

These data were discussed in Chapter 3, section 3.2.2. The data were summarised in Tables 3.6 and 3.7.

The prevalence of patients with CDL conditions as a contribution to the total database increased overall from 34.62% to 46.30% between 2008 and 2012 (refer to Chapter 3, Tables 3.6 and 3.7). Hypertension had the highest contribution to the total database during each of the study years followed by hyperlipidaemia. All CDL conditions had a patient increase 41.30% (n = 139 336) between 2008 and 2012 with an estimated annual increase of 10.33% (n = 34 834). All CDL conditions except bronchiectasis had an overall increase in the number of patients from 2008 until 2012, hypertension had the highest increase (n = 49 531), followed by hyperlipidaemia (n = 35 490) and then diabetes mellitus type 2 (n = 17 120). Bronchiectasis had an overall decrease of 38 patients, and diabetes insipidus had the lowest patient increase (n = 3) between 2008 and 2012.

4.2.2.4 Number of patients with a single CDL condition.

Data used in this section were summarised in Tables 3.8 and 3.9 and analysed in Chapter 3, section 3.2.3.

Patients with a single CDL condition compared to the database stayed relatively constant between 13.32% (2008) and 13.22% (2012), although the number of patients increased ($n = 6\,298$). Hypertensive patients had the highest contribution to all patients on the database throughout the study period, from 5.91% (2008) to 6.73% (2012) as well as the highest increase in number of patients ($n = 11\,621$).

All patients with single CDL conditions had an overall increase of 4.85% ($n = 6\,298$) between 2008 and 2012, with an estimated annual increase of 1.21% ($n = 1\,575$). Patients with single CDL conditions with an overall decrease between 2008 and 2012 were hypothyroidism, diabetes mellitus type 1, cardiomyopathy, coronary artery disease, Addison's disease, bronchiectasis and diabetes insipidus.

Patients with the top 5 single CDL conditions were in the top 5 constantly throughout the study period with hypertension being the most prevalent from 2008 (44.40%; $n = 57\,627$) until 2012 (50.88%; $n = 69\,248$). This is consistent with the study done by McLeod *et al.* (2002:19) (refer to Chapter 2, section 2.6.4) and the high prevalence of this chronic condition as reported by the Medical Research Council (refer to Chapter 1, section 1.2).

Thus, almost all patients with CDL conditions increased throughout the study period and will probably increase after 2012. The increase in top 5 CDL conditions coincide with the data from the study which revealed that the same top 5 conditions may remain in the top 5 as estimated from 1994 until 2025 under the NHI (McLeod, 2009b:7). Furthermore, the prevalence of these top 5 CDL conditions may be responsible for the cardiovascular and respiratory disease burden in South Africa as confirmed in Chapter 1, section 1.2.

4.2.2.5 Change in the number of CDL conditions per patient per year adjusted for age and gender.

This section was discussed in Chapter 3, section 3.2.4 and the data summarised in Table 3.10 as well as Appendix B.

Patients with any of the CDL conditions had an overall increase of 0.20 CDL conditions, with an average from 1.57 ± 0.00 (95%CI:1.57-1.58) (2008) to 1.77 ± 0.00 (95%CI:1.77-1.78) (2012) ($p < 0.05$).

All of the CDL conditions had the following increases in average number of CDL conditions per patient per year from 2008 to 2012 (refer to Appendix B):

- Asthma with 0.18;
- Hyperlipidaemia with 0.20;
- Hypertension with 0.16;
- Hypothyroidism with 0.67; and
- Diabetes mellitus type 2 with 0.24.

The high average number of co-morbid CDL conditions per patient per year for diabetes mellitus type 2 and hyperlipidaemia might be attributed to these conditions also being prevalent in or associated with coronary artery disease (refer to Chapter 2, section 2.7.2.7 and Chapter 3, section 3.2.7). The average number of co-morbidities with hypothyroidism had the highest overall increase from 1.67 ± 0.01 (95%CI:1.66-1.68) (2008) to 2.34 ± 0.01 (95%CI:2.33-2.35) (2012) ($p < 0.05$). This may be attributed to an association between hypothyroidism and cardiovascular disease such as hypertension, hyperlipidaemia and congestive cardiac failure as stated in Chapter 3, sections 3.2.4 and 3.2.7).

The increase in the average number of CDL conditions for patients with hypertension and hyperlipidaemia may also be due to the possibility of these two CDL condition being risk factors for the development of coronary artery disease and chronic renal disease respectively (refer to Chapter 2, sections 2.6.6.4, 2.6.6.5, 2.7.2.7 and 2.7.2.8). Therefore, a single patient with any of the CDL conditions had an increase in CDL conditions during the study period.

4.2.2.6 Number of patients with the top 5 co-morbid CDL conditions.

Chapter 3, section 3.2.5 contained the discussion of the data used and these were summarised in Tables 3.11 and 3.12.

The top 5 CDL conditions in Tables 3.11 and 3.12 showed that the total number of patients with co-morbid CDL conditions as well as the number of co-morbid conditions increased consistently from 2008 until 2012. The average number of CDL conditions per year constantly increased from 2008 until 2012 for all these conditions (refer to Table 4.1 below).

Table 4.1: Changes in patient and co-morbidity prevalence between 2008 until 2012.

CDL condition	Patient prevalence(%) (2008 until 2012)	Co-morbidity prevalence(%) (2008 until 2012)
Hypertension	Increase 38.91% (n = 49 531)	Increase 66.78% (n = 69 576)
Hypothyroidism	Increase 10.83% (n = 4 288)	Increase 121.58% (n = 32 315)
Asthma	Increase 26.90% (n = 54 923)	Increase 36.75% (n = 9 796)
Hyperlipidaemia	Increase 54.74% (n = 35 490)	Increase 79.56% (n = 63 587)
Diabetes mellitus type 2	Increase 54.33% (n = 17 120)	Increase 81.01% (n = 35 383)

Diabetes mellitus type 2 had the highest average number of co-morbid conditions per patient during all the study years. Asthma had the lowest average number of co-morbid CDL conditions during each study year, except for 2008. The increase in diabetes was confirmed that there is a worldwide increase in the prevalence of patients with diabetes (refer to Chapter 2, sections 2.6.6.3 and 2.7.2.11). Diabetes is also an important co-morbidity with depression as reported by Brown *et al.* (2005:1063) and O'Connor *et al.* (2009:328) in Chapter 2, section 2.6.5.

Both patient prevalence as well as their respective co-morbidities increased for all of the top 5 CDL conditions between 2008 and 2012. The high prevalence of hypertension as a co-morbid disease illustrates the results as found in the study report in 2002 by McLeod *et al.* (2002:31) as well as by Lalkhen and Mash (2015:136) in Chapter 3, section 3.2.7, that hypertension was prevalent in most chronic disease co-morbidities. This statement can further be illustrated by Table 3.15, where hypertension and hyperlipidaemia were prevalent in the most of the co-morbidities.

4.2.2.7 Different combinations of CDL conditions and the number of patients with these combinations.

Chapter 3, section 3.2.6 contained the data that were discussed in Chapter 3, section 3.2.6. The data used in this section were summarised in Tables 3.13 and 3.14.

Patients with one CDL condition had a prevalence of 54.43% (n = 665 334), 28.31% (n = 346 010) had two CDL conditions, 12.48% (n = 152 571) had three CDL conditions and 4.79% (n = 58 529) had more than three CDL conditions during the five year study period. Patients with co-morbid CDL conditions thus totalled 557 110 for the entire study period, which resulted in an increase of 56.95% (n = 48 108) from 84 480 (2008) to 132 588 (2012). All of the co-morbid combinations had

consistent increases in every year of the study period as listed below in Table 4.2 (also refer to Chapter 3, Table 3.14):

Table 4.2: Patient changes for combinations of different numbers of CDL conditions.

Number of different CDL conditions	Patients (2008 until 2012)
1	Increase 4.86% (n = 6 298)
2	Increase 40.92% (n = 22 695)
3	Increase 77.95% (n = 16 735)
4	Increase 111.06% (n = 6 468)
5	Increase 125.64% (n = 1 769)
6	Increase 135.04% (n = 370)
7	Increase 209.68% (n = 65)
8	Increase 60.00% (n = 3)
9	Increase 50.00% (n = 3) (n = 1; 2011-2012)

The highest increase in the number of patients occurred in the group with two CDL conditions (n = 22 695) between 2008 and 2012, therefore having the highest estimated annual increase of 5 674 patients. Patients in the group with seven CDL conditions had the highest percentage increase of 209.68% (n = 65), with an estimated annual increase of 52.42% (n = 16). Other groups also with a higher than 100.00% increases between 2008 and 2012 were:

- Four CDL conditions with 111.06% (n = 6 468);
- Five CDL conditions with 125.64% (n = 1 769); and
- Six CDL conditions with 135.04% (n = 370).

This section illustrated that there was an increase in the prevalence of patients with co-morbid CDL conditions irrespective of the increase in number of CDL conditions that may result in greater medical cost and disability as stated by Michaud and Wolfe (2007:886) as well as Wolff *et al.* (2002:2269) in Chapter 2, sections 2.6.1 and 2.6.4. An increase in co-morbid conditions may further result in medicine adherence obstacles, as a result of an increase in medicine use and cost to treat these conditions and side-effect possibilities as reported by Lee *et al.* (2015) in Chapter 3, section 3.2.6 and listed in Chapter 2, section 2.9.5.

4.2.2.8 Number of patients with different CDL co-morbid condition combinations.

Data for this section were discussed in Chapter 3, section 3.2.7 and summarised in Table 3.15.

Two CDL conditions

All of the combinations of CDL conditions prevalent in 2008 were also prevalent in 2009, 2010, 2011 and 2012. In addition, hypertension was prevalent in four of the top 5 combinations and all of the combinations in the top 5 had overall increases to 2012. Although hyperlipidaemia with hypertension had the highest increase of 7 027 patients between 2008 and 2012, hypertension with hypothyroidism had the highest prevalence increase of 104.52% (n = 4 596). The lowest increase in the number of patients was for hypertension with asthma (n = 633), whereas the lowest increase prevalence was 19.59% (n = 1 775) for hypertension with diabetes mellitus type 2.

Three CDL conditions

Combinations of three CDL conditions from 2008 to 2012, had a relatively high number of patients with hyperlipidaemia in the top 5 combinations in 2008 and 2012, and the top 4 in 2009, 2010 and 2011. Hypertension was prevalent in all top 5 combinations throughout the study period. This might be attributed to hypertension being an independent risk factor for stroke, coronary artery disease, chronic kidney disease, cardiac failure, peripheral artery disease and advanced retinopathy (Rosendorff *et al.*, 2007:2762; Seedat & Rayner, 2012:64) (also refer to Chapter 2, sections 2.6.6.4, 2.7.2.7 and 2.7.2.8).

The combination with the highest prevalence throughout the study period were for hyperlipidaemia with hypertension and diabetes mellitus type 2. It was confirmed that there is an approximately two-fold higher incidence of the co-morbidity of hypertension with diabetes, as stated by Kengne *et al.* (2005:3597).

All of the combinations showed an overall increase in number of patients from 2008 to 2012, with hyperlipidaemia with hypertension and diabetes mellitus type 2 having the largest increase of 5 113 patients. In the majority of the combinations where diabetes mellitus type 2 was present, hyperlipidaemia was also present, as these patients have a higher incidence of lipid abnormalities, an important contributor to vascular disease (Amod *et al.*, 2012:S58). Hypertension is further a common co-morbidity in patients with type 2 diabetes, and may affect the majority of patients with type 2 diabetes, resulting in micro and macro-vascular disease as a modifiable risk factor (Amod *et al.*, 2012:S61).

Four CDL condtions

Patients with a combination of four CDL conditions, asthma with diabetes mellitus type 2 with hyperlipidaemia and hypertension had the highest number of patients from 2008 to 2009. This combination had the highest number and prevalence increase of 114.44% (n = 317) between 2008 and 2012. The combination of hypothyroidism with diabetes mellitus type 2 with hyperlipidaemia and hypertension remained the combination with the highest number of patients from 2010 until 2012.

Five CDL conditions

Conditions prevalent in five CDL condition combinations were all prevalent in the top 5 CDL conditions where hypothyroidism with diabetes mellitus type 2 with asthma with hypertension and hyperlipidamia had the highest prevalence throughout the study period, including the highest increase of patients of 42.59% (n = 46).

It can be concluded from this section that cardiovascular CDL conditions, such as hypertension, hyperlipidaemia and diabetes mellitus type 2, were prevalent in most co-morbidities, either as CDL conditions or as risk factors for other CDL condtions. The increase in number of patients with these CDL condtions between 2008 and 2012 with estimated increases may therefore also increase their prevalence as co-morbid CDL conditions with other CDL and chronic conditions. This may result in increasing health resource utilisation and associated treatment cost as found by Lalkhen and Mash (2015:136) in Chapter 3, section 3.2.7.

Specific research objective 7 was to determine how certain medicine pricing structures such as generic substitution, SEP, dispensing fee and patient co-payment for medicine influence prescription patterns and direct medicine cost of CDL medicine.

4.2.2.9 Medicine cost for patients with at least one CDL condition according to the total patient population.

This section was discussed in Chapter 3, section 3.3 and summarised in Table 3.16.

The total CDL medicine cost increased consistently overall from 18.73% in 2008 to 23.89% in 2012 of the total medicine cost on the database.

Female patients with at least one CDL condition contributed more to the total medicine cost than male patients from 2008 to 2011. The total medicine cost of female versus male patients with at least one CDL condition represented 16.33% in 2008 increasing to 21.27% in 2012 versus male patients with 22.21% in 2008 increasing to 27.10% in 2012.

The percentage that the medicine cost of CDL medicine represented to the total medicine cost on the database increased as follows for the different age groups:

- 0 > age ≤ 12 years: increased from 5.10% (2008) to 10.27% (2012).
- 12 > age ≤ 50 years: increased from 11.89% (2008) to 18.03% (2012);
- 50 > age ≤ 60 years: increased from 19.93% (2008) to 25.80% (2012);
- 60 > age ≤ 70 years: increased from 24.02% (2008) to 28.35% (2012); and
- Age > 70 years: increased from 25.53% (2008) to 28.80% (2012).

The total medicine cost contribution further showed a trend in all of the study years, an increase in the cost contribution percentage with increased age.

4.2.2.10 Medicine cost for patients with at least one CDL condition according to different cost types.

This objective was discussed in Chapter 3, section 3.4.1. Data used in this section were summarised in Tables 3.17 to 3.21 and Appendix D.

There was an overall increase in the prevalence of CDL medicine items of 20.14% (n = 513 812) from 2 551 308 (2008) to 3 065 120 (2012) with male patients having the highest increase of 12.68% (n = 174 634) and 28.87% (n = 33 178) for female and male patients respectively

The total cost, medical scheme contribution, patient levy and average cost per medicine item all recorded higher increases for male than for female patients.

All of the age groups had increases in the number of medicine items which might be attributed to the amendment of the SEP in 2010 (refer to Chapter 2, section 2.5.1.6.1).

Age group $0 > \text{age} \leq 12$ years the highest increase in percentage and $60 > \text{age} \leq 70$ years the highest number of CDL medicine items. For all the medicine cost categories, the youngest age group ($0 > \text{age} \leq 12$ years) had the highest average cost per medicine item claimed of all the age groups in 2008 and 2012. This may have resulted in the highest CPI for this group (refer to Table 4.3). The increases in average cost per medicine item for all groups in Table 4.3 may be as a result of the changes in SEP. The medicine items for male patients and groups, $0 > \text{age} \leq 12$ years as well as $12 > \text{age} \leq 50$ years had CPIs > 1 , showing that the medicine claimed was relatively expensive in these groups. Thus, the increases in medicine items due to increases in the number of patients as listed in Chapter 3, Tables 3.1 and 3.2, combined with the increases of medicine cost, especially patient levies and average cost per item may result in undesired possible adherence problems as listed by Ockene *et al.* (2002:632) in Chapter 2, section 2.9.5. This was also relevant for the majority of the top 5 CDL conditions in section 4.2.2.11. This may then result in adverse outcomes including adverse effects on the patient's health, worsening or aggravation of the illness, decreased quality of life, increased utilisation of health services and increased costs to the patient and the health system (Iuga & McGuire, 2014:37; Rosner, 2006:558) (refer to Chapter 2, section 2.9.5.1.1) (also refer to Chapter 3, section 3.4.8 and section 4.2.2.17). The increase in medicine cost between 2008 and 2012 as well as estimated increases thereafter can be confirmed by increases globally and pharmerging markets, which include South Africa, as found by IMS Institute of Healthcare Informatics (2012:5) (refer to Chapter 3, section 3.4.1).

Table 4.3: Changes of CDL medicine items and medicine cost between 2008 and 2012.

Year	CDL condition	Description		Number of CDL medicine items * (n) (2008 versus 2012)	Total medicine cost # (R) (2008 versus 2012)	Medical scheme contribution & (R) (2008 versus 2012)	Patient levy [†] (R) (2008 versus 2012)	Average cost/item (R) (2008 versus 2012)	CPI (2008 versus 2012)
2008 until 2012	All CDL conditions	Gender	Female	↑ 12.69% (174 634)	↑ 23.54% (40 638 041.00)	↑ 27.04% (38 649 028.00)	↑ 6.70% (1 989 013.12)	↑ 125.38 ± 204.54 to 137.47 ± 394.46	0.96-0.96
			Male	↑ 28.87% (339 178)	↑ 39.95% (64 658 560.00)	↑ 42.90% (58 296 145.00)	↑ 24.52% (6 362 415.24)	↑ 137.76 ± 312.44 to 149.61 ± 560.78	1.05-1.04
		Age group (years)	0 > age ≤ 12	↑ 71.56% (14 584)	↑ 136.80% (4 942 259.04)	↑ 132.48% (4 271 054.97)	↑ 172.63% (671 204.07)	↑ 177.27 ± 259.59 to 244.68 ± 1105.26	1.35-1.71
			12 > age ≤ 50	↑ 16.81% (74 965)	↑ 46.66% (32 764 321.70)	↑ 51.50% (30 970 717.64)	↑ 17.80% (1 793 603.93)	↑ 157.45 ± 482.16 to 197.69 ± 934.01	1.20-1.38
			50 > age ≤ 60	↑ 20.70% (122 122)	↑ 31.40% (23 813 473.48)	↑ 34.33% (21 650 492.63)	↑ 16.94% (2 162 980.85)	↑ 128.55 ± 220.55 to 139.94 ± 348.58	0.98-0.98
			60 > age ≤ 70	↑ 27.23% (175 939)	↑ 34.49% (28 391 404.90)	↑ 36.82% (25 116 290.02)	↑ 23.20% (3 275 114.94)	↑ 127.39 ± 189.31 to 134.66 ± 330.10	0.97-0.94
			age > 70	↑ 14.87% (126 202)	↑ 15.02% (15 385 143.00)	↑ 17.74% (14 936 618.30)	↑ 2.46% (448 524.57)	↑ 120.70 ± 132.95 to 120.85 ± 207.19	0.92-0.84
		Total		↑ 20.14% (513 812)	↑ 31.49% (105 296 602.00)	↑ 34.77% (96 945 173.00)	↑ 15.02% (8 351 528.36)	↑ 131.08 ± 259.92 to 143.46 ± 483.84	

* Number of CDL medicine items (2008 vs 2012) = $\frac{\text{Number of CDL medicine items (2008)} - (2012)}{\text{Number of CDL medicine items (2008)}} \times 100$

Total medicine cost (2008 vs 2012) = $\frac{\text{Total medicine costs (2008)} - (2012)}{\text{Total medicine cost (2008)}} \times 100$

& Medical scheme contribution (2008 vs 2012) = $\frac{\text{Medical scheme contribution (2008)} - (2012)}{\text{Medical scheme contribution (2008)}} \times 100$

[†] Patient levy (2008 vs 2012) = $\frac{\text{Patient levy (2008)} - (2012)}{\text{Patient levy (2008)}} \times 100$

4.2.2.11 Medicine cost per item per patient with the top 5 CDL conditions according to different cost types.

Table 4.4 below contains a summary and conclusion the top 5 CDL conditions as discussed and analysed in Chapter 3, section 3.4.2 and *Appendix D*. The change (↓) indicated a reduction in either the number of items, total medicine cost or average cost per medicine item where applicable. The change indicated by (↑) indicated an increase in either the number of items, total medicine cost or average cost per medicine item where applicable.

The discussion was included in Chapter 3, section 3.4.2. The data were derived from Tables 3.22 to 3.26.

Table 4.4: Changes in the number of medicine items and cost between 2008 and 2012.

Year	CDL condition	Description		Number of CDL medicine items * (n) (2008 versus 2012)	Total medicine cost # (R) (2008 versus 2012)	Medical scheme contribution & (R) (2008 versus 2012)	Patient levy ¹ (R) (2008 versus 2012)	Average cost/item (R) (2008 versus 2012)	CPI (2008 versus 2012)
2008 until 2012	Asthma	Gender	Female	↑ 43.67% (42 129)	↑ 66.94% (386 406.14)	↑ 70.21% (10 118 123.91)	↑ 48.81% (1 268 282.23)	↑ 176.32 ± 139.11 to 204.88 ± 149.63	1.33-1.42
			Male	↑ 51.80% (38 224)	↑ 79.28% (10 052 811.71)	↑ 82.12 (8 884 996.93)	↑ 62.78% (1 167 814.78)	↑ 171.83 ± 138.95 to 202.95 ± 146.58	
		Age group (years)	0 > age ≤ 12	↑ 89.04% (13 506)	↑ 126.98% (2 889 028.69)	↑ 115.13% (2 279 201.68)	↑ 206.35% (609 827.01)	↑ 149.99 ± 125.67 to 180.10 ± 131.17	
			12 > age ≤ 50	↑ 29.57% (16 811)	↑ 58.04% (5 558 973.57)	↑ 58.70% (4 866 328.06)	↑ 53.74% (692 645.51)	↑ 168.51 ± 137.67 to 205.52 149.93	
			50 > age ≤ 60	↑ 46.18 (14 449)	↑ 77.21% (4 062 074.70)	↑ 79.94% (3 613 854.95)	↑ 60.55% (448 219.75)	↑ 168.16 ± 142.69 to 203.85 ± 153.78	
			60 > age ≤ 70	↑ 57.24% (17 842)	↑ 81.62% (4 589 988.07)	↑ 88.08% (4 167 289.38)	↑ 47.39% (422 698.69)	↑ 180.41 ± 139.39 to 208.38 ± 148.54	
			age > 70	↑ 49.57% (17 745)	↑ 62.42% (4 339 152.82)	↑ 71.39% (4 076 446.77)	↑ 21.16% (262 706.05)	↑ 194.20 ± 140.41 to 210.88 ± 148.32	
		Total	↑ 47.19% (80 353)	↑ 72.21% (21 439 217.85)	↑ 75.31% (19 003 120.84)	↑ 54.64% (2 436 097.01)	↑ 174.37 ± 139.06 to 204.01 ± 148.27		
2008 until 2012	Diabetes mellitus type 2	Gender	Female	↑ 27.86% (48 476)	↑ 47.95% (11 998 911.96)	↑ 49.12% (11 304 649.15)	↑ 34.55% (694 262.81)	↑ 143.79 ± 212.62 to 166.39 ± 25.18	1.12-1.22
			Male	↑ 44.82% (101 502)	↑ 74.06% (25 184 530.36)	↑ 75.00% (23 465 030.24)	↑ 63.30% (1 719 500.12)	↑ 150.14 ± 217.76 to 180.46 ± 271.73	
		Age group (years)	0 > age ≤ 12	↓ 27.21% (40)	↓ 37.03% (19 947.75)	↓ 42.42% (22 069.66)	↑ 115.09% (2 121.91)	↓ 336.49 ± 163.90 to 317.07 ± 168.37	
			12 > age ≤ 50	↑ 16.86% (15 151)	↑ 43.50% (6 287 553.06)	↑ 44.29% (5 941 640.24)	↑ 33.31% (345 912.82)	↑ 160.87 ± 232.40 to 197.54 ± 279.06	
			50 > age ≤ 60	↑ 35.39% (43 270)	↑ 60.21% (11 432 690.50)	↑ 60.95% (10 698 367.32)	↑ 51.20% (734 323.18)	↑ 155.31 ± 225.09 to 183.78 ± 278.17	
			60 > age ≤ 70	↑ 52.10% (53 884)	↑ 82.93% (12 753 943.55)	↑ 83.55% (11 835 171.48)	↑ 75.67% (918 772.07)	↑ 148.69 ± 218.01 to 178.84 ± 264.84	
			age > 70	↑ 44.46% (37 713)	↑ 66.27% (6 729 202.96)	↑ 69.29% (6 316 570.01)	↑ 39.77% (412 632.95)	↑ 119.70 ± 173.30 to 137.78 ± 219.56	
		Total	↑ 37.45% (149 978)	↑ 62.99% (37 183 442.32)	↑ 64.03% (34 769 679.39)	↑ 51.07% (2 413 762.93)	↑ 147.38 ± 215.57 to 174.78 ± 263.32		
2008 until 2012	Hyperlipidaemia	Gender	Female	↑ 19.13% (529 58)	↓ 14.53% (6 104 457.34)	↓ 18.65% (6 702 390.94)	↑ 9.85% (597 934.53)	↓ 151.77 ± 62.71 to 108.88 ± 92.56	1.19-0.81
			Male	↑ 29.24% (90 321)	↓ 1.66% (819 219.47)	↓ 7.39% (3 157 629.58)	↑ 34.71% (233 841.11)	↓ 160.16 ± 67.25 to 121.88 ± 99.80	
		Age group (years)	0 > age ≤ 12	↓ 6.06% (4)	↓ 26.25% (2 917)	↓ 42.27% (4 287.69)	↑ 141.58% (1 370.69)	↓ 168.35 ± 81.05 to 132.17 ± 92.59	
			12 > age ≤ 50	↑ 10.37% (7728)	↓ 13.50% (1 677 395.02)	↓ 18.16% (1 939 817.77)	↑ 15.08% (262 422.75)	↓ 166.76 ± 73.34 to 130.69 ± 107.30	
			50 > age ≤ 60	↑ 18.59% (26 437)	↓ 8.23% (1 901 190.34)	↓ 13.82% (2 748 030.85)	↑ 26.29% (846 840.51)	↓ 162.46 ± 67.91 to 125.73 ± 103.02	
			60 > age ≤ 70	↑ 26.83% (48 945)	↓ 3.86% (1 096 916.93)	↓ 9.47% (2 321 740.84)	↑ 31.15% (1 224 823.91)	↓ 155.89 ± 65.33 to 118.18 ± 97.94	
			age > 70	↑ 32.27% (60 173)	↓ 8.16% (2 245 257.52)	↓ 12.07% (2 846 143.37)	↑ 15.36% (600 885.85)	↓ 147.49 ± 58.23 to 102.40 ± 85.32	
		Total	↑ 24.46% (143 279)	↓ 7.57% (6 923 676.81)	↓ 12.53% (860 020.52)	↑ 22.93% (2 936 343.71)	↓ 156.20 ± 65.28 to 116.00 ± 96.81		

* Number of CDL medicine items (2008 vs 2012) = $\frac{\text{Number of CDL medicine items (2008)} - \text{(2012)}}{\text{Number of CDL medicine items (2008)}} \times 100$

Number of CDL medicine items (2008)

& Medical scheme contribution (2008 vs 2012) = $\frac{\text{Medical scheme contribution (2008)} - \text{(2012)}}{\text{Medical scheme contribution (2008)}} \times 100$

Medical scheme contribution (2008)

Total medicine cost (2008 vs 2012) = $\frac{\text{Total medicine costs (2008)} - \text{(2012)}}{\text{Total medicine cost (2008)}} \times 100$

Total medicine cost (2008)

¹ Patient levy (2008 vs 2012) = $\frac{\text{Patient levy (2008)} - \text{(2012)}}{\text{Patient levy (2008)}} \times 100$

Patient levy (2008)

Year	CDL condition	Description		Number of CDL medicine items * (n) (2008 versus 2012)	Total medicine cost # (R) (2008 versus 2012)	Medical scheme contribution & (R) (2008 versus 2012)	Patient levy [†] (R) (2008 versus 2012)	Average cost/item (R) (2008 versus 2012)	CPI (2008 versus 2012)
2008 until 2012	Hypertension	Gender	Female	↑ 9.40% (88 774)	↑ 12.74% (12 474 168.00)	↑ 14.49% (11 318 473.68)	↑ 5.84% (1 155 694.41)	↑ 103.62 ± 70.27 to 106.79 ± 71.72	0.81-0.77
			Male	↑ 28.22% (199 822)	↑ 30.68% (24 100 126.70)	↑ 32.27% (20 407 693.77)	↑ 24.11% (3 692 432.39)	↑ 110.93 ± 72.41 to 113.06 ± 74.65	
		Age group (years)	0 > age ≤ 12	↓ 33.09% (46)	↓ 13.98% (1 676.17)	↓ 36.02% (3 797.91)	↑ 146.46% (2 121.74)	↑ 86.27 ± 70.59 to 110.92 ± 93.30	
			12 > age ≤ 50	↑ 11.78% (27 970)	↑ 15.35% (3 790 654.25)	↑ 19.18% (3 766 999.26)	↑ 0.47% (23 654.99)	↑ 104.02 ± 69.57 to 107.34 ± 71.18	
			50 > age ≤ 60	↑ 19.02% (75 627)	↑ 23.86% (10 027 571.30)	↑ 26.19% (8 778 709.97)	↑ 14.69% (1 248 861.33)	↑ 105.69 ± 70.82 to 109.99 ± 73.07	
			60 > age ≤ 70	↑ 24.33% (107 873)	↑ 29.81% (14 283 127.68)	↑ 30.94% (11 880 729.15)	↑ 25.27% (2 402 398.53)	↑ 108.03 ± 71.63 to 112.80 ± 73.90	
			age > 70	↑ 13.43% (77 172)	↑ 13.71% (8 474 617.19)	↑ 14.67% (7 303 526.98)	↑ 9.73% (1 171 090.21)	↑ 107.64 ± 72.00 to 107.89 ± 73.34	
		Total	↑ 17.46% (288 596)	↑ 20.73% (36 574 295.00)	↑ 22.44% (31 726 167.00)	↑ 13.81% (4 848 127.45)	↑ 106.72 ± 71.29 to 109.72 ± 73.18		
2008 until 2012	Hypothyroidism	Gender	Female	↓ 87.92% (230 641)	↓ 86.82% (8 906 532.31)	↓ 86.41% (8 255 019.54)	↓ 92.41% (651 512.77)	↑ 39.10 ± 16.85 to 42.64 ± 23.03	0.30-0.30
			Male	↓ 82.43% (29 601)	↓ 80.86% (1 192 623.42)	↓ 80.41% (1 118 563.96)	↓ 89.40% (75 059.46)	↑ 41.07 ± 19.49 to 44.59 ± 20.24	
		Age group (years)	0 > age ≤ 12	↓ 100.00% (148)	↓ 100.00% (4 125.14)	↓ 100.00% (4 019.86)	↓ 100.00% (105.28)	↓ 27.87 ± 9.95 to 0.00 ± 0.00	
			12 > age ≤ 50	↓ 95.93% (50 541)	↓ 95.49% (2 114 638.23)	↓ 95.47% (200 043.13)	↓ 95.83% (114 395.10)	↑ 42.03 ± 20.33 to 46.56 ± 55.76	
			50 > age ≤ 60	↓ 91.44% (63 326)	↓ 92.00% (2 583 390.89)	↓ 89.91% (2 355 651.09)	↓ 95.83% (180 352.95)	↑ 40.55 ± 18.92 to 45.90 ± 23.17	
			60 > age ≤ 70	↓ 84.55% (69 740)	↓ 82.69% (2 665 164.45)	↓ 82.13% (2 473 551.97)	↓ 90.80% (191 612.48)	↑ 39.07 ± 16.75 to 43.77 ± 19.64	
			age > 70	↓ 81.64% (76 487)	↓ 79.81% (2 780 223.87)	↓ 79.05% (2 540 117.45)	↓ 88.84% (240 106.42)	↑ 39.19 ± 13.68 to 40.41 ± 16.18	
		Total	↓ 87.26% (260 242)	↓ 86.08% (10 100 155.73)	↓ 85.65% (9 373 583.50)	↓ 92.09% (726 572.23)	↑ 39.34 ± 17.20 to 42.97 ± 22.61		

* Number of CDL medicine items (2008 vs 2012) = $\frac{\text{Number of CDL medicine items (2008)} - (2012)}{\text{Number of CDL medicine items (2008)}} \times 100$

Total medicine cost (2008 vs 2012) = $\frac{\text{Total medicine costs (2008)} - (2012)}{\text{Total medicine cost (2008)}} \times 100$

& Medical scheme contribution (2008 vs 2012) = $\frac{\text{Medical scheme contribution (2008)} - (2012)}{\text{Medical scheme contribution (2008)}} \times 100$

[†] Patient levy (2008 vs 2012) = $\frac{\text{Patient levy (2008)} - (2012)}{\text{Patient levy (2008)}} \times 100$

Table 4.4 concluded that all of the top 5 CDL conditions had increases in the number of medicine items in 2012 when compared to 2008, except for hypothyroidism. The total medicine cost decreased only for hyperlipidaemia and hypothyroidism over the same time period. Hyperlipidaemia was the top 5 CDL condition with a reduction in the total medicine cost irrespective of the increase in the number of medicine items. This may be attributed to the decrease in the average medicine cost per item in all groups. All of the groups had an increase in total patient levy, except for hypothyroidism. The only CDL condition with a decrease in average cost per medicine item was for hyperlipidaemia, although these medicine items were relatively expensive considering the high CPI. In contrast, medicine items for hypertension and hypothyroidism were relatively inexpensive, considering the lower CPI, and irrespective of the increase in average cost per medicine item.

4.2.2.12 Medicine cost according to the different number of CDL conditions.

The data analyses were discussed in Chapter 3, section 3.4.3 and summarised in Table 3.27.

Medicine items for single CDL conditions represented less than 50.00% of all medicine items claimed for all CDL condition combinations throughout the study period. Co-morbid CDL conditions further also had a higher share (> 50.00%) of the total medicine cost for all the medicine throughout the study period. The average cost per medicine item also increased for the majority of number of CDL conditions as the number of co-morbidities increased.

The different combinations of CDL conditions changed as listed below in Table 4.5:

Table 4.5: Change in medicine cost of CDL items for different number of CDL conditions from 2008 until 2012.

Total number of CDL conditions	Change (Number of items) (2008 to 2012) (n)	Change (Total cost) (R) (2008 to 2012)	Change (Average cost/item) (R) (2008 to 2012)
1	↑ 12.86% (150 554)	↑ 29.60% (R4 679 027.00)	↑ 135.00 ± 333.49 to 155.03 ± 625.44
2	↑ of 16.17% (132 539)	↑ 23.82% (R24 258 197.00)	↑ 124.29 ± 16.34 to 132.47 ± 384.88
3	↑ 36.94% (146 617)	↑ 39.77% (R20 855 002.57)	↑ 132.15 ± 213.38 to 134.87 ± 262.37
4	↑ 45.18% (57 915)	↑ 52.44% (R9 075 869.14)	↑ 135.04 ± 133.53 to 141.78 ± 315.08
5	↑ 67.61% (20 461)	↑ 83.84% (R3 395 766.45)	↑ 133.85 ± 136.81 to 146.80 ± 242.31
6	↑ 106.51% (5 170)	↑ 143.01% (R849 341.16)	↑ 122.36 ± 116.36 to 143.98 ± 189.02
7	↑ 100.00% (565)	↑ 96.79% (R71 388.53)	↓ 130.54 ± 144.16 to 128.44 ± 174.94
8	↓ 25.62% (10)	↑ 2.76% (R926.59)	↑ 167.36 ± 176.13 to 178.76 ± 152.09
9	↑ 100.00% (1)	↑ 100.00% (R240.08)	↑ 0.00 ± 0.00 to 240.08 ± 0.00

The prevalence of CDL medicine used in co-morbid CDL conditions had an overall increase of 26.32% (n = 363 258) from 2008 (n = 1 380 294) to 2012 (n = 1 743 552). This resulted in an increase in the total medicine cost for all combinations. The majority of combinations had increased in the average cost per medicine item between 2008 and 2012. Throughout the study period the average cost per medicine item was also predominantly higher as the number of co-morbid CDL condition combinations increased. It can thus be concluded that the majority of medicine items were due to co-morbidities and increases as predicted in Chapter 2, Table 2.5. Also, those patients with multiple CDL conditions may use more medicine at an increased cost. This increase in CDL conditions and associated risk factors may further lead to increased direct medicine cost and indirect costs (such as loss of productivity) (refer to Chapter 2, sections 2.6.5 and 2.6.6).

4.2.2.13 Medicine cost for all CDL medicine according to different generic indicators.

This section was discussed in Chapter 3, section 3.4.4. Data from this section were derived from Tables 3.28 to 3.41 as well as Appendix E and Appendix F.

Original medicine items (group-N) as a contribution to the total number of CDL medicine decreased from 24.22% (n = 617 863) (2008) to 15.95% (n = 488 882) (2012). There was further a constant increase (n = 5 738) in the number of original medicine items (group-M) with a total medicine cost of R299 940 415.00 from 2008 to 2012. Where original medicine items were claimed (group-O), the total medicine item prevalence increased by 29.85% (n = 114 957) from 385 081 (2008) to 500 038 (2012).

Group-N, had a decrease in the number of medicine items between 2008 and 2012. However, there was an overall increase in the total medicine cost due to the high average cost per medicine item between 2008 and 2012.

Group-Y had the highest total medical scheme contribution cost with 47.65% (R55 103 243.00) from 2008 until 2012. This group also had the lowest average cost per medicine item and increased from 2008 to 2012. In addition, all of the top 5 CDL conditions increased overall in the number of generic medicine items claimed from 2008 until 2012. Hyperlipidaemia and diabetes mellitus type 2 were the only two CDL conditions with an overall decrease in the average levy per medicine item (group-Y) from 2008 to 2012 respectively. Generic medicine items (group-Y) had an overall increase in the number of medicine items claimed between 2008 and 2012 as well as a total medicine cost increase with an estimated increase thereafter. The average medicine item cost per generic equivalent for all CDL conditions provided,

increased between 2008 and 2012, but were still lower than any of the original medicine items claimed. This will then allow for generic substitution as the cost of the generic equivalent should be lower than the original before substitution (refer to Chapter 2, section 2.5.1.5.2).

The prevalence of generic medicine items claimed (group-Y) represented 62.59% (n = 9 642 131; R887 989 562.000) of the total number of medicine items from 2008 to 2012.

The difference between original medicine items (even when a generic was available) and generic medicine items claimed showed the potential cost savings by choosing and claiming a generic medicine over the original medicine where applicable. The increase in the drive of generic medicine prescribing and estimated increase beyond 2012 in conjunction with a reduction in original medicine items (group-N) may have resulted in possible cost savings available in the South African private health sector (refer to Chapter 2, section 2.5.1.5.2). The increase in the use of generic medicine items was also prevalent as the generic medicine industry was an integral and essential part of health delivery across Europe (IMS Health, 2010:14). The generic medicine industry supplied over a half of the total demand volume for medicines in Europe (IMS Health, 2010:14). A global increase in generic medicine spending was predicted to 2017, as stated in Chapter 2, section 2.5.1.5.2. The increase in generic medicine in this study was in line with these predicted increases. South Africa's generic market is expected to grow as stated by Makholwa (2014) in Chapter 2, section 2.5.1.5.2. Thus, slowing the rate of growth in prescription medicine expenditures could be accomplished by increasing the use of generic medicine because of the large cost difference between original name medicine items and generic medicine items (Mott & Cline, 2002:663) (refer to Chapter 3, Table 3.30 to 3.32). This statement can be confirmed that the difference between original medicine items (even when a generic was available) and generic medicine items claimed showed potential cost savings by choosing and claiming a generic medicine over the original medicine where applicable.

To ensure continuous access to medicine, sustainability of the generic market is and should remain imperative (IMS Health, 2010:14). Generic medicine provided medicine treatments at affordable prices, expecting an improved quality of life. This resulted from the facilitation in the rising demand of patients requiring chronic medicine therapy by living longer lives and requiring chronic medicine therapy (IMS Health, 2010:14).

4.2.2.14 Average cost per prescription per patient according to different cost structures.

Data used in this section were summarised in Table 3.42 and Appendix G. The data were discussed in Chapter 3, section 3.4.5.

It can be concluded that, during the entire study period, all CDL conditions increased overall in average SEP per prescription and decreased in average dispensing fee per prescription. All of the top 5 CDL conditions also had an overall increase in average SEP per prescription, except for hypothyroidism, while there was an overall increase in the average dispensing fee per prescription for the top 5 conditions, except for hypothyroidism and hyperlipidaemia. The average dispensing fee per prescription was higher than the SEP throughout the study period for hypertension, diabetes mellitus type 2, hyperlipidaemia and hypothyroidism. Asthma had a higher average SEP per prescription than dispensing fee for the entire study period.

Refer to Table 4.6 for the changes in average cost per prescription of the single exit price and dispensing fee for the CDL conditions between 2008 and 2012.

Table 4.6: Summary of average cost per prescription for CDL conditions.

CDL condition	Single exit price (2008 versus 2012)	Dispensing fee (2008 versus 2012)
All CDL conditions	Increase (R17.21 ± R54.33) to (R24.91 ± R101.75)	Decrease (R42.85 ± R46.17) to (R42.38 ± R64.11)
Hypertension	Increase (R5.94 ± R18.06) to (R8.98 ± R55.12)	Increase (R40.85 ± R30.60) to (R41.07 ± R37.48)
Hypothyroidism	Decrease (R12.64 ± R38.81) to (R6.29 ± R40.49)	Decrease (R56.01 ± R41.97) to (R27.43 ± R30.03)
Asthma	Increase (R85.43 ± R103.86) to (R111.93 ± R130.54)	Increase (R42.76 ± R31.84) to (R43.30 ± R54.40)
Hyperlipidaemia	Increase (R7.29 ± R18.20) to (R10.49 ± R48.86)	Decrease (R47.85 ± R35.15) to (R43.24 ± R42.32)
Diabetes mellitus type 2	Increase (R14.29 ± R32.55) to (R19.02 ± R46.35)	Increase (R49.54 ± R38.94) to (R51.11 ± R47.48)

Furthermore, during the entire study period the average SEP per prescription increased and the average dispensing fee per prescription decreased for all CDL conditions. The top 5 CDL conditions also had an overall increase in the average SEP per prescription, except for hypothyroidism. There was also an overall increase in the average dispensing fee per prescription for the top 5 conditions, except for hypothyroidism and hyperlipidaemia.

Asthma was the only CDL condition in the top 5 with a higher average SEP per prescription than dispensing fee for the entire study period. This may be attributed to the higher SEP per medicine item than dispensing fee for asthma throughout the study period.

4.2.2.15 Average medicine cost per item per patient according to different cost structures.

Chapter 3, section 3.4.6 contained the data analyses and discussion relating to this section. The data were summarised in Table 3.43 and Appendix H.

It can be concluded that all CDL conditions had an overall increase in SEP between 2008 and 2012 and a decrease in dispensing fee. In addition, all of the top 5 CDL conditions had an overall increase in average SEP, except for hypothyroidism. All of the top 5 conditions had an overall decrease in dispensing fee per item. Four of the top 5 conditions (hypothyroidism, diabetes mellitus type 2, hypertension and hyperlipidaemia) had an overall higher average dispensing fee than SEP for the entire study period.

Refer to Table 4.7 for the changes in average cost per medicine item of the single exit price and dispensing fee for the CDL conditions between 2008 and 2012.

Table 4.7: Summary of average cost per medicine item for CDL conditions.

CDL condition	Single exit price (2008 versus 2012)	Dispensing fee (2008 versus 2012)
All CDL conditions	Increase (R12.98 ± R43.67) to (R17.66 ± R85.75)	Decrease (R30.00 ± R32.90) to (R28.14 ± R50.21)
Hypertension	Increase (R3.72 ± R10.51) to (R5.47 ± R45.82)	Decrease (R27.34 ± R15.60) to (R26.35 ± R22.79)
Hypothyroidism	Decrease (R7.99 ± R27.15) to (R3.42 ± R21.11)	Decrease (R32.90 ± R21.44) to (R16.47 ± R12.95)
Asthma	Increase (R68.05 ± R86.35) to (R80.35 ± R108.15)	Decrease (R31.09 ± R21.49) to (R28.64 ± R39.01)
Hyperlipidaemia	Increase (R4.85 ± R10.46) to (R6.09 ± R37.30)	Decrease (R32.42 ± R16.11) to (R26.50 ± R22.61)
Diabetes mellitus type 2	Increase (R8.17 ± R19.13) to (R10.01 ± R27.02)	Decrease (R28.13 ± R17.83) to (R27.00 ± R20.10)

The high SEP may be attributed to the possible higher cost of asthma medicine such as inhalers. Thus, of the top 5 conditions it can be concluded that overall the average SEP increased, except for hypothyroidism, and the average dispensing fee per medicine item decreased for all of the top 5 CDL conditions. The average dispensing fee for all CDL

conditions was also consistently higher than the SEP for all CDL conditions throughout the study period.

Asthma had a consistently higher average SEP than dispensing fee from 2008 until 2012, where the high SEP may be attributed to the possible higher cost of asthma medicine such as inhalers.

Thus, of the top 5 conditions it can be concluded that overall the average SEP and dispensing fee did not show a large increase or decrease throughout the study period, but did increase constantly overall even with a change in pricing regulations (refer to Chapter 2, section 2.5.1.6.1). This resulted in no difference of any large practical significance for any condition that could have resulted in possible significant cost savings from the change in SEP.

Specific research objective 8 of this study was to determine the potential cost savings of CDL medicine from changes in the SEP.

4.2.2.16 Potential cost savings per medicine item from changes in SEP.

Results of this objective were discussed in Chapter 3, section 3.4.7. Data from these results were summarised in Tables 3.44 to 3.48.

A reduction in average cost per medicine item may have resulted in possible cost saving potential. An increase in the average cost per medicine item did possibly not results in cost savings at the time of SEP amendments during the study period.

All CDL conditions had a decrease and increase during the study period, with an overall decrease in average cost per CDL medicine item. All of the top 5 CDL conditions had individual decreases in the average cost per medicine item after the first amendment of the SEP. This included:

- Top 5 CDL conditions: Hypertension had an overall decrease of 6.00%, asthma had a decrease of 5.29%, hyperlipidaemia decreased by 56.80%, hypothyroidism decreased by 3.20% and diabetes mellitus type 2 increased with 2.27%.
- Generic indicator groups: Group-M had an overall decrease of 18.12%, group-N increased by 13.60%, group-O decreased by 4.40% and group-Y increased by 2.09%.

For all CDL conditions, group-N and group-Y were the only generic indicator groups with increases in the average cost per medicine item across both SEP changes. The other two groups had alternating increases and decreases for this period.

Although two changes in SEP occurred, there was a reduction in the total average medicine item cost for all CDL conditions as well as for four of the top 5 CDL conditions (refer to Chapter 3, Tables 3.44 and 3.45). Changes in the average cost per medicine item may not be from the changes in SEP, but may be attributed to generic substitution with the increased utilisation of generic medicine items and reduced average cost per medicine item, compared to the other generic indicator groups as indicated in Chapter 3, section 3.4.4.

It can be concluded from this section that during the study period two changes in SEP calculations occurred, resulting in a reduction in the total average cost per medicine item for all CDL conditions as well as for 4 of the top 5 CDL conditions. This may have resulted in potential cost savings.

Specific research objective 9 of this study was to investigate adherence as a proxy to determine under-and over-supply of CDL medicine as well as the associated cost.

4.2.2.17 Patient adherence by determining under- and over-supply of CDL medicine and associated medicine cost.

These results were discussed in Chapter 3, section 3.4.8 and summarised in Table 3.49.

It can be concluded that all of the top 5 conditions had more medicine items in the under-supplied group than the over-supplied group. The total number of under-supplied medicine items for the top 5 CDL conditions were 3.52 times more (n = 306 662) than the medicine items that were over-supplied. The total cost of CDL medicine items in the under-supplied group (R921 876 153.32) was 30.26 times higher (R891 414 894.44) when compared to medicine items in the over-supplied group (R30 461 258.88).

Hypertension, hyperlipidaemia and diabetes mellitus type 2 were the only top 5 CDL conditions with a higher prevalence of medicine items in the adequate supply group than those in the under- or over-supply groups. Hyperlipidaemia had the highest percentage of medicine items in the adequate supply group of 61.84% (n = 131 677), followed by hypertension with 57.93% (n = 373 759). Hypertension had the highest number of CDL medicine items under-supplied (n = 203 234) as well as over-supplied medicine items (n = 68 146) when compared to the other CDL conditions in the top 5. This may be attributed to the fact that hypertension had the most number of patients as well as the most number of medicine items claimed.

Asthma had the lowest percentage medicine items in the adequate-supply group with 19.45% (n = 24 191), as well as the highest percentage of medicine items in the under-supplied group

with 74.61% (n = 92 800). Furthermore, asthma also had the second highest number of under-supplied medicine items (n = 92 800), 12.56 times more when compared to over-supplied medicine items with 7 386. The high number of patients receiving an under-supply of asthma medicine items, as confirmed by Rand (2005:98) (refer to Chapter 2, section 2.9.5.1). Reasons may include a lack of proper education as reported by Bester and Hammann (2008:18) (refer to Chapter 2, section 2.9.5) resulting in improper inhaler technique used for chronic respiratory ailments such as COPD and asthma, as reported by Rifaat *et al.* (2013:372) as well as AL-Jahdali *et al.* (2013:2) in Chapter 3, section 3.4.8.

Also, co-morbidity with other CDL airways diseases may have attributed to the high number of medicine items in the under-supplied group. Hypothyroidism had the second highest percentage of the number of medicine items in the under-supplied group with 53.23% (n = 5 696). These medicine items were 18.20 times more, compared to the medicine items in the over-supplied group (n = 313).

Thus, in all of the top 5 CDL conditions, the majority of medicine items claimed were in adequate supply group with 52.96% (n = 618 914; R1 024 201 075.69). Under-supplied and over-supplied medicine items (n = 549 704; R952 337 412.20) may result in complications, increased utilisation of healthcare resources, unnecessary costs with increased morbidity and mortality as stated by Rademan (2008:2) and Van Wijk *et al.* (2006:11) (refer to Chapter 2, section 2.9.1). Even a relatively small number of medicine items may have a relatively large impact on cost. This was demonstrated by diabetes mellitus type 2 (refer to Chapter 3, Table 3.49).

4.3 Limitations

The following limitations were identified throughout this study and are summarised below:

- Data for bipolar mood disorder were not included in this study as a result of a standardised treatment algorithm only not being available in 2009, with an amendment to the Medical Schemes Act (131 of 1998) (SA, 2009).
- The data from the analyses were obtained from one medicine claims database, thus limiting external validity, implying that results can only be generalised to the specific database used. Since the PMB company used, serves approximately 1.6 million beneficiaries, results from this study should not be generalised to the entire South African population of approximately 47 million people.

- This study only used one data set from one PMB company, thus limiting the incorporation of triangulated data.
- Health care in the South Africa's public health system differs from the private health system, thus limiting the generalisation of the study results.
- Specific medicine may be represented more than once on the database, due to the overlapping of disease treatments.
- The data on the database were assumed to be correct.
- Specific diagnoses such as ICD-10 codes or other scientific relevant diagnostic classification systems were correct when claiming medicine for specific CDL conditions.

4.4 Recommendations

The following recommendations can be made for further studies:

- Data should be made available from more than one medicine claims database to extend the analyses and include more patients from the South African private health sector.
- Include bipolar mood disorder included as CDL condition and other PMB conditions in detailed medicine use and cost analyses studies.
- Include medicine use and cost of the different medicine groups to treat individual CDL conditions.
- A detailed study of the medicine use and medicine cost of CDL conditions in the public health sector should be conducted.

4.5 Chapter Summary

In this chapter the conclusions, recommendations and limitations of this study were summarised.

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APPENDIX A

Treatment protocols for all CDL conditions are illustrated below (SA, 2003b; SA, 2009):

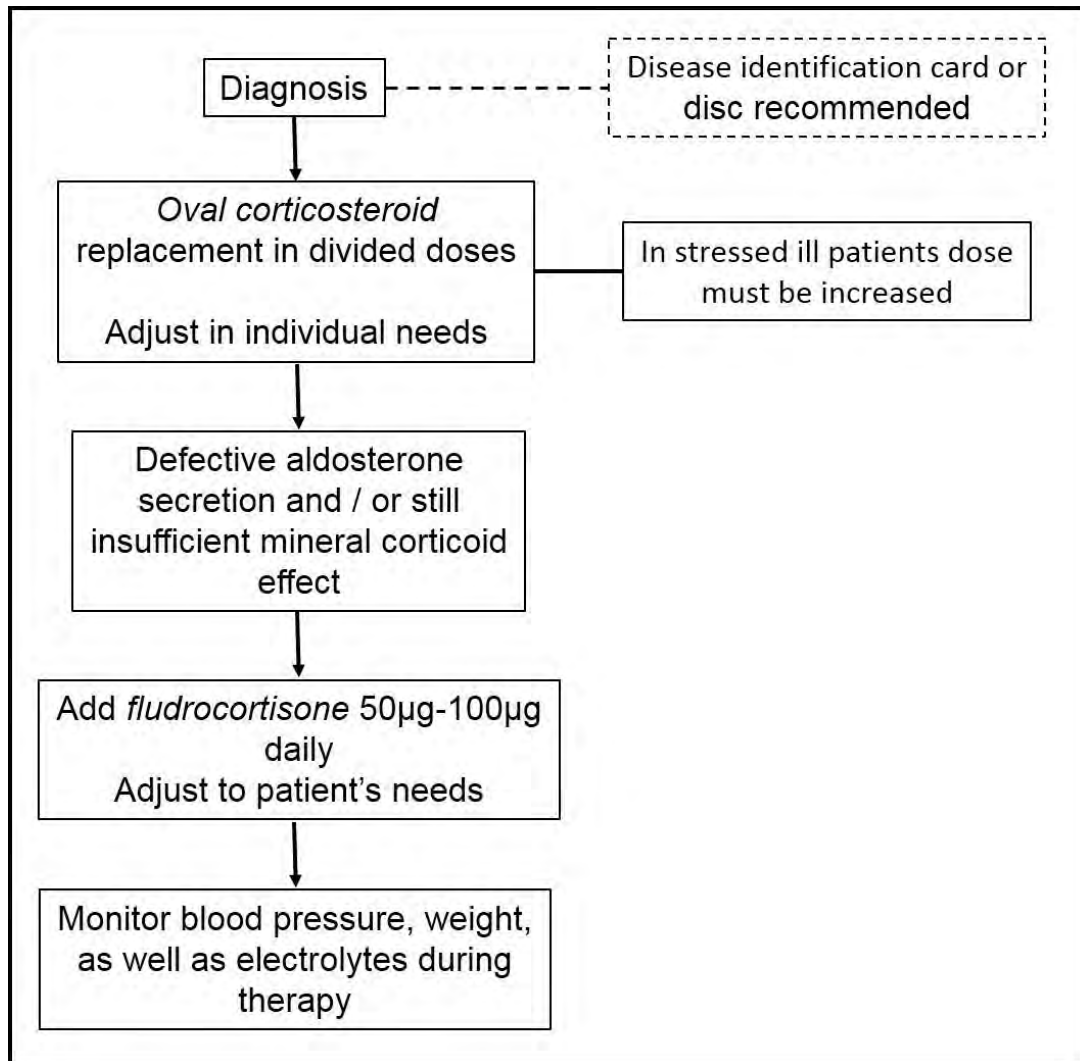


Figure A1: Treatment algorithm for Addison's disease.

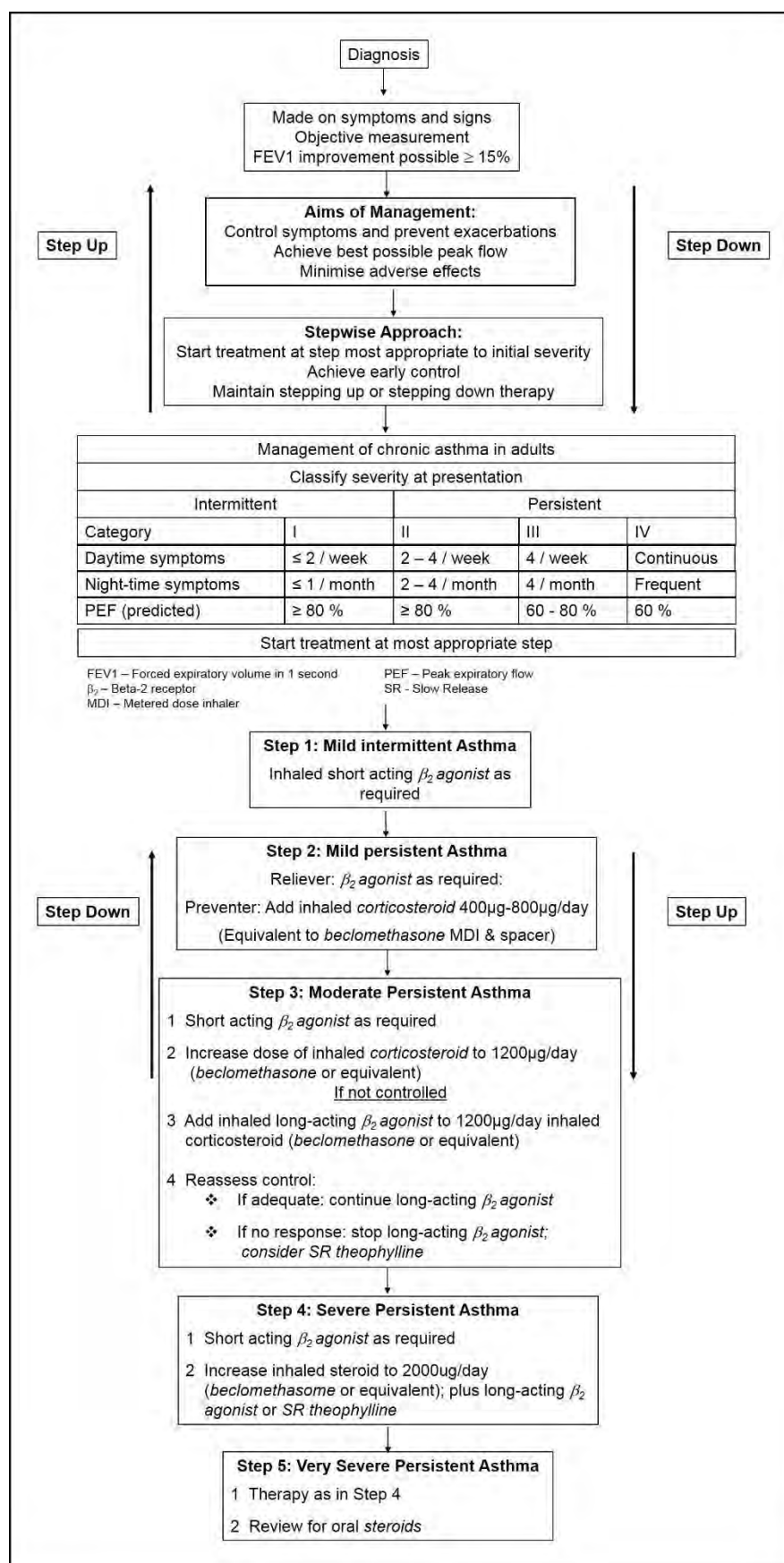


Figure A2: Treatment algorithm for asthma.

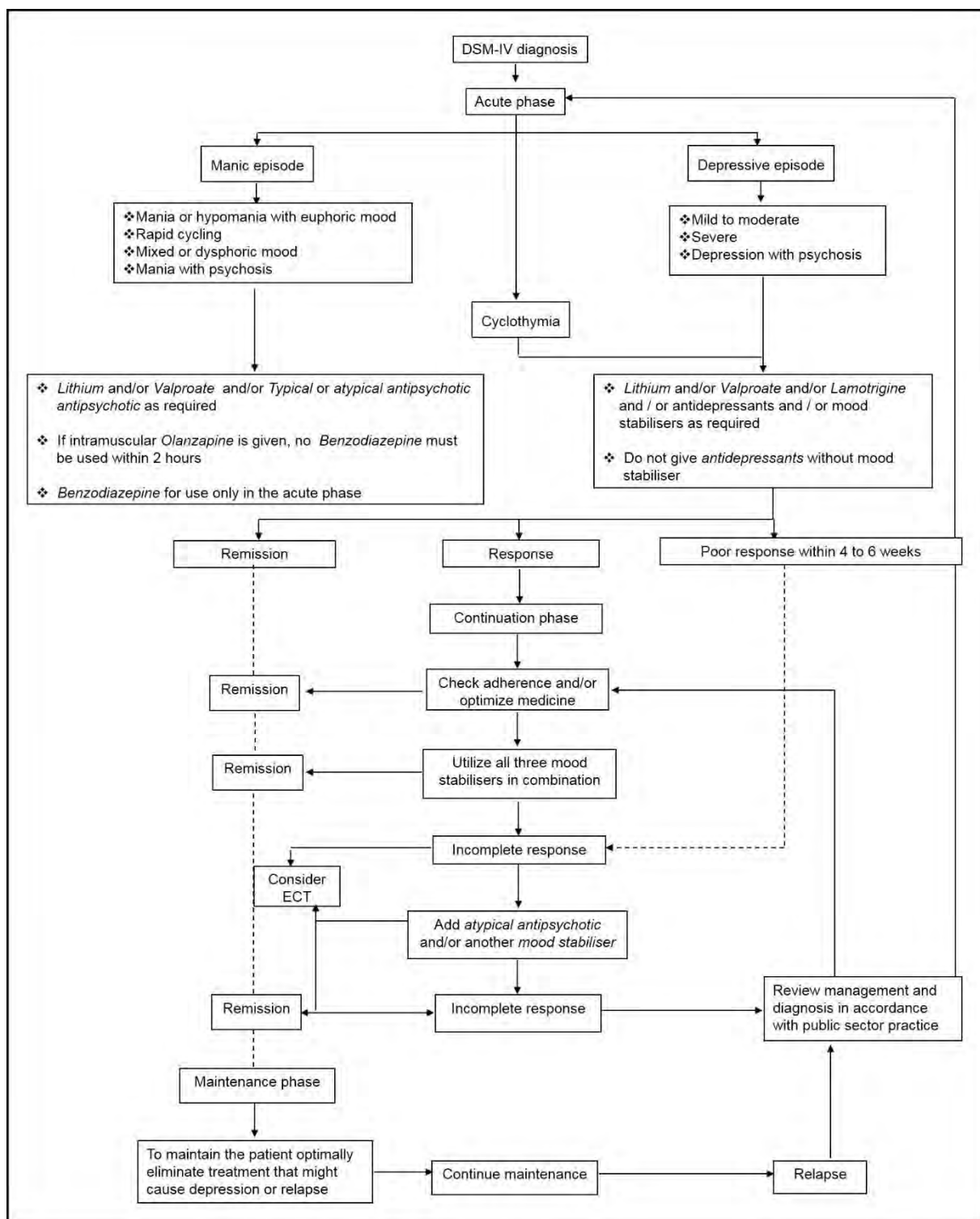


Figure A3: Treatment algorithm for bipolar mood disorder (SA, 2009).

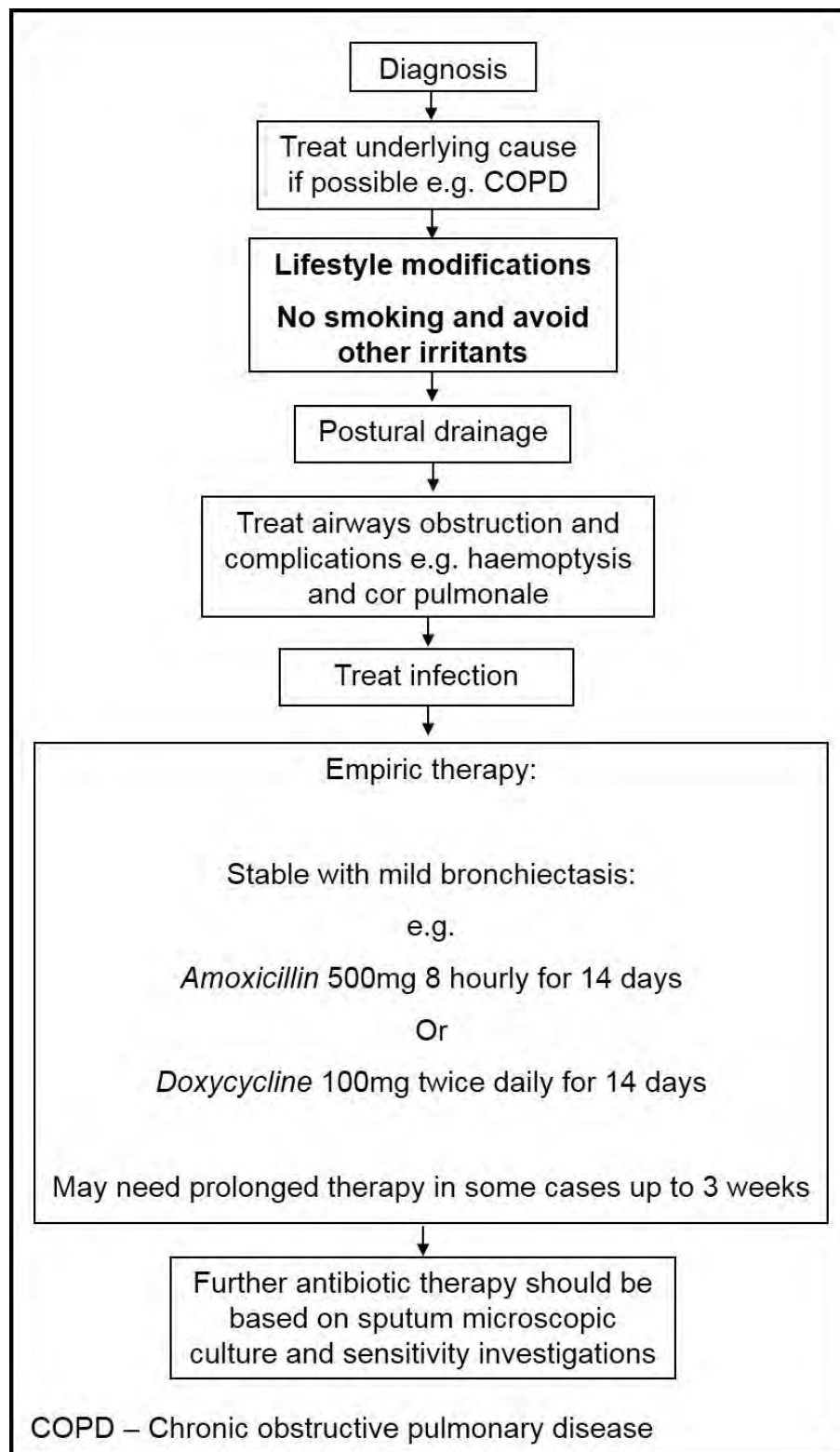


Figure A4: Treatment algorithm for bronchiectasis.

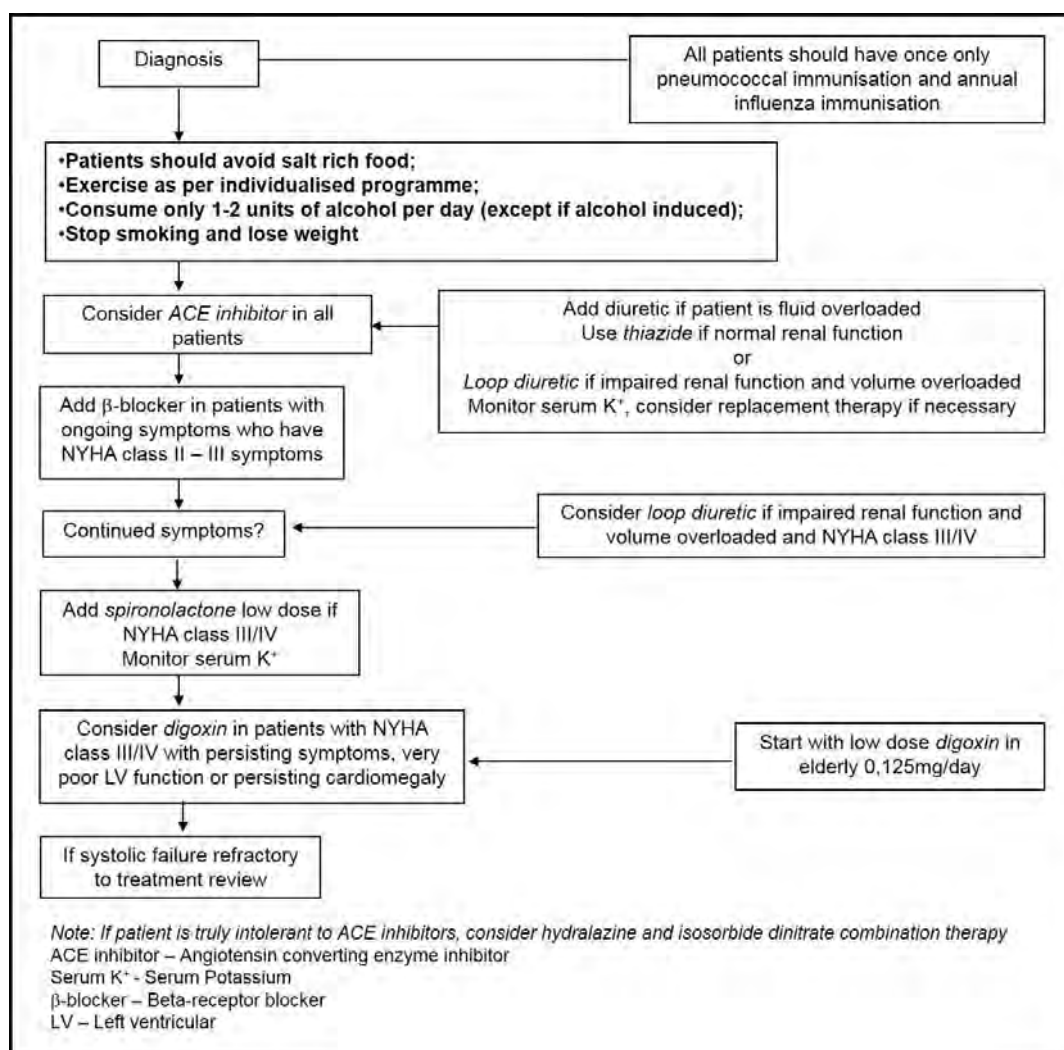


Figure A5: Treatment algorithm for cardiac failure.

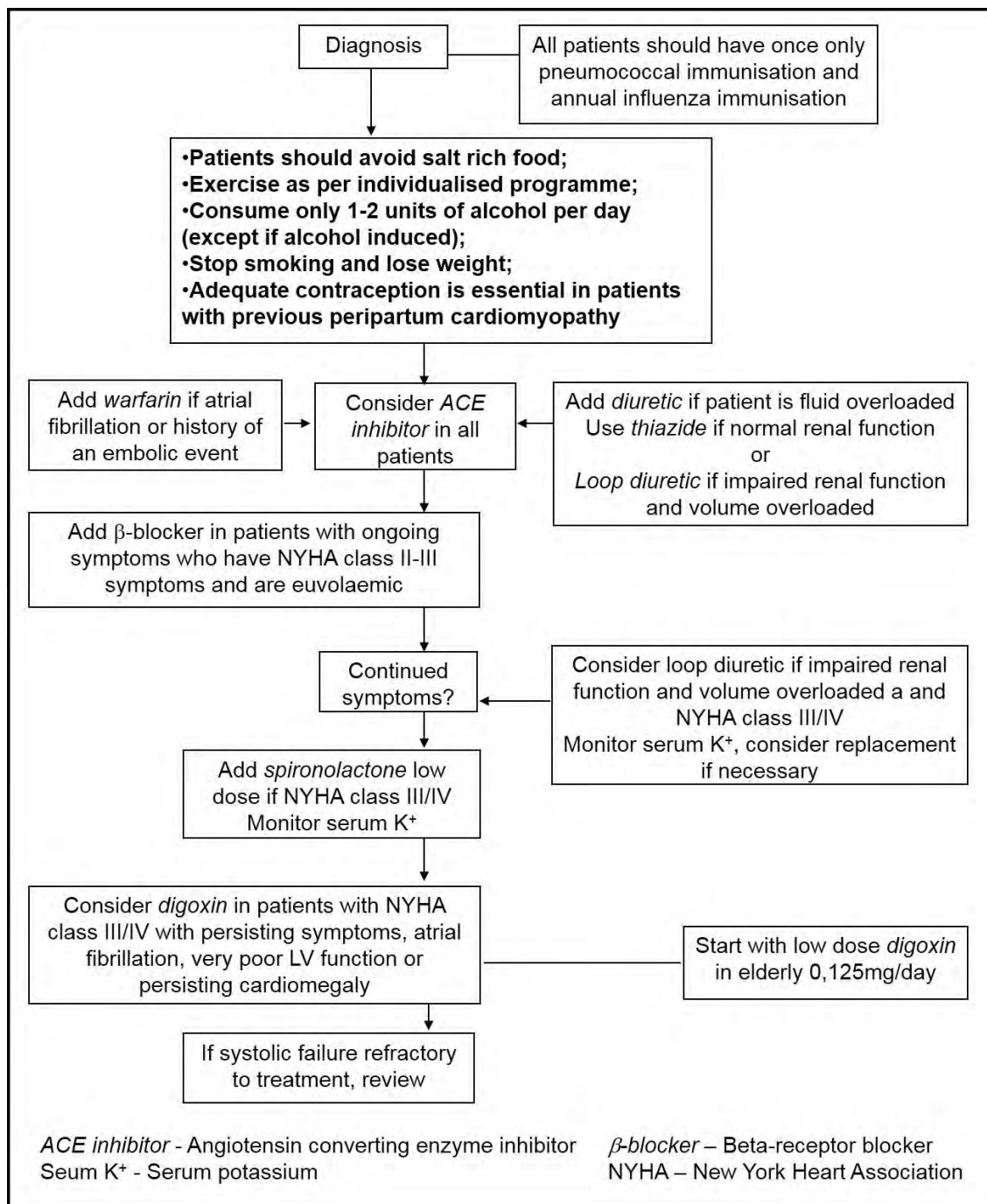


Figure A6: Treatment algorithm for cardiomyopathy.

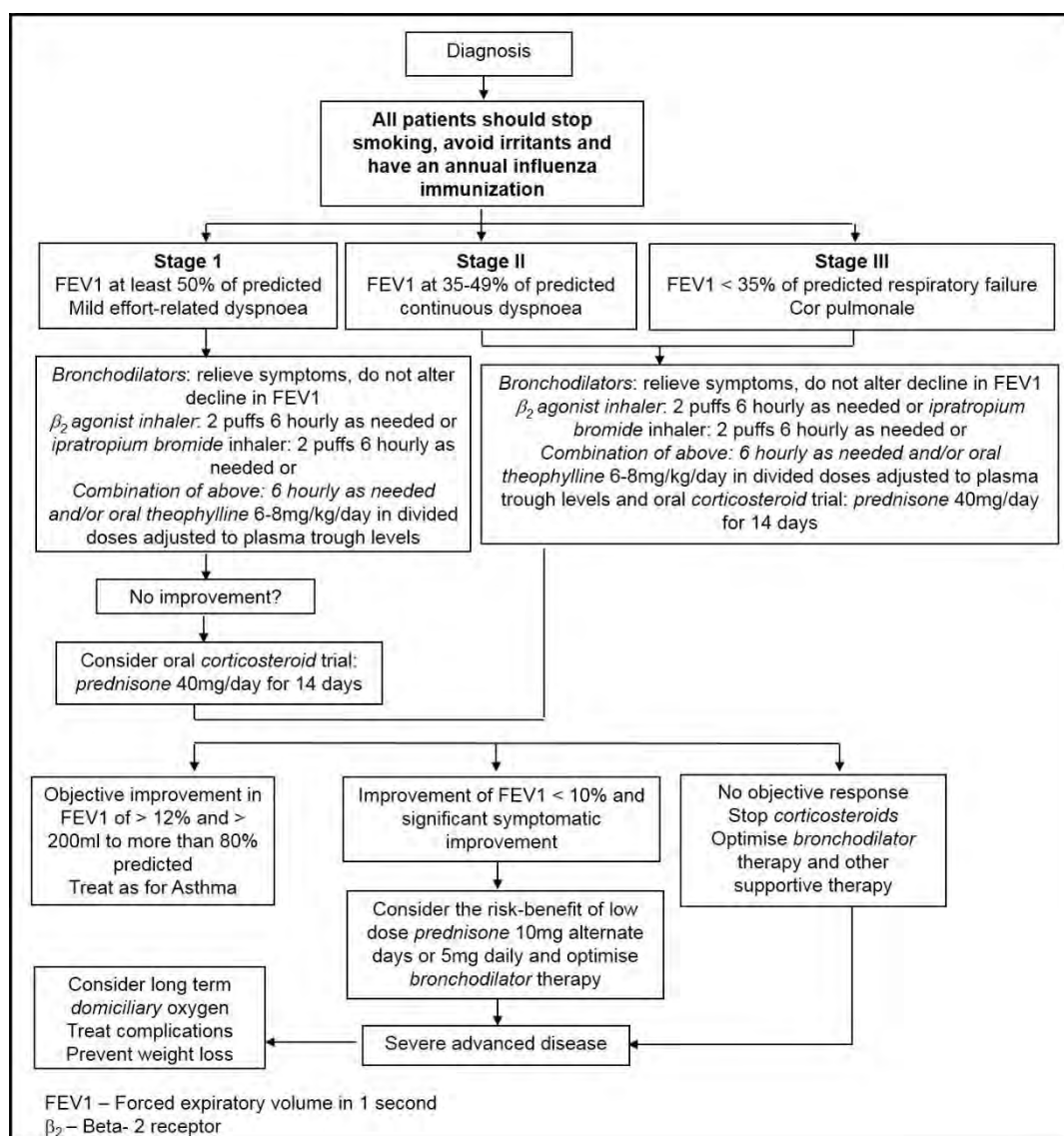


Figure A7: Treatment algorithm for chronic obstructive pulmonary disease.

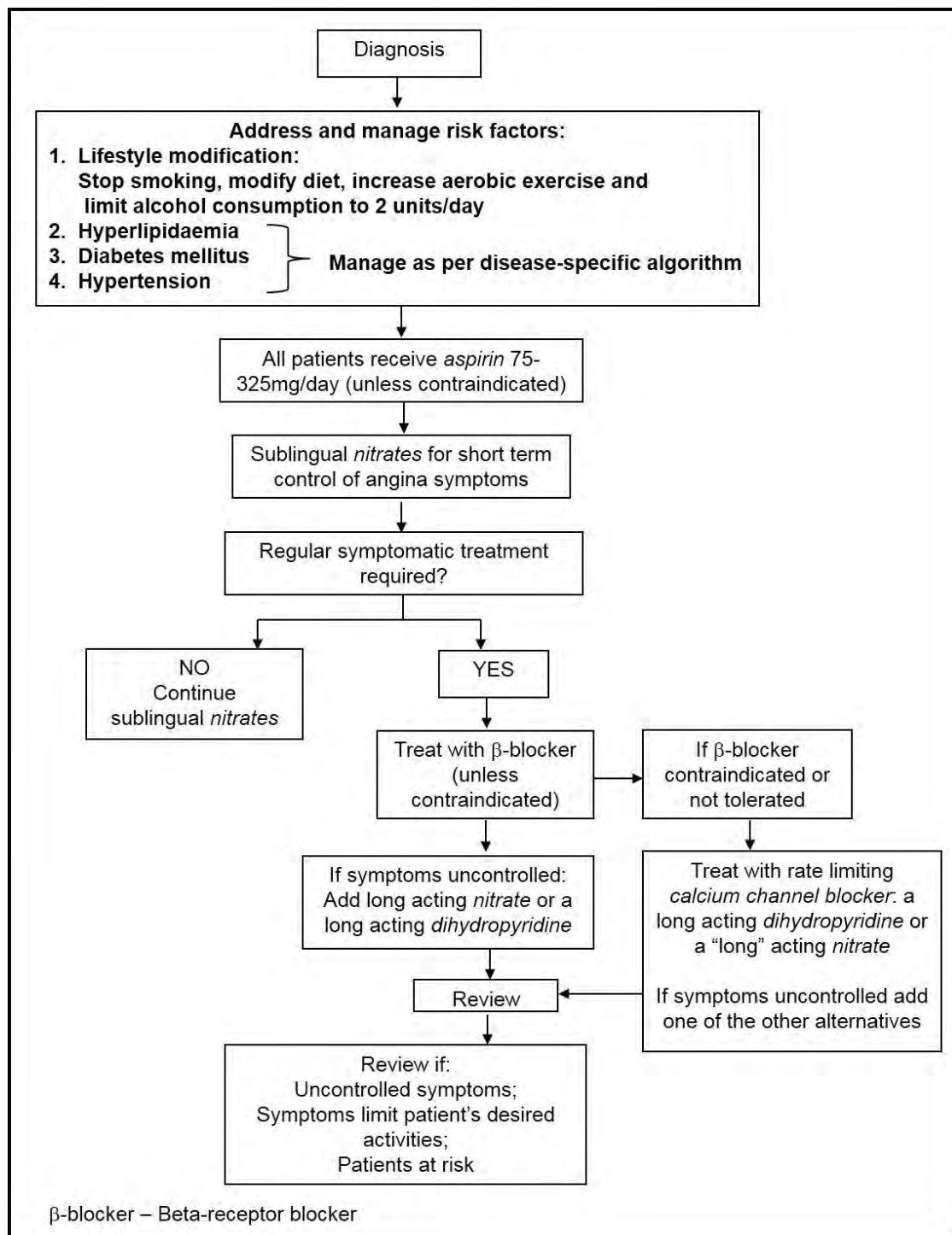


Figure A8: Treatment algorithm for coronary artery disease.

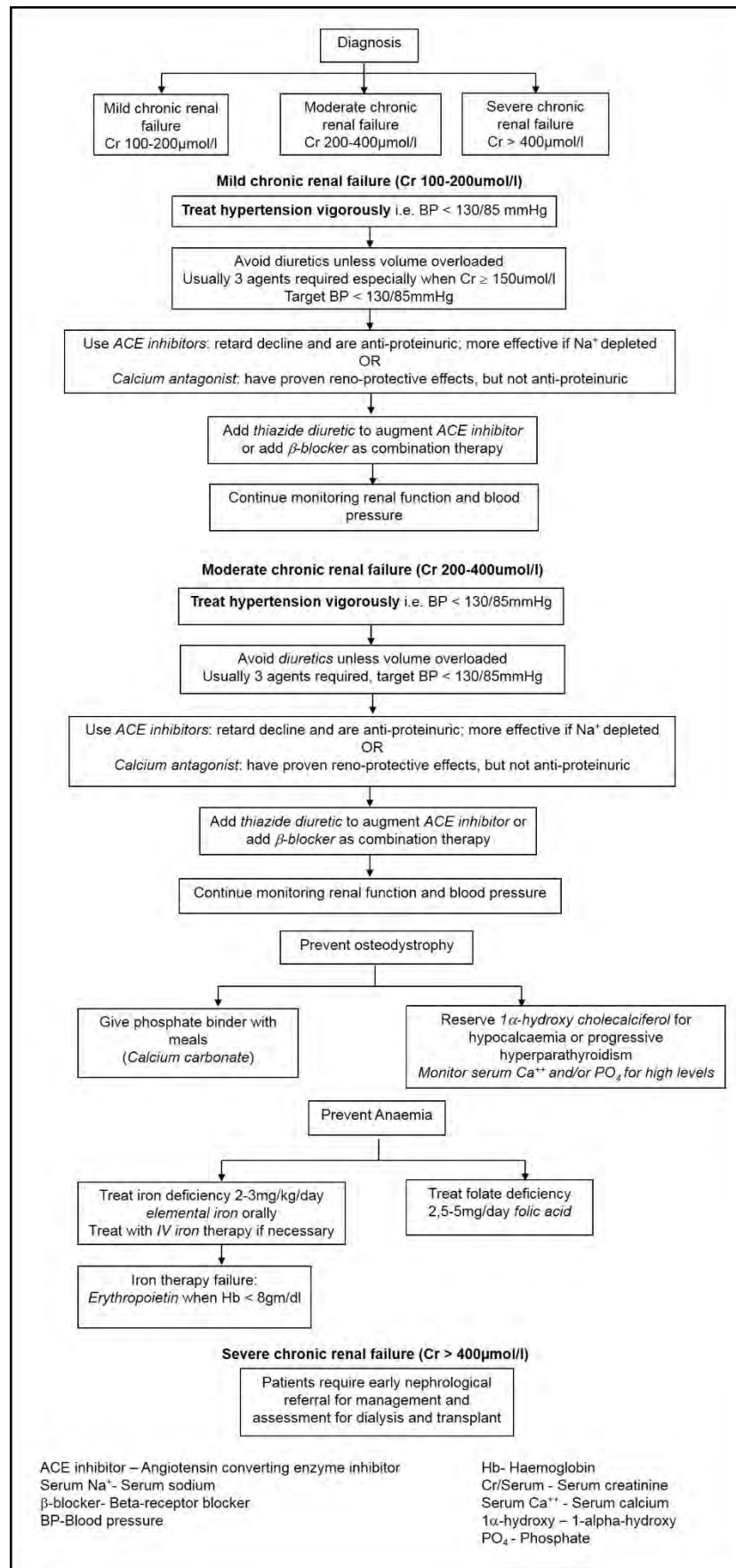


Figure A9: Treatment algorithm for chronic renal disease.

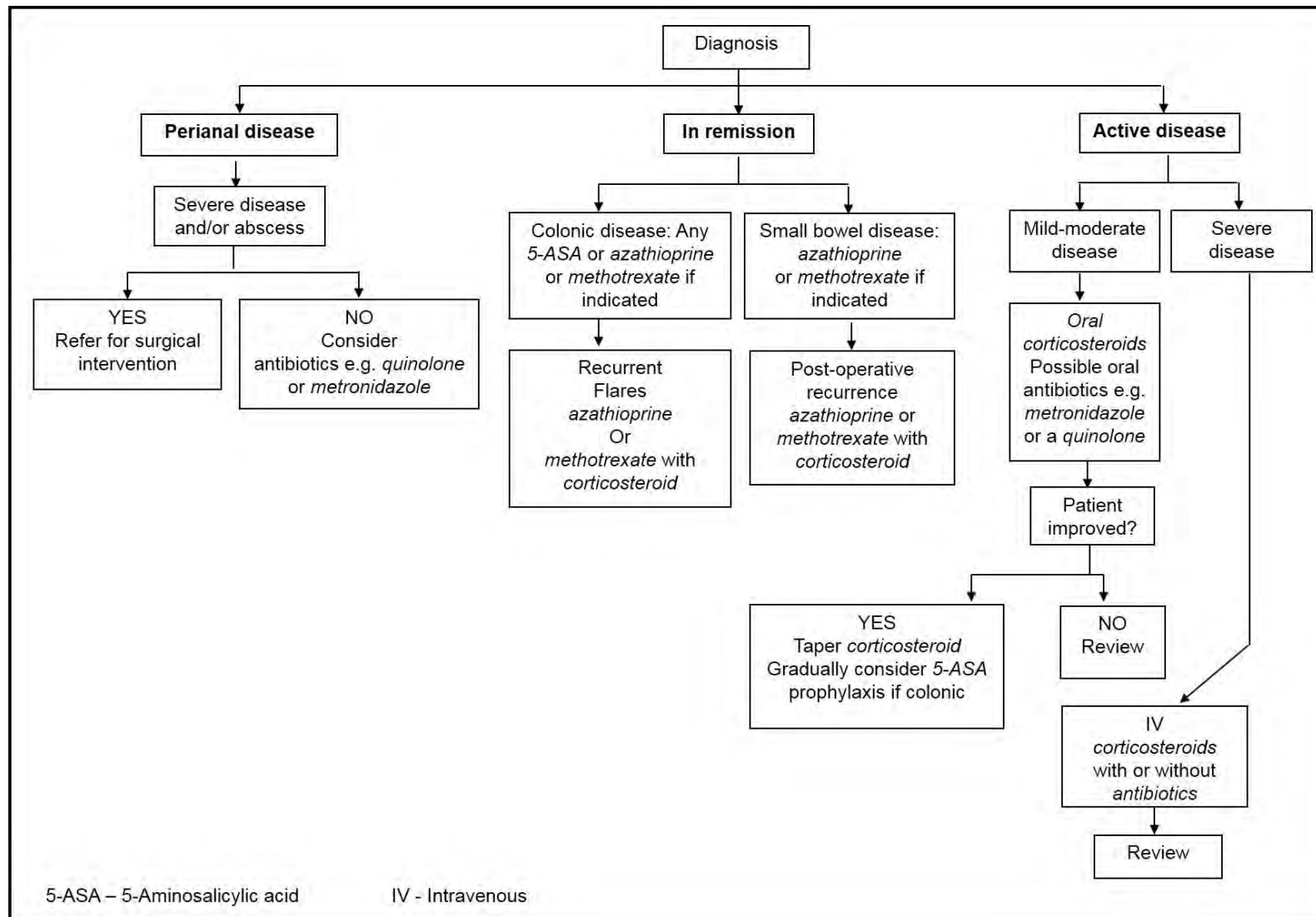


Figure A10: Treatment algorithm for Crohn's disease.

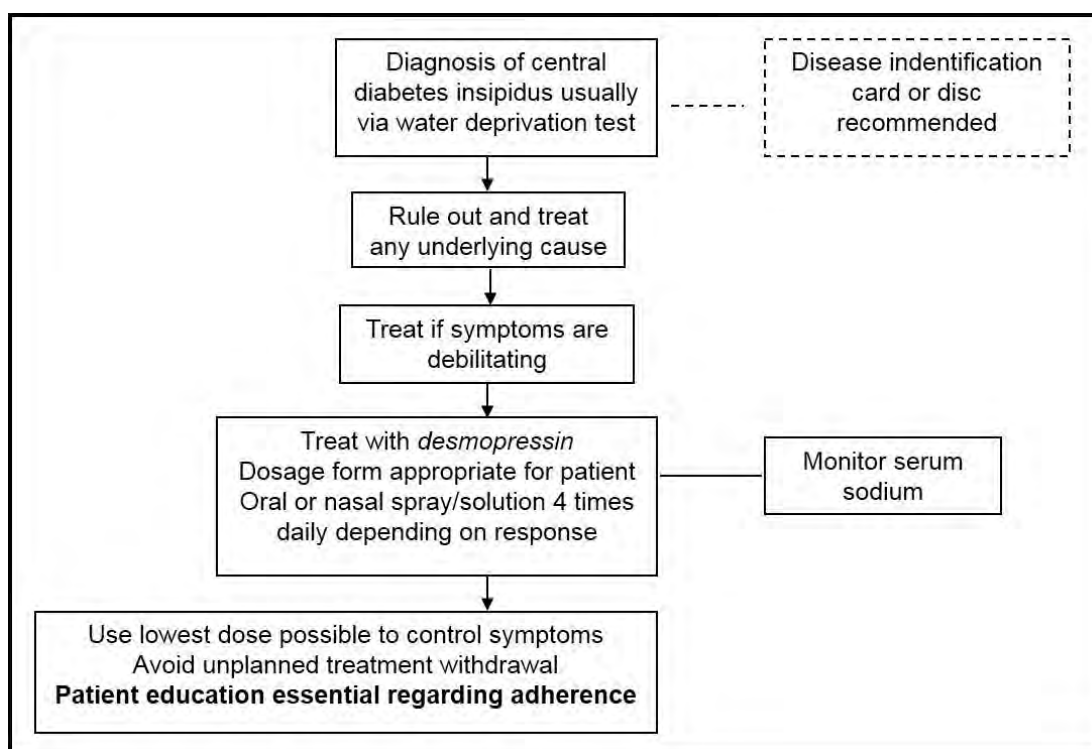


Figure A11: Treatment algorithm for diabetes insipidus.

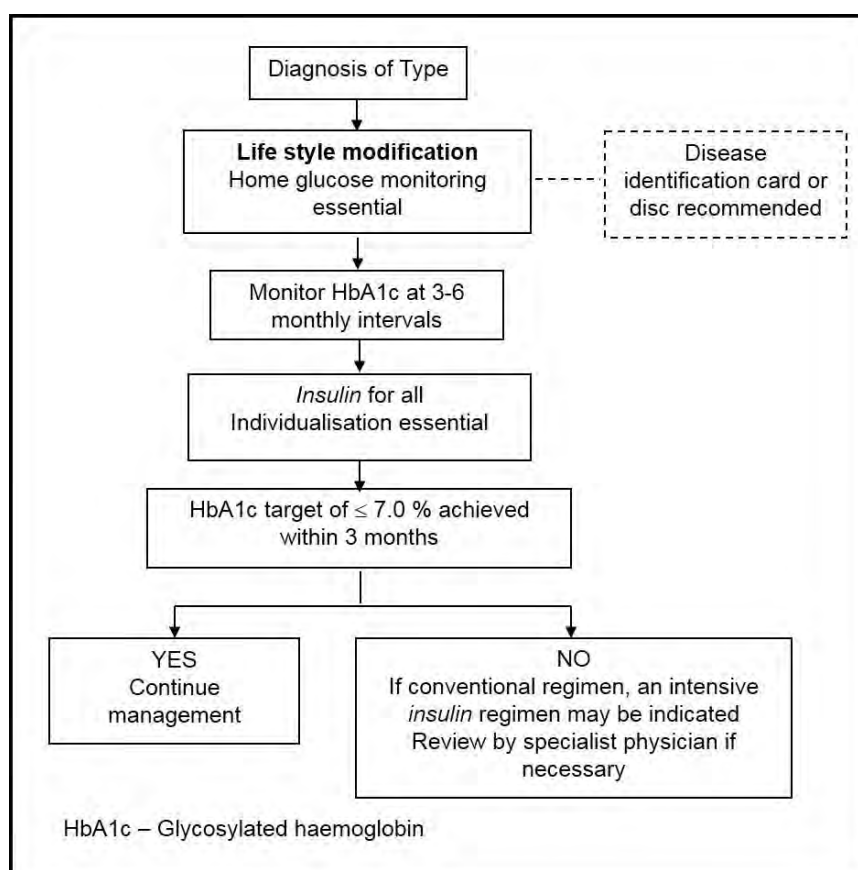


Figure A12: Treatment algorithm for diabetes mellitus type 1.

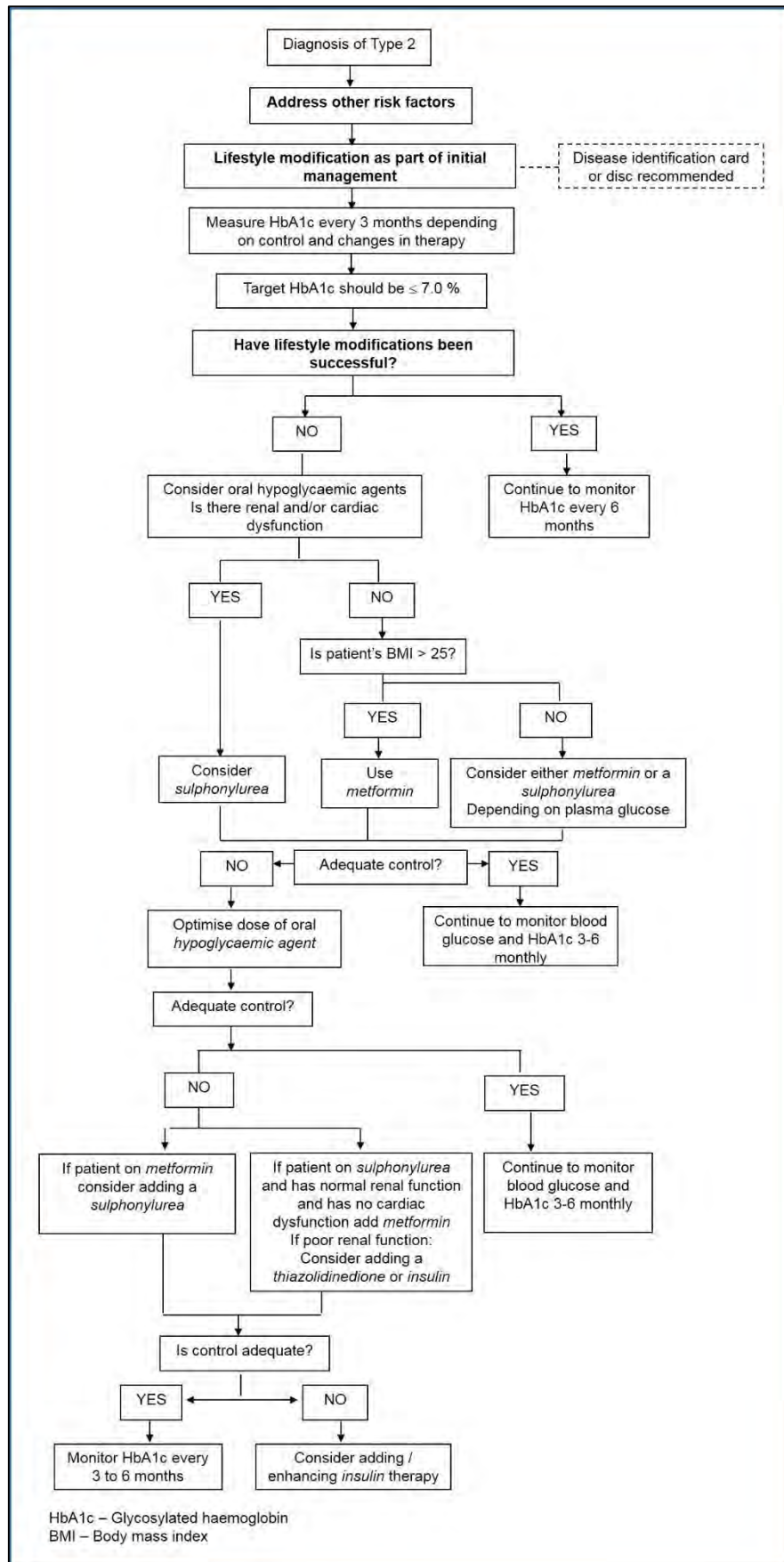


Figure A13: Treatment algorithm for diabetes mellitus type 2.

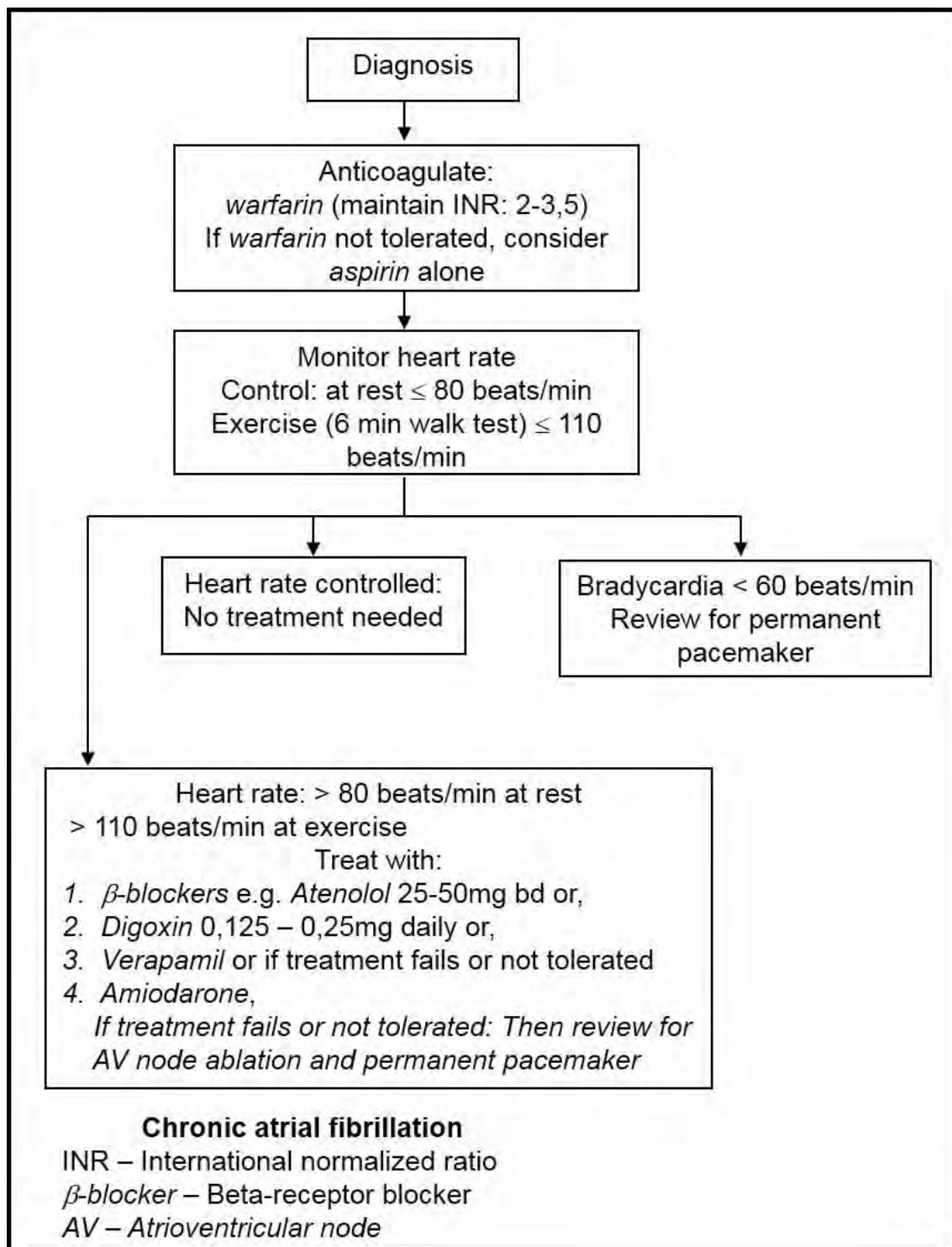


Figure A14: Treatment algorithm of dysrhythmias (chronic atrial fibrillation).

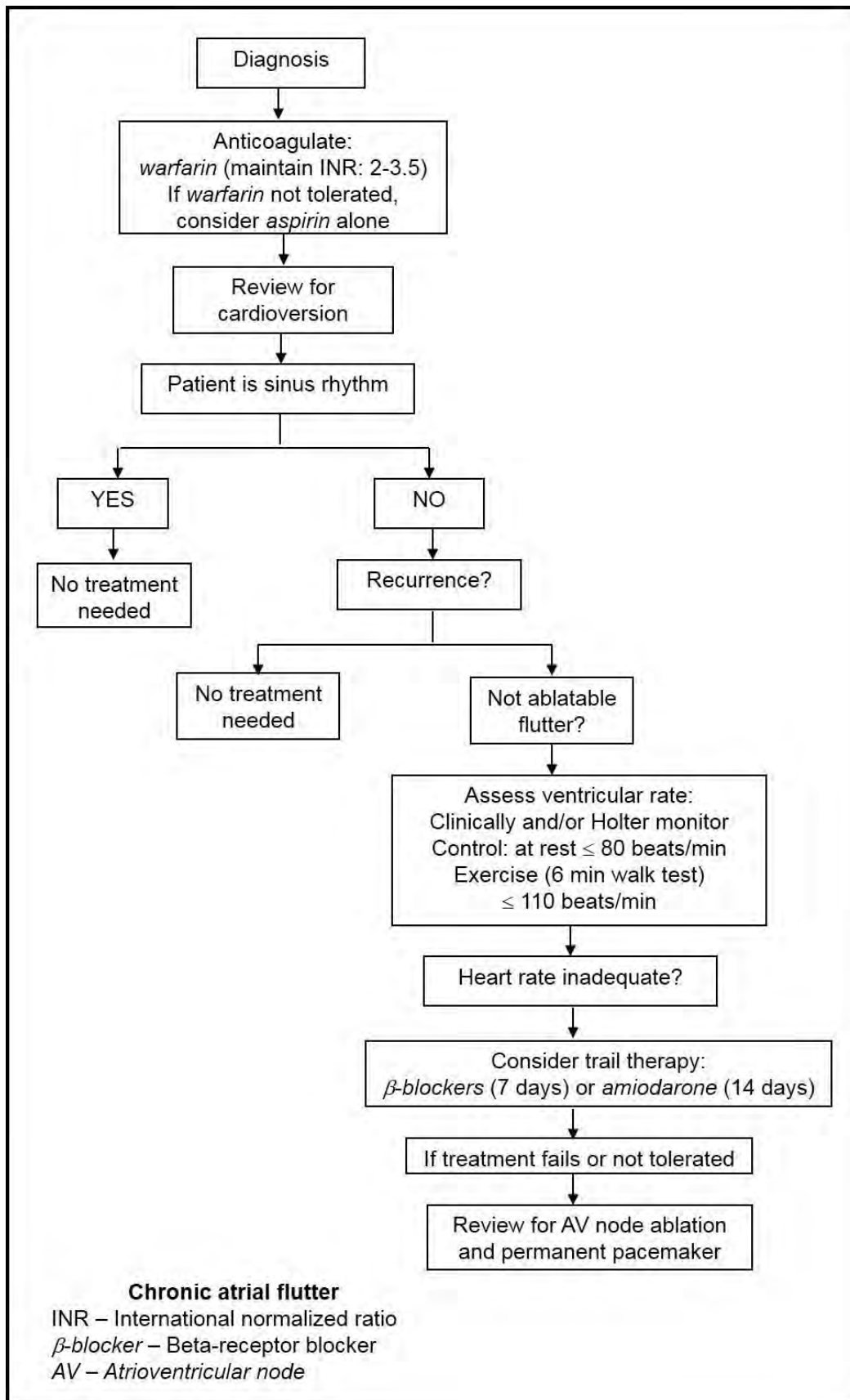


Figure A14: Treatment algorithm of dysrhythmias (chronic atrial fibrillation) (continue).

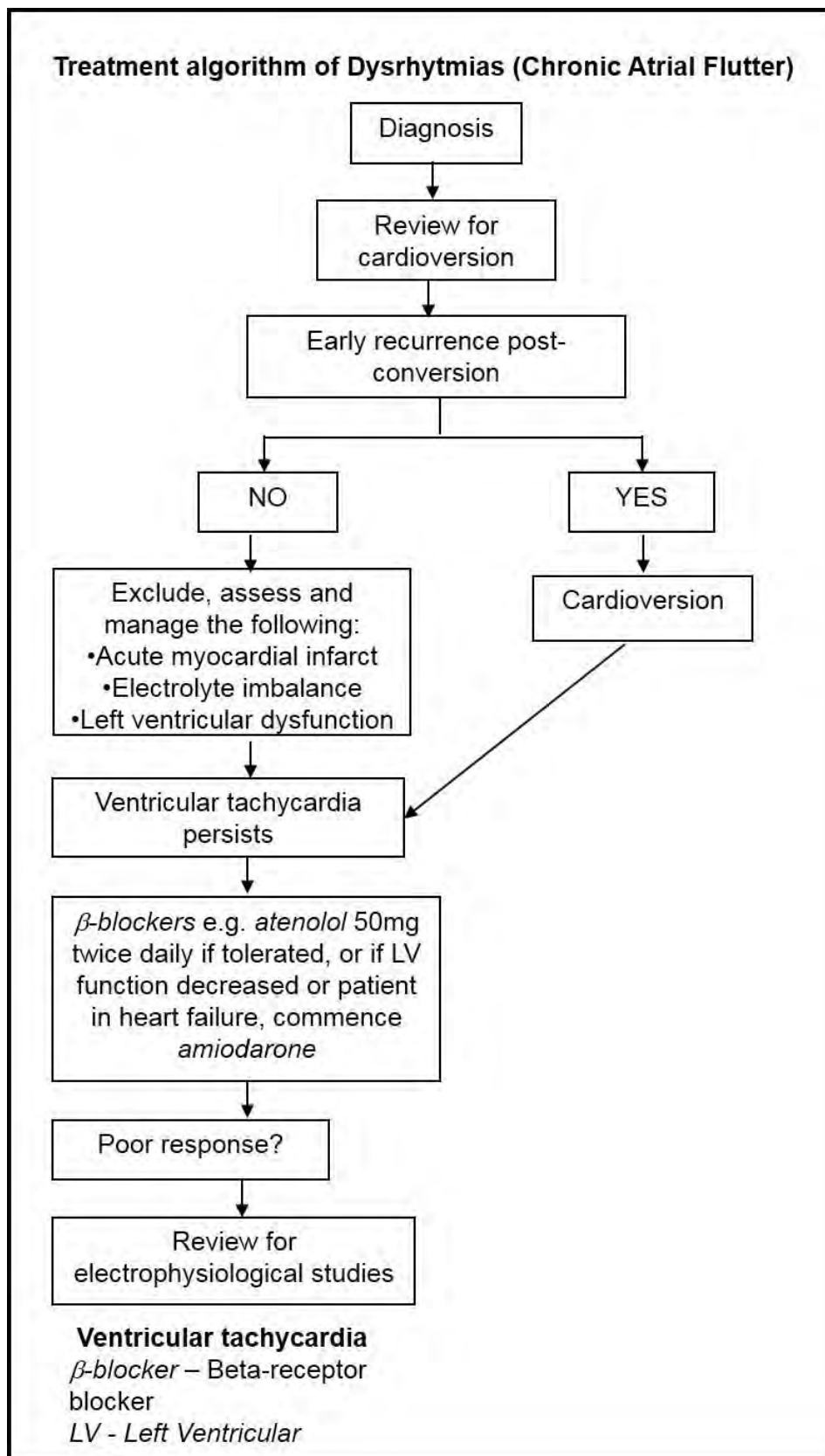


Figure A14: Treatment algorithm of dysrhythmias (chronic atrial fibrillation (continue)).

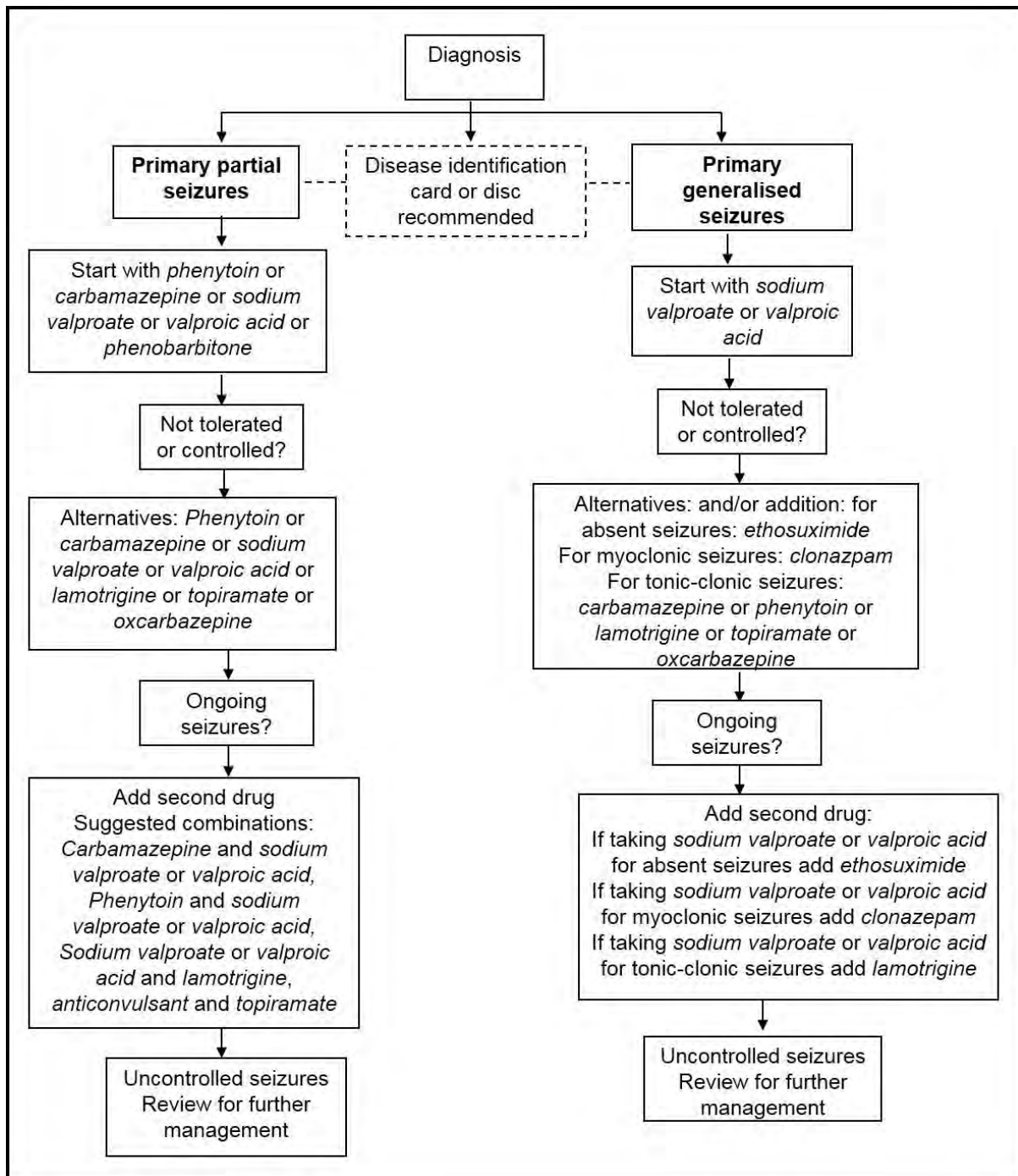


Figure A15: Treatment algorithm for epilepsy.

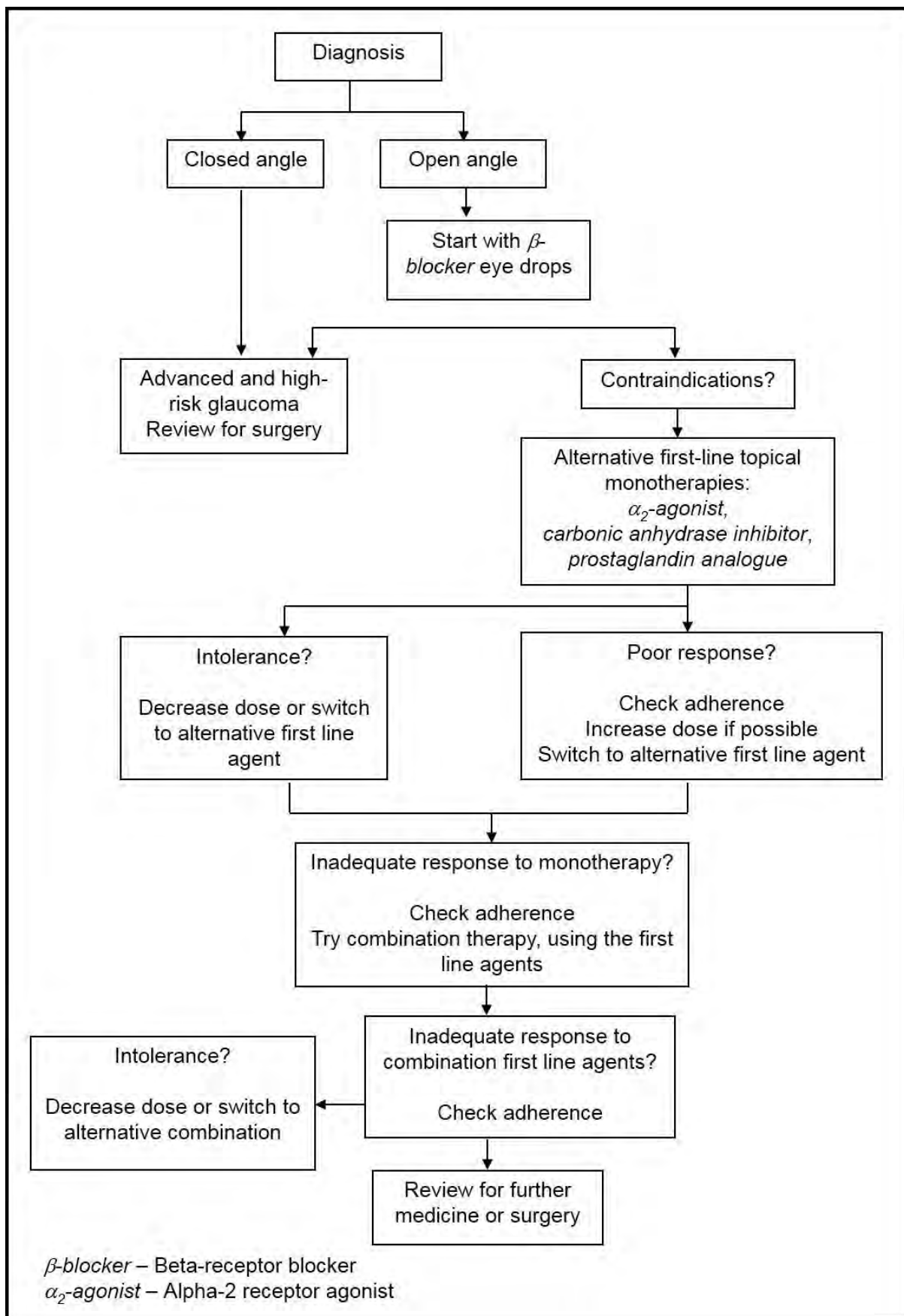


Figure A16: Treatment algorithm for glaucoma.

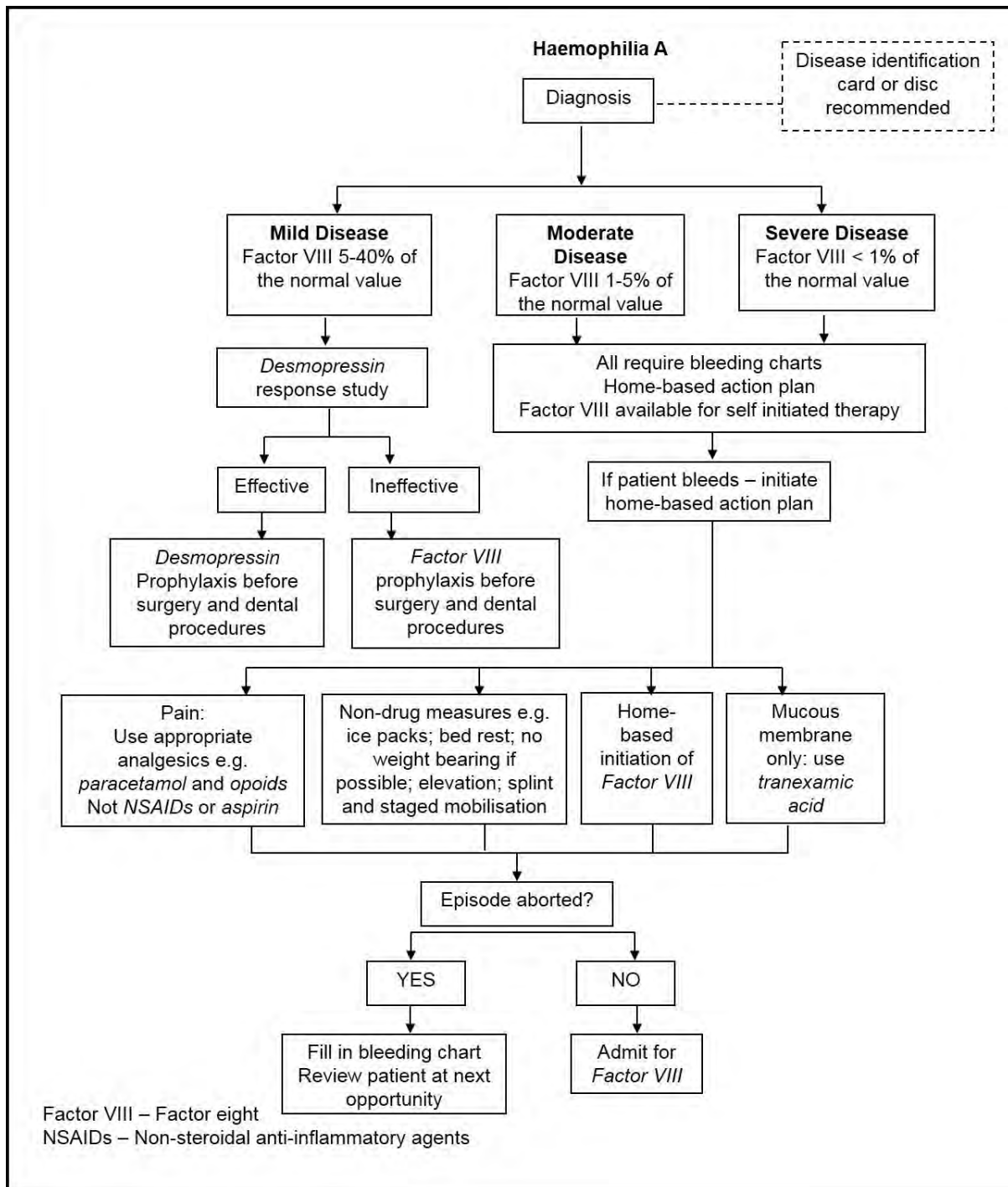


Figure A17: Treatment algorithm for haemophilia A.

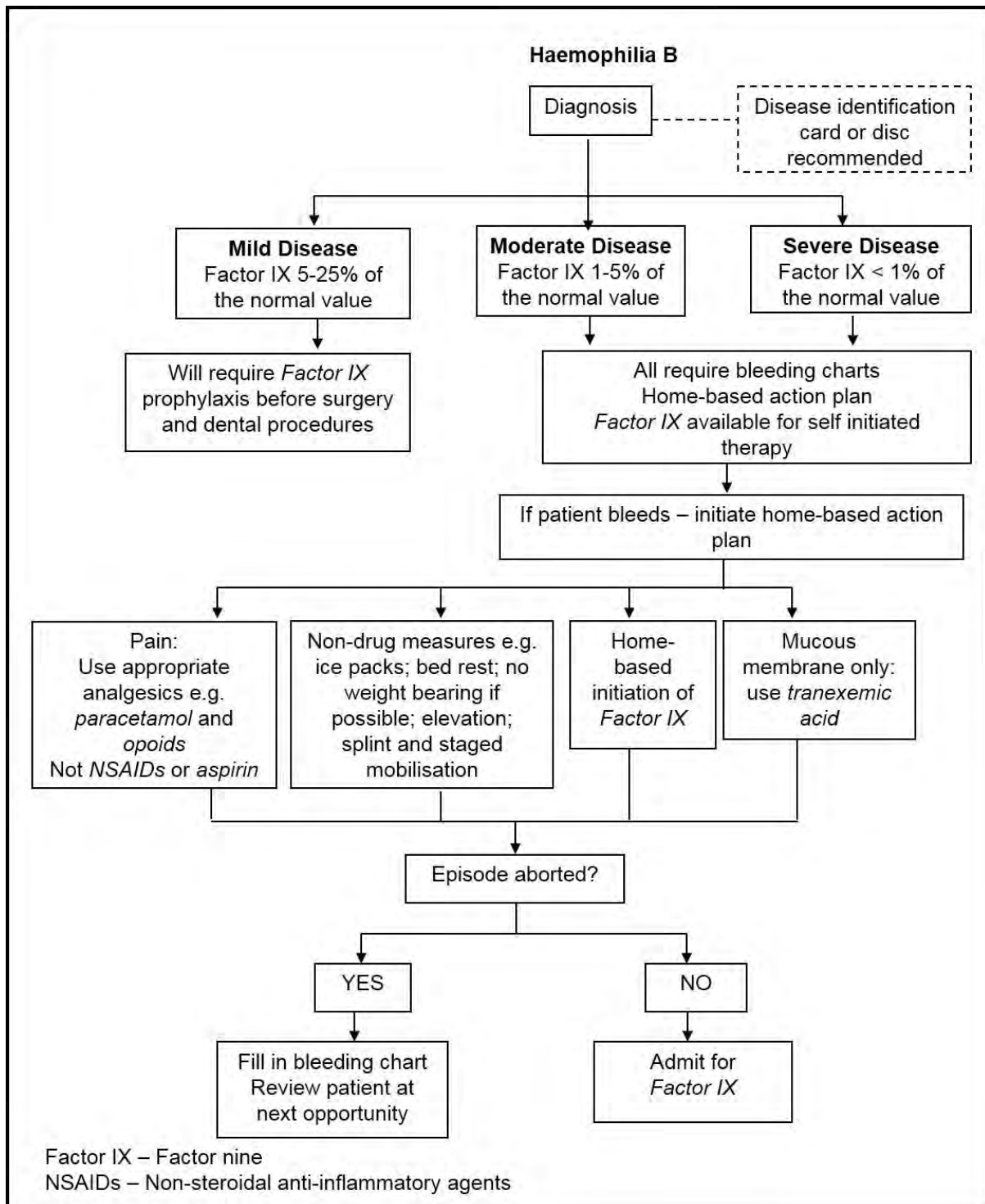


Figure A18: Treatment algorithm for haemophilia B.

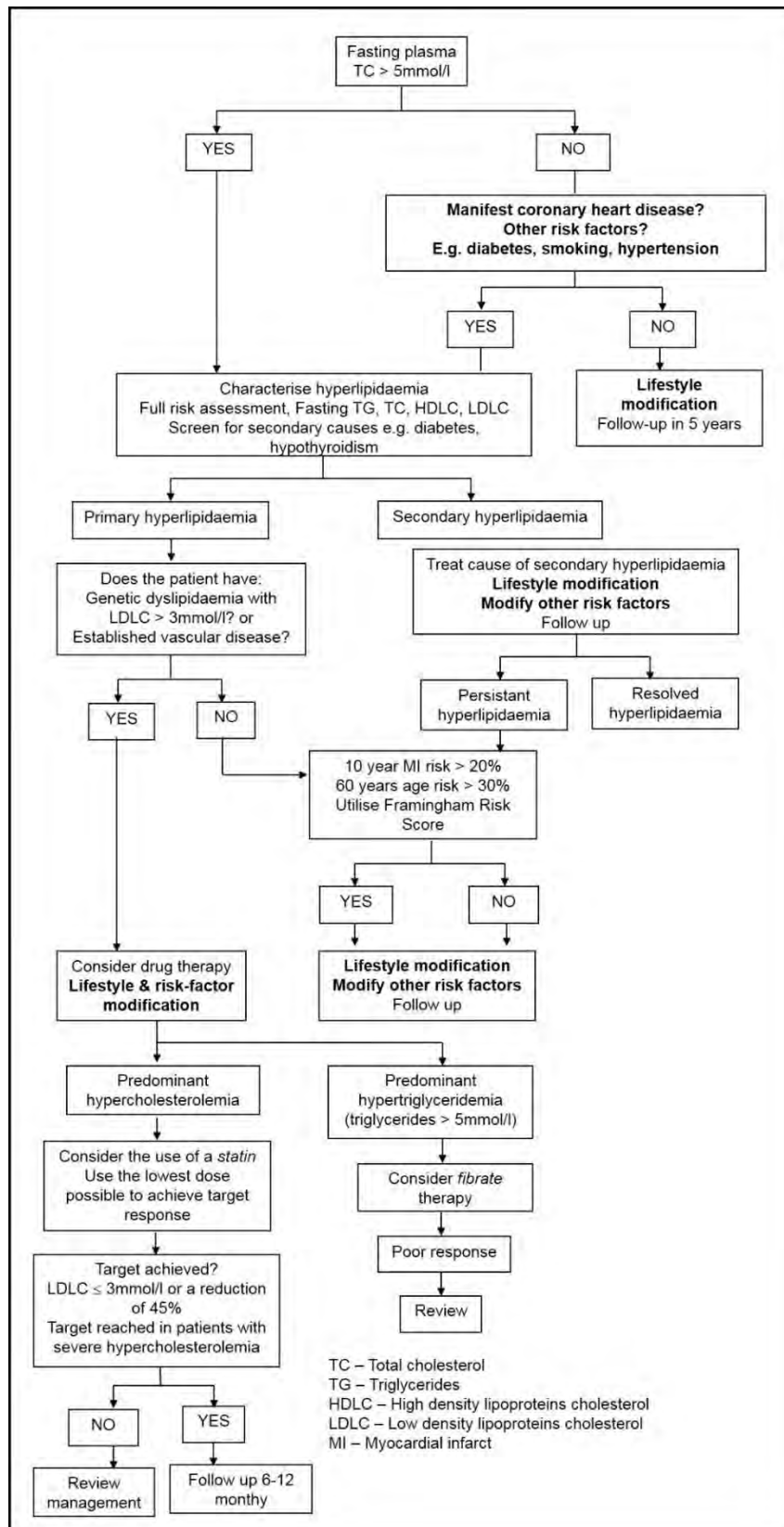


Figure A19: Treatment algorithm for hyperlipidaemia.

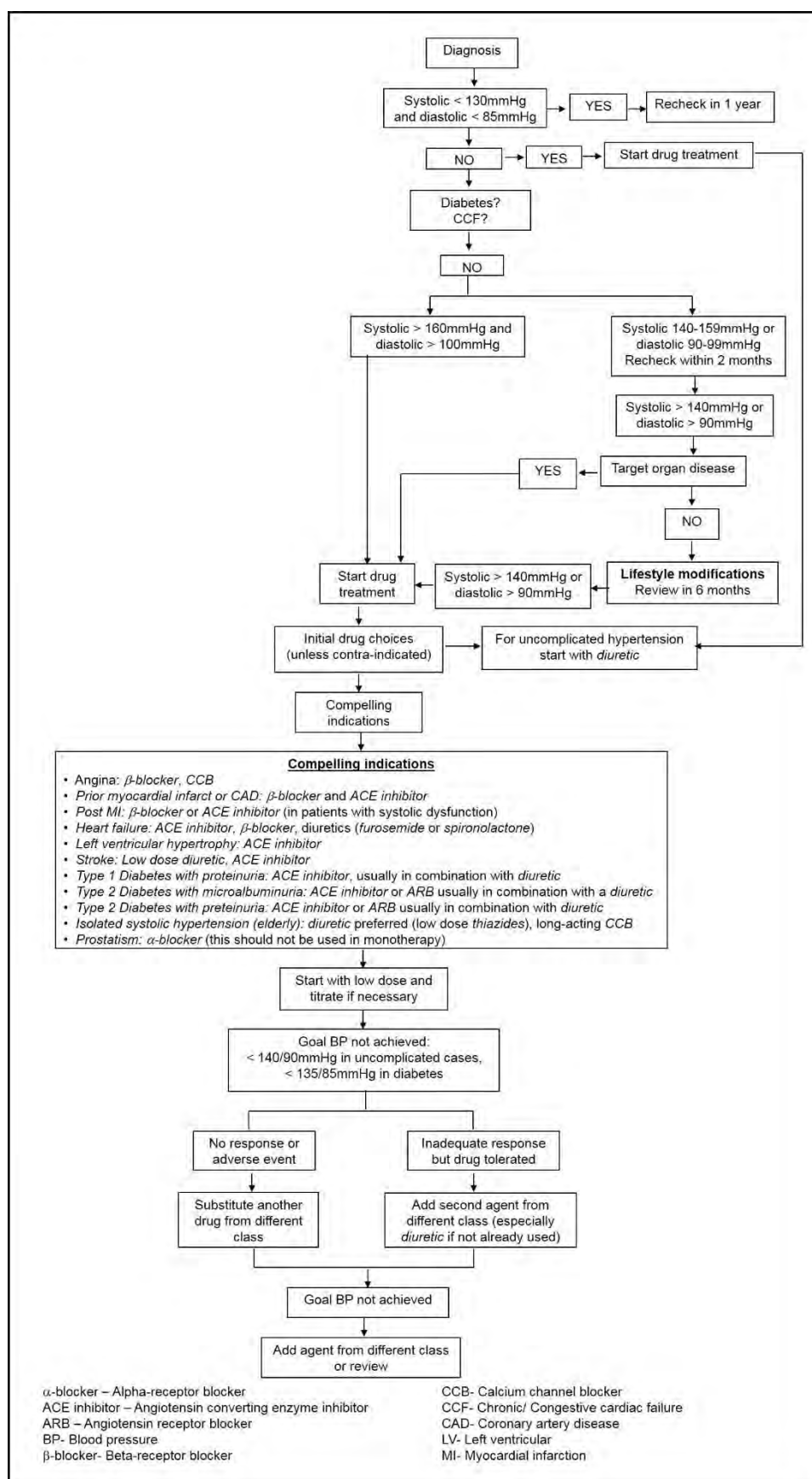


Figure A20: Treatment algorithm for hypertension.

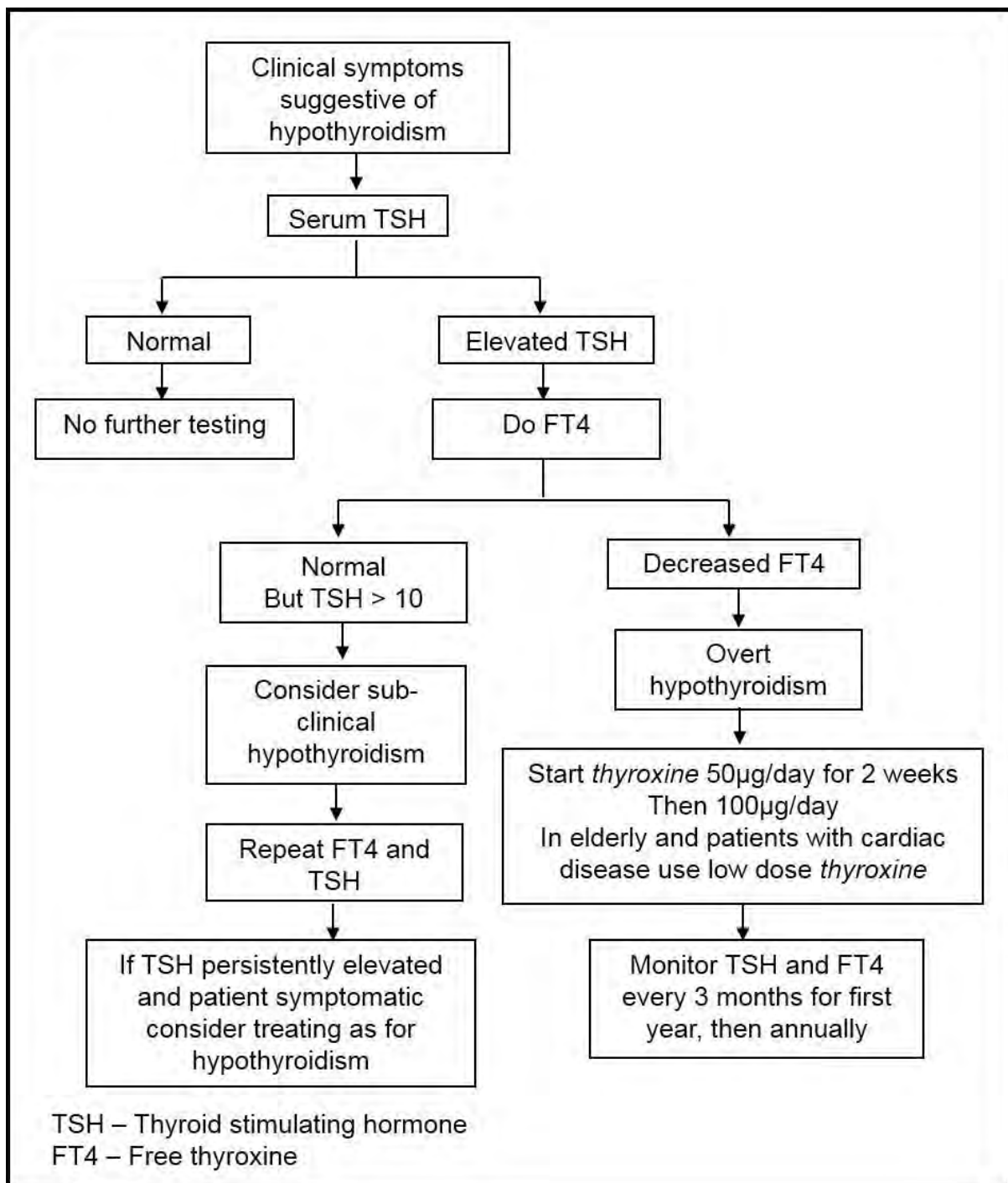


Figure A21: Treating algorithm for hypothyroidism.

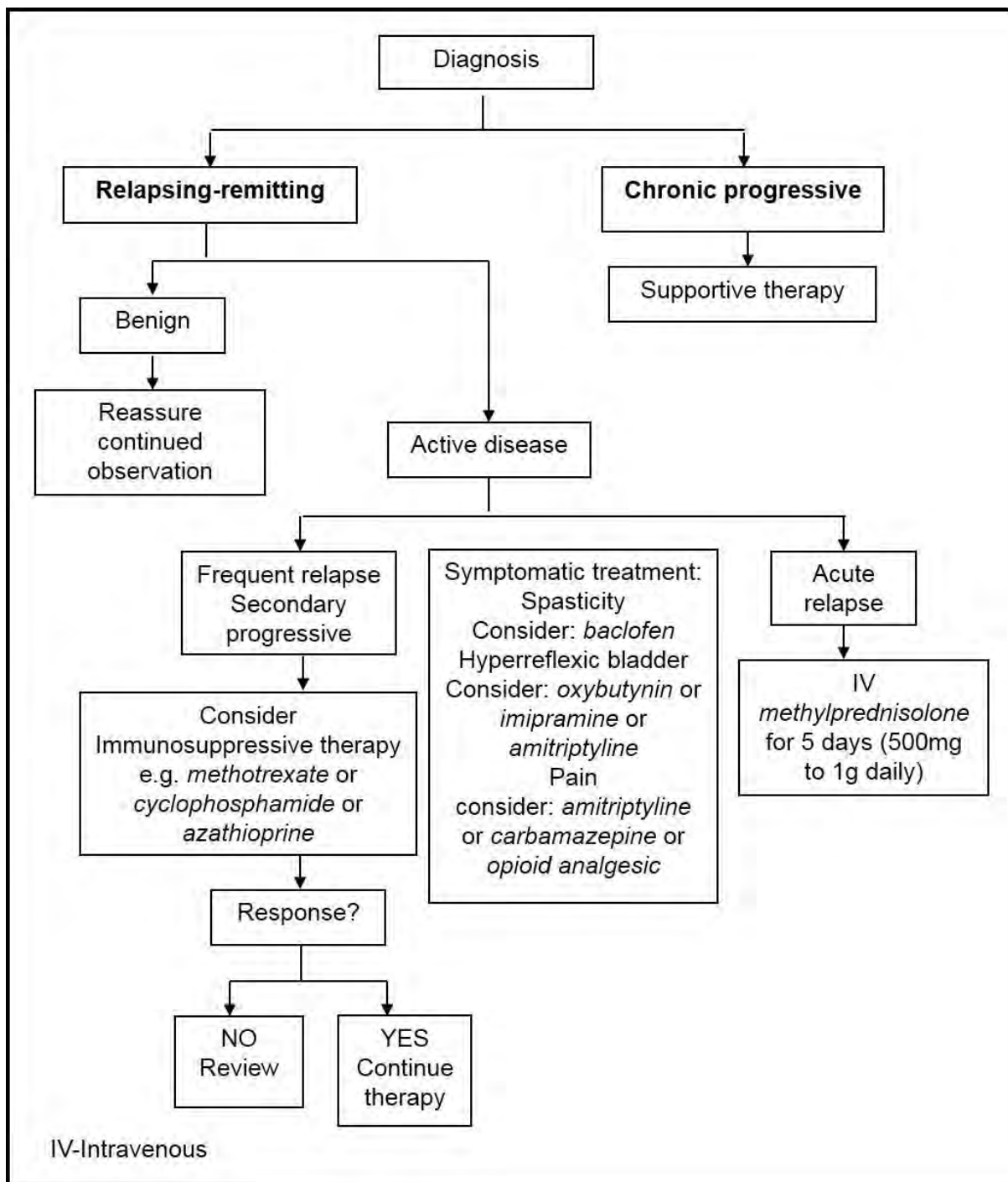


Figure A22: Treatment algorithm for multiple sclerosis.

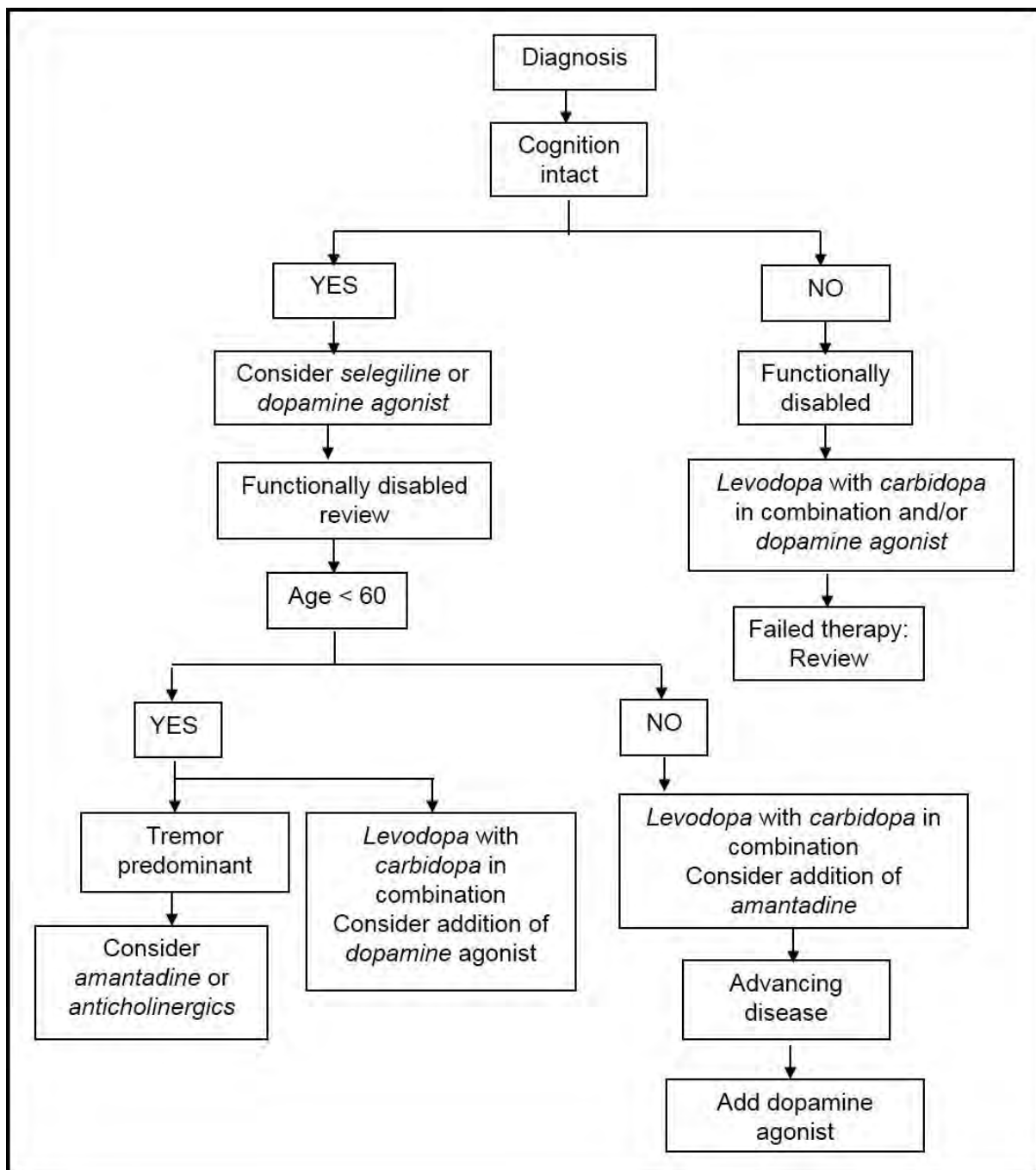


Figure A23: Treatment algorithm for Parkinson's disease.

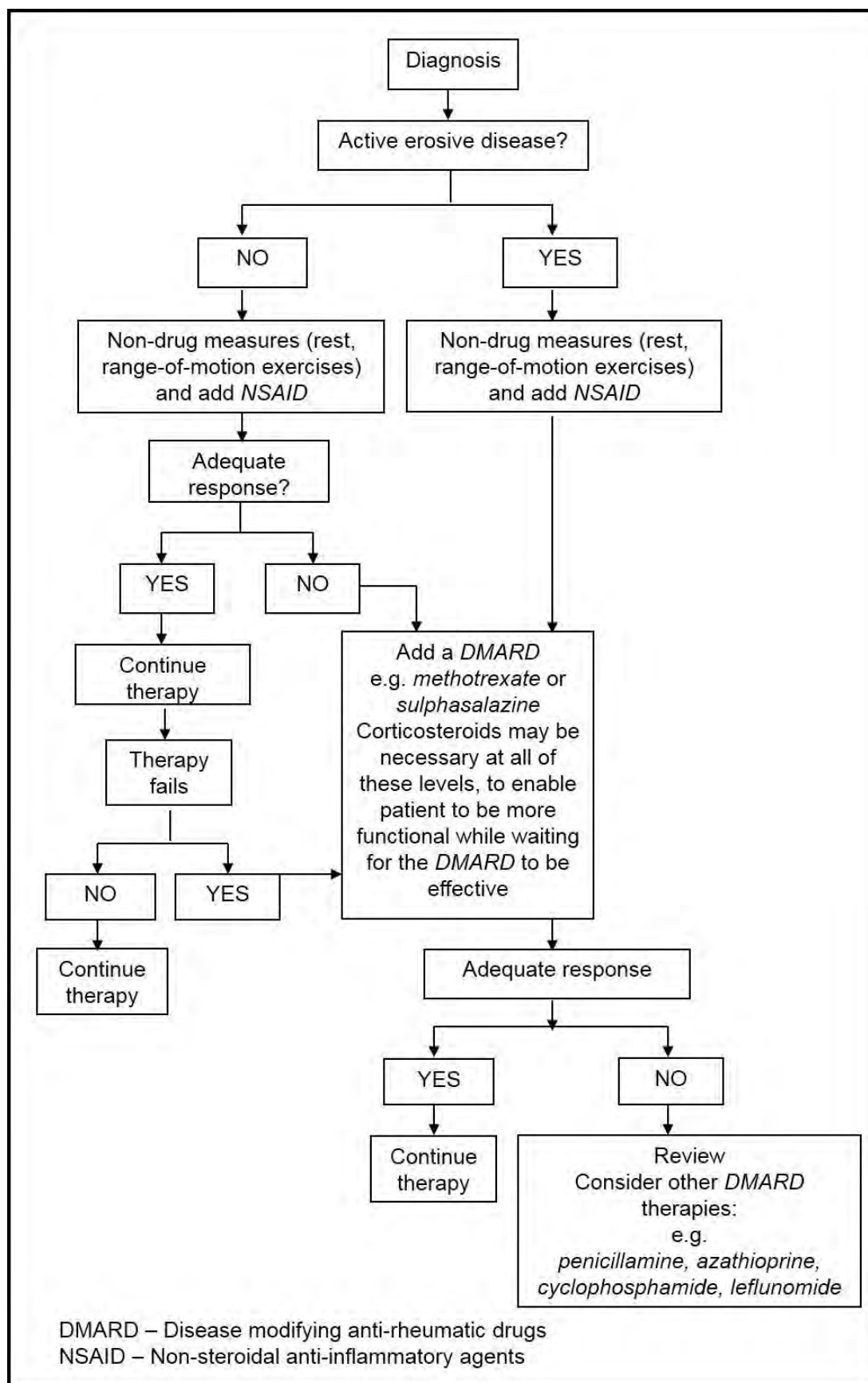


Figure A24: Treatment algorithm for rheumatoid arthritis.

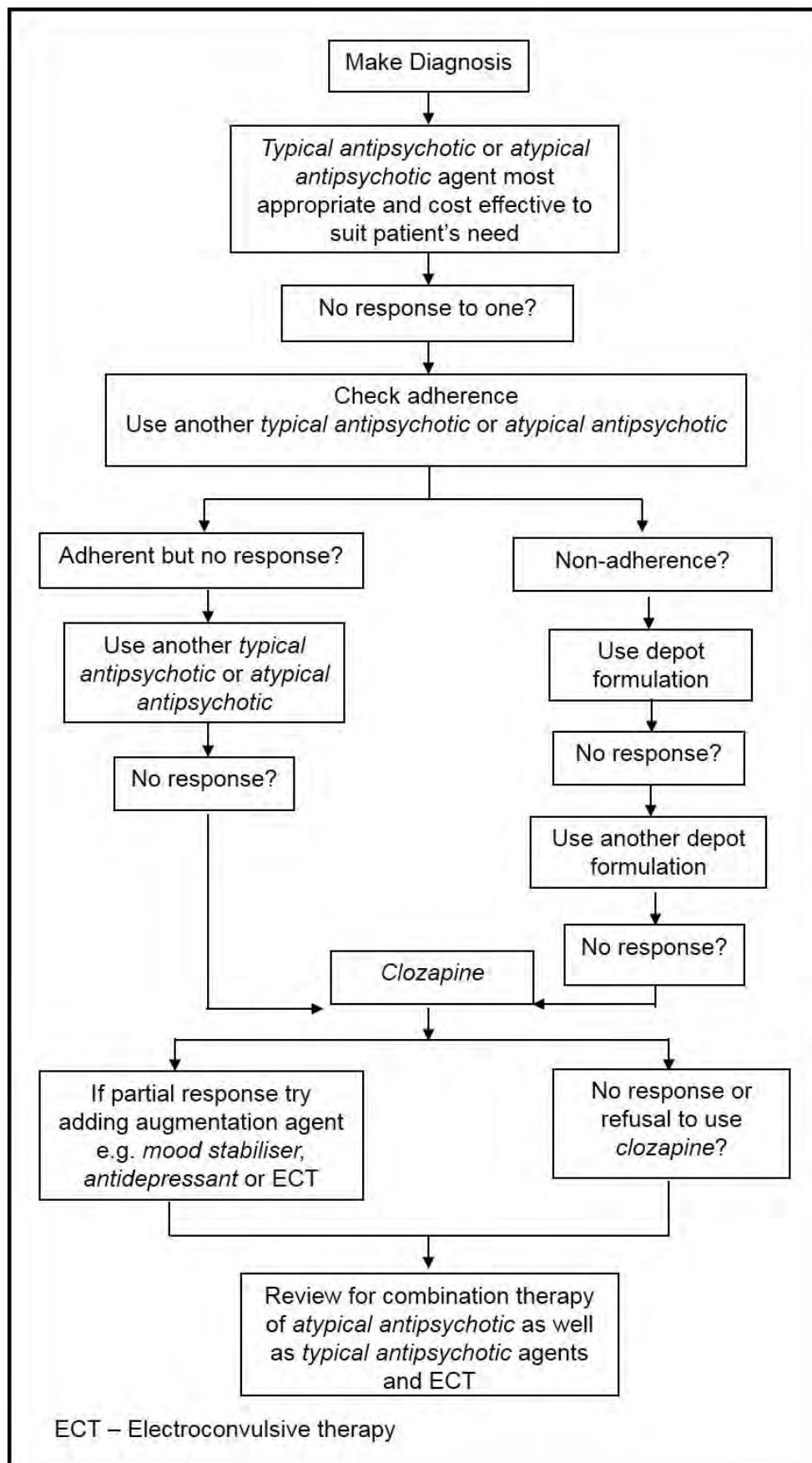


Figure A25: Treatment algorithm for schizophrenia.

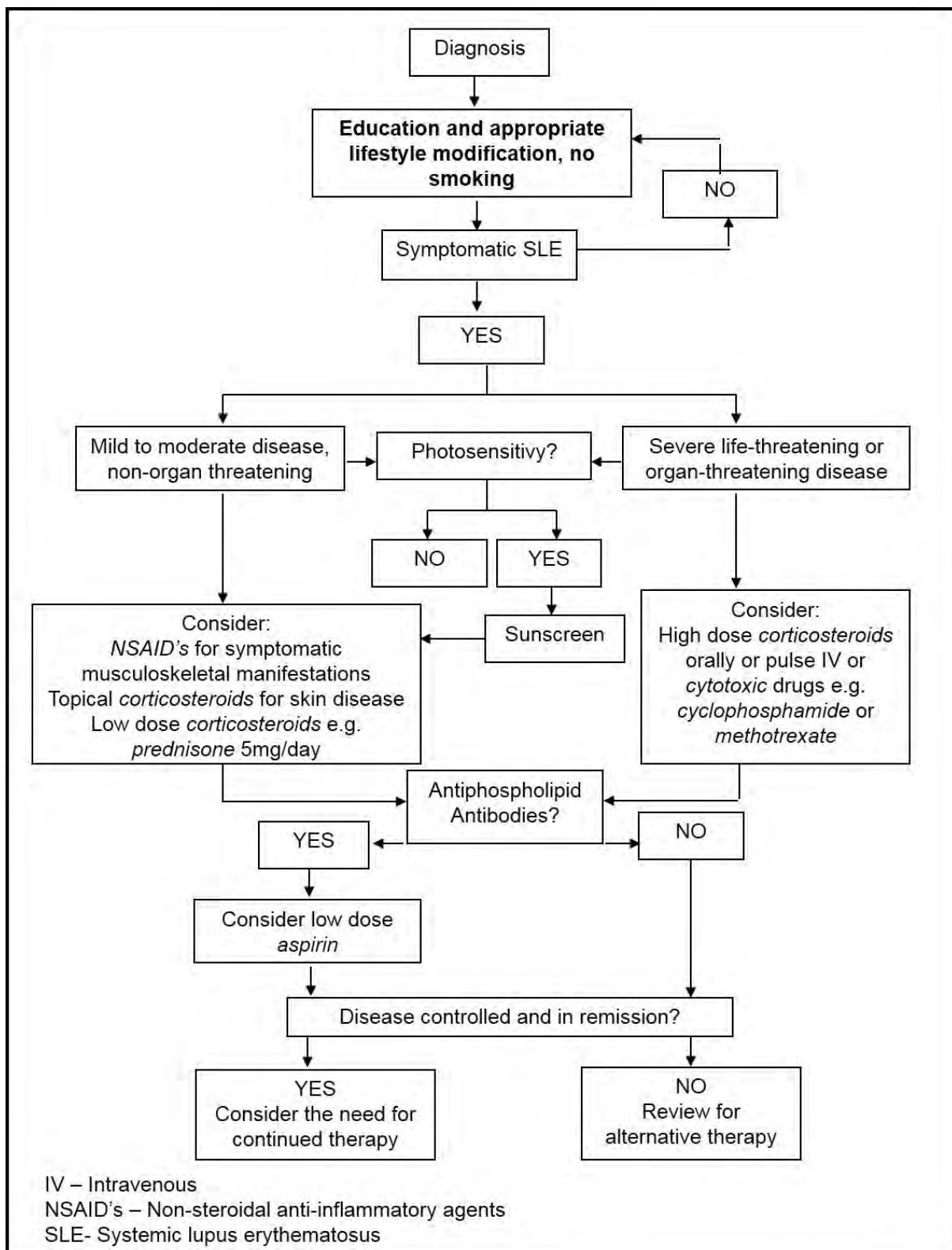


Figure A26: Treatment algorithm for systemic lupus erythematosus.

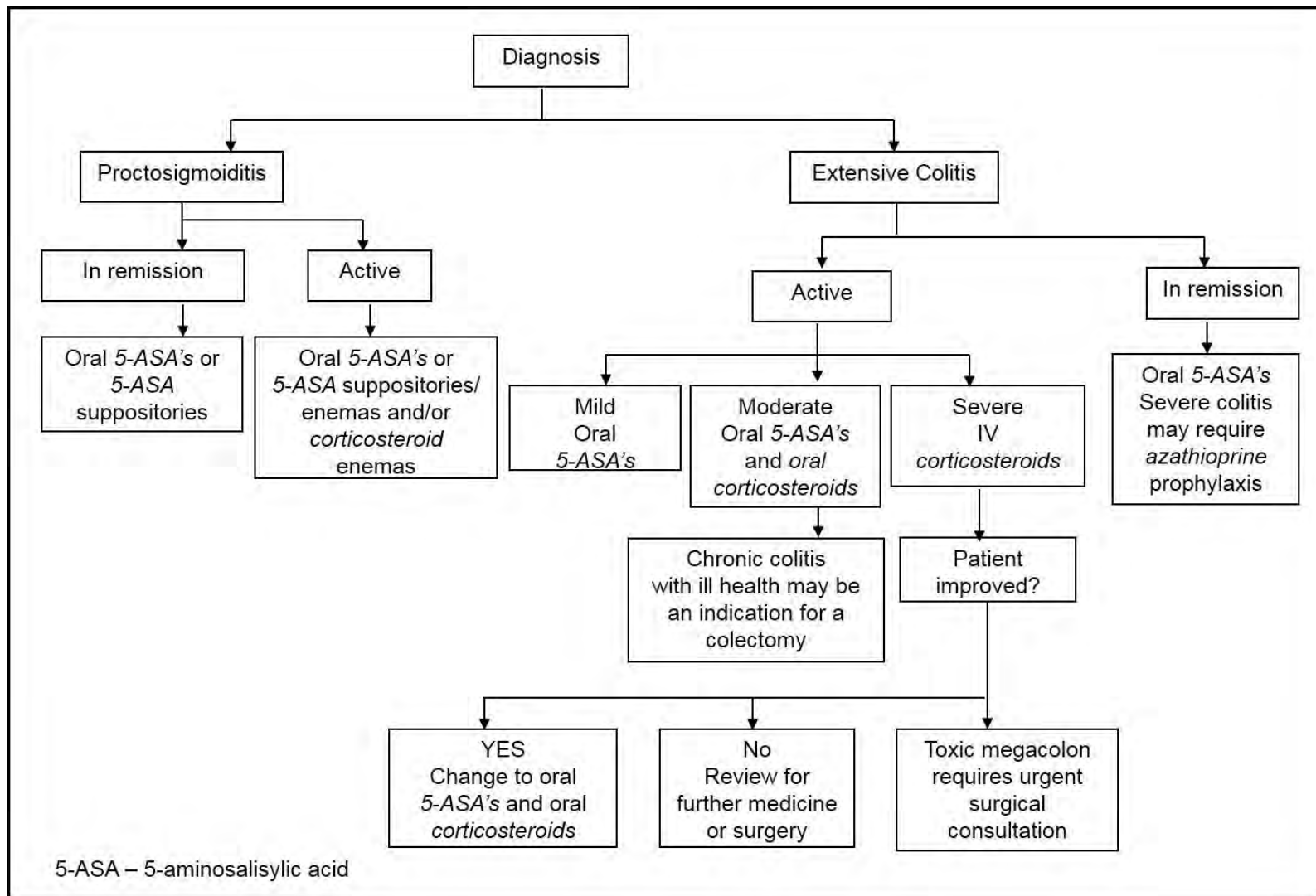


Figure A27: Treatment algorithm for ulcerative colitis.

APPENDIX B

Table B1: Number of the top 5 CDL conditions per patient per year adjusted for age and gender from 2008 until 2012.

Type of CDL condition	Total number of CDL patients (2008-2012) (n)	Year [#]	Mean (number of CDL conditions/patient)	Standard error	Confidence interval (95%CI)	p-value	d-value
Asthma	128 994	2008	1.77	0.01	1.75-1.78	0.00	0.17
		2009	1.81	0.01	1.79-1.82		
		2010	1.83	0.01	1.82-1.85		
		2011	1.87	0.01	1.86-1.87		
		2012	1.95	0.01	1.94-1.97		
Hyperlipidaemia	417 862	2008	2.23	0.00	2.23-2.24	0.00	0.20
		2009	2.31	0.00	2.30-2.31		
		2010	2.32	0.00	2.31-2.33		
		2011	2.39	0.00	2.38-2.40		
		2012	2.43	0.00	2.42-2.44		
Hypertension	782 104	2008	1.82	0.00	1.81-1.82	0.00	0.17
		2009	1.88	0.00	1.87-1.88		
		2010	1.88	0.00	1.88-1.89		
		2011	1.92	0.00	1.92-1.93		
		2012	1.98	0.00	1.98-1.99		
Hypothyroidism	200 728	2008	1.67	0.01	1.66-1.68	0.00	0.61
		2009	2.23	0.01	2.22-2.24		
		2010	2.23	0.01	2.22-2.24		
		2011	2.29	0.01	2.28-2.30		
		2012	2.34	0.01	2.33-2.35		
Diabetes mellitus type 2	206 882	2008	2.39	0.01	2.37-2.40	0.00	0.23
		2009	2.47	0.01	2.46-2.48		
		2010	2.50	0.01	2.49-2.51		
		2011	2.57	0.01	2.56-2.58		
		2012	2.63	0.01	2.62-2.64		

[#] Data were analysed by using linear mixed-effect modelling (MIXED): refer to Chapter 1, section 1.11.2.4.

APPENDIX C

Table C1: Medicine cost of items for haemophilia A according to gender from 2008 until 2012.

Type of CDL condition	Year	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Haemophilia A	2008	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	152	Total cost	18 742.02	14 477.34	16 421.90-21 062.13	2 848 786.47
	2009	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	240	Total cost	20 999.68	16 353.32	18 920.21-23 079.15	5 039 922.73
	2010	Gender	Female	3	Total cost	301.25	33.61	217.76-384.74	903.74
			Male	279	Total cost	22 522.51	16 988.04	20 520.41-24 524.60	6 283 778.99
	2011	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	312	Total cost	23 741.80	16 631.51	21 889.14-25 594.46	7 407 440.69
	2012	Gender	Female	2	Total cost	12 102.20	1.61	12 087.71-12 116.69	24 204.40
			Male	326	Total cost	26 897.92	23 957.47	24 287.56-29 508.28	8 768 722.16

Table C2: Medicine cost of items for haemophilia B according to gender from 2008 until 2012.

Type of CDL condition	Year	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Haemophilia B	2008	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	0	Total cost	0.00	0.00	0.00	0.00
	2009	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	7	Total cost	7 378.36	2 627.42	4 948.41-9 808.31	51 648.52
	2010	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	6	Total cost	8 782.96	318.77	8 448.43-9 117.48	52 697.74
	2011	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	15	Total cost	7 588.61	5 184.76	4 717.38-10 459.83	113 829.12
	2012	Gender	Female	0	Total cost	0.00	0.00	0.00	0.00
			Male	14	Total cost	9 124.96	9 819.59	3 455.30-14 794.62	127 749.47

APPENDIX D

Table D1: Medicine cost for patients with asthma according to different cost types, age and gender for 2008.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2008	Asthma	Gender	Female	96 473	Medical scheme contribution	149.39	126.66	148.60-150.19	14 412 241.53	
					Patient levy	26.93	51.69	26.61-27.26	2 598 210.15	
					Total cost	176.32	139.11	175.45-177.21	17 010 451.68	
			Male	73 793	Medical scheme contribution	146.62	125.59	145.72-147.53	10 819 470.13	
					Patient levy	25.21	51.17	24.84-25.58	1 860 073.26	
					Total cost	171.83	138.95	170.83-172.83	12 679 543.39	
		Age	0 > age ≤ 12	15 168	Medical scheme contribution	130.51	116.11	128.67-132.36	1 979 591.44	
					Patient levy	19.48	40.25	18.85-20.13	295 524.65	
					Total cost	149.99	125.67	148.00-152.00	2 275 116.09	
			12 > age ≤ 50	56 845	Medical scheme contribution	145.84	127.01	144.80-146.89	8 290 121.29	
					Patient levy	22.67	43.56	22.32-23.03	1 288 803.26	
					Total cost	168.51	137.67	167.38-169.65	9 578 924.55	
			50 > age ≤ 60	31 286	Medical scheme contribution	144.50	129.22	143.07-145.93	4 520 792.40	
					Patient levy	23.66	48.15	23.13-24.20	740 226.42	
					Total cost	168.16	142.69	166.58-169.74	5 261 018.82	
			60 > age ≤ 70	31 171	Medical scheme contribution	151.79	126.46	150.39-153.20	4 731 474.86	
					Patient levy	28.61	57.58	27.98-29.26	891 943.13	
					Total cost	180.41	139.39	178.86-181.96	5 623 417.99	
			age >70	35 796	Medical scheme contribution	159.51	124.94	158.22-160.81	5 709 731.67	
					Patient levy	34.69	62.17	34.05-35.34	1 241 785.95	
					Total cost	194.20	140.41	192.75-195.66	6 951 517.62	
			Total		170 266	Medical scheme contribution	148.19	126.20	147.59-148.79	25 231 711.66
						Patient levy	26.18	51.47	25.94-26.43	4 458 283.41
						Total cost	174.37	139.06	173.72-175.04	29 689 995.07

Table D2: Medicine cost for patients with asthma according to different cost types, age and gender for 2009.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2009	Asthma	Gender	Female	155 851	Medical scheme contribution	166.86	143.95	166.15-167.58	26 004 990.75		
					Patient levy	36.60	67.72	36.26-36.94	5 703 506.33		
					Total cost	203.45	158.76	202.67-204.25	31 708 497.08		
			Male	119 901	Medical scheme contribution	168.78	142.80	167.98-169.59	20 237 098.24		
					Patient levy	34.29	74.46	33.87-34.72	4 111 490.41		
					Total cost	203.07	162.40	202.16-204.00	24 348 588.65		
		Age	0 > age ≤ 12	35 789	Medical scheme contribution	175.37	137.24	173.95-176.79	6 276 283.38		
					Patient levy	37.30	66.09	36.61-37.98	1 334 762.54		
					Total cost	212.66	148.80	211.13-214.21	7 611 045.92		
			12 > age ≤ 50	87 620	Medical scheme contribution	168.15	146.05	167.19-169.13	14 733 684.08		
					Patient levy	31.97	61.54	31.57-32.38	2 801 276.03		
					Total cost	200.13	159.11	199.08-201.18	17 534 960.11		
			50 > age ≤ 60	47 684	Medical scheme contribution	161.78	142.33	160.50-163.06	7 714 106.05		
					Patient levy	33.52	63.67	32.95-34.09	1 598 261.91		
					Total cost	195.29	157.53	193.88-196.71	9 312 367.96		
			60 > age ≤ 70	50 146	Medical scheme contribution	166.64	145.67	165.37-167.92	8 356 492.08		
					Patient levy	37.58	91.17	36.79-38.38	1 884 615.03		
					Total cost	204.23	174.10	202.71-205.75	10 241 107.11		
			age >70	54 513	Medical scheme contribution	168.06	141.90	166.87-169.26	9 161 523.40		
					Patient levy	40.29	71.51	39.69-40.89	2 196 081.23		
					Total cost	208.35	158.43	207.02-209.68	11 357 604.63		
			Total			275 752	Medical scheme contribution	167.69	143.45	167.16-168.23	46 242 088.99
							Patient levy	35.59	70.74	35.33-35.86	9 814 996.74
							Total cost	203.29	160.35	202.69-203.89	56 057 085.73

Table D3: Medicine cost for patients with asthma according to different cost types, age and gender for 2010.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2010	Asthma	Gender	Female	150 809	Medical scheme contribution	177.66	150.18	176.91-178.42	26 792 858.21		
					Patient levy	38.97	70.05	38.62-39.32	5 876 479.08		
					Total cost	216.63	166.74	215.79-217.47	32 669 337.29		
			Male	115 708	Medical scheme contribution	177.77	148.89	176.92-178.64	20 569 819.26		
					Patient levy	35.90	71.78	35.49-36.31	4 153 570.70		
					Total cost	213.67	167.54	212.71-214.64	24 723 389.96		
		Age	0 > age ≤ 12	33 165	Medical scheme contribution	183.42	142.19	181.90-184.96	6 083 262.88		
					Patient levy	38.31	66.56	37.60-39.03	1 270 533.89		
					Total cost	221.73	154.77	220.07-223.40	7 353 796.77		
			12 > age ≤ 50	81 933	Medical scheme contribution	179.47	153.30	178.43-180.53	14 704 912.35		
					Patient levy	34.67	63.75	34.23-35.11	2 840 391.16		
					Total cost	214.14	168.58	212.99-215.30	17 545 303.51		
			50 > age ≤ 60	46 738	Medical scheme contribution	172.93	149.65	171.58-174.29	8 082 523.93		
					Patient levy	35.23	65.96	34.63-35.83	1 646 517.74		
					Total cost	208.16	165.94	206.66-209.67	9 729 041.67		
			60 > age ≤ 70	49 594	Medical scheme contribution	174.81	150.11	173.50-176.14	8 669 770.20		
					Patient levy	39.68	85.47	38.93-40.43	1 967 698.34		
					Total cost	214.49	173.71	212.97-216.02	10 637 468.54		
			age >70	55 087	Medical scheme contribution	178.30	147.78	177.07-179.54	9 822 208.11		
					Patient levy	41.84	72.45	41.24-42.45	2 304 908.65		
					Total cost	220.14	166.66	218.76-221.54	12 127 116.76		
			Total			266 517	Medical scheme contribution	177.71	149.62	177.15-178.28	47 362 677.47
							Patient levy	37.63	70.83	37.37-37.91	10 030 049.78
							Total cost	215.34	167.09	214.71-215.98	57 392 727.25

Table D4: Medicine cost for patients with asthma according to different cost types, age and gender for 2011.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2011	Asthma	Gender	Female	161 908	Medical scheme contribution	178.00	134.85	177.35-178.66	28 819 530.55		
					Patient levy	28.20	48.76	27.97-28.44	4 566 032.21		
					Total cost	206.20	151.65	205.47-206.94	33 385 562.76		
			Male	125 811	Medical scheme contribution	176.82	133.13	176.08-177.56	22 245 323.89		
					Patient levy	26.83	49.25	26.56-27.11	3 375 492.60		
					Total cost	203.65	149.41	202.82-204.47	25 620 816.49		
		Age	0 > age ≤ 12	33 555	Medical scheme contribution	166.72	128.04	165.35-168.09	5 594 318.24		
					Patient levy	28.26	51.18	27.71-28.81	948 138.30		
					Total cost	194.98	144.85	193.43-196.53	6 542 456.54		
			12 > age ≤ 50	86 116	Medical scheme contribution	179.76	136.67	178.85-180.67	15 479 984.50		
					Patient levy	26.32	48.44	26.00-26.65	2 266 663.91		
					Total cost	206.08	152.39	205.06-207.10	17 746 648.41		
			50 > age ≤ 60	50 471	Medical scheme contribution	173.51	135.63	172.33-174.70	8 757 220.56		
					Patient levy	25.36	47.65	24.94-25.77	1 279 693.30		
					Total cost	198.86	150.84	197.55-200.18	10 036 913.86		
			60 > age ≤ 70	55 000	Medical scheme contribution	179.99	134.77	178.86-181.12	9 899 301.99		
					Patient levy	26.75	48.09	26.35-27.15	1 471 091.06		
					Total cost	206.73	150.79	205.48-208.00	11 370 393.05		
			age >70	62 577	Medical scheme contribution	181.12	131.47	180.10-182.16	11 334 029.15		
					Patient levy	31.58	50.08	31.19-31.97	1 975 938.24		
					Total cost	212.70	150.68	211.52-213.88	13 309 967.39		
			Total			287 719	Medical scheme contribution	177.48	134.10	177.00-177.98	51 064 854.44
							Patient levy	27.60	48.98	27.43-27.78	7 941 524.81
							Total cost	205.08	150.68	204.54-205.64	59 006 379.25

Table D5: Medicine cost for patients with asthma according to different cost types, age and gender for 2012.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2012	Asthma	Gender	Female	138 602	Medical scheme contribution	176.98	133.36	176.29-177.69	24 530 365.44		
					Patient levy	27.90	50.74	27.63-28.17	3 866 492.38		
					Total cost	204.88	149.63	204.10-205.67	28 396 857.82		
			Male	112 017	Medical scheme contribution	175.91	130.91	175.14-176.68	19 704 467.06		
					Patient levy	27.03	50.63	26.74-27.33	3 027 888.04		
					Total cost	202.94	146.58	202.08-203.80	22 732 355.10		
		Age	0 > age ≤ 12	28 674	Medical scheme contribution	148.52	110.11	147.25-149.80	4 258 793.12		
					Patient levy	31.57	54.24	30.95-32.21	905 351.66		
					Total cost	180.10	131.17	178.58-181.62	5 164 144.78		
			12 > age ≤ 50	73 656	Medical scheme contribution	178.62	134.16	177.66-179.59	13 156 449.35		
					Patient levy	26.90	50.34	26.54-27.27	1 981 448.77		
					Total cost	205.52	149.93	204.44-206.61	15 137 898.12		
			50 > age ≤ 60	45 735	Medical scheme contribution	177.86	138.22	176.60-179.14	8 134 647.35		
					Patient levy	25.99	48.89	25.54-26.44	1 188 446.17		
					Total cost	203.85	153.78	202.44-205.26	9 323 093.52		
			60 > age ≤ 70	49 013	Medical scheme contribution	181.56	132.75	180.39-182.74	8 898 764.24		
					Patient levy	26.82	51.10	26.37-27.28	1 314 641.82		
					Total cost	208.38	148.54	207.07-209.70	10 213 406.06		
			age >70	53 541	Medical scheme contribution	182.78	133.06	181.66-183.91	9 786 178.44		
					Patient levy	28.10	50.21	27.68-28.53	1 504 492.00		
					Total cost	210.88	148.32	209.63-212.14	11 290 670.44		
			Total			250 619	Medical scheme contribution	176.50	132.27	175.99-177.02	44 234 832.50
							Patient levy	27.51	50.69	27.31-27.71	6 894 380.42
							Total cost	204.01	148.27	203.44-204.60	51 129 212.92

Table D6: Medicine cost for patients with diabetes mellitus type 2 according to different cost types, age and gender for 2008.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2008	Diabetes mellitus type 2	Gender	Female	174 013	Medical scheme contribution	132.25	207.04	131.28-133.22	23 012 349.46	
					Patient levy	11.55	34.09	11.39-11.71	2 009 693.87	
					Total cost	143.79	212.62	142.80-144.80	25 022 043.33	
			Male	226 486	Medical scheme contribution	138.15	211.83	137.28-139.02	31 288 223.22	
					Patient levy	11.99	35.37	11.85-12.14	2 716 567.21	
					Total cost	150.14	217.76	149.25-151.04	34 004 790.43	
		Age	0 > age ≤ 12	147	Medical scheme contribution	353.95	158.74	328.08-379.83	52 030.36	
					Patient levy	12.54	32.87	7.19-17.91	1 843.77	
					Total cost	366.49	163.90	339.78-393.21	53 874.13	
			12 > age ≤ 50	89 847	Medical scheme contribution	149.31	225.98	147.84-150.79	13 415 109.24	
					Patient levy	11.56	34.62	11.33-11.79	1 038 364.86	
					Total cost	160.87	232.40	159.35-162.39	14 453 474.10	
			50 > age ≤ 60	122 252	Medical scheme contribution	143.58	219.89	142.35-144.81	17 552 389.47	
					Patient levy	11.73	35.63	11.54-11.94	1 434 315.86	
					Total cost	155.31	225.09	154.05-156.57	18 986 705.33	
			60 > age ≤ 70	103 429	Medical scheme contribution	136.95	211.97	135.67-138.25	14 165 085.48	
					Patient levy	11.74	35.13	11.53-11.96	1 214 106.61	
					Total cost	148.69	218.01	147.37-150.03	15 379 192.09	
			age >70	84 824	Medical scheme contribution	107.47	167.40	106.35-108.60	9 115 958.13	
					Patient levy	12.23	33.44	12.01-12.46	1 037 629.98	
					Total cost	119.70	173.33	118.54-120.87	10 153 588.11	
		Total			400 499	Medical scheme contribution	135.58	209.79	134.94-136.24	54 300 572.68
						Patient levy	11.80	34.82	11.70-11.91	4 726 261.08
						Total cost	147.38	215.57	146.72-148.05	59 026 833.76

Table D7: Medicine cost for patients with diabetes mellitus type 2 according to different cost types, age and gender for 2009.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2009	Diabetes mellitus type 2	Gender	Female	237 393	Medical scheme contribution	141.39	222.70	140.50-142.29	33 565 486.54	
					Patient levy	12.61	38.09	12.46-12.77	2 993 338.70	
					Total cost	154.00	231.89	153.07-154.94	36 558 825.24	
			Male	309 161	Medical scheme contribution	150.37	231.57	149.56-151.19	46 489 303.86	
					Patient levy	14.01	42.47	13.86-14.16	4 330 229.11	
					Total cost	164.38	241.67	163.53-165.23	50 819 532.97	
		Age	0 > age ≤ 12	198	Medical scheme contribution	294.41	150.98	273.26-315.58	58 293.66	
					Patient levy	29.68	51.73	22.43-36.94	5 876.89	
					Total cost	324.09	178.32	299.11-349.09	64 170.55	
			12 > age ≤ 50	119 462	Medical scheme contribution	166.05	248.74	164.65-167.47	19 837 069.68	
					Patient levy	13.55	44.57	13.30-13.81	1 618 600.63	
					Total cost	179.60	260.10	178.13-181.08	21 455 670.31	
			50 > age ≤ 60	163 501	Medical scheme contribution	154.39	236.25	153.24-155.53	25 242 215.03	
					Patient levy	13.83	42.15	13.63-14.04	2 261 531.49	
					Total cost	168.22	247.09	167.02-169.42	27 503 746.52	
			60 > age ≤ 70	143 768	Medical scheme contribution	147.93	230.56	146.74-149.12	21 267 139.50	
					Patient levy	13.01	38.90	12.82-13.22	1 870 768.60	
					Total cost	160.94	238.78	159.71-162.18	23 137 908.10	
			age >70	119 625	Medical scheme contribution	114.11	183.17	113.07-115.15	13 650 072.53	
					Patient levy	13.10	36.15	12.90-13.31	1 566 790.20	
					Total cost	127.20	191.32	126.12-128.29	15 216 862.73	
			Total		546 554	Medical scheme contribution	146.47	227.81	145.87-147.08	80 054 790.40
						Patient levy	13.40	40.63	13.30-13.51	7 323 567.81
						Total cost	159.87	237.53	159.25-160.51	87 378 358.21

Table D7: Medicine cost for patients with diabetes mellitus type 2 according to different cost types, age and gender for 2010.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2010	Diabetes mellitus type 2	Gender	Female	245 082	Medical scheme contribution	149.73	236.69	148.80-150.67	36 696 109.85		
					Patient levy	14.02	40.27	13.86-14.18	3 435 218.71		
					Total cost	163.75	246.68	162.77-164.73	40 131 328.56		
			Male	326 006	Medical scheme contribution	160.57	251.11	159.72-161.44	52 348 214.25		
					Patient levy	15.54	43.78	15.39-15.69	5 065 816.78		
					Total cost	176.11	262.45	175.22-177.02	57 414 031.03		
		Age	0 > age ≤ 12	100	Medical scheme contribution	279.05	170.74	245.17-312.93	27 904.65		
					Patient levy	38.94	64.24	26.20-51.69	3 893.98		
					Total cost	317.99	207.13	276.89-359.09	31 798.63		
			12 > age ≤ 50	117 696	Medical scheme contribution	175.63	263.33	174.13-177.14	20 671 065.87		
					Patient levy	15.47	45.98	15.21-15.74	1 821 163.58		
					Total cost	191.10	276.17	189.53-192.69	22 492 229.45		
			50 > age ≤ 60	170 150	Medical scheme contribution	165.56	255.84	164.35-166.78	28 170 533.45		
					Patient levy	15.25	45.26	15.04-15.47	2 594 983.77		
					Total cost	180.81	267.80	179.55-182.09	30 765 517.22		
			60 > age ≤ 70	153 730	Medical scheme contribution	158.26	248.78	157.02-159.51	24 329 327.65		
					Patient levy	14.84	40.54	14.64-15.05	2 281 186.84		
					Total cost	173.10	258.62	171.81-174.40	26 610 514.49		
			age >70	129 412	Medical scheme contribution	122.44	201.93	121.35-123.55	15 845 492.48		
					Patient levy	13.91	36.43	13.71-14.11	1 799 807.32		
					Total cost	136.35	209.90	135.21-137.50	17 645 299.80		
			Total			571 088	Medical scheme contribution	155.92	245.08	155.29-156.56	89 044 324.10
							Patient levy	14.89	42.31	14.78-15.00	8 501 035.49
							Total cost	170.81	255.88	170.15-171.47	97 545 359.59

Table D8: Medicine cost for patients with diabetes mellitus type 2 according to different cost types, age and gender for 2011.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2011	Diabetes mellitus type 2	Gender	Female	238 225	Medical scheme contribution	154.44	245.63	153.45-155.43	36 790 424.94		
					Patient levy	12.91	35.29	12.77-13.06	3 075 495.58		
					Total cost	167.35	253.73	166.33-168.37	39 865 920.52		
			Male	323 693	Medical scheme contribution	165.97	261.23	165.07-166.87	53 722 750.44		
					Patient levy	14.28	39.62	14.15-14.42	4 621 678.39		
					Total cost	180.25	270.90	179.32-181.18	58 344 428.83		
		Age	0 > age ≤ 12	194	Medical scheme contribution	352.32	222.39	320.83-383.82	68 350.15		
					Patient levy	35.26	70.08	25.34-45.19	6 841.22		
					Total cost	387.58	234.86	354.33-420.85	75 191.37		
			12 > age ≤ 50	110 373	Medical scheme contribution	186.32	274.68	184.71-187.95	20 564 998.61		
					Patient levy	14.21	42.40	13.96-14.46	1 567 890.75		
					Total cost	200.53	285.74	198.85-202.22	22 132 889.36		
			50 > age ≤ 60	164 781	Medical scheme contribution	172.63	268.22	171.34-179.93	28 445 609.12		
					Patient levy	13.85	40.43	13.66-14.05	2 281 645.67		
					Total cost	186.47	278.16	185.13-187.82	30 727 254.79		
			60 > age ≤ 70	155 101	Medical scheme contribution	162.90	259.02	161.61-164.19	25 265 925.08		
					Patient levy	13.79	36.71	13.61-13.97	2 138 227.24		
					Total cost	176.69	267.15	175.36-178.02	27 404 152.32		
			age >70	131 469	Medical scheme contribution	122.98	206.24	121.87-124.10	16 168 292.42		
					Patient levy	12.95	31.09	12.79-13.12	1 702 569.09		
					Total cost	135.93	213.11	134.78-137.09	17 870 861.51		
			Total			561 918	Medical scheme contribution	161.08	254.80	160.42-161.75	90 513 175.38
							Patient levy	13.70	37.85	13.60-13.80	7 697 173.97
							Total cost	174.78	263.84	174.09-175.47	98 210 349.35

Table D9: Medicine cost for patients with diabetes mellitus type 2 according to different cost types, age and gender for 2012.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2012	Diabetes mellitus type 2	Gender	Female	222 489	Medical scheme contribution	154.24	242.91	153.24-155.25	34 316 998.61	
					Patient levy	12.15	33.75	12.02-12.30	2 703 956.68	
					Total cost	166.39	250.18	165.36-167.44	37 020 955.29	
			Male	327 988	Medical scheme contribution	166.94	263.56	166.04-167.84	54 753 253.46	
					Patient levy	13.53	37.99	13.40-13.66	4 436 067.33	
					Total cost	180.46	271.73	179.54-181.40	59 189 320.79	
		Age	0 > age ≤ 12	107	Medical scheme contribution	280.01	131.65	254.78-305.24	29 960.70	
					Patient levy	37.06	78.56	22.01-52.12	3 965.68	
					Total cost	317.07	168.37	284.80-349.34	33 926.38	
			12 > age ≤ 50	104 998	Medical scheme contribution	184.35	270.13	182.72-185.99	19 356 749.48	
					Patient levy	13.18	38.51	12.95-13.42	1 384 277.68	
					Total cost	197.54	279.06	195.85-199.23	20 741 027.16	
			50 > age ≤ 60	165 522	Medical scheme contribution	170.68	269.73	169.38-171.98	28 250 756.79	
					Patient levy	13.10	38.75	12.92-13.29	2 168 639.04	
					Total cost	183.78	278.17	182.44-185.12	30 419 395.83	
			60 > age ≤ 70	157 313	Medical scheme contribution	165.28	257.60	164.01-166.55	26 000 256.96	
					Patient levy	13.56	36.42	13.38-13.74	2 132 878.68	
					Total cost	178.84	264.84	177.53-180.15	28 133 135.64	
			age >70	122 537	Medical scheme contribution	125.94	213.02	124.75-127.14	15 432 528.14	
					Patient levy	11.84	30.39	11.67-12.01	1 450 262.93	
					Total cost	137.78	219.56	136.55-139.01	16 882 791.07	
		Total			550 477	Medical scheme contribution	161.81	255.49	161.13-162.48	89 070 252.07
						Patient levy	12.97	36.34	12.88-13.07	7 140 024.01
						Total cost	174.78	263.32	174.08-175.48	96 210 276.08

Table D10: Medicine cost for patients with hyperlipidaemia according to different cost types, age and gender for 2008.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2008	Hyper lipidaemia	Gender	Female	276 787	Medical scheme contribution	129.84	53.78	129.65-130.05	35 939 385.04
					Patient levy	21.92	36.55	21.79-22.06	6 068 370.93
					Total cost	151.77	62.71	151.54-152.01	42 007 755.97
			Male	308 919	Medical scheme contribution	138.36	58.60	138.15-138.57	42 741 253.39
					Patient levy	21.81	39.27	21.67-21.95	6 736 690.74
					Total cost	160.16	67.25	159.93-160.41	49 477 944.13
		Age	0 > age ≤ 12	66	Medical scheme contribution	153.68	70.56	136.34-171.03	10 143.14
					Patient levy	14.67	26.05	8.27-21.08	968.15
					Total cost	168.35	81.05	148.43-188.28	11 111.29
			12 > age ≤ 50	74 498	Medical scheme contribution	143.39	63.66	142.91-143.85	10 682 422.02
					Patient levy	23.37	43.97	23.06-23.069	1 740 813.94
					Total cost	166.76	73.34	166.24-167.29	12 423 235.96
			50 > age ≤ 60	142 249	Medical scheme contribution	139.82	60.43	139.51-140.14	19 888 942.30
					Patient levy	22.64	40.79	22.43-22.86	3 220 472.12
					Total cost	162.46	67.91	162.11-162.81	23 109 414.42
			60 > age ≤ 70	182 435	Medical scheme contribution	134.34	57.06	134.09-134.61	24 508 934.21
					Patient levy	21.55	37.98	21.38-21.73	3 931 648.69
					Total cost	155.89	65.33	155.60-156.20	28 440 582.90
			age >70	186 458	Medical scheme contribution	126.52	48.28	126.30-126.74	23 590 196.76
					Patient levy	20.98	32.91	20.83-21.13	3 911 158.77
					Total cost	147.49	58.23	147.23-147.76	27 501 355.53
		Total		585 706	Medical scheme contribution	134.33	56.54	134.19-134.48	78 680 638.43
					Patient levy	21.86	38.01	21.77-21.96	12 805 061.67
					Total cost	156.20	65.28	156.03-156.37	91 485 700.10

Table D11: Medicine cost for patients with hyperlipidaemia according to different cost types, age and gender for 2009.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)						
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)		
2009	Hyper lipidaemia	Gender	Female	14 472	Medical scheme contribution	216.63	116.89	214.73-218.54	3 135 128.05		
					Patient levy	41.88	86.63	40.47-43.29	606 044.68		
					Total cost	258.51	128.79	256.42-260.61	3 741 172.73		
			Male	25 389	Medical scheme contribution	217.13	108.86	215.79-218.47	5 512 656.72		
					Patient levy	39.65	82.19	38.62-40.66	1 006 605.44		
					Total cost	256.78	119.67	255.31-258.25	6 519 262.16		
		Age	0 > age ≤ 12	18	Medical scheme contribution	196.75	158.02	118.17-275.34	3 541.45		
					Patient levy	23.05	28.92	8.67-37.43	414.90		
					Total cost	219.80	179.64	130.47-309.14	3 956.35		
			12 > age ≤ 50	7 645	Medical scheme contribution	227.58	111.81	225.07-230.09	1 739 831.78		
					Patient levy	39.52	81.51	37.70-41.35	302 137.23		
					Total cost	267.10	118.73	264.44-269.76	2 041 969.01		
			50 > age ≤ 60	12 035	Medical scheme contribution	220.56	108.52	218.63-222.50	2 654 445.27		
					Patient levy	40.59	82.37	39.12-42.07	488 506.67		
					Total cost	261.15	117.85	259.05-263.26	3 142 951.94		
			60 > age ≤ 70	11 850	Medical scheme contribution	214.27	115.88	212.18-216.36	2 539 062.38		
					Patient levy	39.37	84.20	37.86-40.89	466 568.62		
					Total cost	253.64	127.70	251.34-255.94	3 005 631.00		
			age >70	8 313	Medical scheme contribution	205.81	109.49	203.46-208.17	1 710 903.89		
					Patient levy	42.71	87.47	40.83-44.59	355 022.70		
					Total cost	248.52	126.58	245.80-251.24	2 065 926.59		
			Total			39 861	Medical scheme contribution	216.95	111.84	215.85-218.05	8 647 784.77
							Patient levy	40.46	83.83	39.64-41.28	1 612 650.12
							Total cost	257.41	123.06	256.20-258.62	10 260 434.89

Table D12: Medicine cost for patients with hyperlipidaemia according to different cost types, age and gender for 2010.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2010	Hyper lipidaemia	Gender	Female	12 551	Medical scheme contribution	230.35	114.53	228.35-232.36	2 891 100.73	
					Patient levy	43.39	84.37	41.91-44.87	544 526.91	
					Total cost	273.73	123.70	271.57-275.90	3 435 627.64	
			Male	24 858	Medical scheme contribution	229.47	107.34	228.14-230.81	5 704 283.96	
					Patient levy	41.35	81.51	40.34-42.37	1 027 828.62	
					Total cost	270.82	117.07	269.37-272.28	6 732 112.58	
		Age	0 > age ≤ 12	10	Medical scheme contribution	416.09	0.00	0.00	4 160.90	
					Patient levy	0.00	0.00	0.00	0.00	
					Total cost	416.09	0.00	0.00	4 160.90	
			12 > age ≤ 50	7 502	Medical scheme contribution	235.10	110.26	232.61-237.60	1 763 725.42	
					Patient levy	40.19	79.42	38.40-41.99	301 499.17	
					Total cost	275.29	117.04	272.65-277.94	2 065 224.59	
			50 > age ≤ 60	11 320	Medical scheme contribution	229.82	103.51	227.91-231.73	2 601 533.46	
					Patient levy	41.14	80.18	39.67-42.62	465 732.53	
					Total cost	270.96	113.56	268.87-273.06	3 067 265.99	
			60 > age ≤ 70	10 885	Medical scheme contribution	231.08	116.06	228.90-233.26	2 515 270.76	
					Patient levy	42.80	86.88	41.17-44.44	465 905.35	
					Total cost	273.88	123.85	271.56-276.21	2 981 176.11	
			age >70	7 692	Medical scheme contribution	222.40	108.77	219.97-224.83	1 710 694.15	
					Patient levy	44.10	82.38	42.26-45.95	339 218.48	
					Total cost	266.50	123.11	263.75-269.25	2 049 912.63	
			Total		37 409	Medical scheme contribution	229.77	109.81	228.66-230.88	8 595 384.69
						Patient levy	42.03	82.49	41.20-42.87	1 572 355.53
						Total cost	271.80	119.34	270.59-273.01	10 167 740.22

Table D13: Medicine cost for patients with hyperlipidaemia according to different cost types, age and gender for 2011.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2011	Hyper lipidaemia	Gender	Female	353 472	Medical scheme contribution	88.30	73.33	88.06-88.55	31 211 677.25	
					Patient levy	19.62	36.42	19.50-19.74	6 935 192.09	
					Total cost	107.92	89.79	107.63-108.22	38 146 869.34	
			Male	395 475	Medical scheme contribution	99.01	82.00	98.76-99.27	39 157 334.71	
					Patient levy	22.19	41.04	22.06-22.32	8 774 343.33	
					Total cost	121.20	98.55	120.90-121.51	47 931 678.04	
		Age	0 > age ≤ 12	123	Medical scheme contribution	100.77	66.05	88.98-112.56	12 394.23	
					Patient levy	33.22	50.14	24.28-42.18	4 086.48	
					Total cost	133.99	89.62	118.00-149.99	16 480.71	
			12 > age ≤ 50	86 302	Medical scheme contribution	109.04	90.60	108.44-109.65	9 410 184.85	
					Patient levy	22.99	41.92	22.71-23.27	1 984 008.03	
					Total cost	132.03	106.28	131.32-132.74	11 394 192.88	
			50 > age ≤ 60	169 629	Medical scheme contribution	102.84	83.04	102.45-103.24	17 445 444.13	
					Patient levy	23.55	42.82	23.35-23.76	3 995 417.63	
					Total cost	126.40	100.25	125.93-126.88	21 440 861.76	
			60 > age ≤ 70	226 619	Medical scheme contribution	94.84	79.60	94.52-95.18	21 493 408.47	
					Patient levy	21.40	39.41	21.24-21.57	4 850 377.08	
					Total cost	116.25	95.69	115.86-116.65	26 343 785.55	
			age >70	266 274	Medical scheme contribution	82.65	67.12	82.40-82.91	22 007 580.28	
					Patient levy	18.31	34.55	18.18-18.45	4 875 646.20	
					Total cost	100.96	83.75	100.65-101.28	26 883 226.48	
			Total		748 947	Medical scheme contribution	93.96	78.21	93.78-94.14	70 369 011.96
						Patient levy	20.98	38.95	20.89-21.07	15 709 535.42
						Total cost	114.93	94.75	114.72-115.15	86 078 547.38

Table D14: Medicine cost for patients with hyperlipidaemia according to different cost types, age and gender for 2012.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2012	Hyper lipidaemia	Gender	Female	329 745	Medical scheme contribution	88.67	75.97	88.41-88.93	29 236 994.10	
					Patient levy	20.22	37.34	20.09-20.35	6 666 304.53	
					Total cost	108.88	92.56	108.57-109.20	35 903 298.63	
			Male	399 240	Medical scheme contribution	99.15	83.11	98.89-99.41	39 583 623.81	
					Patient levy	22.73	41.38	22.61-22.86	9 075 100.85	
					Total cost	121.88	99.80	121.57-122.19	48 658 724.66	
		Age	0 > age ≤ 12	62	Medical scheme contribution	94.44	75.27	75.33-113.56	5 855.45	
					Patient levy	37.72	46.07	26.03-49.43	2 338.84	
					Total cost	132.17	92.59	108.66-155.68	8 194.29	
			12 > age ≤ 50	82 226	Medical scheme contribution	106.32	90.50	105.71-106.95	8 742 604.25	
					Patient levy	24.36	42.86	24.07-24.66	2 003 236.69	
					Total cost	130.69	107.30	129.96-131.42	10 745 840.94	
			50 > age ≤ 60	168 686	Medical scheme contribution	101.61	85.30	101.21-102.03	17 140 911.45	
					Patient levy	24.11	42.58	23.91-24.32	4 067 312.63	
					Total cost	125.73	103.02	125.24-126.22	21 208 224.08	
			60 > age ≤ 70	231 380	Medical scheme contribution	95.89	81.44	95.56-96.23	22 187 193.37	
					Patient levy	22.29	40.37	22.13-22.45	5 156 472.60	
					Total cost	118.18	97.94	117.78-118.58	27 343 665.97	
			age >70	246 631	Medical scheme contribution	84.11	69.68	83.84-84.39	20 744 053.39	
					Patient levy	18.29	35.22	18.16-18.44	4 512 044.62	
					Total cost	102.40	85.32	102.07-102.75	25 256 098.01	
		Total			728 985	Medical scheme contribution	94.41	80.13	94.23-94.59	68 820 617.91
						Patient levy	21.59	39.62	21.51-21.69	15 741 405.38
						Total cost	116.00	96.81	115.78-116.23	84 562 023.29

Table D15: Medicine cost for patients with hypertension according to different cost types, age and gender for 2008.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2008	Hypertension	Gender	Female	944 860	Medical scheme contribution	82.69	58.42	82.57-82.81	78 128 027.01	
					Patient levy	20.94	32.13	20.88-21.01	19 782 903.08	
					Total cost	103.62	70.27	103.49-103.77	97 910 930.09	
			Male	708 174	Medical scheme contribution	89.30	61.09	89.16-89.45	63 242 176.78	
					Patient levy	21.62	34.36	21.55-21.71	15 313 053.57	
					Total cost	110.93	72.41	110.76-111.10	78 555 230.35	
		Age	0 > age ≤ 12	139	Medical scheme contribution	75.85	68.03	64.45-87.27	10 543.31	
					Patient levy	10.42	23.13	6.55-14.30	1 448.64	
					Total cost	86.27	70.59	47.44-98.12	11 991.95	
			12 > age ≤ 50	237 376	Medical scheme contribution	82.72	57.98	82.49-82.96	19 635 892.18	
					Patient levy	21.30	34.40	21.16-21.44	5 055 082.88	
					Total cost	104.02	69.57	103.74-104.30	24 690 975.06	
			50 > age ≤ 60	397 620	Medical scheme contribution	84.31	59.53	84.13-84.50	33 522 031.00	
					Patient levy	21.38	34.02	21.28-21.49	8 501 544.53	
					Total cost	105.69	70.82	105.47-105.91	42 023 575.53	
			60 > age ≤ 70	443 453	Medical scheme contribution	86.60	60.12	86.42-86.78	38 401 398.21	
					Patient levy	21.44	34.25	21.34-21.54	9 506 845.54	
					Total cost	108.03	71.63	107.83-108.25	47 908 243.75	
			age >70	574 446	Medical scheme contribution	86.69	60.05	86.54-86.85	49 800 339.09	
					Patient levy	20.94	30.94	20.87-21.03	12 031 035.06	
					Total cost	107.64	72.00	107.45-107.83	61 831 374.15	
			Total		1 653 034	Medical scheme contribution	85.52	59.67	85.43-85.62	141 370 204.00
						Patient levy	21.23	33.10	21.18-21.29	35 095 956.65
						Total cost	106.75	71.29	106.65-106.87	176 466 160.00

Table D16: Medicine cost for patients with hypertension according to different cost types, age and gender for 2009.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2009	Hypertension	Gender	Female	1 241 393	Medical scheme contribution	89.09	62.12	88.99-89.21	110 601 676.00
					Patient levy	22.77	36.51	22.71-22.84	28 270 652.02
					Total cost	111.87	75.36	111.74-112.00	138 872 328.00
			Male	958 575	Medical scheme contribution	95.86	65.45	95.74-96.00	91 891 725.22
					Patient levy	23.61	39.09	23.53-23.69	22 628 977.73
					Total cost	119.47	78.19	119.32-119.63	114 520 703.00
		Age	0 > age ≤ 12	202	Medical scheme contribution	69.67	48.25	62.98-76.37	14 073.50
					Patient levy	12.35	32.27	7.87-16.83	2 493.89
					Total cost	82.02	64.84	73.02-91.02	16 567.39
			12 > age ≤ 50	312 167	Medical scheme contribution	91.24	62.65	91.03-91.47	28 483 606.78
					Patient levy	22.73	38.23	22.60-22.87	7 094 728.87
					Total cost	113.97	74.56	113.71-114.24	35 578 335.65
			50 > age ≤ 60	523 455	Medical scheme contribution	91.40	64.16	91.23-91.58	47 843 999.36
					Patient levy	23.49	38.83	23.39-23.60	12 294 225.21
					Total cost	114.89	76.82	114.68-115.10	60 138 224.57
			60 > age ≤ 70	592 988	Medical scheme contribution	93.24	64.03	93.08-93.41	55 291 198.13
					Patient levy	23.37	38.42	23.28-23.47	13 859 220.48
					Total cost	116.61	76.79	116.42-116.81	69 150 418.61
			age >70	771 156	Medical scheme contribution	91.89	63.48	91.75-92.03	70 860 523.37
					Patient levy	22.89	35.99	22.81-22.97	17 648 961.30
					Total cost	114.78	77.39	114.61-114.95	88 509 484.67
		Total		2 199 968	Medical scheme contribution	92.04	63.68	91.96-92.13	202 493 401.00
					Patient levy	23.14	37.66	23.09-23.19	50 899 629.75
					Total cost	115.18	76.70	115.08-115.29	253 393 031.00

Table D17: Medicine cost for patients with hypertension according to different cost types, age and gender for 2010.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2010	Hypertension	Gender	Female	1 226 763	Medical scheme contribution	90.32	61.89	90.21-90.43	110 797 854.00
					Patient levy	23.14	37.47	23.08-23.22	28 393 255.51
					Total cost	113.46	76.50	113.33-113.60	139 191 109.00
			Male	957 233	Medical scheme contribution	96.62	64.97	96.50-96.76	92 491 997.43
					Patient levy	24.13	40.80	24.06-24.22	23 100 759.30
					Total cost	120.76	79.50	120.60-120.92	115 592 757.00
		Age	0 > age ≤ 12	244	Medical scheme contribution	77.35	52.88	70.69-84.02	18 873.60
					Patient levy	17.63	44.94	11.97-23.30	4 301.55
					Total cost	94.98	76.01	85.40-104.57	23 175.15
			12 > age ≤ 50	301 269	Medical scheme contribution	91.92	62.11	91.70-92.15	27 692 480.52
					Patient levy	22.05	38.32	21.92-22.19	6 643 999.77
					Total cost	113.97	75.19	113.71-114.25	34 336 480.29
			50 > age ≤ 60	512 508	Medical scheme contribution	92.33	63.56	92.16-92.51	47 321 404.19
					Patient levy	23.43	39.22	23.33-23.55	12 010 013.77
					Total cost	115.77	77.62	115.56-115.98	59 331 417.96
			60 > age ≤ 70	588 440	Medical scheme contribution	94.56	63.56	94.37-94.73	55 642 498.36
					Patient levy	24.07	40.00	23.97-24.18	14 163 205.88
					Total cost	118.63	77.68	118.43-118.83	69 805 704.24
			age >70	781 535	Medical scheme contribution	92.91	63.47	92.78-93.06	72 614 594.30
					Patient levy	23.89	38.24	23.81-23.98	18 672 493.84
					Total cost	116.80	79.26	116.63-116.98	91 287 088.14
		Total		2 183 996	Medical scheme contribution	93.08	63.34	93.00-93.17	203 289 851.00
					Patient levy	23.58	38.97	23.53-23.63	51 494 014.81
					Total cost	116.66	77.91	116.56-116.77	254 783 866.00

Table D18: Medicine cost for patients with hypertension according to different cost types, age and gender for 2011.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2011	Hypertension	Gender	Female	1 181 058	Medical scheme contribution	87.11	58.82	87.01-87.22	102 882 638.00	
					Patient levy	21.07	33.01	21.02-21.14	24 889 978.78	
					Total cost	108.18	73.21	108.06-108.32	127 772 617.00	
			Male	926 385	Medical scheme contribution	92.47	61.29	92.35-92.60	85 662 816.61	
					Patient levy	21.54	35.22	21.47-21.61	19 951 420.69	
					Total cost	114.01	75.79	113.86-114.17	105 614 237.00	
		Age	0 > age ≤ 12	96	Medical scheme contribution	74.97	50.45	64.75-85.20	7 197.41	
					Patient levy	22.71	50.18	12.55-32.88	2 180.51	
					Total cost	97.69	70.66	83.37-112.01	9 377.92	
			12 > age ≤ 50	280 284	Medical scheme contribution	88.85	58.09	88.64-89.07	24 903 650.36	
					Patient levy	19.13	32.12	19.02-19.26	5 362 946.83	
					Total cost	107.99	70.66	107.73-108.25	30 266 597.19	
			50 > age ≤ 60	482 019	Medical scheme contribution	89.49	60.01	89.32-89.66	43 135 060.54	
					Patient levy	20.79	34.23	20.69-20.89	10 019 029.29	
					Total cost	110.27	74.43	110.07-110.49	53 154 089.83	
			60 > age ≤ 70	564 380	Medical scheme contribution	91.44	61.03	91.28-91.60	51 605 897.27	
					Patient levy	21.70	34.73	21.61-21.79	12 245 562.23	
					Total cost	113.14	74.87	112.94-113.33	63 851 459.50	
			age >70	780 664	Medical scheme contribution	88.25	59.82	88.12-88.39	68 893 648.86	
					Patient levy	22.05	33.94	21.98-22.13	17 211 680.61	
					Total cost	110.30	75.33	110.13-110.47	86 105 329.47	
			Total		2 107 443	Medical scheme contribution	89.47	59.98	89.39-89.55	188 545 454.00
						Patient levy	21.28	34.00	21.24-21.33	44 841 399.47
						Total cost	110.74	74.41	110.65-110.85	233 386 854.00

Table D19: Medicine cost for patients with hypertension according to different cost types, age and gender for 2012.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2012	Hypertension	Gender	Female	1 033 634	Medical scheme contribution	86.54	58.02	86.43-86.65	89 446 500.69
					Patient levy	20.26	33.44	20.20-20.33	20 938 597.49
					Total cost	106.79	71.72	106.66-106.94	110 385 098.00
			Male	907 996	Medical scheme contribution	92.13	60.70	92.00-92.25	83 649 870.55
					Patient levy	20.93	35.22	20.86-21.01	19 005 485.96
					Total cost	113.06	74.65	112.91-113.21	102 655 357.00
		Age	0 > age ≤ 12	93	Medical scheme contribution	72.53	41.09	64.07-81.00	6 745.40
					Patient levy	38.39	77.11	22.51-54.28	3 570.38
					Total cost	110.92	93.30	91.71-130.14	10 315.78
			12 > age ≤ 50	265 346	Medical scheme contribution	88.20	58.63	87.98-88.42	23 402 891.44
					Patient levy	19.14	32.34	19.02-19.27	5 078 737.87
					Total cost	107.34	71.18	107.07-107.61	28 481 629.31
			50 > age ≤ 60	473 247	Medical scheme contribution	89.38	58.80	89.22-89.56	42 300 740.97
					Patient levy	20.60	34.70	20.51-20.71	9 750 405.86
					Total cost	109.99	73.07	109.78-110.20	52 051 146.83
			60 > age ≤ 70	551 326	Medical scheme contribution	91.20	60.15	91.05-91.36	50 282 127.36
					Patient levy	21.60	35.26	21.51-21.70	11 909 244.07
					Total cost	112.80	73.90	112.61-113.00	62 191 371.43
			age >70	651 618	Medical scheme contribution	87.63	59.31	87.49-87.78	57 103 866.07
					Patient levy	20.26	33.88	20.18-20.35	13 202 125.27
					Total cost	107.89	73.34	107.72-108.08	70 305 991.34
		Total		1 941 630	Medical scheme contribution	89.15	59.35	89.07-89.24	173 096 371.00
					Patient levy	20.57	34.28	20.53-20.62	39 944 083.45
					Total cost	109.72	73.18	109.62-109.83	213 040 455.00

Table D20: Medicine cost for patients with hypothyroidism according to different cost types, age and gender for 2008.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2008	Hypothyroidism	Gender	Female	262 343	Medical scheme contribution	36.42	16.55	36.35-36.48	9 553 371.90	
					Patient levy	2.69	5.72	2.67-2.71	705 008.51	
					Total cost	39.10	16.85	39.04-39.17	10 258 380.41	
			Male	35 911	Medical scheme contribution	38.74	18.95	38.54-38.93	1 391 049.76	
					Patient levy	2.34	5.77	2.28-2.40	83 956.16	
					Total cost	41.07	19.49	40.87-41.28	1 475 005.92	
		Age	0 > age ≤ 12	148	Medical scheme contribution	27.16	9.37	25.64-28.68	4 019.86	
					Patient levy	0.71	3.55	0.13-1.29	105.28	
					Total cost	27.87	9.95	26.26-29.49	4 125.14	
			12 > age ≤ 50	52 686	Medical scheme contribution	39.77	20.11	39.59-39.94	2 095 130.90	
					Patient levy	2.27	5.50	2.22-2.31	119 368.00	
					Total cost	42.03	20.33	41.86-42.21	2 214 498.90	
			50 > age ≤ 60	69 254	Medical scheme contribution	37.83	18.33	37.69-37.97	2 619 906.51	
					Patient levy	2.72	6.84	2.67-2.77	188 192.10	
					Total cost	40.55	18.92	40.41-40.69	2 808 098.61	
			60 > age ≤ 70	82 482	Medical scheme contribution	36.52	16.41	36.40-36.63	3 011 901.26	
					Patient levy	2.56	5.84	2.52-2.59	211 015.73	
					Total cost	39.07	16.75	38.96-39.19	3 222 916.99	
		age >70	93 684	Medical scheme contribution	34.30	13.45	34.21-34.39	3 213 463.13		
				Patient levy	2.89	4.77	2.85-2.92	270 283.56		
				Total cost	37.19	13.68	37.10-37.27	3 483 746.69		
		Total			298 254	Medical scheme contribution	36.69	16.87	36.63-36.76	10 944 421.66
						Patient levy	2.65	5.73	2.62-2.67	788 964.67
						Total cost	39.34	17.20	39.28-39.40	11 733 386.33

Table D21: Medicine cost for patients with hypothyroidism according to different cost types, age and gender for 2009.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2009	Hypothyroidism	Gender	Female	29 603	Medical scheme contribution	39.21	19.86	38.98-39.44	1 160 707.70
					Patient levy	3.69	6.51	3.62-3.77	109 288.86
					Total cost	42.90	20.59	42.67-43.14	1 269 996.56
			Male	5 786	Medical scheme contribution	39.73	16.85	39.30-40.17	229 887.14
					Patient levy	3.17	5.28	3.03-3.30	18 334.81
					Total cost	42.90	16.98	42.46-43.34	248 221.95
		Age	0 > age ≤ 12	5	Medical scheme contribution	27.70	0.00	0.00	138.50
					Patient levy	6.93	0.00	0.00	34.65
					Total cost	34.63	0.00	0.00	173.15
			12 > age ≤ 50	3 848	Medical scheme contribution	43.76	26.16	42.94-44.59	168 395.71
					Patient levy	3.23	5.74	3.05-3.41	12 439.45
					Total cost	46.99	25.64	46.18-47.81	180 835.16
			50 > age ≤ 60	6 766	Medical scheme contribution	40.85	23.63	40.29-41.42	276 424.87
					Patient levy	4.02	6.90	3.86-4.18	27 198.74
					Total cost	44.87	25.41	44.27-45.48	303 623.61
			60 > age ≤ 70	10 223	Medical scheme contribution	39.20	18.65	38.84-39.56	400 711.98
					Patient levy	3.67	7.38	3.53-3.82	37 539.44
					Total cost	42.87	19.36	42.49-43.24	438 251.42
		age >70	14 547	Medical scheme contribution	37.46	14.84	37.22-37.70	544 923.78	
				Patient levy	3.47	5.32	3.38-3.55	50 411.39	
				Total cost	40.92	15.15	40.68-41.17	595 335.17	
		Total		35 389	Medical scheme contribution	39.29	19.40	39.09-39.50	1 390 594.84
					Patient levy	3.61	6.33	3.54-3.67	127 623.67
					Total cost	42.90	20.04	42.69-43.11	1 518 218.51

Table D22: Medicine cost for patients with hypothyroidism according to different cost types, age and gender for 2010.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2010	Hypothyroidism	Gender	Female	28 948	Medical scheme contribution	41.26	27.97	40.93-41.58	1 194 266.89
					Patient levy	3.21	19.64	2.98-3.44	92 890.92
					Total cost	44.46	33.97	44.07-44.86	1 287 157.81
			Male	5 808	Medical scheme contribution	41.24	18.31	40.76-41.71	239 497.25
					Patient levy	2.83	6.76	2.65-3.00	16 414.72
					Total cost	44.06	18.10	43.60-44.53	255 911.97
		Age	0 > age ≤ 12	12	Medical scheme contribution	34.13	7.32	29.48-38.78	409.59
					Patient levy	8.54	1.83	7.37-9.70	102.43
					Total cost	42.67	9.15	36.85-48.48	512.02
			12 > age ≤ 50	2 187	Medical scheme contribution	45.22	30.08	43.96-46.48	98 892.51
					Patient levy	1.67	7.52	1.35-1.98	3 643.11
					Total cost	46.88	33.47	45.48-48.29	102 535.62
			50 > age ≤ 60	4 790	Medical scheme contribution	45.72	55.31	44.15-47.29	219 003.75
					Patient levy	4.04	45.77	2.79-5.33	19 330.02
					Total cost	49.76	71.75	47.72-51.79	238 333.77
			60 > age ≤ 70	10 552	Medical scheme contribution	41.80	19.63	41.42-42.17	441 046.56
					Patient levy	2.96	8.05	2.81-3.12	31 276.13
					Total cost	44.76	20.02	44.38-45.14	472 322.69
			age >70	17 215	Medical scheme contribution	39.18	14.66	38.96-39.39	674 411.73
					Patient levy	3.19	5.81	3.11-3.28	54 953.95
					Total cost	42.37	14.74	42.15-42.59	729 365.68
		Total		34 756	Medical scheme contribution	41.25	26.60	40.97-41.53	1 433 764.14
					Patient levy	3.14	18.13	2.95-3.34	109 305.64
					Total cost	44.40	31.87	44.06-44.73	1 543 069.78

Table D23: Medicine cost for patients with hypothyroidism according to different cost types, age and gender for 2011.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)				
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
2011	Hypothyroidism	Gender	Female	29 518	Medical scheme contribution	40.60	17.99	40.39-40.80	1 198 292.45
					Patient levy	2.05	4.15	2.00-2.09	60 368.18
					Total cost	42.64	18.48	42.43-42.85	1 258 660.63
			Male	5 961	Medical scheme contribution	40.89	17.50	40.45-41.33	243 749.50
					Patient levy	2.10	4.02	1.99-2.20	12 498.62
					Total cost	42.99	17.71	42.54-43.44	256 248.12
		Age	0 > age ≤ 12	0	Medical scheme contribution	0.00	0.00	0.00	0.00
					Patient levy	0.00	0.00	0.00	0.00
					Total cost	0.00	0.00	0.00	0.00
			12 > age ≤ 50	1 856	Medical scheme contribution	45.21	25.27	44.06-46.16	83 913.69
					Patient levy	1.45	4.66	1.23-1.66	2 683.50
					Total cost	46.66	26.14	45.47-47.85	86 597.19
			50 > age ≤ 60	4 834	Medical scheme contribution	45.00	22.83	44.36-45.64	217 530.20
					Patient levy	1.48	4.35	1.36-1.61	7 177.52
					Total cost	46.48	23.95	45.81-47.16	224 707.72
			60 > age ≤ 70	10 417	Medical scheme contribution	42.29	18.62	41.94-42.65	440 572.87
					Patient levy	1.71	3.91	1.64-1.79	17 844.61
					Total cost	44.01	19.02	43.64-44.37	458 417.48
			age >70	18 372	Medical scheme contribution	38.10	14.34	37.90-38.31	700 025.19
					Patient levy	2.46	4.09	2.40-2.52	45 161.17
					Total cost	40.56	14.64	40.35-40.77	745 186.36
		Total		35 479	Medical scheme contribution	40.64	17.91	40.46-40.83	1 442 041.95
					Patient levy	2.05	4.13	2.01-2.10	72 866.80
					Total cost	42.70	18.35	42.51-42.89	1 514 908.75

Table D24: Medicine cost for patients with hypothyroidism according to different cost types, age and gender for 2012.

Year	Type of CDL condition	Description		Number of CDL medicine items (n)	Cost (R)					
					Type of cost	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)	
2012	Hypothyroidism	Gender	Female	31 702	Medical scheme contribution	40.95	20.93	40.72-41.19	1 298 352.36	
					Patient levy	1.69	4.88	1.63-1.74	53 495.74	
					Total cost	42.64	23.03	42.39-42.90	1 351 848.10	
			Male	6 310	Medical scheme contribution	43.18	19.81	42.69-43.67	272 485.80	
					Patient levy	1.41	3.48	1.32-1.50	8 896.70	
					Total cost	44.59	20.24	44.09-45.09	281 382.50	
		Age	0 > age ≤ 12	0	Medical scheme contribution	0.00	0.00	0.00	0.00	
					Patient levy	0.00	0.00	0.00	0.00	
					Total cost	0.00	0.00	0.00	0.00	
			12 > age ≤ 50	2 145	Medical scheme contribution	44.24	43.84	42.38-46.09	94 887.77	
					Patient levy	2.32	13.60	1.74-2.89	4 972.90	
					Total cost	46.56	55.76	44.19-48.92	99 860.67	
			50 > age ≤ 60	5 928	Medical scheme contribution	44.58	23.03	43.99-45.16	264 255.42	
					Patient levy	1.32	3.25	1.24-1.41	7 839.15	
					Total cost	45.90	23.17	45.31-46.49	272 094.57	
			60 > age ≤ 70	12 742	Medical scheme contribution	42.25	19.14	41.92-42.58	538 349.29	
					Patient levy	1.52	3.56	1.46-1.58	19 403.25	
					Total cost	43.77	19.64	43.43-44.11	557 752.54	
			age >70	17 197	Medical scheme contribution	39.15	15.79	39.92-39.39	673 345.68	
					Patient levy	1.75	3.49	1.70-1.81	30 177.14	
					Total cost	40.91	16.18	40.67-41.15	703 522.82	
			Total		38 012	Medical scheme contribution	41.32	20.77	41.12-41.53	1 570 838.16
						Patient levy	1.64	4.68	1.59-1.69	62 392.44
						Total cost	42.97	22.61	42.74-43.19	1 633 230.60

APPENDIX E

Table E1: Total cost of hypertension items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Hypertension	2008	M	Total cost	0	0.00	0.00	0.00	0.00
		N		351 683	173.02	74.04	172.78-173.27	60 849 372.19
		O		183 688	147.63	63.34	147.34-147.92	27 117 822.15
		Y		1 117 663	79.18	52.11	79.09-79.28	88 498 966.10
	2009	M		0	0.00	0.00	0.00	0.00
		N		422 462	177.44	78.69	177.20-177.68	74 959 666.83
		O		269 804	174.38	84.10	174.07-174.70	47 049 069.17
		Y		1 507 702	87.14	55.54	87.06-87.23	131 384 295.00
	2010	M		0	0.00	0.00	0.00	0.00
		N		358 455	179.12	83.74	178.85-179.40	64 205 534.27
		O		276 924	180.61	86.95	180.29-180.93	50 014 118.93
		Y		1 548 617	90.77	57.28	90.68-90.86	140 564 213.00
	2011	M		0	0.00	0.00	0.00	0.00
		N		238 745	182.49	93.15	182.12-182.87	43 569 058.30
		O		298 296	162.27	80.64	161.99-162.57	48 405 940.27
		Y		1 570 402	90.05	56.22	89.96-90.14	141 411 855.00
	2012	M		0	0.00	0.00	0.00	0.00
		N		196 393	192.70	96.02	192.28-193.13	37 844 802.53
		O		242 747	157.14	80.68	156.82-157.46	38 144 546.86
		Y		1 502 490	91.22	55.29	91.13-91.31	137 051 105.00

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E2: Medical scheme contribution of hypertension items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Hypertension	2008	M	Medical scheme contribution	0	0.00	0.00	0.00	0.00
		N		351 683	135.83	70.18	135.60-136.06	47 768 053.07
		O		183 688	101.03	56.77	100.77-101.29	18 558 343.77
		Y		1 117 663	67.14	44.87	67.06-67.23	75 043 806.95
	2009	M		0	0.00	0.00	0.00	0.00
		N		422 462	139.44	74.87	139.21-139.66	58 906 080.03
		O		269 804	118.60	73.35	118.33-118.88	31 999 857.31
		Y		1 507 702	74.01	47.99	73.94-74.09	111 587 464.00
	2010	M		0	0.00	0.00	0.00	0.00
		N		358 455	141.71	77.93	141.45-141.96	50 795 500.89
		O		276 924	118.24	70.52	117.98-118.51	32 744 742.59
		Y		1 548 617	77.33	49.54	77.25-77.40	119 749 607.00
	2011	M		0	0.00	0.00	0.00	0.00
		N		238 745	145.23	84.56	144.89-145.56	34 671 881.36
		O		298 296	111.95	60.10	111.73-112.16	33 393 888.08
		Y		1 570 402	76.72	48.20	76.64-76.79	120 479 685.00
	2012	M		0	0.00	0.00	0.00	0.00
		N		196 393	150.60	88.30	150.21-150.99	29 577 053.42
		O		242 747	107.60	59.32	107.37-107.84	26 120 543.11
		Y		1 502 490	78.14	47.91	78.06-78.21	117 398 775.00

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table E3: Patient levy of hypertension items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total cost (R)
Hypertension	2008	M	Patient levy	0	0.00	0.00	0.00	0.00
		N		351 683	37.20	43.82	37.05-37.34	13 081 319.12
		O		183 688	46.60	43.22	46.40-46.80	8 559 478.38
		Y		1 117 663	12.04	20.96	12.00-12.08	13 455 159.15
	2009	M		0	0.00	0.00	0.00	0.00
		N		422 462	38.00	47.24	37.86-38.14	16 053 586.80
		O		269 804	55.78	55.49	55.57-55.99	15 049 211.86
		Y		1 507 702	13.13	23.25	13.09-13.17	19 796 831.09
	2010	M		0	0.00	0.00	0.00	0.00
		N		358 455	37.41	48.00	37.25-37.57	13 410 033.38
		O		276 924	62.36	59.23	62.14-62.58	17 269 376.34
		Y		1 548 617	13.44	23.76	13.40-13.48	20 814 605.09
	2011	M		0	0.00	0.00	0.00	0.00
		N		238 745	37.27	41.33	37.10-37.43	8 897 176.94
		O		298 296	50.33	53.99	50.13-50.52	15 012 052.19
		Y		1 570 402	13.33	21.81	13.30-13.36	20 932 170.34
	2012	M		0	0.00	0.00	0.00	0.00
		N		196 393	42.10	46.06	41.89-42.30	8 267 749.11
		O		242 747	49.53	55.18	49.31-49.75	12 024 003.75
		Y		1 502 490	13.08	22.31	13.04-13.12	19 652 330.59

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table E4: Total cost of asthma items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Asthma	2008	M	Total cost	0	0.00	0.00	0.00	0.00
		N		90 314	267.18	117.39	266.41-267.95	24 129 695.42
		O		11 246	108.95	104.63	107.02-110.89	1 225 233.04
		Y		68 706	63.10	60.09	62.65-63.55	4 335 066.61
	2009	M		0	0.00	0.00	0.00	0.00
		N		161 191	299.32	131.53	298.68-299.96	48 247 035.70
		O		16 373	115.77	115.22	114.01-117.54	1 895 466.40
		Y		98 188	60.24	68.71	59.81-60.67	5 914 583.63
	2010	M		0	0.00	0.00	0.00	0.00
		N		147 687	309.17	133.52	308.49-309.86	45 660 493.59
		O		22 257	218.89	175.50	216.59-221.20	4 871 870.26
		Y		96 573	71.04	91.66	70.46-71.62	6 860 363.40
	2011	M		0	0.00	0.00	0.00	0.00
		N		106 544	272.32	146.49	271.44-273.20	29 013 931.31
		O		43 848	253.79	147.48	252.41-255.17	11 127 967.10
		Y		137 327	137.37	122.99	136.72-138.02	18 864 480.84
	2012	M		0	0.00	0.00	0.00	0.00
		N		77 053	264.90	151.54	263.83-265.97	20 410 993.97
		O		33 151	244.51	153.63	242.86-246.17	8 105 830.51
		Y		140 415	161.04	129.61	160.37-161.72	22 612 388.44

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E5: Medical scheme contribution of asthma items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Asthma	2008	M	Medical scheme contribution	0	0.00	0.00	0.00	0.00
		N		90 314	230.39	113.74	229.65-231.14	20 807 782.56
		O		11 246	69.24	77.70	67.80-70.68	778 678.11
		Y		68 706	53.06	50.21	52.68-53.43	3 645 250.99
	2009	M		0	0.00	0.00	0.00	0.00
		N		161 191	249.67	127.72	249.04-250.29	40 244 094.83
		O		16 373	71.71	83.09	70.44-72.98	1 174 085.41
		Y		98 188	49.13	56.89	48.77-49.49	4 823 908.75
	2010	M		0	0.00	0.00	0.00	0.00
		N		147 687	260.56	133.05	259.89-261.24	38 482 026.52
		O		22 257	147.91	137.98	146.10-149.73	3 292 092.81
		Y		96 573	57.87	72.50	57.41-58.33	5 588 558.14
	2011	M		0	0.00	0.00	0.00	0.00
		N		106 544	239.40	136.52	238.58-240.22	25 506 206.79
		O		43 848	198.56	118.36	197.45-199.67	8 706 565.18
		Y		137 327	122.71	112.38	122.12-123.31	16 852 082.47
	2012	M		0	0.00	0.00	0.00	0.00
		N		77 053	235.16	140.63	234.17-236.15	18 119 719.89
		O		33 151	175.41	115.23	174.17-176.65	5 814 997.90
		Y		140 415	144.57	119.72	143.95-145.20	20 300 114.71

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E6: Patient levy of asthma items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Asthma	2008	M	Patient levy	0	0.00	0.00	0.00	0.00
		N		90 314	36.78	58.99	36.40-37.17	3 321 912.86
		O		11 246	39.71	63.12	38.54-40.87	446 554.93
		Y		68 706	10.04	30.01	9.82-10.26	689 815.62
	2009	M		0	0.00	0.00	0.00	0.00
		N		161 191	49.65	81.53	49.25-50.05	8 002 940.87
		O		16 373	44.06	76.73	42.88-45.23	721 380.99
		Y		98 188	11.11	34.96	10.89-11.33	1 090 674.88
	2010	M		0	0.00	0.00	0.00	0.00
		N		147 687	48.61	73.43	48.23-48.98	7 178 467.07
		O		22 257	70.98	95.77	69.72-72.24	1 579 777.45
		Y		96 573	13.17	49.46	12.86-13.48	1 271 805.26
	2011	M		0	0.00	0.00	0.00	0.00
		N		106 544	32.92	49.84	32.62-33.22	3 507 724.52
		O		43 848	55.22	71.68	54.55-55.89	2 421 401.92
		Y		137 327	14.65	32.01	14.48-14.82	2 012 398.37
	2012	M		0	0.00	0.00	0.00	0.00
		N		77 053	29.74	49.44	29.39-30.85	2 291 274.08
		O		33 151	69.10	77.57	68.27-69.94	2 290 832.61
		Y		140 415	16.47	35.94	16.28-16.66	2 312 273.73

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E7: Total cost of hyperlipidaemia items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total cost (R)
Hyperlipidaemia	2008	M	Total cost	0	0.00	0.00	0.00	0.00
		N		111 250	229.75	76.45	229.30-230.20	25 559 141.37
		O		65 178	202.12	65.40	201.62-202.63	13 173 910.91
		Y		409 278	128.89	35.74	128.79-129.01	52 752 647.82
	2009	M		0	0.00	0.00	0.00	0.00
		N		16 729	356.92	109.82	355.26-358.59	5 970 937.76
		O		919	374.33	99.34	367.91-380.77	344 012.26
		Y		22 213	177.62	57.40	176.87-178.38	3 945 484.87
	2010	M		0	0.00	0.00	0.00	0.00
		N		17 054	356.71	108.06	355.09-358.34	6 083 355.39
		O		847	408.91	123.04	400.61-417.21	346 342.94
		Y		19 508	191.62	53.83	190.86-192.38	3 738 041.89
	2011	M		0	0.00	0.00	0.00	0.00
		N		166 237	237.57	92.70	237.13-238.02	39 493 119.73
		O		39 040	175.32	103.87	174.29-176.35	6 844 438.15
		Y		543 670	73.10	48.51	72.97-73.23	39 740 989.50
	2012	M		0	0.00	0.00	0.00	0.00
		N		170 580	238.72	98.51	238.22-239.19	40 720 719.20
		O		34 575	164.11	99.97	163.06-165.17	5 674 039.26
		Y		523 830	72.86	48.02	72.74-73.00	38 167 264.83

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E8: Medical scheme contribution of hyperlipidaemia items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Hyperlipidaemia	2008	M	Medical scheme contribution	0	0.00	0.00	0.00	0.00
		N		111 250	187.92	78.49	187.46-188.38	20 906 061.34
		O		65 178	152.75	56.96	152.31-153.19	9 955 855.40
		Y		409 278	116.84	35.25	116.73-116.94	47 818 721.69
	2009	M		0	0.00	0.00	0.00	0.00
		N		16 729	279.12	132.83	277.11-281.13	4 669 415.55
		O		919	246.14	110.96	238.96-253.32	226 203.84
		Y		22 213	168.92	58.29	168.15-169.68	3 752 165.38
	2010	M		0	0.00	0.00	0.00	0.00
		N		17 054	280.07	129.31	278.13-282.01	4 776 289.80
		O		847	283.45	141.20	273.92-292.70	240 079.20
		Y		19 508	183.46	56.21	182.68-184.25	3 579 015.69
	2011	M		0	0.00	0.00	0.00	0.00
		N		166 237	190.95	88.17	190.53-191.38	31 743 778.16
		O		39 040	103.12	76.40	102.36-103.88	4 025 881.22
		Y		543 670	63.64	42.76	63.53-63.75	34 599 352.58
	2012	M		0	0.00	0.00	0.00	0.00
		N		170 580	190.46	93.09	190.02-190.90	32 489 125.03
		O		34 575	102.65	72.43	101.88-103.41	3 549 011.74
		Y		523 830	62.58	41.77	62.47-62.70	32 782 481.14

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E9: Patient levy of hyperlipidaemia items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total cost (R)
Hyperlipidaemia	2008	M	Patient levy	0	0.00	0.00	0.00	0.00
		N		111 250	41.83	57.43	41.49-42.16	4 653 080.03
		O		65 178	49.37	49.33	48.99-49.75	3 218 055.51
		Y		409 278	12.06	21.42	11.99-12.12	4 933 926.13
	2009	M		0	0.00	0.00	0.00	0.00
		N		16 729	77.80	110.43	76.13-79.47	1 301 522.21
		O		919	128.19	105.87	121.34-135.05	117 808.42
		Y		22 213	8.70	24.22	8.38-9.02	193 319.49
	2010	M		0	0.00	0.00	0.00	0.00
		N		17 054	76.64	104.10	75.08-78.21	1 307 065.59
		O		847	125.46	109.77	118.06-132.86	106 263.74
		Y		19 508	8.15	23.54	7.82-8.48	159 026.20
	2011	M		0	0.00	0.00	0.00	0.00
		N		166 237	46.62	50.59	46.37-46.86	7 749 341.57
		O		39 040	72.20	76.61	71.44-72.96	2 818 556.93
		Y		543 670	9.46	19.07	9.41-9.51	5 141 636.92
	2012	M		0	0.00	0.00	0.00	0.00
		N		170 580	48.26	53.39	48.00-48.51	8 231 594.17
		O		34 575	61.46	77.35	60.65-62.28	2 125 027.52
		Y		523 830	10.28	19.93	10.23-10.33	5 384 783.69

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table E10: Total cost of diabetes mellitus type 2 items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Diabetes mellitus type 2	2008	M	Total cost	0	0.00	0.00	0.00	0.00
		N		96 618	425.35	291.21	423.51-427.19	41 096 102.51
		O		119 918	58.31	45.69	58.06-58.58	6 992 967.16
		Y		183 963	59.46	42.24	59.27-59.65	10 937 764.09
	2009	M		2 975	671.36	322.45	659.78-682.96	1 997 305.25
		N		140 421	434.75	319.34	433.09-436.43	61 048 338.62
		O		164 309	61.92	44.44	61.71-62.14	10 173 609.77
		Y		238 849	59.28	45.81	59.10-59.47	14 159 104.57
	2010	M		6 775	657.54	348.48	649.25-665.84	4 454 836.45
		N		132 126	498.40	334.61	496.60-500.21	65 851 908.55
		O		181 554	67.82	46.22	67.61-68.04	12 313 294.00
		Y		250 633	59.55	47.85	59.37-59.74	14 925 320.59
	2011	M		4 420	510.98	226.70	504.30-517.67	2 258 518.72
		N		118 406	577.86	327.99	576.00-579.73	68 422 158.18
		O		172 418	68.61	43.69	68.40-68.82	11 828 905.64
		Y		266 674	58.88	45.71	58.71-59.05	15 700 766.81
	2012	M		8 990	536.39	238.69	531.45-541.32	4 822 104.68
		N		112 660	573.27	331.33	571.34-575.21	64 584 423.07
		O		150 411	68.69	40.49	68.49-68.90	10 332 301.25
		Y		278 416	59.16	44.95	59.00-59.33	16 471 447.08

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table E11: Medical scheme contribution of diabetes mellitus type 2 items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Diabetes mellitus type 2	2008	M	Medical scheme contribution	0	0.00	0.00	0.00	0.00
		N		96 618	399.87	293.51	398.02-401.72	38 634 776.54
		O		119 918	48.79	35.33	48.59-48.99	5 850 547.75
		Y		183 963	53.35	37.38	53.18-53.53	9 815 248.39
	2009	M		2 975	645.93	317.99	634.50-657.36	1 921 634.67
		N		140 421	404.90	314.33	403.25-406.54	56 855 812.50
		O		164 309	51.57	33.53	51.41-51.74	8 473 986.51
		Y		238 849	53.60	38.00	53.45-53.76	12 803 356.72
	2010	M		6 775	635.95	338.23	627.89-644.00	4 308 550.58
		N		132 126	464.46	328.36	462.68-466.23	61 366 612.71
		O		181 554	54.20	35.91	54.03-54.36	9 840 192.49
		Y		250 633	53.98	41.21	53.82-54.14	13 528 968.32
	2011	M		4 420	499.13	225.52	492.48-505.78	2 206 171.95
		N		118 406	546.69	325.20	544.84-548.54	64 731 498.84
		O		172 418	54.48	32.84	54.33-54.64	9 393 583.55
		Y		266 674	53.18	37.38	53.04-53.32	14 181 921.04
	2012	M		8 990	524.98	237.44	520.07-529.89	4 719 574.60
		N		112 660	545.25	328.28	543.33-547.17	61 427 886.70
		O		150 411	53.83	28.63	53.69-53.97	8 096 636.46
		Y		278 416	53.25	36.79	53.12-53.39	14 826 154.31

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.
O - Original medicine provided (patent expired) and generic medicine available.
N - Original medicine provided (no generic medicine available).
Y - Generic medicine provided.

Table E12: Patient levy of diabetes mellitus type 2 items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Diabetes mellitus type 2	2008	M	Patient levy	0	0.00	0.00	0.00	0.00
		N		96 618	25.47	59.32	25.10-25.85	2 461 325.97
		O		119 918	9.53	23.09	9.40-9.66	1 142 419.41
		Y		183 963	6.10	17.59	6.02-6.18	1 122 515.70
	2009	M		2 975	25.44	84.25	22.41-28.46	75 670.58
		N		140 421	29.86	67.44	29.50-30.21	4 192 526.12
		O		164 309	10.34	23.94	10.23-10.46	1 699 623.26
		Y		238 849	5.68	19.84	5.60-5.76	1 355 747.85
	2010	M		6 775	21.59	79.90	19.69-23.49	146 285.87
		N		132 126	33.95	74.36	33.55-34.35	4 485 295.84
		O		181 554	13.62	22.99	13.52-13.73	2 473 101.51
		Y		250 633	5.57	18.14	5.50-5.64	1 396 352.27
	2011	M		4 420	11.84	43.72	10.55-13.13	52 346.77
		N		118 406	31.17	70.52	30.77-31.57	3 690 659.34
		O		172 418	14.12	21.11	14.02-14.22	2 435 322.09
		Y		266 674	5.70	17.07	5.63-5.76	1 518 845.77
	2012	M		8 990	11.40	45.88	10.46-12.35	102 530.08
		N		112 660	28.02	67.42	27.62-28.41	3 156 536.37
		O		150 411	14.86	21.60	14.75-14.97	2 235 664.79
		Y		278 416	5.91	17.55	5.84-5.97	1 645 292.77

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E13: Total cost of hypothyroidism items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total cost (R)
Hypothyroidism	2008	M	Total cost	0	0.00	0.00	0.00	0.00
		N		298 254	39.34	17.20	39.28-39.41	11 733 386.33
		O		0	0.00	0.00	0.00	0.00
		Y		0	0.00	0.00	0.00	0.00
	2009	M		0	0.00	0.00	0.00	0.00
		N		28 251	42.83	20.74	42.59-43.07	1 209 856.42
		O		7 134	43.19	16.96	42.80-43.59	308 133.63
		Y		4	57.12	51.54	24.90-139.13	228.46
	2010	M		0	0.00	0.00	0.00	0.00
		N		1 987	52.25	112.56	47.31-57.21	103 827.65
		O		32 323	43.99	17.43	43.80-44.18	1 421 882.35
		Y		446	38.92	20.07	37.06-40.80	17 359.78
	2011	M		0	0.00	0.00	0.00	0.00
		N		2 321	36.16	24.71	35.16-37.17	83 928.41
		O		31 848	43.33	17.71	43.14-43.53	1 379 907.36
		Y		1 310	38.99	17.76	38.03-39.95	51 072.98
	2012	M		0	0.00	0.00	0.00	0.00
		N		2 644	39.15	52.08	37.17-41.14	103 505.99
		O		34 074	43.66	18.63	43.46-43.86	1 487 530.49
		Y		1 294	32.61	13.61	31.87-33.35	42 194.12

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E14: Medical scheme contribution of hypothyroidism items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Hypothyroidism	2008	M	Medical scheme contribution	0	0.00	0.00	0.00	0.00
		N		298 254	36.69	16.87	36.36-36.76	10 944 421.66
		O		0	0.00	0.00	0.00	0.00
		Y		0	0.00	0.00	0.00	0.00
	2009	M		0	0.00	0.00	0.00	0.00
		N		28 251	39.26	19.86	39.02-39.49	1 109 010.14
		O		7 134	39.44	17.40	39.03-39.84	281 356.24
		Y		4	57.12	51.54	24.90-139.13	228.46
	2010	M		0	0.00	0.00	0.00	0.00
		N		1 987	43.04	85.75	39.27-46.81	85 523.94
		O		32 323	41.20	17.41	41.01-41.39	1 331 841.59
		Y		446	36.77	20.60	34.85-38.69	16 398.61
	2011	M		0	0.00	0.00	0.00	0.00
		N		2 321	33.49	21.17	32.63-34.35	77 725.72
		O		31 848	41.31	17.53	41.11-41.50	1 315 554.67
		Y		1 310	37.22	17.52	36.27-38.17	48 761.56
	2012	M		0	0.00	0.00	0.00	0.00
		N		2 644	37.00	41.10	35.43-38.56	97 820.96
		O		34 074	42.03	18.37	41.83-42.22	1 432 044.38
		Y		1 294	31.66	13.56	30.92-32.40	40 972.82

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

Table E15: Patient levy of hypothyroidism items according to generic indicator from 2008 until 2012.

Type of CDL condition	Year	Generic indicator*	Cost	Cost (R)				
				Number of CDL medicine items (n)	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	Total cost (R)
Hypothyroidism	2008	M	Patient levy	0	0.00	0.00	0.00	0.00
		N		298 254	2.65	5.73	2.62-2.67	788 964.67
		O		0	0.00	0.00	0.00	0.00
		Y		0	0.00	0.00	0.00	0.00
	2009	M		0	0.00	0.00	0.00	0.00
		N		28 251	3.57	6.23	3.50-3.64	100 846.28
		O		7 134	3.75	6.73	3.60-3.91	26 777.39
		Y		4	0.00	0.00	0.00	0.00
	2010	M		0	0.00	0.00	0.00	0.00
		N		1 987	9.21	71.08	6.08-12.34	18 303.71
		O		32 323	2.79	6.34	2.72-2.85	90 040.76
		Y		446	2.16	6.29	1.57-2.74	961.17
	2011	M		0	0.00	0.00	0.00	0.00
		N		2 321	2.67	6.12	2.42-2.92	6 202.69
		O		31 848	2.02	3.96	1.98-2.06	64 352.69
		Y		1 310	1.76	3.58	1.57-1.96	2 311.42
	2012	M		0	0.00	0.00	0.00	0.00
		N		2 644	2.15	12.58	1.67-2.63	5 685.03
		O		34 074	1.63	3.44	1.59-1.66	55 486.11
		Y		1 294	0.94	2.44	0.81-1.08	1 221.30

* Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

APPENDIX F

Table F1: Statistical and practical significant difference between the total average cost per medicine item for hypertension according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypertension	Total CDL medicine item cost	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	173.02	74.04	172.78-173.27		
			Group-N and	173.02	74.04	172.78-173.27	< 0.05	0.34
			Group-O	147.63	63.34	147.34-147.92		
			Group-O and	147.63	63.34	147.34-147.92	< 0.05	1.08
			Group-Y	79.18	52.11	79.09-79.28		
			Group-N and	173.02	74.04	172.78-173.27	< 0.05	1.26
			Group-Y	79.18	52.11	79.09-79.28		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	79.18	52.11	79.09-79.28		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	147.63	63.34	147.34-147.92		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	177.44	78.69	177.20-177.68		
			Group-N and	177.44	78.69	177.20-177.68	< 0.05	0.04
			Group-O	174.38	84.10	174.07-174.70		
			Group-O and	174.38	84.10	174.07-174.70	< 0.05	1.04
			Group-Y	87.14	55.54	87.06-87.23		
			Group-N and	177.44	78.69	177.20-177.68	< 0.05	1.15
			Group-Y	87.14	55.54	87.06-87.23		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	87.14	55.54	87.06-87.23		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	174.38	84.10	174.07-174.70		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	179.12	83.74	178.85-179.40		
			Group-N and	179.12	83.74	178.85-179.40	< 0.05	0.02
			Group-O	180.61	86.95	180.29-180.93		
			Group-O and	180.61	86.95	180.29-180.93	< 0.05	1.03
			Group-Y	90.77	57.28	90.68-90.86		
			Group-N and	179.12	83.74	178.85-179.40	< 0.05	1.06
			Group-Y	90.77	57.28	90.68-90.86		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	90.77	57.28	90.68-90.86		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	180.61	86.95	180.29-180.93		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F1 (continue): Statistical and practical significant difference between the total average cost per medicine item for hypertension according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypertension	Total CDL medicine item cost	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	182.49	93.15	182.12-182.87		
			Group-N and	182.49	93.15	182.12-182.87	< 0.05	0.22
			Group-O	162.27	80.64	161.99-162.57		
			Group-O and	162.27	80.64	161.99-162.57	< 0.05	0.90
			Group-Y	90.05	56.22	89.96-90.14		
			Group-N and	182.49	93.15	182.12-182.87	< 0.05	0.99
			Group-Y	90.05	56.22	89.96-90.14		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	90.05	56.22	89.96-90.14		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	162.27	80.64	161.99-162.57		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	192.70	96.02	192.28-193.13		
			Group-N and	192.70	96.02	192.28-193.13	< 0.05	0.37
			Group-O	157.14	80.68	156.82-157.46		
			Group-O and	157.14	80.68	156.82-157.46	< 0.05	0.82
			Group-Y	91.22	55.29	91.13-91.31		
			Group-N and	192.70	96.02	192.28-193.13	< 0.05	1.06
			Group-Y	91.22	55.29	91.13-91.31		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	91.22	55.29	91.13-91.31		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	157.14	80.68	156.82-157.46		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F2: Statistical and practical significant difference between the average medical scheme contribution per medicine item for hypertension according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypertension	Medical scheme contribution	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	135.83	70.18	135.60-136.06		
			Group-N and	135.83	70.18	135.60-136.06	< 0.05	0.50
			Group-O	101.03	56.77	100.77-101.29		
			Group-O and	101.03	56.77	100.77-101.29	< 0.05	0.60
			Group-Y	67.14	44.87	67.06-67.23		
			Group-N and	135.83	70.18	135.60-136.06	< 0.05	0.98
			Group-Y	67.14	44.87	67.06-67.23		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	67.14	44.87	67.06-67.23		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	101.03	56.77	100.77-101.29		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	139.44	74.87	139.21-139.66		
			Group-N and	139.44	74.87	139.21-139.66	< 0.05	0.28
			Group-O	118.60	73.35	118.33-118.88		
			Group-O and	118.60	73.35	118.33-118.88	< 0.05	0.61
			Group-Y	74.01	47.99	73.94-74.09		
			Group-N and	139.44	74.87	139.21-139.66	< 0.05	0.87
			Group-Y	74.01	47.99	73.94-74.09		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	74.01	47.99	73.94-74.09		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	118.60	73.35	118.33-118.88		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	141.71	77.93	141.45-141.96		
			Group-N and	141.71	77.93	141.45-141.96	< 0.05	0.30
			Group-O	118.24	70.52	117.98-118.51		
			Group-O and	118.24	70.52	117.98-118.51	< 0.05	0.58
			Group-Y	77.33	49.54	77.25-77.40		
			Group-N and	141.71	77.93	141.45-141.96	< 0.05	0.83
			Group-Y	77.33	49.54	77.25-77.40		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	77.33	49.54	77.25-77.40		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	118.24	70.52	117.98-118.51		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F2 (continue): Statistical and practical significant difference between the average medical scheme contribution per medicine item for hypertension according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypertension	Medical scheme contribution	2011	Group-M and	0.00	0.00	0.00	– #	–
			Group-N	145.23	84.56	144.89-145.56		
			Group-N and	145.23	84.56	144.89-145.56	< 0.05	0.39
			Group-O	111.95	60.10	111.73-112.16		
			Group-O and	111.95	60.10	111.73-112.16	< 0.05	0.59
			Group-Y	76.72	48.20	76.64-76.79		
			Group-N and	145.23	84.56	144.89-145.56	< 0.05	0.81
			Group-Y	76.72	48.20	76.64-76.79		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	76.72	48.20	76.64-76.79		
		2012	Group-M and	0.00	0.00	0.00	– #	–
			Group-O	111.95	60.10	111.73-112.16		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-N	150.60	88.30	150.21-150.99		
			Group-N and	150.60	88.30	150.21-150.99	< 0.05	0.49
			Group-O	107.60	59.32	107.37-107.84		
			Group-O and	107.60	59.32	107.37-107.84	< 0.05	0.33
			Group-Y	78.14	47.91	78.06-78.21		
			Group-N and	150.60	88.30	150.21-150.99	< 0.05	0.82
			Group-Y	78.14	47.91	78.06-78.21		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	78.14	47.91	78.06-78.21		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-O	107.60	59.32	107.37-107.84		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F3: Statistical and practical significant difference between the average patient levy per medicine item for hypertension according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypertension	Patient levy	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	37.20	43.82	37.05-37.34		
			Group-N and	37.20	43.82	37.05-37.34	< 0.05	0.22
			Group-O	46.60	43.22	46.40-46.80		
			Group-O and	46.60	43.22	46.40-46.80	< 0.05	0.80
			Group-Y	12.04	20.96	12.00-12.08		
			Group-N and	37.20	43.82	37.05-37.34	< 0.05	0.57
			Group-Y	12.04	20.96	12.00-12.08		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	12.04	20.96	12.00-12.08		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	46.60	43.22	46.40-46.80		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	38.00	47.24	37.86-38.14		
			Group-N and	38.00	47.24	37.86-38.14	< 0.05	0.32
			Group-O	55.78	55.49	55.57-55.99		
			Group-O and	55.78	55.49	55.57-55.99	< 0.05	0.77
			Group-Y	13.13	23.25	13.09-13.17		
			Group-N and	38.00	47.24	37.86-38.14	< 0.05	0.53
			Group-Y	13.13	23.25	13.09-13.17		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	13.13	23.25	13.09-13.17		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	55.78	55.49	55.57-55.99		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	37.41	48.00	37.25-37.57		
			Group-N and	37.41	48.00	37.25-37.57	< 0.05	0.42
			Group-O	62.36	59.23	62.14-62.58		
			Group-O and	62.36	59.23	62.14-62.58	< 0.05	0.83
			Group-Y	13.44	23.76	13.40-13.48		
			Group-N and	37.41	48.00	37.25-37.57	< 0.05	0.50
			Group-Y	13.44	23.76	13.40-13.48		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	13.44	23.76	13.40-13.48		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	62.36	59.23	62.14-62.58		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F3 (continue): Statistical and practical significant difference between the average patient levy per medicine item for hypertension according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypertension	Patient levy	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	37.27	41.33	37.10-37.43		
			Group-N and	37.27	41.33	37.10-37.43	< 0.05	0.24
			Group-O	50.33	53.99	50.13-50.52		
			Group-O and	50.33	53.99	50.13-50.52	< 0.05	0.68
			Group-Y	13.33	21.81	13.30-13.36		
			Group-N and	37.27	41.33	37.10-37.43	< 0.05	0.58
			Group-Y	13.33	21.81	13.30-13.36		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	13.33	21.81	13.30-13.36		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	50.33	53.99	50.13-50.52		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	42.10	46.06	41.89-42.30		
			Group-N and	42.10	46.06	41.89-42.30	< 0.05	0.13
			Group-O	49.53	55.18	49.31-49.75		
			Group-O and	49.53	55.18	49.31-49.75	< 0.05	0.66
			Group-Y	13.08	22.31	13.04-13.12		
			Group-N and	42.10	46.06	41.89-42.30	< 0.05	0.63
			Group-Y	13.08	22.31	13.04-13.12		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	13.08	22.31	13.04-13.12		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	49.53	55.18	49.31-49.75		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F4: Statistical and practical significant difference between the total average cost per medicine item for hyperlipidaemia according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hyperlipidaemia	Total CDL medicine item cost	2008	Group-M and	0.00	0.00	0.00	– #	–
			Group-N	229.75	76.45	229.30-230.20		
			Group-N and	229.75	76.45	229.30-230.20	< 0.05	0.36
			Group-O	202.12	65.40	201.62-202.63		
			Group-O and	202.12	65.40	201.62-202.63	< 0.05	1.12
			Group-Y	128.89	35.74	128.79-129.01		
			Group-N and	229.75	76.45	229.30-230.20	< 0.05	1.31
			Group-Y	128.89	35.74	128.79-129.01		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	128.89	35.74	128.79-129.01		
		2009	Group-M and	0.00	0.00	0.00	– #	–
			Group-O	202.12	65.40	201.62-202.63		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-N	356.92	109.82	355.26-358.59		
			Group-N and	356.92	109.82	355.26-358.59	< 0.05	0.16
			Group-O	374.33	99.34	367.91-380.77		
			Group-O and	374.33	99.34	367.91-380.77	< 0.05	1.98
			Group-Y	177.62	57.40	176.87-178.38		
			Group-N and	356.92	109.82	355.26-358.59	< 0.05	1.63
			Group-Y	177.62	57.40	176.87-178.38		
		2010	Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	177.62	57.40	176.87-178.38		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-O	374.33	99.34	367.91-380.77		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-N	356.71	108.06	355.09-358.34		
			Group-N and	356.71	108.06	355.09-358.34	< 0.05	0.42
			Group-O	408.91	123.04	400.61-417.21		
			Group-O and	408.91	123.04	400.61-417.21	< 0.05	1.77
			Group-Y	191.62	53.83	190.86-192.38		
			Group-N and	356.71	108.06	355.09-358.34	< 0.05	1.53
			Group-Y	191.62	53.83	190.86-192.38		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	191.62	53.83	190.86-192.38		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-O	408.91	123.04	400.61-417.21		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F4 (continue): Statistical and practical significant difference between the total average cost per medicine item for hyperlipidaemia according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hyperlipidaemia	Total CDL medicine item cost	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	237.57	92.70	237.13-238.02		
			Group-N and	237.57	92.70	237.13-238.02	< 0.05	0.60
			Group-O	175.32	103.87	174.29-176.35		
			Group-O and	175.32	103.87	174.29-176.35	< 0.05	0.98
			Group-Y	73.10	48.51	72.97-73.23		
			Group-N and	237.57	92.70	237.13-238.02	< 0.05	1.77
			Group-Y	73.10	48.51	72.97-73.23		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	73.10	48.51	72.97-73.23		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	175.32	103.87	174.29-176.35		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	238.72	98.51	238.22-239.19		
			Group-N and	238.72	98.51	238.22-239.19	< 0.05	0.75
			Group-O	164.11	99.97	163.06-165.17		
			Group-O and	164.11	99.97	163.06-165.17	< 0.05	0.91
			Group-Y	72.86	48.02	72.74-73.00		
			Group-N and	238.72	98.51	238.22-239.19	< 0.05	1.68
			Group-Y	72.86	48.02	72.74-73.00		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	72.86	48.02	72.74-73.00		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	164.11	99.97	163.06-165.17		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F5: Statistical and practical significant difference between the average medical scheme contribution per medicine item for hyperlipidaemia according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hyperlipidaemia	Medical scheme contribution	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	187.92	78.49	187.46-188.38		
			Group-N and	187.92	78.49	187.46-188.38	< 0.05	0.45
			Group-O	152.75	56.96	152.31-153.19		
			Group-O and	152.75	56.96	152.31-153.19	< 0.05	0.63
			Group-Y	116.84	35.25	116.73-116.94		
			Group-N and	187.92	78.49	187.46-188.38	< 0.05	0.91
			Group-Y	116.84	35.25	116.73-116.94		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	116.84	35.25	116.73-116.94		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	152.75	56.96	152.31-153.19		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	279.12	132.83	277.11-281.13		
			Group-N and	279.12	132.83	277.11-281.13	< 0.05	0.25
			Group-O	246.14	110.96	238.96-253.32		
			Group-O and	246.14	110.96	238.96-253.32	< 0.05	0.70
			Group-Y	168.92	58.29	168.15-169.68		
			Group-N and	279.12	132.83	277.11-281.13	< 0.05	0.83
			Group-Y	168.92	58.29	168.15-169.68		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	168.92	58.29	168.15-169.68		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	246.14	110.96	238.96-253.32		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	280.07	129.31	278.13-282.01		
			Group-N and	280.07	129.31	278.13-282.01	_ &	0.02
			Group-O	283.45	141.20	273.92-292.70		
			Group-O and	283.45	141.20	273.92-292.70	< 0.05	0.71
			Group-Y	183.46	56.21	182.68-184.25		
			Group-N and	280.07	129.31	278.13-282.01	< 0.05	0.75
			Group-Y	183.46	56.21	182.68-184.25		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	183.46	56.21	182.68-184.25		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	283.45	141.20	273.92-292.70		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F5 (continue): Statistical and practical significant difference between the average medical scheme contribution per medicine item for hyperlipidaemia according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hyperlipidaemia	Medical scheme contribution	2011	Group-M and	0.00	0.00	0.00	– #	–
			Group-N	190.95	88.17	190.53-191.38		
			Group-N and	190.95	88.17	190.53-191.38	< 0.05	1.00
			Group-O	103.12	76.40	102.36-103.88		
			Group-O and	103.12	76.40	102.36-103.88	< 0.05	0.52
			Group-Y	63.64	42.76	63.53-63.75		
			Group-N and	190.95	88.17	190.53-191.38	< 0.05	1.44
			Group-Y	63.64	42.76	63.53-63.75		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	63.64	42.76	63.53-63.75		
		2012	Group-M and	0.00	0.00	0.00	– #	–
			Group-O	103.12	76.40	102.36-103.88		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-N	190.46	93.09	190.02-190.90		
			Group-N and	190.46	93.09	190.02-190.90	< 0.05	0.94
			Group-O	102.65	72.43	101.88-103.41		
			Group-O and	102.65	72.43	101.88-103.41	< 0.05	0.55
			Group-Y	62.58	41.77	62.47-62.70		
			Group-N and	190.46	93.09	190.02-190.90	< 0.05	1.37
			Group-Y	62.58	41.77	62.47-62.70		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	62.58	41.77	62.47-62.70		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-O	102.65	72.43	101.88-103.41		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F6: Statistical and practical significant difference between the average patient levy per medicine item for hyperlipidaemia according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hyperlipidaemia	Patient levy	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	41.83	57.43	41.49-42.16		
			Group-N and	41.83	57.43	41.49-42.16	< 0.05	0.13
			Group-O	49.37	49.33	48.99-49.75		
			Group-O and	49.37	49.33	48.99-49.75	< 0.05	0.76
			Group-Y	12.06	21.42	11.99-12.12		
			Group-N and	41.83	57.43	41.49-42.16	< 0.05	0.52
			Group-Y	12.06	21.42	11.99-12.12		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	12.06	21.42	11.99-12.12		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	49.37	49.33	48.99-49.75		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	77.80	110.43	76.13-79.47		
			Group-N and	77.80	110.43	76.13-79.47	< 0.05	0.46
			Group-O	128.19	105.87	121.34-135.05		
			Group-O and	128.19	105.87	121.34-135.05	< 0.05	1.13
			Group-Y	8.70	24.22	8.38-9.02		
			Group-N and	77.80	110.43	76.13-79.47	< 0.05	0.63
			Group-Y	8.70	24.22	8.38-9.02		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	8.70	24.22	8.38-9.02		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	128.19	105.87	121.34-135.05		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	76.64	104.10	75.08-78.21		
			Group-N and	76.64	104.10	75.08-78.21	< 0.05	0.45
			Group-O	125.46	109.77	118.06-132.86		
			Group-O and	125.46	109.77	118.06-132.86	< 0.05	1.06
			Group-Y	8.15	23.54	7.82-8.48		
			Group-N and	76.64	104.10	75.08-78.21	< 0.05	0.66
			Group-Y	8.15	23.54	7.82-8.48		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	8.15	23.54	7.82-8.48		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	125.46	109.77	118.06-132.86		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F6 (continue): Statistical and practical significant difference between the average patient levy per medicine item for hyperlipidaemia according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hyperlipidaemia	Patient levy	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	46.62	50.59	46.37-46.86		
			Group-N and	46.62	50.59	46.37-46.86	< 0.05	0.33
			Group-O	72.20	76.61	71.44-72.96		
			Group-O and	72.20	76.61	71.44-72.96	< 0.05	0.82
			Group-Y	9.46	19.07	9.41-9.51		
			Group-N and	46.62	50.59	46.37-46.86	< 0.05	0.74
			Group-Y	9.46	19.07	9.41-9.51		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	9.46	19.07	9.41-9.51		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	72.20	76.61	71.44-72.96		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	48.26	53.39	48.00-48.51		
			Group-N and	48.26	53.39	48.00-48.51	< 0.05	0.17
			Group-O	61.46	77.35	60.65-62.28		
			Group-O and	61.46	77.35	60.65-62.28	< 0.05	0.66
			Group-Y	10.28	19.93	10.23-10.33		
			Group-N and	48.26	53.39	48.00-48.51	< 0.05	0.71
			Group-Y	10.28	19.93	10.23-10.33		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	10.28	19.93	10.23-10.33		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	61.46	77.35	60.65-62.28		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F7: Statistical and practical significant difference between the total average cost per medicine item for asthma according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Asthma	Total CDL medicine item cost	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	267.18	117.39	266.41-267.95		
			Group-N and	267.18	117.39	266.41-267.95	< 0.05	1.35
			Group-O	108.95	104.63	107.02-110.89		
			Group-O and	108.95	104.63	107.02-110.89	< 0.05	0.44
			Group-Y	63.10	60.09	62.65-63.55		
			Group-N and	267.18	117.39	266.41-267.95	< 0.05	1.74
			Group-Y	63.10	60.09	62.65-63.55		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	63.10	60.09	62.65-63.55		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	108.95	104.63	107.02-110.89		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	299.32	131.53	298.68-299.96		
			Group-N and	299.32	131.53	298.68-299.96	< 0.05	1.40
			Group-O	115.77	115.22	114.01-117.54		
			Group-O and	115.77	115.22	114.01-117.54	< 0.05	0.48
			Group-Y	60.24	68.71	59.81-60.67		
			Group-N and	299.32	131.53	298.68-299.96	< 0.05	1.82
			Group-Y	60.24	68.71	59.81-60.67		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	60.24	68.71	59.81-60.67		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	115.77	115.22	114.01-117.54		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	309.17	133.52	308.49-309.86		
			Group-N and	309.17	133.52	308.49-309.86	< 0.05	0.51
			Group-O	218.89	175.50	216.59-221.20		
			Group-O and	218.89	175.50	216.59-221.20	< 0.05	0.84
			Group-Y	71.04	91.66	70.46-71.62		
			Group-N and	309.17	133.52	308.49-309.86	< 0.05	1.78
			Group-Y	71.04	91.66	70.46-71.62		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	71.04	91.66	70.46-71.62		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	218.89	175.50	216.59-221.20		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F7 (continue): Statistical and practical significant difference between the total average cost per medicine item for asthma according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Asthma	Total CDL medicine item cost	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	272.32	146.49	271.44-273.20		
			Group-N and	272.32	146.49	271.44-273.20	< 0.05	0.13
			Group-O	253.79	147.48	252.41-255.17		
			Group-O and	253.79	147.48	252.41-255.17	< 0.05	0.79
			Group-Y	137.37	122.99	136.72-138.02		
			Group-N and	272.32	146.49	271.44-273.20	< 0.05	0.92
			Group-Y	137.37	122.99	136.72-138.02		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	137.37	122.99	136.72-138.02		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	253.79	147.48	252.41-255.17		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	264.90	151.54	263.83-265.97		
			Group-N and	264.90	151.54	263.83-265.97	< 0.05	0.13
			Group-O	244.51	153.63	242.86-246.17		
			Group-O and	244.51	153.63	242.86-246.17	< 0.05	0.54
			Group-Y	161.04	129.61	160.37-161.72		
			Group-N and	264.90	151.54	263.83-265.97	< 0.05	0.69
			Group-Y	161.04	129.61	160.37-161.72		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	161.04	129.61	160.37-161.72		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	244.51	153.63	242.86-246.17		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F8: Statistical and practical significant difference between the average medical scheme contribution per medicine item for asthma according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Asthma	Medical scheme contribution	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	230.39	113.74	229.65-231.14		
			Group-N and	230.39	113.74	229.65-231.14	< 0.05	1.42
			Group-O	69.24	77.70	67.80-70.68		
			Group-O and	69.24	77.70	67.80-70.68	< 0.05	0.21
			Group-Y	53.06	50.21	52.68-53.43		
			Group-N and	230.39	113.74	229.65-231.14	< 0.05	1.56
			Group-Y	53.06	50.21	52.68-53.43		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	53.06	50.21	52.68-53.43		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	69.24	77.70	67.80-70.68		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	249.67	127.72	249.04-250.29		
			Group-N and	249.67	127.72	249.04-250.29	< 0.05	1.39
			Group-O	71.71	83.09	70.44-72.98		
			Group-O and	71.71	83.09	70.44-72.98	< 0.05	0.27
			Group-Y	49.13	56.89	48.77-49.49		
			Group-N and	249.67	127.72	249.04-250.29	< 0.05	1.57
			Group-Y	49.13	56.89	48.77-49.49		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	49.13	56.89	48.77-49.49		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	71.71	83.09	70.44-72.98		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	260.56	133.05	259.89-261.24		
			Group-N and	260.56	133.05	259.89-261.24	< 0.05	0.82
			Group-O	147.91	137.98	146.10-149.73		
			Group-O and	147.91	137.98	146.10-149.73	< 0.05	0.65
			Group-Y	57.87	72.50	57.41-58.33		
			Group-N and	260.56	133.05	259.89-261.24	< 0.05	1.52
			Group-Y	57.87	72.50	57.41-58.33		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	57.87	72.50	57.41-58.33		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	147.91	137.98	146.10-149.73		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F8 (continue): Statistical and practical significant difference between the average medical scheme contribution per medicine item for asthma according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Asthma	Medical scheme contribution	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	239.40	136.52	238.58-240.22		
			Group-N and	239.40	136.52	238.58-240.22	< 0.05	0.30
			Group-O	198.56	118.36	197.45-199.67		
			Group-O and	198.56	118.36	197.45-199.67	< 0.05	0.64
			Group-Y	122.71	112.38	122.12-123.31		
			Group-N and	239.40	136.52	238.58-240.22	< 0.05	0.85
			Group-Y	122.71	112.38	122.12-123.31		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	122.71	112.38	122.12-123.31		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	198.56	118.36	197.45-199.67		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	235.16	140.63	234.17-236.15		
			Group-N and	235.16	140.63	234.17-236.15	< 0.05	0.43
			Group-O	175.41	115.23	174.17-176.65		
			Group-O and	175.41	115.23	174.17-176.65	< 0.05	0.26
			Group-Y	144.57	119.72	143.95-145.20		
			Group-N and	235.16	140.63	234.17-236.15	< 0.05	0.64
			Group-Y	144.57	119.72	143.95-145.20		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	144.57	119.72	143.95-145.20		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	175.41	115.23	174.17-176.65		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F9: Statistical and practical significant difference between the average patient levy per medicine item for asthma according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	p-value	d-value [†]
Asthma	Patient levy	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	36.78	58.99	36.40-37.17		
			Group-N and	36.78	58.99	36.40-37.17		
			Group-O	39.71	63.12	38.54-40.87	< 0.05	0.05
			Group-O and	39.71	63.12	38.54-40.87		
			Group-Y	10.04	30.01	9.82-10.26	< 0.05	0.47
			Group-N and	36.78	58.99	36.40-37.17		
			Group-Y	10.04	30.01	9.82-10.26	< 0.05	0.45
			Group-M and	0.00	0.00	0.00		
			Group-Y	10.04	30.01	9.82-10.26	_ #	–
			Group-M and	0.00	0.00	0.00		
			Group-O	39.71	63.12	38.54-40.87	_ #	–
		2009	Group-M and	0.00	0.00	0.00		
			Group-N	49.65	81.53	49.25-50.05	< 0.05	0.07
			Group-N and	49.65	81.53	49.25-50.05		
			Group-O	44.06	76.73	42.88-45.23		
			Group-O and	44.06	76.73	42.88-45.23	< 0.05	0.43
			Group-Y	11.11	34.96	10.89-11.33		
			Group-N and	49.65	81.53	49.25-50.05	< 0.05	0.47
			Group-Y	11.11	34.96	10.89-11.33		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	11.11	34.96	10.89-11.33		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	44.06	76.73	42.88-45.23		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	48.61	73.43	48.23-48.98		
			Group-N and	48.61	73.43	48.23-48.98	< 0.05	0.23
			Group-O	70.98	95.77	69.72-72.24		
			Group-O and	70.98	95.77	69.72-72.24	< 0.05	0.60
			Group-Y	13.17	49.46	12.86-13.48		
			Group-N and	48.61	73.43	48.23-48.98	< 0.05	0.48
			Group-Y	13.17	49.46	12.86-13.48		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	13.17	49.46	12.86-13.48		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	70.98	95.77	69.72-72.24		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F9 (continue): Statistical and practical significant difference between the average patient levy per medicine item for asthma according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Asthma	Patient levy	2011	Group-M and	0.00	0.00	0.00	– #	–
			Group-N	32.92	49.84	32.62-33.22		
			Group-N and	32.92	49.84	32.62-33.22	< 0.05	0.31
			Group-O	55.22	71.68	54.55-55.89		
			Group-O and	55.22	71.68	54.55-55.89	< 0.05	0.57
			Group-Y	14.65	32.01	14.48-14.82		
			Group-N and	32.92	49.84	32.62-33.22	< 0.05	0.37
			Group-Y	14.65	32.01	14.48-14.82		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	14.65	32.01	14.48-14.82		
		2012	Group-M and	0.00	0.00	0.00	– #	–
			Group-O	55.22	71.68	54.55-55.89		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-N	29.74	49.44	29.39-30.85		
			Group-N and	29.74	49.44	29.39-30.85	< 0.05	0.51
			Group-O	69.10	77.57	68.27-69.94		
			Group-O and	69.10	77.57	68.27-69.94	< 0.05	0.68
			Group-Y	16.47	35.94	16.28-16.66		
			Group-N and	29.74	49.44	29.39-30.85	< 0.05	0.27
			Group-Y	16.47	35.94	16.28-16.66		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-Y	16.47	35.94	16.28-16.66		
			Group-M and	0.00	0.00	0.00	– #	–
			Group-O	69.10	77.57	68.27-69.94		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F10: Statistical and practical significant difference between the total average cost per medicine item for diabetes mellitus type 2 according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Diabetes mellitus type 2	Total CDL medicine item cost	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	425.35	291.21	423.51-427.19		
			Group-N and	425.35	291.21	423.51-427.19	< 0.05	1.26
			Group-O	58.31	45.69	58.06-58.58		
			Group-O and	58.31	45.69	58.06-58.58	_ &	0.03
			Group-Y	59.46	42.24	59.27-59.65		
			Group-N and	425.35	291.21	423.51-427.19	< 0.05	1.26
			Group-Y	59.46	42.24	59.27-59.65		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	59.46	42.24	59.27-59.65		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	58.31	45.69	58.06-58.58		
		2009	Group-M and	671.36	322.45	659.78-682.96	< 0.05	0.73
			Group-N	434.75	319.34	433.09-436.43		
			Group-N and	434.75	319.34	433.09-436.43	< 0.05	1.17
			Group-O	61.92	44.44	61.71-62.14		
			Group-O and	61.92	44.44	61.71-62.14	< 0.05	0.06
			Group-Y	59.28	45.81	59.10-59.47		
			Group-N and	434.75	319.34	433.09-436.43	< 0.05	1.18
			Group-Y	59.28	45.81	59.10-59.47		
			Group-M and	671.36	322.45	659.78-682.96	< 0.05	1.90
			Group-Y	59.28	45.81	59.10-59.47		
			Group-M and	671.36	322.45	659.78-682.96	< 0.05	1.89
			Group-O	61.92	44.44	61.71-62.14		
		2010	Group-M and	657.54	348.48	649.25-665.84	< 0.05	0.46
			Group-N	498.40	334.61	496.60-500.21		
			Group-N and	498.40	334.61	496.60-500.21	< 0.05	1.29
			Group-O	67.82	46.22	67.61-68.04		
			Group-O and	67.82	46.22	67.61-68.04	< 0.05	0.17
			Group-Y	59.55	47.85	59.37-59.74		
			Group-N and	498.40	334.61	496.60-500.21	< 0.05	1.31
			Group-Y	59.55	47.85	59.37-59.74		
			Group-M and	657.54	348.48	649.25-665.84	< 0.05	1.72
			Group-Y	59.55	47.85	59.37-59.74		
			Group-M and	657.54	348.48	649.25-665.84	< 0.05	1.69
			Group-O	67.82	46.22	67.61-68.04		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F10 (continue): Statistical and practical significant difference between the total average cost per medicine item for diabetes mellitus type 2 according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Diabetes mellitus type 2	Total CDL medicine item cost	2011	Group-M and	510.98	226.70	504.30-517.67	< 0.05	0.20
			Group-N	577.86	327.99	576.00-579.73		
			Group-N and	577.86	327.99	576.00-579.73	< 0.05	1.55
			Group-O	68.61	43.69	68.40-68.82		
			Group-O and	68.61	43.69	68.40-68.82	< 0.05	0.21
			Group-Y	58.88	45.71	58.71-59.05		
			Group-N and	577.86	327.99	576.00-579.73	< 0.05	1.58
			Group-Y	58.88	45.71	58.71-59.05		
			Group-M and	510.98	226.70	504.30-517.67	< 0.05	1.99
			Group-Y	58.88	45.71	58.71-59.05		
		2012	Group-M and	510.98	226.70	504.30-517.67	< 0.05	1.95
			Group-O	68.61	43.69	68.40-68.82		
			Group-M and	536.39	238.69	531.45-541.32	< 0.05	0.11
			Group-N	573.27	331.33	571.34-575.21		
			Group-N and	573.27	331.33	571.34-575.21	< 0.05	1.52
			Group-O	68.69	40.49	68.49-68.90		
			Group-O and	68.69	40.49	68.49-68.90	< 0.05	0.21
			Group-Y	59.16	44.95	59.00-59.33		
			Group-N and	573.27	331.33	571.34-575.21	< 0.05	1.55
			Group-Y	59.16	44.95	59.00-59.33		
			Group-M and	536.39	238.69	531.45-541.32	< 0.05	1.99
			Group-Y	59.16	44.95	59.00-59.33		
			Group-M and	536.39	238.69	531.45-541.32	< 0.05	1.98
			Group-O	68.69	40.49	68.49-68.90		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F11: Statistical and practical significant difference between the average medical scheme contribution per medicine item for diabetes mellitus type 2 according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Diabetes mellitus type 2	Medical scheme contribution	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	399.87	293.51	398.02-401.72		
			Group-N and	399.87	293.51	398.02-401.72	< 0.05	1.20
			Group-O	48.79	35.33	48.59-48.99		
			Group-O and	48.79	35.33	48.59-48.99	< 0.05	0.12
			Group-Y	53.35	37.38	53.18-53.53		
			Group-N and	399.87	293.51	398.02-401.72	< 0.05	1.18
			Group-Y	53.35	37.38	53.18-53.53		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	53.35	37.38	53.18-53.53		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	48.79	35.33	48.59-48.99		
		2009	Group-M and	645.93	317.99	634.50-657.36	< 0.05	0.76
			Group-N	404.90	314.33	403.25-406.54		
			Group-N and	404.90	314.33	403.25-406.54	< 0.05	1.12
			Group-O	51.57	33.53	51.41-51.74		
			Group-O and	51.57	33.53	51.41-51.74	< 0.05	0.05
			Group-Y	53.60	38.00	53.45-53.76		
			Group-N and	404.90	314.33	403.25-406.54	< 0.05	1.12
			Group-Y	53.60	38.00	53.45-53.76		
			Group-M and	645.93	317.99	634.50-657.36	< 0.05	1.86
			Group-Y	53.60	38.00	53.45-53.76		
			Group-M and	645.93	317.99	634.50-657.36	< 0.05	1.87
			Group-O	51.57	33.53	51.41-51.74		
		2010	Group-M and	635.95	338.23	627.89-644.00	< 0.05	0.51
			Group-N	464.46	328.36	462.68-466.23		
			Group-N and	464.46	328.36	462.68-466.23	< 0.05	1.25
			Group-O	54.20	35.91	54.03-54.36		
			Group-O and	54.20	35.91	54.03-54.36	_ &	0.01
			Group-Y	53.98	41.21	53.82-54.14		
			Group-N and	464.46	328.36	462.68-466.23	< 0.05	1.25
			Group-Y	53.98	41.21	53.82-54.14		
			Group-M and	635.95	338.23	627.89-644.00	< 0.05	1.72
			Group-Y	53.98	41.21	53.82-54.14		
			Group-M and	635.95	338.23	627.89-644.00	< 0.05	1.72
			Group-O	54.20	35.91	54.03-54.36		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F11 (continue): Statistical and practical significant difference between the average medical scheme contribution per medicine item for diabetes mellitus type 2 according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Diabetes mellitus type 2	Medical scheme contribution	2011	Group-M and	499.13	225.52	492.48-505.78	< 0.05	0.15
			Group-N	546.69	325.20	544.84-548.54		
			Group-N and	546.69	325.20	544.84-548.54	< 0.05	1.51
			Group-O	54.48	32.84	54.33-54.64		
			Group-O and	54.48	32.84	54.33-54.64	< 0.05	0.03
			Group-Y	53.18	37.38	53.04-53.32		
			Group-N and	546.69	325.20	544.84-548.54	< 0.05	1.52
			Group-Y	53.18	37.38	53.04-53.32		
			Group-M and	499.13	225.52	492.48-505.78	< 0.05	1.98
			Group-Y	53.18	37.38	53.04-53.32		
		2012	Group-M and	499.13	225.52	492.48-505.78	< 0.05	1.98
			Group-O	54.48	32.84	54.33-54.64		
			Group-M and	524.98	237.44	520.07-529.89	< 0.05	0.06
			Group-N	545.25	328.28	543.33-547.17		
			Group-N and	545.25	328.28	543.33-547.17	< 0.05	1.50
			Group-O	53.83	28.63	53.69-53.97		
			Group-O and	53.83	28.63	53.69-53.97	_ &	0.02
			Group-Y	53.25	36.79	53.12-53.39		
			Group-N and	545.25	328.28	543.33-547.17	< 0.05	1.50
			Group-Y	53.25	36.79	53.12-53.39		
			Group-M and	524.98	237.44	520.07-529.89	< 0.05	1.99
			Group-Y	53.25	36.79	53.12-53.39		
			Group-M and	524.98	237.44	520.07-529.89	< 0.05	1.98
			Group-O	53.83	28.63	53.69-53.97		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F12: Statistical and practical significant difference between the average patient levy per medicine item for diabetes mellitus type 2 according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Diabetes mellitus type 2	Patient levy	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	25.47	59.32	25.10-25.85		
			Group-N and	25.47	59.32	25.10-25.85	< 0.05	0.27
			Group-O	9.53	23.09	9.40-9.66		
			Group-O and	9.53	23.09	9.40-9.66	< 0.05	0.15
			Group-Y	6.10	17.59	6.02-6.18		
			Group-N and	25.47	59.32	25.10-25.85	< 0.05	0.33
			Group-Y	6.10	17.59	6.02-6.18		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	6.10	17.59	6.02-6.18		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	9.53	23.09	9.40-9.66		
		2009	Group-M and	25.44	84.25	22.41-28.46	< 0.05	0.05
			Group-N	29.86	67.44	29.50-30.21		
			Group-N and	29.86	67.44	29.50-30.21	< 0.05	0.29
			Group-O	10.34	23.94	10.23-10.46		
			Group-O and	10.34	23.94	10.23-10.46	< 0.05	0.20
			Group-Y	5.68	19.84	5.60-5.76		
			Group-N and	29.86	67.44	29.50-30.21	< 0.05	0.36
			Group-Y	5.68	19.84	5.60-5.76		
			Group-M and	25.44	84.25	22.41-28.46	< 0.05	0.23
			Group-Y	5.68	19.84	5.60-5.76		
			Group-M and	25.44	84.25	22.41-28.46	< 0.05	0.18
			Group-O	10.34	23.94	10.23-10.46		
		2010	Group-M and	21.59	79.90	19.69-23.49	< 0.05	0.16
			Group-N	33.95	74.36	33.55-34.35		
			Group-N and	33.95	74.36	33.55-34.35	< 0.05	0.27
			Group-O	13.62	22.99	13.52-13.73		
			Group-O and	13.62	22.99	13.52-13.73	< 0.05	0.35
			Group-Y	5.57	18.14	5.50-5.64		
			Group-N and	33.95	74.36	33.55-34.35	< 0.05	0.38
			Group-Y	5.57	18.14	5.50-5.64		
			Group-M and	21.59	79.90	19.69-23.49	< 0.05	0.20
			Group-Y	5.57	18.14	5.50-5.64		
			Group-M and	21.59	79.90	19.69-23.49	< 0.05	0.10
			Group-O	13.62	22.99	13.52-13.73		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F12 (continue): Statistical and practical significant difference between the average patient levy per medicine item for diabetes mellitus type 2 according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Diabetes mellitus type 2	Patient levy	2011	Group-M and	11.84	43.72	10.55-13.13	< 0.05	0.27
			Group-N	31.17	70.52	30.77-31.57		
			Group-N and	31.17	70.52	30.77-31.57	< 0.05	0.24
			Group-O	14.12	21.11	14.02-14.22		
			Group-O and	14.12	21.11	14.02-14.22	< 0.05	0.40
			Group-Y	5.70	17.07	5.63-5.76		
			Group-N and	31.17	70.52	30.77-31.57	< 0.05	0.36
			Group-Y	5.70	17.07	5.63-5.76		
			Group-M and	11.84	43.72	10.55-13.13	< 0.05	0.14
			Group-Y	5.70	17.07	5.63-5.76		
		2012	Group-M and	11.84	43.72	10.55-13.13	< 0.05	0.05
			Group-O	14.12	21.11	14.02-14.22		
			Group-M and	11.40	45.88	10.46-12.35	< 0.05	0.25
			Group-N	28.02	67.42	27.62-28.41		
			Group-N and	28.02	67.42	27.62-28.41	< 0.05	0.20
			Group-O	14.86	21.60	14.75-14.97		
			Group-O and	14.86	21.60	14.75-14.97	< 0.05	0.41
			Group-Y	5.91	17.55	5.84-5.97		
			Group-N and	28.02	67.42	27.62-28.41	< 0.05	0.33
			Group-Y	5.91	17.55	5.84-5.97		
			Group-M and	11.40	45.88	10.46-12.35	< 0.05	0.12
			Group-Y	5.91	17.55	5.84-5.97		
			Group-M and	11.40	45.88	10.46-12.35	< 0.05	0.08
			Group-O	14.86	21.60	14.75-14.97		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F13: Statistical and practical significant difference between the total average cost per medicine item for hypothyroidism according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypothyroidism	Total CDL medicine item cost	2008	Group-M and	0.00	0.00	0.00	_ #	-
			Group-N	39.34	17.20	39.28-39.41		
			Group-N and	39.34	17.20	39.28-39.41	_ #	-
			Group-O	0.00	0.00	0.00		
			Group-O and	0.00	0.00	0.00	_ #	-
			Group-Y	0.00	0.00	0.00		
			Group-N and	39.34	17.20	39.28-39.41	_ #	-
			Group-Y	0.00	0.00	0.00		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-Y	0.00	0.00	0.00		
		2009	Group-M and	0.00	0.00	0.00	_ #	-
			Group-O	0.00	0.00	0.00		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-N	42.83	20.74	42.59-43.07		
			Group-N and	42.83	20.74	42.59-43.07	_ &	0.02
			Group-O	43.19	16.96	42.80-43.59		
			Group-O and	43.19	16.96	42.80-43.59	_ &	0.27
			Group-Y	57.12	51.54	24.90-139.13		
			Group-N and	42.83	20.74	42.59-43.07	_ &	0.28
			Group-Y	57.12	51.54	24.90-139.13		
		2010	Group-M and	0.00	0.00	0.00	_ #	-
			Group-Y	57.12	51.54	24.90-139.13		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-O	43.19	16.96	42.80-43.59		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-N	52.25	112.56	47.31-57.21		
			Group-N and	52.25	112.56	47.31-57.21	< 0.05	0.07
			Group-O	43.99	17.43	43.80-44.18		
			Group-O and	43.99	17.43	43.80-44.18	< 0.05	0.25
			Group-Y	38.92	20.07	37.06-40.80		
			Group-N and	52.25	112.56	47.31-57.21	< 0.05	0.12
			Group-Y	38.92	20.07	37.06-40.80		
		2011	Group-M and	0.00	0.00	0.00	_ #	-
			Group-Y	38.92	20.07	37.06-40.80		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-O	43.99	17.43	43.80-44.18		
			Group-M and	0.00	0.00	0.00	_ #	-
			Group-O	43.99	17.43	43.80-44.18		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F13 (continue): Statistical and practical significant difference between the total average cost per medicine item for hypothyroidism according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypothyroidism	Total CDL medicine item cost	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	36.16	24.71	35.16-37.17		
			Group-N and	36.16	24.71	35.16-37.17	< 0.05	0.29
			Group-O	43.33	17.71	43.14-43.53		
			Group-O and	43.33	17.71	43.14-43.53	< 0.05	0.24
			Group-Y	38.99	17.76	38.03-39.95		
			Group-N and	36.16	24.71	35.16-37.17	< 0.05	0.12
			Group-Y	38.99	17.76	38.03-39.95		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	38.99	17.76	38.03-39.95		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	43.33	17.71	43.14-43.53		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	39.15	52.08	37.17-41.14		
			Group-N and	39.15	52.08	37.17-41.14	< 0.05	0.09
			Group-O	43.66	18.63	43.46-43.86		
			Group-O and	43.66	18.63	43.46-43.86	< 0.05	0.59
			Group-Y	32.61	13.61	31.87-33.35		
			Group-N and	39.15	52.08	37.17-41.14	< 0.05	0.13
			Group-Y	32.61	13.61	31.87-33.35		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	32.61	13.61	31.87-33.35		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	43.66	18.63	43.46-43.86		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F14: Statistical and practical significant difference between the average medical scheme contribution per medicine item for hypothyroidism according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypothyroidism	Medical scheme contribution	2008	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	36.69	16.87	36.36-36.76		
			Group-N and	36.69	16.87	36.36-36.76	_ #	–
			Group-O	0.00	0.00	0.00		
			Group-O and	0.00	0.00	0.00	_ #	–
			Group-Y	0.00	0.00	0.00		
			Group-N and	36.69	16.87	36.36-36.76	_ #	–
			Group-Y	0.00	0.00	0.00		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	0.00	0.00	0.00		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	0.00	0.00	0.00		
		2009	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	39.26	19.86	39.02-39.49		
			Group-N and	39.26	19.86	39.02-39.49	_ &	0.01
			Group-O	39.44	17.40	39.03-39.84		
			Group-O and	39.44	17.40	39.03-39.84	_ &	0.34
			Group-Y	57.12	51.54	24.90-139.13		
			Group-N and	39.26	19.86	39.02-39.49	_ &	0.35
			Group-Y	57.12	51.54	24.90-139.13		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	57.12	51.54	24.90-139.13		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	39.44	17.40	39.03-39.84		
		2010	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	43.04	85.75	39.27-46.81		
			Group-N and	43.04	85.75	39.27-46.81	< 0.05	0.02
			Group-O	41.20	17.41	41.01-41.39		
			Group-O and	41.20	17.41	41.01-41.39	< 0.05	0.22
			Group-Y	36.77	20.60	34.85-38.69		
			Group-N and	43.04	85.75	39.27-46.81	< 0.05	0.07
			Group-Y	36.77	20.60	34.85-38.69		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	36.77	20.60	34.85-38.69		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	41.20	17.41	41.01-41.39		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F14 (continue): Statistical and practical significant difference between the average medical scheme contribution per medicine item for hypothyroidism according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypothyroidism	Medical scheme contribution	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	33.49	21.17	32.63-34.35		
			Group-N and	33.49	21.17	32.63-34.35	< 0.05	0.37
			Group-O	41.31	17.53	41.11-41.50		
			Group-O and	41.31	17.53	41.11-41.50	< 0.05	0.23
			Group-Y	37.22	17.52	36.27-38.17		
			Group-N and	33.49	21.17	32.63-34.35	< 0.05	0.18
			Group-Y	37.22	17.52	36.27-38.17		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	37.22	17.52	36.27-38.17		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	41.31	17.53	41.11-41.50		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	37.00	41.10	35.43-38.56		
			Group-N and	37.00	41.10	35.43-38.56	< 0.05	0.12
			Group-O	42.03	18.37	41.83-42.22		
			Group-O and	42.03	18.37	41.83-42.22	< 0.05	0.56
			Group-Y	31.66	13.56	30.92-32.40		
			Group-N and	37.00	41.10	35.43-38.56	< 0.05	0.13
			Group-Y	31.66	13.56	30.92-32.40		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	31.66	13.56	30.92-32.40		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	42.03	18.37	41.83-42.22		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F15: Statistical and practical significant difference between the average patient levy per medicine item for hypothyroidism according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypothyroidism	Patient levy	2008	Group-M and	0.00	0.00	0.00	— #	—
			Group-N	2.65	5.73	2.62-2.67	— #	—
			Group-N and	2.65	5.73	2.62-2.67	— #	—
			Group-O	0.00	0.00	0.00	— #	—
			Group-O and	0.00	0.00	0.00	— #	—
			Group-Y	0.00	0.00	0.00	— #	—
			Group-N and	2.65	5.73	2.62-2.67	— #	—
			Group-Y	0.00	0.00	0.00	— #	—
			Group-M and	0.00	0.00	0.00	— #	—
			Group-Y	0.00	0.00	0.00	— #	—
		2009	Group-M and	0.00	0.00	0.00	— #	—
			Group-N	3.57	6.23	3.50-3.64	— &	0.03
			Group-N and	3.57	6.23	3.50-3.64	— #	—
			Group-O	3.75	6.73	3.60-3.91	— #	—
			Group-O and	3.75	6.73	3.60-3.91	— #	—
			Group-Y	0.00	0.00	0.00	— #	—
			Group-N and	3.57	6.23	3.50-3.64	— #	—
			Group-Y	0.00	0.00	0.00	— #	—
			Group-M and	0.00	0.00	0.00	— #	—
			Group-Y	0.00	0.00	0.00	— #	—
		2010	Group-M and	0.00	0.00	0.00	— #	—
			Group-N	9.21	71.08	6.08-12.34	< 0.05	0.09
			Group-N and	9.21	71.08	6.08-12.34	— &	0.10
			Group-O	2.79	6.34	2.72-2.85	— &	0.10
			Group-O and	2.79	6.34	2.72-2.85	< 0.05	0.10
			Group-Y	2.16	6.29	1.57-2.74	— #	—
			Group-N and	9.21	71.08	6.08-12.34	— #	—
			Group-Y	2.16	6.29	1.57-2.74	— #	—
			Group-M and	0.00	0.00	0.00	— #	—
			Group-Y	2.16	6.29	1.57-2.74	— #	—
			Group-M and	0.00	0.00	0.00	— #	—
			Group-O	2.79	6.34	2.72-2.85	— #	—

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

Table F15 (continue): Statistical and practical significant difference between the average patient levy per medicine item for hypothyroidism according to generic indicator from 2008 until 2012.

Type of CDL condition	Cost	Year	Generic indicator* comparison	Mean (Cost/item) (R)	Standard deviation (±)	Confidence interval (95%CI)	p-value	d-value [†]
Hypothyroidism	Patient levy	2011	Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	2.67	6.12	2.42-2.92		
			Group-N and	2.67	6.12	2.42-2.92	< 0.05	0.11
			Group-O	2.02	3.96	1.98-2.06		
			Group-O and	2.02	3.96	1.98-2.06	_ &	0.07
			Group-Y	1.76	3.58	1.57-1.96		
			Group-N and	2.67	6.12	2.42-2.92	< 0.05	0.15
			Group-Y	1.76	3.58	1.57-1.96		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	1.76	3.58	1.57-1.96		
		2012	Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	2.02	3.96	1.98-2.06		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-N	2.15	12.58	1.67-2.63		
			Group-N and	2.15	12.58	1.67-2.63	< 0.05	0.04
			Group-O	1.63	3.44	1.59-1.66		
			Group-O and	1.63	3.44	1.59-1.66	< 0.05	0.20
			Group-Y	0.94	2.44	0.81-1.08		
			Group-N and	2.15	12.58	1.67-2.63	< 0.05	0.10
			Group-Y	0.94	2.44	0.81-1.08		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-Y	0.94	2.44	0.81-1.08		
			Group-M and	0.00	0.00	0.00	_ #	–
			Group-O	1.63	3.44	1.59-1.66		

*Generic indicators: M - Original medicine provided (patent not expired) and generic medicine available.

O - Original medicine provided (patent expired) and generic medicine available.

N - Original medicine provided (no generic medicine available).

Y - Generic medicine provided.

No medicine claimed for the appropriated time period (any generic indicator group), thus p-value and d-value not calculated.

& p-value not < 0.05.

[†] Mean variance analyses between generic indicators: ANOVA was conducted (also refer to Chapter 1, section 1.11.2.3).

APPENDIX G

Table G1: Cost per prescription for hypertension according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost/prescription (R)			
				Mean (R)	Standard deviation ($\pm$)	Confidence interval (95%CI)	Total (R)
Hypertension	2008	122 247	Single exit price (SEP)	5.94	18.06	5.84-6.05	726 749.96
			Dispensing fee	40.85	30.60	40.68-41.02	4 994 193.16
			Value-added-tax (VAT)	6.65	4.98	6.62-6.68	813 008.19
	2009	158 970	Single exit price (SEP)	7.34	31.46	7.19-7.50	1 167 326.98
			Dispensing fee	42.11	35.23	41.94-42.28	6 694 487.33
			Value-added-tax (VAT)	6.86	5.74	6.83-6.88	1 089 800.26
	2010	157 345	Single exit price (SEP)	7.92	46.62	7.69-8.15	1 246 829.13
			Dispensing fee	42.38	35.64	42.21-42.56	6 668 920.05
			Value-added-tax (VAT)	6.90	5.80	6.87-6.93	1 085 638.15
	2011	147 259	Single exit price (SEP)	8.54	46.10	8.30-8.77	1 256 938.78
			Dispensing fee	38.85	56.55	38.56-39.14	5 721 485.29
			Value-added-tax (VAT)	6.32	9.21	6.28-6.37	931 404.58
	2012	142 922	Single exit price (SEP)	8.98	55.12	8.69-9.26	1 282 838.59
			Dispensing fee	41.07	37.48	40.87-41.26	5 869 615.50
			Value-added-tax (VAT)	6.69	6.10	6.65-6.72	955 518.80

Table G2: Cost per prescription for hypothyroidism according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost/prescription (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Hypothyroidism	2008	1 484	Single exit price (SEP)	12.64	38.81	10.67-14.62	18 762.94
			Dispensing fee	56.01	41.97	53.87-58.15	83 120.37
			Value-added-tax (VAT)	9.12	6.83	8.77-9.47	13 531.22
	2009	3 810	Single exit price (SEP)	5.16	31.11	4.18-6.15	19 676.42
			Dispensing fee	35.25	34.16	34.17-36.34	134 310.51
			Value-added-tax (VAT)	5.74	5.56	5.56-5.92	21 864.50
	2010	3 193	Single exit price (SEP)	5.40	42.25	3.94-6.87	17 256.79
			Dispensing fee	29.90	33.11	28.75-31.05	95 474.10
			Value-added-tax (VAT)	4.87	5.39	4.68-5.05	15 542.30
	2011	3 186	Single exit price (SEP)	6.37	54.24	4.49-8.25	20 293.13
			Dispensing fee	28.09	50.61	26.33-29.84	89 482.47
			Value-added-tax (VAT)	4.57	8.24	4.29-4.86	14 566.91
	2012	4 081	Single exit price (SEP)	6.29	40.49	5.05-7.54	25 688.80
			Dispensing fee	27.43	30.03	26.51-28.36	111 961.21
			Value-added-tax (VAT)	4.47	4.89	4.32-4.62	18 226.24

Table G3: Cost per prescription for asthma according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost/prescription (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Asthma	2008	19 910	Single exit price (SEP)	85.43	103.86	83.99-86.87	1 700 956.40
			Dispensing fee	42.76	31.84	42.32-43.20	851 310.33
			Value-added-tax (VAT)	6.96	5.18	6.89-7.03	138 585.40
	2009	25 721	Single exit price (SEP)	100.89	114.63	99.49-102.29	2 595 086.21
			Dispensing fee	46.21	47.64	45.63-46.79	1 188 625.05
			Value-added-tax (VAT)	7.52	7.75	7.43-7.62	193 497.10
	2010	25 417	Single exit price (SEP)	107.34	124.50	105.81-108.87	2 728 215.38
			Dispensing fee	46.33	47.27	45.75-46.91	1 177 502.28
			Value-added-tax (VAT)	7.54	7.69	7.45-7.64	191 686.42
	2011	25 328	Single exit price (SEP)	115.75	120.49	114.26-117.23	2 931 677.03
			Dispensing fee	40.03	61.70	39.27-40.79	1 013 933.71
			Value-added-tax (VAT)	6.52	10.04	6.39-6.64	165 058.98
	2012	22 942	Single exit price (SEP)	111.93	130.54	110.24-113.61	2 567 783.99
			Dispensing fee	43.30	54.40	42.60-44.00	993 371.14
			Value-added-tax (VAT)	7.05	8.86	6.93-7.16	161 711.58

Table G4: Cost per prescription for hyperlipidaemia according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost/prescription (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Hyperlipidaemia	2008	61 843	Single exit price (SEP)	7.29	18.20	7.14-7.43	450 588.74
			Dispensing fee	47.85	35.15	47.57-48.12	2 958 957.35
			Value-added-tax (VAT)	7.79	5.72	7.74-7.83	481 690.73
	2009	63 807	Single exit price (SEP)	13.35	51.46	12.95-13.75	851 976.21
			Dispensing fee	50.11	45.93	49.76-50.47	3 197 609.52
			Value-added-tax (VAT)	8.16	7.48	8.10-8.22	520 541.09
	2010	63 958	Single exit price (SEP)	14.76	57.24	14.32-15.20	944 013.03
			Dispensing fee	50.00	48.62	49.62-50.38	3 197 786.03
			Value-added-tax (VAT)	8.14	7.92	8.08-8.20	520 569.82
	2011	77 300	Single exit price (SEP)	9.74	39.36	9.46-10.02	752 860.16
			Dispensing fee	42.86	83.24	42.28-43.45	3 313 451.71
			Value-added-tax (VAT)	6.98	13.55	6.88-7.07	539 399.11
	2012	77 195	Single exit price (SEP)	10.49	48.86	10.14-10.83	809 547.88
			Dispensing fee	43.24	42.32	42.94-43.54	3 337 811.18
			Value-added-tax (VAT)	7.04	6.89	6.99-7.09	543 364.61

Table G5: Cost per prescription for diabetes mellitus type 2 according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost/prescription (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Diabetes mellitus type 2	2008	30 225	Single exit price (SEP)	14.29	32.55	13.92-14.66	431 962.95
			Dispensing fee	49.54	38.94	49.10-49.98	1 497 299.68
			Value-added-tax (VAT)	8.06	6.34	7.99-8.14	243 746.46
	2009	40 423	Single exit price (SEP)	17.34	42.19	16.93-17.75	700 871.10
			Dispensing fee	51.10	48.30	50.63-51.57	2 065 716.16
			Value-added-tax (VAT)	8.32	7.86	8.24-8.40	336 279.37
	2010	41 053	Single exit price (SEP)	19.25	44.67	18.81-19.68	790 151.27
			Dispensing fee	52.01	48.52	51.54-52.48	2 135 278.13
			Value-added-tax (VAT)	8.47	7.90	8.39-8.54	347 603.42
	2011	38 878	Single exit price (SEP)	18.80	42.77	18.38-19.23	731 082.16
			Dispensing fee	50.54	103.47	49.51-51.57	1 964 822.15
			Value-added-tax (VAT)	8.23	16.84	8.06-8.39	319 854.77
	2012	38 517	Single exit price (SEP)	19.02	46.35	18.56.-19.49	732 740.40
			Dispensing fee	51.11	47.48	50.64-51.58	1 968 528.22
			Value-added-tax (VAT)	8.32	7.73	8.24-8.40	320 458.08

APPENDIX H

Table H1: Medicine cost per item for hypertension according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost /item (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Hypertension	2008	122 247	Single exit price (SEP)	3.72	10.51	3.66-3.78	454 511.44
			Dispensing fee	27.34	15.60	27.25-27.43	3 341 927.70
			Value-added-tax (VAT)	4.45	2.54	4.44-4.47	544 034.74
	2009	158 970	Single exit price (SEP)	4.56	23.84	4.45-4.68	725 097.70
			Dispensing fee	27.91	18.44	27.82-28.00	4 436 575.41
			Value-added-tax (VAT)	4.54	3.00	4.53-4.56	722 233.21
	2010	157 345	Single exit price (SEP)	4.92	31.17	4.77-5.07	773 387.40
			Dispensing fee	28.20	19.03	28.11-28.29	4 436 626.82
			Value-added-tax (VAT)	4.59	3.10	4.58-4.61	722 241.58
	2011	147 259	Single exit price (SEP)	5.22	31.55	5.06-5.39	768 691.42
			Dispensing fee	25.25	24.22	25.13-25.38	3 718 171.42
			Value-added-tax (VAT)	4.11	3.94	4.09-4.13	605 283.72
	2012	142 922	Single exit price (SEP)	5.47	45.82	5.23-5.71	781 222.16
			Dispensing fee	26.35	22.79	26.24-26.48	3 766 653.80
			Value-added-tax (VAT)	4.29	3.71	4.28-4.31	613 176.20

Table H2: Medicine cost per item for hypothyroidism according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost /item (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Hypothyroidism	2008	1 484	Single exit price (SEP)	7.99	27.15	6.61-9.38	11 861.03
			Dispensing fee	32.90	21.44	31.81-34.00	48 826.32
			Value-added-tax (VAT)	5.36	3.49	5.18-5.54	7 948.47
	2009	3 810	Single exit price (SEP)	2.71	25.77	1.90-3.53	10 332.27
			Dispensing fee	16.65	20.19	16.02-17.30	63 455.40
			Value-added-tax (VAT)	2.71	3.29	2.61-2.82	10 329.95
	2010	3 193	Single exit price (SEP)	3.42	39.21	2.06-4.78	10 917.34
			Dispensing fee	18.42	18.35	17.79-19.06	58 819.47
			Value-added-tax (VAT)	3.00	2.99	2.90-3.11	9 575.26
	2011	3 186	Single exit price (SEP)	3.92	45.01	2.36-5.48	12 477.71
			Dispensing fee	17.07	23.61	16.25-17.89	54 376.42
			Value-added-tax (VAT)	2.78	3.84	2.65-2.92	8 851.98
	2012	4 081	Single exit price (SEP)	3.42	21.11	2.77-4.07	13 945.28
			Dispensing fee	16.47	12.95	16.08-16.88	67 231.17
			Value-added-tax (VAT)	2.68	2.11	2.62-2.75	10 944.61

Table H3: Medicine cost per item for asthma according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost /item (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Asthma	2008	19 910	Single exit price (SEP)	68.06	86.35	66.86-69.26	1 355 002.34
			Dispensing fee	31.09	21.49	30.80-31.39	619 039.46
			Value-added-tax (VAT)	5.06	3.50	5.02-5.11	100 773.87
	2009	25 721	Single exit price (SEP)	75.72	92.89	74.59-76.85	1 947 475.63
			Dispensing fee	31.73	34.06	31.32-32.15	816 139.91
			Value-added-tax (VAT)	5.17	5.54	5.10-5.24	132 859.99
	2010	25 417	Single exit price (SEP)	80.36	100.07	79.14-81.60	2 042 545.06
			Dispensing fee	31.95	31.21	31.57-32.33	811 959.69
			Value-added-tax (VAT)	5.20	5.08	5.14-5.27	132 179.48
	2011	25 328	Single exit price (SEP)	82.07	94.15	80.91-83.23	2 078 624.65
			Dispensing fee	26.07	36.54	25.63-26.53	660 353.53
			Value-added-tax (VAT)	4.24	5.95	4.18-4.32	107 499.41
	2012	22 941	Single exit price (SEP)	80.35	108.15	78.95-81.75	1 843 250.40
			Dispensing fee	28.64	39.01	28.14-29.15	657 156.94
			Value-added-tax (VAT)	4.66	6.35	4.58-4.75	106 979.04

Table H4: Medicine cost per item for hyperlipidaemia according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost /item (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Hyperlipidaemia	2008	61 843	Single exit price (SEP)	4.58	10.46	4.51-4.67	283 507.69
			Dispensing fee	32.42	16.11	32.30-32.55	2 005 116.49
			Value-added-tax (VAT)	5.28	2.62	5.26-5.30	326 414.31
	2009	63 807	Single exit price (SEP)	8.65	43.62	8.31-8.99	551 890.57
			Dispensing fee	30.15	23.98	29.96-30.34	1 923 490.11
			Value-added-tax (VAT)	4.91	3.90	4.88-4.94	313 126.30
	2010	63 958	Single exit price (SEP)	9.44	45.16	9.10-9.80	603 956.04
			Dispensing fee	30.38	30.01	30.15-30.62	1 943 189.91
			Value-added-tax (VAT)	4.95	4.88	4.91-4.99	316 333.24
	2011	77 300	Single exit price (SEP)	5.73	27.54	5.54-5.93	443 264.07
			Dispensing fee	26.52	29.88	26.32-26.74	2 050 358.42
			Value-added-tax (VAT)	4.32	4.86	4.29-4.36	333 779.28
	2012	77 194	Single exit price (SEP)	6.09	37.30	5.83-6.35	469 791.67
			Dispensing fee	26.50	22.61	26.34-26.66	2 045 410.78
			Value-added-tax (VAT)	4.31	3.68	4.29-4.34	332 973.85

Table H5: Medicine cost per item for diabetes mellitus type 2 according to different cost structures from 2008 until 2012.

Type of CDL condition	Year	Number of CDL patients (n)	Cost structure	Cost /item (R)			
				Mean (R)	Standard deviation (±)	Confidence interval (95%CI)	Total (R)
Diabetes mellitus type 2	2008	30 225	Single exit price (SEP)	8.17	19.13	7.96-8.39	246 890.13
			Dispensing fee	28.18	17.83	27.98-28.39	851 785.27
			Value-added-tax (VAT)	4.59	2.90	4.56-4.62	138 662.72
	2009	40 423	Single exit price (SEP)	9.76	26.51	9.51-10.02	394 568.64
			Dispensing fee	28.37	21.93	28.16-28.59	1 146 734.22
			Value-added-tax (VAT)	4.62	3.57	4.59-4.66	186 677.66
	2010	41 053	Single exit price (SEP)	10.76	26.81	10.51-11.03	441 933.27
			Dispensing fee	28.93	24.31	28.70-29.17	1 187 646.20
			Value-added-tax (VAT)	4.71	3.96	4.68-4.75	193 337.75
	2011	38 878	Single exit price (SEP)	10.16	24.14	9.92-10.40	394 921.51
			Dispensing fee	26.83	28.39	26.55-27.11	1 042 942.37
			Value-added-tax (VAT)	4.37	4.62	4.33-4.42	169 781.32
	2012	38 517	Single exit price (SEP)	10.01	27.02	9.74-10.28	385 509.17
			Dispensing fee	27.00	20.10	26.80-27.20	1 039 813.43
			Value-added-tax (VAT)	4.39	3.27	4.37-4.43	169 271.95

APPENDIX I: CONFERENCE PRESENTATIONS

The following conference poster presentations were delivered during the study period (see attached copies of the presentations).

- 1) L. Rothmann, M.S. Lubbe, J.J. Gerber, A. Bekker. Prevalence of Comorbidity of Chronic Diseases: A South African Pharmacy Benefit Management Company (PBM) Database Analysis. 28th International Conference on Pharmacoepidemiology and Therapeutic Risk Management, 23 August – 26 August 2012, Barcelona, Spain. (see attached poster copy).
- 2) L.J. Rothmann, M.S. Lubbe, J.J. Gerber, A. Bekker. Using A South African Pharmacy Benefit Management Company (PBM) Database To Determine The Prevalence Of Co-morbidity Of Chronic Diseases. Second Global symposium on Health System Research. 31 October – 3 November 2012. Beijing, China. (see attached poster copy).
- 3) L.J. Rothmann, M.S. Lubbe, J.J. Gerber, J.H.P. Serfontein. Prevalence of Chronic Diseases: A longitudinal analysis (2008 – 2012) of medicine claims data of South African Pharmacy Benefit Management Company. ISPOR South Africa annual congress 2014. 8 - 9 September 2014. Saint George Hotel, Irene, South Africa. (see attached poster copy).

** References used on the poster presentations are available on request.**

Prevalence Of Comorbidity Of Chronic Diseases: A South African Pharmacy Benefit Management Company (PBM) Database Analysis

L Rothmann¹, Lubbe MS¹, Gerber JJ¹, A Bekker¹

¹Niche area: Medicine Usage in South Africa (MUSA), North-West University (Potchefstroom campus), Potchefstroom, South Africa

BACKGROUND

The major impact of chronic diseases, with regard to their large disease burden and associated costs, has placed them at the fore of international and South African (SA) strategic health priorities. Integral to this is the increasing number of patients with multimorbidity of chronic conditions. Persons with multiple chronic conditions may have more rapid declines in health status and a greater likelihood of disability (Wolff et al., 2002:2269). The more comorbid of chronic diseases a person has, the greater the interference with treatment and the greater the medical cost and risk of mortality. The treatment of multiple chronic diseases puts much pressure on the already overstretched health system, because of additional resources required (Puoane et al., 2008:79). South Africa is also going to face a growing burden of chronic diseases, simple due to the growth in the population, the aging of the population and severity of diseases that can be expected (McLeod, 2009). Thus, it is important to recognise such illnesses and to account for them in the care of the individual patient and the individual patient and in understanding research outcomes.

OBJECTIVES

To determine the prevalence of co-morbidity of the most prevalent chronic diseases (as defined in the SA Chronic Disease List [CDL]) in the private health care sector of South Africa.

RESEARCH METHODOLOGY

Research design

- A cross-sectional study was conducted.

Research database

- Data were obtained from a SA Pharmaceutical Benefit Management company (PBM) for 2008.

Study population

- The study populations consisted of all patients (N = 974 497) who received one or more prescriptions during 1 Jan. 2008 to 31 Dec. 2008.

Classification of chronic diseases

- Prescribed Minimum Benefits (PMB) are a feature of the Medical Scheme Act (31/1998) and is a set of defined benefits to ensure that all medical scheme members have access to certain minimum health services, regardless of the benefit option they have selected. The medical schemes have to cover the costs related to the diagnoses, treatment and care of the 26 chronic conditions (defined as the Chronic Disease List (CDL)). The aim is to provide people with continuous care to improve their health and well-being and to make healthcare more affordable.
- Treatment algorithms for the CDL conditions have been published in the Government Gazette [Medical Scheme Act (31/1998)] to manage the risk and ensure appropriate standards of treatment. These treatment algorithms can be regarded as benchmarks, or minimum standards for treatment.

Identification of chronic diseases

- Chronic diseases were identified according to
 - Medication prescribed as indicated in the treatment algorithms; and
 - ICD-10 code; and / or
 - Diagnosed code indicated by the PBM

Table 1 Chronic Disease List

Addison's disease	Glaucoma
Asthma	Haemophilia A
Bronchiectasis	Haemophilia B
Cardiac failure	Hyperlipidaemia
Cardiomyopathy	Hypertension
Chronic obstructive pulmonary disorder	Hypothyroidism
Chronic renal disease	Multiple sclerosis
Coronary artery disease	Parkinson's disease
Crohn's disease	Rheumatoid arthritis
Diabetes insipidus	Schizophrenia
Diabetes mellitus types 1	Systemic Lupus erythematosus
Diabetes mellitus types 2	Ulcerative colitis
Dysrhythmias	
Epilepsy	

Ethical consideration:

- Ethical consent was given by the medicine claims database company, as well as the North-West University (Ethical application number: NWU-0046-08-S5)

Data analyses:

- Statistical Analysis System® (SAS 9.1®)

RESULTS

A total of 190 519 patients (19.5%, n = 974 497) had ≥1 CDL condition, with an average number of 1.60 (SEM = 0.001; 95% CI [1.598-1.601]) CDL conditions per patient. The most prevalent CDL conditions were hypertension (64.3%, n = 122 566), hyperlipidaemia (32.6%, n = 62 084), Type 2 diabetes (15.8%, n = 30 176), hypothyroidism (14.9%, n = 28 542) and asthma (4.4%, n = 20 947).

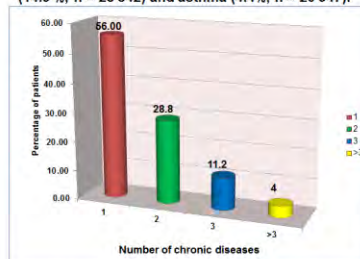


Figure 1: Number of chronic disease

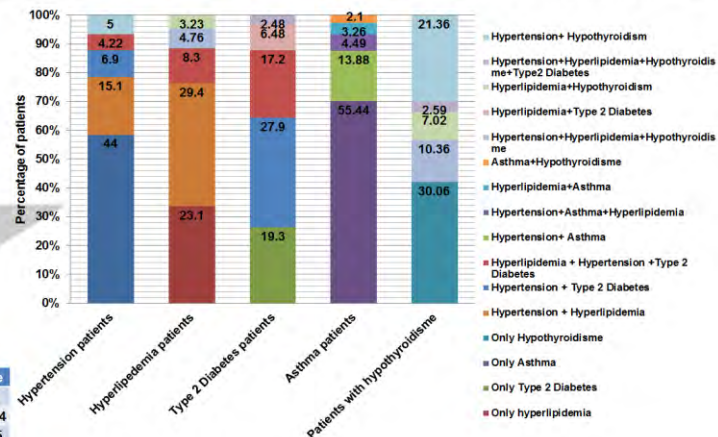


Table 2: Co-morbidity in patients with the Top 5 chronic diseases

Chronic patients	Number of chronic disease		
	Average	SEM	95% CI
Hypertension patients	1.83	0.003	1.82 - 1.84
Patients with hyperlipidaemia	2.24	0.003	2.23-2.25
Type 2 diabetes patients	2.40	0.005	2.39-2.41
Patients with hypothyroidism	2.20	0.006	
Asthma patients	1.76	0.007	

CONCLUSION

Results show that the costs associated with the metabolic syndrome contributes significantly towards the annual expenditure of the health system. Insurers carry most of this burden, although out-of-pocket expenses for patients show an increasing trend.

Using A South African Pharmacy Benefit Management Company (PBM) Database To Determine The Prevalence Of Co-morbidity Of Chronic Diseases

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The project was funded from the following sources:

- Medicine usage in South Africa, North-West University, South Africa.
- Medical Research Council, South Africa.

BACKGROUND

The major impact of chronic diseases, with regard to their large disease burden and associated costs, has placed them at the fore of international and South African (SA) strategic health priorities. Integral to this is the increasing number of patients with multimorbidity of chronic conditions. Patients with multiple chronic conditions may have more rapid declines in health status and a greater likelihood of disability¹. The more comorbid of chronic diseases a person has, the greater the interference with treatment and the greater the medical cost and risk of mortality. The treatment of multiple chronic diseases puts much pressure on the already overstrained health system, because of additional resources required². South Africa (SA) is also going to face a growing burden of chronic diseases, simple due to the growth in the population, the aging of the population and severity of diseases that can be expected³. Thus, it is important to recognise such illnesses and to account for them in the care of the individual patient and the individual patient and in understanding research outcomes.

OBJECTIVE

To determine the prevalence of comorbidity of the most prevalent chronic diseases (as defined in the SA Chronic Disease List [CDL]) in the private health care sector of South Africa.

METHOD

Research design

- A cross-sectional study was conducted.

Research database

- Data were obtained from a SA Pharmaceutical Benefit Management company (PBM) for 2008.

Setting

- A section of the private health care sector.

Study population

- The study populations consisted of all patients (N = 974 497) who received one or more prescriptions during 1 Jan. 2008 to 31 Dec. 2008.

Classification of chronic diseases

- Prescribed Minimum Benefits (PMB) are a feature of the Medical Scheme Act (31/1998) and is a set of defined benefits to ensure that all medical scheme members have access to certain minimum health services, regardless of the benefit option they have selected.
- The medical schemes have to cover the costs related to the diagnoses, treatment and care of the 26 chronic conditions [defined as the Chronic Disease List (CDL)]. The aim is to provide people with continuous care to improve their health and well-being and to make healthcare more affordable.
- Treatment algorithms for the CDL conditions have been published in the Government Gazette [Medical Scheme Act (31/1998)] to manage the risk and ensure appropriate standards of treatment.
- These treatment algorithms can be regarded as benchmarks, or minimum standards for treatment.

Table 1 SA Chronic Disease List

Addison's disease	Glaucoma
Asthma	Haemophilia A
Bronchiectasis	Haemophilia B
Cardiac failure	Hyperlipidaemia
Cardiomyopathy	Hypertension
Chronic obstructive pulmonary disorder	Hypothyroidism
Chronic renal disease	Multiple sclerosis
Coronary artery disease	Parkinson's disease
Crohn's disease	Rheumatoid arthritis
Diabetes insipidus	Schizophrenia
Diabetes mellitus types 1	Systemic Lupus erythematosus
Diabetes mellitus types 2	Ulcerative colitis
Dysrhythmias	
Epilepsy	

Identification of chronic diseases

- Chronic diseases were identified according to
 - Medication prescribed as indicated in the treatment algorithms; and
 - ICD-10 code; and / or
 - Diagnosed code indicated by the PBM.

Ethical consideration

- Ethical consent was given by the medicine claims database company, as well as the North-West University (Ethical application number: NWU-0046-08-S5).

Data analyses

- Statistical Analysis System® (SAS 9.1®).

RESULTS

A total of 190 519 patients (19.5%, n = 974 497) had ≥1 CDL condition, with an average number of 1.60 (SEM = 0.001; 95% CI [1.598-1.601] CDL conditions per patient. The most prevalent CDL conditions were hypertension (64.3%, n = 122 566), hyperlipidaemia (32.6%, n = 62 084), Type 2 diabetes (15.8%, n = 30 176), hypothyroidism (14.9%, n = 28 542) and asthma (4.4%, n = 20 947).

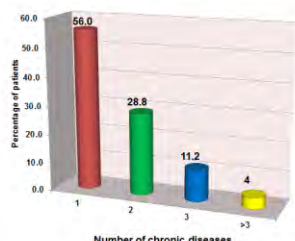


Figure 1: Number of chronic diseases per patient

Table 2: Comorbidity of chronic diseases in patients with the Top 5 chronic diseases

Chronic patients	Number of chronic disease		
	Average	SEM	95% CI
Hypertension patients	1.83	0.003	1.82 - 1.84
Patients with hyperlipidaemia	2.24	0.003	2.23 - 2.25
Type 2 diabetes patients	2.40	0.005	2.39 - 2.41
Patients with hypothyroidism	2.20	0.006	2.19 - 2.22
Asthma patients	1.76	0.007	1.75 - 1.78

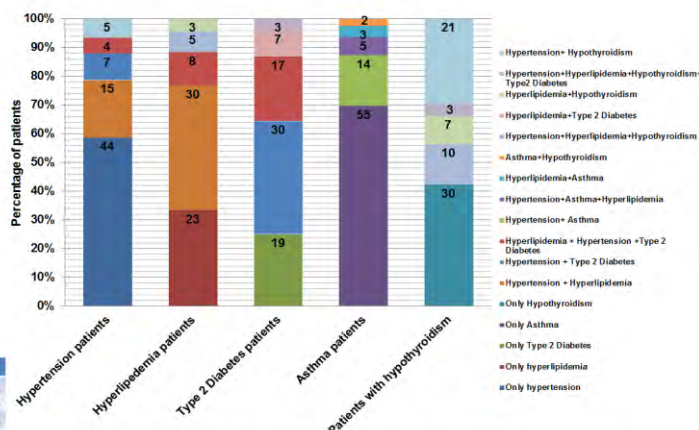


Figure 2 Prevalence of comorbidity in chronic patients with Top 5 chronic diseases

CONCLUSION

This study emphasised the need for increased research to provide an appropriate scientific basis on which to build evidence based care guidelines for patients with multimorbidity of chronic conditions.

References are available on request: (Email: martie.lubbe@nwu.ac.za)

Prevalence of Chronic Diseases: A longitudinal analysis (2008 – 2012) of medicine claims data of South African Pharmacy Benefit Management Company

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BACKGROUND

The major impact of chronic diseases, with regard to their large disease burden and associated costs, has placed them at the fore of international and South African (SA) strategic health priorities. Integral to this is the increasing number of patients with multimorbidity of chronic conditions.

OBJECTIVE

To determine the prevalence of chronic diseases (as defined in the SA Chronic Disease List [CDL]) in the SA private health sector from 2008 to 2012.

RESEARCH METHODOLOGY

Research design

A cross-sectional study was conducted.

Setting

A section of the private health care sector.

Data source

Retrospective, longitudinal data were obtained from a SA Pharmaceutical Benefit Management company (PBM) for 2008 until 2012.

Study population

- The database consisted of 974 497 (2008), 1 307 528 (2009), 1 220 289 (2010) and 1 077 834 (2011) and 1 029 699 (2012) patients.
- Inclusion criteria: All patients with at least one Chronic Disease List (CDL) condition.

Classification of chronic diseases

- Prescribed Minimum Benefits (PMB) are a feature of the Medical Scheme Act (31/1998) and is a set of defined benefits to ensure that all medical scheme members have access to certain minimum health services, regardless of the benefit option they have selected.
- The medical schemes have to cover the costs related to the diagnoses, treatment and care of the 26 chronic conditions (during 2008) [defined as the Chronic Disease List (CDL)]. The aim is to provide people with continuous care to improve their health and well-being and to make healthcare more affordable.
- Treatment algorithms for the CDL conditions have been published in the Government Gazette [Medical Scheme Act (31/1998)] to manage the risk and ensure appropriate standards of treatment.
- These treatment algorithms can be regarded as benchmarks, or minimum standards for treatment.

Identification of chronic diseases

- Chronic diseases were identified according to the following:
 - Medication prescribed as indicated in the treatment algorithms;
 - ICD-10 code; and / or
 - Diagnosed code indicated by the PBM.

Table 1: South African chronic disease list (CDL)

Addison's disease	Glaucoma
Asthma	Haemophilia A
Bronchietasis	Haemophilia B
Cardiac failure	Hyperlipidaemia
Cardiomyopathy	Hypertension
Chronic obstructive pulmonary disorder	Hypothyroidism
Chronic renal disease	Multiple sclerosis
Coronary artery disease	Parkinson's disease
Crohn's disease	Rheumatoid arthritis
Diabetes insipidus	Schizophrenia
Diabetes mellitus types 1	Systemic Lupus erythematosus
Diabetes mellitus types 2	Ulcerative colitis
Dysrhythmias	
Epilepsy	

Statistical Analysis

Performed with SAS Version 9.1.3 (SAS Institute, Cary, NC) and SPSS Version 2.1.

Ethical Considerations

Approved by the Ethics committee of the North-West University, Potchefstroom campus (NWU-0046-08-A5) and the Boards of directors of the PBM. Data were analyzed anonymously.

ACKNOWLEDGEMENTS

The authors acknowledge the North-West University (Potchefstroom Campus) and National Research Foundation for financial support.

RESULTS

- A total of 214 279 patients (21.99%) had ≥ 1 CDL during 2008, 19.50% (n=254 934) in 2009, 20.59% (n=251 295) in 2010, 21.65% (n=233 351) in 2011 and 26.09% in 2012 (n=233 351).
- The Mixed Model analysis of SPSS (adjusted for age and gender) indicated a statistical significant increase in the average number of CDL conditions per patient from 2008 to 2012 ($p < 0.0001$).
 - $1.57(\text{SD}=0.85, 95\% \text{ CI } 1.57-1.58)$ CDL conditions per patient for 2008.
 - $1.68(\text{SD}=0.90, 95\% \text{ CI } 1.67-1.69)$ CDL conditions per patient for 2009.
 - $1.69(\text{SD}=0.90, 95\% \text{ CI } 1.68-1.69)$ CDL conditions per patient for 2010.
 - $1.72(\text{SD}=0.93, 95\% \text{ CI } 1.71-1.72)$ CDL conditions per patient for 2011.
 - $1.77(\text{SD}=0.97, 95\% \text{ CI } 1.77-1.78)$ CDL conditions per patient for 2012.
- 54.43% (n=665 334) of all patients had, during the five year study period, only one CDL condition, 28.31% (n=346 010) had two, 12.48% (n=152 571) had three and 4.79% (n=58 529) had more than three.
- The Top 5 most prevalent single CDL conditions alone, for the total study period were hypertension (49.45%), hyperlipidaemia (12.72%), hypothyroidism (10.62%), asthma (10.25%) and Type 2 diabetes (5.14%).
- The prevalence of patients with multimorbid CDL conditions increased from 39.43% (n=84 480) in 2008 to 45.23% (n=115 300) in 2009, 45.77% (n=114 971) in 2010, 47.04% (n=109 771) in 2011 and 49.35% (n=132 588) in 2012.
- Hyperlipidaemia and hypertension had the highest total prevalence (n=120 255) of all CDL condition combinations throughout the entire study period showing an increase from 9.40% (n=20 140) in 2008 to 10.14% (n=27 167) in 2012.

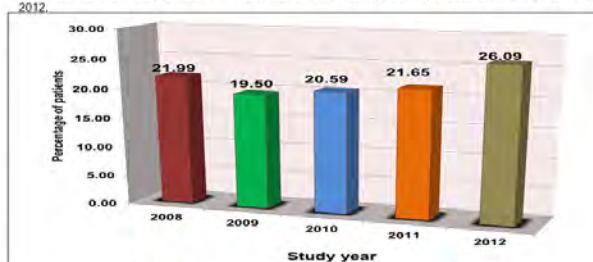


Figure 1: Patients with ≥ 1 chronic condition from 2008 to 2012.

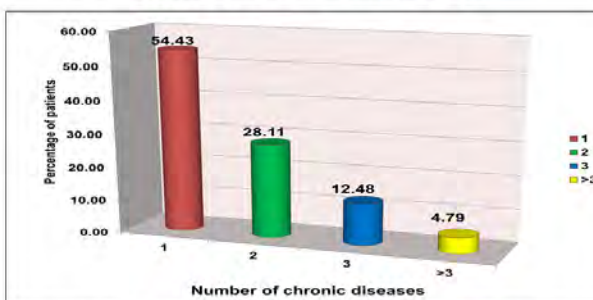


Figure 2: Patients with different numbers of chronic condition from 2008 to 2012.

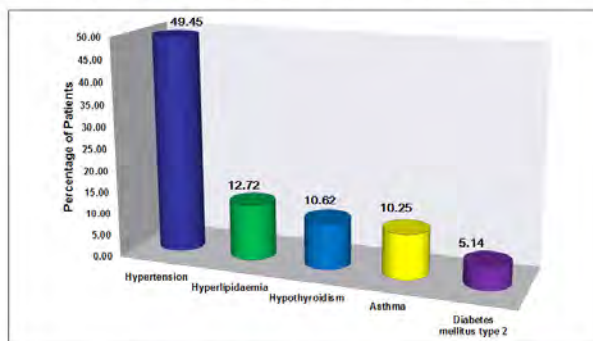
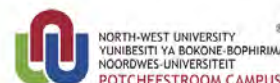


Figure 3: Patients with the top 5 single chronic conditions from 2008 to 2012.

CONCLUSION

South African private health sector is facing a growing burden of chronic diseases. This study emphasised the need for increased research to provide an appropriate scientific basis on which to build evidence based care guidelines for patients with multimorbidity of chronic conditions.



APPENDIX J: ARTICLE SUBMITTED FOR PUBLICATION

The following article was submitted to the *Tropical journal of pharmaceutical research* for publication during the study (see attached copy of the article as well as acceptance letter).



Tropical Journal of Pharmaceutical Research
Official Online Journal of Pharmacotherapy Group

c/o Faculty of Pharmacy
University of Benin
Benin City 300001, Nigeria

Email: editor@tjpr.org
Tel: +234-(0)8181266737
Fax: +27865213270
<http://www.tjpr.org>

May 26, 2015

Dr Madeeba Malik
Medicine Usage in South Africa (MUSA), School of Pharmacy
Faculty of Health Sciences, North-West University
Potchefstroom Campus, Potchefstroom

Dear Dr Malik:

RE: MANUSCRIPT TITLED "OVERVIEW OF PREVALENCE OF CHRONIC DISEASES IN PRIVATE HEALTHCARE SECTION OF SOUTH AFRICA: A THREAT TO PUBLIC HEALTH"

Your manuscript sent to TJPR has been duly reviewed and recommended for publication subject to your satisfactorily attending to the issues raised by the reviewer. The review comments are annotated directly on the reviewed manuscript which is attached here.

Please act promptly and let me have the revised manuscript as an email attachment as soon as possible. Indicate clearly, in an itemized format in a separate document, how the issues raised by the reviewers were addressed. Also revise your manuscript in line with the corrections (including punctuations, etc) indicated in red font and the comments annotated directly on your reviewed manuscript. Ensure you leave the review 'Comments' on the right margin intact. To assist you in this regard, do exactly the following:

Download the reviewed manuscript we sent to you. Save it with a slightly different file name by changing 'reviewed' to 'revised'. On the menu bar, click on 'Review' and then 'Track changes'. On the menu bar to the right, look for a tab where you have 'Accept'; click on the drop-down arrow beside it, and click on the option 'Accept all changes in Document'. This will change all the red fonts in the reviewed manuscript to black and automatically incorporate all the corrections we directly effected on the reviewed manuscript. Further revisions required should be made on this copy but ensure you leave your own revisions in red font and that the review comments on the right margin are retained.

Note that failure to revise your manuscript exactly as indicated above may result in a delay in its publication and, possibly, rejection.

We look forward to hearing from you soon.

Sincerely,

Professor AO Okhamafe
Editor-in-Chief

Editor-in-Chief: Professor AO Okhamafe, BPharm (Benin, Nigeria); PhD (Bradford, UK)
Editor: Dr Patrick O Erah, BPharm, MPharm Clin. Pharm (Benin, Nigeria); PhD (Nottingham, UK)

Overview of Prevalence of Chronic Diseases in Private Healthcare Section of South Africa: A Threat to Public Health.

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³ Assistant Professor, Hamdard Institute of Pharmaceutical Sciences, Hamdard University, Islamabad, Pakistan.

Abstract

Purpose: The present study was designed to evaluate the prevalence of patients suffering from registered chronic disease list (CDL) conditions in a section of the South African private health sector since 2008-2012. **Methods:** This study was a retrospective analysis of the medicine claims database of a nationally (South African) representative Pharmacy Benefit Management (PBM) company data between 2008 and 2012. Statistical Analysis System®, SAS 9.3® [13] and Statistical Package for the Social Sciences (IBM SPSS® 22) were used to analyse the data. Descriptive analysis was performed for calculating the prevalence of CDL conditions for the entire population and stratified by age and gender. However, MIXED linear modelling was used to determine changes in the average number of CDL conditions per patient adjusted for age and gender since 2008-2012. **Results:** For patients with any of the CDL in 2008 had a statistical significant increase of 0.20 CDL conditions since 2008-2012, with an average of 1.57 (1.57-1.58, 95 % CI) co-morbid CDL conditions in 2008 and 1.77 (1.77-1.78, 95 % CI) in 2012. This increase in average number of CDL conditions per patient between 2008 and 2012 was of statistical significance ($p < 0.05$), but with no large practical significance ($d < 0.8$). **Conclusion:** The study concluded that prevalence of patients with CDL conditions along with risk of co-morbidity has been increasing with time in the private health sector of South Africa. Risk of increase co-morbidities with age and among different genders was prevalent.

Keywords: Chronic disease, chronic disease list, prevalence, private health sector, South Africa

1.0 Introduction

Chronic non-communicable diseases (NCDs) such as diabetes, cardiovascular disease (CVD) and cancers pose a major public health threat worldwide. According to an estimate by WHO by 2020, one third of the global burden of disease will be attributable to chronic diseases [1]. Nearly one-third and 44% of the deaths before age 60 are due to chronic diseases in middle-income and low income countries respectively. Various risk factors including unhealthy diets, physical inactivity, alcohol consumptions, poor knowledge of health workers, low quality services and lack of access to medicines have been identified towards contribution of burden of chronic diseases [2]. This rise of burden of chronic diseases in turns has led to high costs of illness and potentially significant productivity losses [3].

The burden of non-communicable diseases as well as multi-morbidity, the co-existence of more than one chronic condition in one person, is particularly rising in Africa. According to the study conducted by The Global Burden of Disease, HIV rank first, TB fourth, cerebrovascular disease seventh, diabetes eighth while non-communicable diseases contributes to fifty percent causes of morbidity in South Africa, respectively [4]. An estimated increase from 11% to 13 % and 3.2% to 4.0% since 2009 to 2025, for CDL conditions and multi-morbidity is anticipated [4]. The current situation of increased burden of chronic diseases is a major challenge to existing models of healthcare delivery systems in South Africa. Thus, it is important to recognise such illnesses and strategize appropriately to address them at individual patient care level [5]. To address this dilemma, the South African Council for Medical Schemes formulated a chronic disease list (CDL) including the most common, life-threatening diseases. These conditions fall under a larger group, called prescribed minimum benefits, defined as a set of benefits to ensure that all medical scheme members have access to certain minimum health services; regardless of the benefit option they have selected [6, 7]. This has created a positive impact on prescribing practices carried in private healthcare facilities. But, still limited data exists on assessing the prevalence of these particular

combinations or clusters of chronic conditions, as most of the studies conducted so far in South Africa have been focused on comorbidities of a specific disease. Thus, the present study was designed to evaluate the prevalence of patients suffering from registered chronic disease list (CDL) conditions in a section of the South African private health sector since 2008-2012.

2.0 Methods

This study was a retrospective analysis of the medicine claims database of a nationally (South African) representative PBM company data between 2008 and 2012. Approval was obtained for the study from the appropriate Pharmacy Benefit Management companies (PBM) as well as from the Ethics Committee of the North-West University (Human)(Potchefstroom campus) (number NWU-0046-08-A5) to conduct this drug utilisation study. The PBM Company provides services to four capitation providers, thirty-two medical schemes and four sick benefit society funds. The medicine benefits of approximately 1.6 million beneficiaries are maintained annually by the PBM company. The data fields used in this study included: quantity of medication claimed, member gender, member date of birth, NAPPI code, ICD-10 code, diagnose code, active pharmacological ingredient of the medication, number of prescriptions dispensed containing medication used to treat CDL conditions and period in which the item was dispensed. The chronic conditions included in this paper are listed (Table 1).

Table 1: South African chronic disease list (CDL)

Addison's disease	Glaucoma
Asthma	Haemophilia A
Bronchiectasis	Haemophilia B
Cardiac failure	Hyperlipidaemia
Cardiomyopathy	Hypertension
Chronic obstructive pulmonary disease	Hypothyroidism
Chronic renal disease	Multiple sclerosis
Coronary artery disease	Parkinson's disease
Crohn's disease	Rheumatoid arthritis
Diabetes insipidus	Schizophrenia
Diabetes mellitus type 1	Systemic lupus erythematosus
Diabetes mellitus type 2	Ulcerative colitis
Dysrhythmia	
Epilepsy	

Analyses were performed on patient level. The prevalence of each condition was calculated by dividing the number of patients with the condition by the number of active patients. Statistical Analysis System®, SAS 9.3® and Statistical Package for the Social Sciences (IBM SPSS® 22) were used to analyse the data. Descriptive analysis was performed for calculating the prevalence of CDL conditions for the entire population and stratified by age and gender. MIXED linear modelling was used to calculate average number of CDL conditions per patient for the influence of age and gender differences so that the same patients prevalent in 2008 remained also prevalent in 2012. This also involved patient that have either entered or left the medical scheme for any reason or came onto the medical scheme any time during the study period into consideration.

3.0 Results

3.1 Prevalence of patients with at least one CDL condition

The total number of patients on the database consisted of 974, 497 patients in 2008, 1,307, 528 in 2009, 1, 220, 289 in 2010, 1, 077, 834 in 2011 and 1, 029, 699 patients in 2012, respectively. Patients with at least one CDL condition represented 21.99% (n = 214 279) of

the total number of patients on the database in 2008, and they increased to 26.09% (n = 268 685) in 2012. The representation of female patients with at least one CDL condition increased from 23.33% (2008) to 26.91% (2012) and those of male patients from 20.34% (2008) to 25.18% (2012). Most of the age groups had an overall increase as contribution to the total database except for age group ≤ 12 year with a decrease from 2.90% (2008) to 2.79% (2012). The other age groups: $12 > \text{age} \leq 50$ years increased from 9.43% (2008) to 10.79% (2012); $50 > \text{age} \leq 60$ years increase from 33.65% (2008) to 40.18% (2012); $60 > \text{age} \leq 70$ years increased from 57.18% (2008) to 65.06% (2012) and age > 70 years from 71.59% in 2008 to 77.84% in 2012. A detail summary is given (Table 2).

Table 2: Prevalence of patients with at least one CDI condition according to the total number of patients on the database.

Description			2008	2009	2010	2011	2012
Total number of patients On the database (n)	Gender	Female	538 254	712 305	661 007	578 593	545 068
		Male	436 243	595 223	559 282	499 237	484 627
	Age Group (Years)	> 12	124 440	192 387	175 664	156 805	146 296
		≤ 12 - > 50	524 962	705 064	640 480	557 250	523 587
		≤ 50 - > 60	154 659	191 661	182 559	160 018	156 430
		≤ 60 - > 70	89 570	115 114	114 697	102 425	102 047
		≤ 70	80 866	103 302	106 889	101 336	101 339
		Total	974 497	1 307 528	1 220 289	1 077 834	1 029 699
Total number of patients With at least one CDI Condition (n)	Gender	Female	125 548 (23.33 %)	142 690 (20.03 %)	140 133 (21.20 %)	129 192 (22.33 %)	146 678 (26.91 %)
		Male	88 731 (20.34 %)	112 244 (18.86 %)	111 062 (19.86 %)	104 159 (20.86 %)	122 007 (25.18 %)
	Age Group (Years)	> 12	3 611 (2.90 %)	4511 (2.34 %)	2 273 (2.43 %)	4165 (2.66 %)	4 088 (2.79 %)
		≤ 12 - > 50	49 519 (9.43 %)	60 697 (8.61 %)	57 516 (8.98 %)	52 628 (2.66 %)	56 479 (10.79 %)
		≤ 50 - > 60	52 040 (33.65 %)	61 735 (32.21 %)	60 167 (32.96 %)	54 364 (9.44 %)	62 851 (40.18 %)
		≤ 60 - > 70	51 215 (57.18 %)	60 026 (52.14 %)	59 716 (52.06 %)	54 988 (33.97 %)	66 388 (65.06 %)
		≤ 70	57 894 (71.59 %)	67 965 (65.79 %)	69 523 (65.04 %)	67 206 (53.69 %)	78 879 (77.84 %)
		Total	214 279 (21.99 %)	254 934 (19.49 %)	251 195 (20.58 %)	233 351 (21.65 %)	268 685 (26.09 %)

Total number of items on the database (n)	Gender	Female	9 893 928	12 834 715	12 103 038 *	10 327 159 *	9 237 012 *
		Male	6 545 325	8 814 276	8 424 739 *	7 439 420 *	7 172 238 *
	Age Group (Years)	> 12	1 085 511	1 727 830	1 552 825	1 303 782	1 209 684
		≤ 12 - > 50	6 416 499	8 347 338	7 604 671	6 378 677	5 906 537
		≤ 50 - > 60	3 288 346	4 153 722	3 945 088	3 384 147	3 280 626
		≤ 60 - > 70	2 585 064	3 418 324	3 366 712	2 945 546	2 876 437
		≤ 70	3 063 833	4 001 777	4 058 470	3 754 442	3 136 008
	Total		16 439 253	21 648 991	20 527 766	17 766 594	16 409 292
Total number of CDL conditions items (n)	Gender	Female	1 376 575 (13.91 %)	1 804 555 (14.06 %)	1 728 965 (14.92 %)	1 735 386 (16.80 %)	1 551 209 (16.79 %)
		Male	1 174 733 (17.95 %)	1 526 551 (17.32 %)	1 480 315 (17.58 %)	1 515 603 (20.37 %)	1 513 911 (21.11 %)
	Age Group (Years)	> 12	20 380 (1.88 %)	43 014 (2.49 %)	39 469 (2.54 %)	40 356 (3.09 %)	34 964 (2.89 %)
		≤ 12 - > 50	445 947 (6.95 %)	578 377 (6.93 %)	541 606 (7.12 %)	554 426 (8.69 %)	520 912 (8.82 %)
		≤ 50 - > 60	589 949 (17.94 %)	746 537 (17.97 %)	710 961 (18.02 %)	712 964 (21.07 %)	712 071 (21.71 %)
		≤ 60 - > 70	646 249 (25.00 %)	837 411 (24.50 %)	807 093 (23.97 %)	817 432 (27.75 %)	822 188 (28.58%)
		≤ 70	848 783 (27.00 %)	1 125 767 (28.13 %)	1 110 151 (27.35 %)	1 124 811 (29.96 %)	974 985 (31.09 %)
	Total		2 551 308 (15.52 %)	3 331 106 (15.39 %)	3 209 280 (15.63 %)	3 249 989 (18.29 %)	3 065 120 (18.68 %)

Note: All percentages in the table are expressed as a percentage of the equivalent group on the total database.* (2010)- Unidentified patients (n = 11; R1 045.66), (2011)- Unidentified patients (n = 15; R316.05), (2012)- Unidentified patients (n = 42; R1 334.97).

The estimated annual increase was also higher for male patients and their associated CDL conditions. All age groups had their highest prevalence in 2012, except for age groups less than 12 and 12 to 50 years. Age group > 70 years had the highest prevalence of patients in all the age groups for the study period in 2012 with 29.36% (n = 78 879). The largest increase in the number of patients with at least one CDL condition were between 2008 and 2012 was for age group > 70 years (36.25%; n = 20 985) and for chronic conditions (group > 70 years; 51.79%; n = 55 613). Age group > 70 years, thus had the highest estimated annual patient increase of 9.06% (n = 5 246) and estimated increase in number of CDL conditions of 12.95% (n = 13 903) (Table 3).

Table 3: Change in number of patients with at least one CDL condition and the total number of CDL conditions, stratified according to age and gender

Description		2008		2012		Patient change (2008 vs 2012) (n)	Chronic disease change (2008 vs 2012) (n)	Estimated annual patient change (n)	Estimated annual chronic disease change (n)
		Patients (n)	Chronic diseases (n)	Patients (n)	Chronic diseases (n)				
Gender	Female	125 548	193 182	146 678	258 263	↑ 21 130 (16.83%)	↑ 65 081 (33.69%)	↑ 5 283 (4.21%)	↑ 16 270 (8.42%)
	Male	88 731	144 200	122 007	218 455	↑ 33 276 (37.50%)	↑ 74 255 (51.49%)	↑ 8 319 (9.38%)	↑ 18 564 (12.87%)
Age Group (Years)	> 12	3 611	3 654	4 088	4 137	↑ 477 (13.21%)	↑ 483 (13.22%)	↑ 119 (3.30%)	↑ 121 (3.31%)
	≤ 12 - > 50	49 519	63 090	56 479	77 362	↑ 6 960 (14.06%)	↑ 14 272 (22.62%)	↑ 1 740 (3.52%)	↑ 3 568 (5.66%)
	≤ 50 - > 60	52 040	77 881	62 851	105 427	↑ 10 811 (17.20%)	↑ 27 546 (35.37%)	↑ 2 703 (4.30%)	↑ 6 887 (8.84%)
	≤ 60 - > 70	51 215	85 375	66 388	126 797	↑ 15 173 (29.63%)	↑ 41 422 (48.52%)	↑ 3 793 (7.41%)	↑ 10 356 (12.13%)
	≤ 70	57 894	107 382	78 879	162 995	↑ 20 985 (36.25%)	↑ 55 613 (51.79%)	↑ 5 246 (9.06%)	↑ 13 903 (12.95%)

Of all the CDL conditions, hypertension had the highest contribution during each of the study years followed by hyperlipidaemia. All 26 conditions, had a patient increase of 139 336 with an estimated annual increase of 34 834. The total number of patients increased by 41.30% (n = 139 336) between 2008 and 2012 with an estimated annual increase of 10.33% (n = 34 834). All CDL conditions except bronchiectasis had an overall increase in the number of patients from 2008 until 2012, hypertension had the highest increase (n = 49 531), followed by hyperlipidaemia (n = 35 490) and diabetes mellitus type 2 (n = 17 120). Bronchiectasis had an overall decrease between 2008 and 2012 of 38 patients. The prevalence

included patients with a single CDL condition or in combination with other CDL conditions. Diabetes insipidus had the lowest patient increase (n = 3) between 2008 and 2012 (Table 4).

Table 4: Prevalence of patients with all individual CDL conditions per condition.

Chronic disease	2008		2009		2010		2011		2012		Change (2008 vs 2012) (n)	Estimated annual change (n)
	Number of patients (n)	%	Number of patients (n)	%	Number of patients (n)	%	Number of patients (n)	%	Number of patients (n)	%		
Hypertension	57 627	44.40	70 058	50.17	69 193	50.79	62 909	50.91	69 248	50.88	↑ 11 621 (20.17%)	↑ 2 905 (5.04%)
Hypothyroidism	24 558	18.92	11 824	8.47	11 899	8.73	10 658	8.62	11 724	8.61	↓ 12 834 (52.26%)	↓ 3 209 (13.07%)
Hyperlipidaemia	15 239	11.74	18 385	13.17	17 778	13.05	15 002	12.14	18 216	13.38	↑ 2 977 (12.12%)	↑ 744 (3.03%)
Asthma	12 139	9.35	14 559	10.43	14 107	10.36	13 586	10.99	13 803	10.14	↑ 1 664 (13.71%)	↑ 416 (3.43%)
Diabetes Mellitus Type 2	6 158	4.74	7 425	5.32	7 097	5.21	6 393	5.17	7 133	5.24	↑ 975 (15.83%)	↑ 244 (3.96%)
Epilepsy	3 770	2.90	4 991	3.57	4 635	3.40	4 101	3.32	4 665	3.43	↑ 895 (23.74%)	↑ 224 (5.94%)
Diabetes Mellitus Type 1	2 912	2.24	2 199	1.57	1 744	1.28	1 952	1.58	1 656	1.22	↓ 1 256 (43.13%)	↓ 314 (10.78%)
Glaucoma	1 622	1.25	1 967	1.41	1 987	1.46	1 817	1.47	2 185	1.61	↑ 563 (34.71%)	↑ 141 (8.68%)

Cardiac failure	1 271	0.98	2 402	1.72	2 277	1.67	1 861	1.51	2 227	1.64	↑ 956 (75.22%)	↑ 239 (18.81%)
Rheumatoid arthritis	872	0.67	1 109	0.79	1 108	0.81	1 042	0.84	1 257	0.92	↑ 385 (44.15%)	↑ 96 (11.04%)
Dysthyrthmia	759	0.58	902	0.65	900	0.66	809	0.65	846	0.62	↑ 87 (11.46%)	↑ 22 (2.87%)
Cardiomyopathy	606	0.47	474	0.34	416	0.31	349	0.28	270	0.2	↓ 336 (55.45%)	↓ 84 (13.86%)
Coronary artery disease	588	0.45	781	0.56	641	0.47	991	0.80	562	0.37	↓ 26 (4.42%)	↓ 7 (1.11%)
Parkinson's disease	531	0.41	645	0.46	642	0.47	568	0.46	598	0.44	↑ 67 (12.62%)	↑ 17 (3.16%)
Chronic obstructive pulmonary disease	421	0.32	578	0.41	538	0.39	451	0.36	504	0.37	↑ 83 (19.72%)	↑ 21 (4.93%)
Schizophrenia	367	0.28	489	0.35	460	0.34	424	0.34	482	0.35	↑ 115 (31.36%)	↑ 29 (7.84%)
Crohn's disease	100	0.08	239	0.17	232	0.17	218	0.18	237	0.17	↑ 137 (137.00%)	↑ 34 (34.25%)
Multiple sclerosis	63	0.05	315	0.23	293	0.22	198	0.16	171	0.13	↑ 108 (171.43%)	↑ 27 (42.86%)
Ulcerative colitis	42	0.03	92	0.07	77	0.06	71	0.06	84	0.06	↑ 42 (100.00%)	↑ 11 (25.00%)
Addison's disease	40	0.03	42	0.03	36	0.03	37	0.03	38	0.03	↓ 2 (5.00%)	↓ 1 (1.25%)
Systemic lupus erythematosus	38	0.03	51	0.04	59	0.04	49	0.04	65	0.05	↑ 27 (71.05%)	↑ 7 (17.76%)

Bronchiectasis	36	0.03	36	0.03	30	0.02	21	0.02	4	0.00	↓ 32 (88.89%)	↓ 8 (22.22%)
Haemophilia A	20	0.02	27	0.02	31	0.02	35	0.03	30	0.02	↑ 10 (50.00%)	↑ 3 (12.50%)
Diabetes insipidus	10	0.01	7	0.01	10	0.01	8	0.01	8	0.01	↓ 2 (20.00%)	↓ 1 (5.00%)
Chronic renal disease	9	0.01	36	0.03	33	0.02	29	0.02	82	0.06	↑ 73 (811.11%)	↑ 18 (202.78%)
Haemophilia B	1	0.00	1	0.00	1	0.00	1	0.00	2	0.00	↑ 1 (100.00%)	↑ 1 (25.00%)
Total	129 799	100.00	139 634	100.00	136 224	100.00	123 580	100.00	136 097	100.00	↑ 6 298 (4.85%)	↑ 1 575 (1.21%)

3.2 Changes in the number of CDL conditions per patient from 2008 to 2012 adjusted for the influence of age and gender

The data has been analysed for all CDL conditions combined as well as for the individual CDL conditions. For patients with any of the CDL in 2008 had an increase of 0.20, with an average of 1.57 (2008) co-morbid CDL conditions to 1.77 in 2012. This difference in increase in average number of CDL conditions per patient between 2008 and 2012 was of statistical significance ($p < 0.05$), but no large practical significance ($d < 0.8$) (Table 5).

Table 5: Average number of CDL conditions per patient adjusted for age and gender.

Diagnosis	Total number of patients (2008-2012) (n)	Year	Mean (number of CDL conditions/patient)	Standard error	Confidence interval (95%CI)	p-value	Effect size (d-value)
All CDL conditions	1 222 444	2008	1.57	0.00	1.57-1.58	0.00	0.22
		2009	1.68	0.00	1.67-1.68		
		2010	1.69	0.00	1.68-1.69		
		2011	1.72	0.00	1.72-1.72		
		2012	1.77	0.00	1.77-1.78		

All of the CDL conditions had increases in the average number of co-morbid CDL conditions per patient, however, glaucoma, haemophilia B and bronchiectasis were the only CDL conditions with an increase in co-morbid CDL conditions per patient of large practical significance ($d > 0.8$). Asthma (increased by 0.18 co-morbid CDL conditions), hyperlipidaemia (increased by 0.20), hypertension (increased by 0.16), hypothyroidism (increased by 0.67) and diabetes mellitus type 2 (increased by 0.24). Addison's disease (increased by 0.23), coronary artery disease (increased by 0.25), cardiac failure (increased by 0.14), multiple sclerosis (increased by 0.92), Parkinson's disease (increased by 0.25) and chronic obstructive pulmonary disease increased by 0.17 CDL conditions per patient between 2008 and 2012. The CDL condition with the smallest increase in CDL conditions per patient was for schizophrenia with 0.08 and the highest increase for patients with bronchiectasis with 1.07 CDL conditions per patient. Epilepsy, glaucoma, haemophilia A and haemophilia B had increased of 0.17, 0.15, 0.29 and 0.50 respectively between 2008 and 2012. The only CDL condition with an overall decrease of 0.21 in average number of CDL conditions

was chronic renal disease. The CDL condition with the highest number of co-morbid CDL conditions was chronic renal disease with 3.54 in 2008 to 3.37 in 2011. Cardiomyopathy had the highest average number of CDL conditions per patient during 2012 with 3.36. Average number of co-morbidities with hypothyroidism had an overall increase from 2008 with 1.67 to 2012 with 2.34.

4.0 Discussion

Chronic Diseases List conditions play a vital role in the consumption of health resources, not only due to the number of patients increasing but also the financial impact on medical schemes, patients and other resources. The present study reported continuous increase of total number of patients with at least one CDL over time. This might be attributed to chronic disease related lifestyle risk factors, increased registration of CDL conditions by medical scheme beneficiaries and increase in the number of medical scheme beneficiaries as reported by the pharmaceutical benefit company used in this study. Similar increased burden of disease associated with chronic conditions was reported by a study conducted in twenty three different countries [8].

The current study reported higher prevalence of CDL conditions in female patients as compared to male patients since 2008 to 2012. Higher prevalence of non-communicable disease in females was also reported by other studies conducted in South Africa and Germany [9, 10]. Findings from another study conducted in United States reported higher prevalence of co-morbid chronic conditions in females as compared to males [11].

The present study found an increase in CDL conditions proportionate to increase in age. This might be due to the fact that people live longer than before. According to a survey, one in twenty people were aged 65 years and older a century ago, however, the proportion was one in six in 2011 and it has been estimated that by 2050, the proportion will be one in four with chronic disease. This situation will lead to an increase risk of CDL conditions such as hypertension, hyperlipidaemia and diabetes associated with aging [8]. The results of the study conducted in the

United States confirmed that prevalence of co-morbid chronic conditions increase with increase in age. Higher prevalence of non-communicable diseases in elderly was also reported by another study conducted in South Africa [9].

It has been estimated that deaths associated with all chronic diseases globally, may increase from 61% of the total disease burden in 2005 to 71% in 2030. On the other hand, deaths from cardiovascular disease and chronic respiratory disease may increase from 33% to 36% and 8% to 12 % of the total disease burden by 2030 [8]. The findings of the current study revealed that chances of co-morbidities in individual patients with a CDL condition exists more. Patients with chronic renal disease, was the only CDL condition with an overall decrease in co-morbidity, although the average was still higher than the other conditions over the majority of the study period. This higher co-morbidity prevalence might be due to associated risk factors, such as hypertension, diabetes mellitus type 2 and obesity. The high average number of co-morbid CDL conditions for coronary artery disease, may be attributed to diabetes mellitus type 2 and hyperlipidaemia, as being most commonly prevalent CDL condition [12]. The present study reported hypertension and hyperlipidaemia among the top three most prevalent chronic diseases. These results are in line with similar findings from another study conducted in South Africa [13]. Another study conducted in United States confirmed hypertension and hyperlipidaemia currently as the most prevalent chronic diseases [14]. The increase in burden of chronic diseases will result in use of complex drug regimens which in turn will not only increase cost of therapy but will also promote issues related to unwanted side effects, drug-drug interactions, resistance and patient non-compliance.

5.0 Conclusion

The study concluded that prevalence of patients with CDL conditions along with risk of co-morbidity has been increasing with time in private healthcare section of South Africa. Individual patients with any of the CDL conditions acquired on average at least one additional CDL co-

morbidity (except for chronic renal disease), especially, when other CDL conditions were known as risk factors. Risk 3 of increase co-morbidities with age and among different genders was prevalent. The current situation will easily overwhelm healthcare system as awareness regarding the magnitude and consequences of increased chronic disease burden as well as the capacity to respond appropriately with cost-effective measures is still lower. Thus, this calls for more extensive research to recognise and accommodate the impact of the increased chronic disease burden to address this public health concern appropriately, especially in private healthcare section of South Africa.

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