MEDICINE USAGE PATTERNS IN A DISTRICT HOSPITAL:

A THERAPEUTIC BUDGET MODEL APPROACH

PART 1

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MEDICINE USAGE PATTERNS IN A DISTRICT HOSPITAL: A THERAPEUTIC BUDGET MODEL APPROACH

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Dissertation submitted in partial fulfilment of the requirements for the degree Magister Pharmaciae in Pharmacy Practice at the Potchefstroom campus of the North-West University.

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"If the Lord does not build the house, the work of the builders is useless..."

Psalm 127:1 (Today's English version, The Good News Bible)

"I have the strength to face all conditions by the power that Christ gives me."

Philippians 4:13 (Today's English version, The Good News Bible)

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ABSTRACT

Title: Medicine usage patterns in a district hospital: A therapeutic budget model approach
Keywords: therapeutic budget model, medicine usage, drug utilisation review, cost prevalence index, budget groups, pharmacological groups, therapeutic codes, ICD-10 codes, ATC classification system.

According to the National Drug Policy one of the health services objectives is to ensure the availability and accessibility of essential drugs to all citizens. An economic objective of the same policy is to promote the cost-effective and rational use of drugs (Department of Health, 1996). Currently, there is no system to scientifically determine the usage of medicines in the public sector and whether the current usage is satisfactory enough (John, 2004:2). The World Health Organization states that "*good drug supply management is an essential component of effective and affordable health care services globally*" (World Health Organization, 1998:1). In the South African context, even though the Essential Drug List helps health care professionals to treat diseases in the public sector, it does not prescribe the minimum guidelines for medicine supply systems (Department of Health, 2006a).

The general objective of this study was to develop a therapeutic medicine budget model in a district hospital in the public sector of the North-West Province to control medicine usage. This can be done after analysing the medicine usage patterns and then developing a framework for therapeutic budgeting by evaluating appropriate systems, i.e. the International Code for Disease (ICD-10) classification system, with the therapeutic budget model framework.

Retrospective drug utilisation of six months (January 2007 until June 2007) was documented. A random sample population of 25% was selected (n = 1 494). After the data collection period of 9 weeks, the actual study population was only 18.67% (only 1 166 of the 1 494 patients files had a medicine history). All the medicine items prescribed were classified in the therapeutic budget model. Patient confidentially was assured by using a unique pin number on the survey form, so that no names of patients or other biographical details were collected from the patient files onto the survey form, which is in line with the requirements of the Ethics Committee approval conditions for the North-West University.

The total number of medicine items dispensed during the study period was 11 768. The average cost per medicine item was R19.36 ± 86.79 for inpatients. The total number of consultations was 3 220. The average number of medicine items per consultation was 3.66 ± 1.98. The total cost of medicine items during the study period was R244 677.11. The average medicine cost per consultation for inpatients was R70.80 ± 177.72.

The top three budget groups according to frequency represented 68.11% of all medicine used according to budget groups. The top three pharmacological groups according to total cost represented 61.68% of the total cost of pharmacological groups. The top three therapeutic codes according to frequency represented 18.75% of all therapeutic codes. The top three ICD-10 codes based on total cost represented 59.35% of all medical conditions diagnosed.

The total hospital budget for 2007 was predicted at R3 276 750.00. Of this budget, 75% was for pharmaceuticals (R2 457 562.50). The total pharmaceutical medicine cost (excluding surgicals) from the study was R224 677.11 (this was for 18.67% of the total patient visits for six months) which can be calculated at R2 406 824.96 for all patients visits in a full year.

The correlation between the actual budget and the projected budget showed a R50 737.54 surplus in the budget of the hospital. A therapeutic budget model can also help in achieving the following:

- Proper preparation and planning of budgetary policies in a phased manner based on scientific evidence;
- Evaluation of budgetary compliance, cost-efficiency of therapy and standard treatment guidelines (STG) / Essential Drug List (EDL) / formulary compliance;
- Better procurement strategies based on demand, expenditure and inventory control; and
- Better delivery and maintenance of quality health care by evaluating operational and clinical policies.

The therapeutic budget model is a more appropriate manner to use in the projections of budgets and medicine usage. The scope of a therapeutic budget model to be implemented in the hospitals in the public sector of the North-West Province seems to be promising.

OPSOMMING

Titel: Medisyneverbruikspatrone in 'n distrikshospitaal: 'n terapeutiese begrotingsmodel benadering

Sleutelwoorde: terapeutiese begrotingsmodel, medisyneverbruik, medisyneverbruisevaluering, koste-voorkoms indeks, begrotingsgroepe, farmakologiese groepe, terapeutiese kodes, IKS-10-kodes, ATC-klassifikasiestelsel

Volgens die Nasionale Geneesmiddelbeleid is een van die oogmerke met gesondheidsdienste om die beskikbaarheid en toegaanklikheid van noodsaaklike geneesmiddels aan alle burgers te verseker. 'n Ekonomiese doel van dieselfde beleid is om koste-effektiewe en rasionele gebruik van medisyne te bevorder (Departement van Gesondheid, 1996). Daar is tans geen stelsel om die gebruik van medisyne in die openbare sektor wetenskaplik te bepaal en om te kyk of die huidige gebruik bevredigend is nie (John, 2004). Die Wêreldgesondheidsorganisasie (1998:1) sê "*goeie bestuur van geneesmiddelverskaffing is wêreldwyd 'n noodsaaklike komponent van effektiewe en bekostigbare gesondheidsorgdienste*". Hoewel die Lys van Essensiële Middels gesondheidsorgwerkers in die Suid-Afrikaanse konteks help om siektes in die publieke sektor te behandel, gee dit nie die minimum riglyne vir verskaffing van geneesmiddels nie.

Die oorhoofse doelstelling van hierdie studie was om 'n terapeutiese begrotingsmodel vir medisyne in 'n distrikshospitaal in die publieke sektor van die Noordwes-Provinsie te ontwikkel om medisyneverbruik te beheer. Dit kan gedoen word nadat die medisyneverbruikspatrone ontleed is en 'n raamwerk vir die terapeutiese begroting dan ontwikkel word deur geskikte stelsels te beoordeel, d.i. die klassifikasiestelsel van die Internasionale Kode vir Siektes (IKS-10) saam met die raamwerk van die terapeutiese begrotingsmodel.

Gebruik van medisyne oor ses maande (Januarie 2007 tot Junie 2007) is retrospektief gedokumenteer. 'n Ewekansige steekproef van 25% van die populasie is gekies (n = 1 494). Na die periode van 9 weke van dataversameling was die werklike studiepopulasie net 18.67% (slegs 1 166 van die 1 494 pasiënt leêrs het 'n geskiedenis van medisyne gehad). Al die medisyne-items wat voorgeskryf is, is volgens die terapeutiese begrotingsmodel geklassifiseer. Die vertroulikheid van pasiënte is verseker deur 'n unieke pin-nommer op die datavorm te gebruik sodat die name of biografiese besonderhede van die pasiënt nie van die lêer op die vorm oorgedra word nie wat in lyn is met die vereistes van die etiekkomitee van die Noordwes-Universiteit.

Die totale aantal medisyne-items wat tydens die studieperiode uitgegee is, was 11 768. Die gemiddelde koste per medisyne-item vir binnepasiënte was R19.36 ± 86.79. Die totale aantal

konsultasies was 3 220. Die gemiddelde aantal medisyne-items per konsultasie was 3.66 ± 1.98. Die totale koste van medisyne-items tydens die studieperiode was R244 677.11. Die gemiddelde medisynekoste per konsultasie vir binnepasiënte was R70.80 ± 177.72.

Die boonste drie begrotingsgroepe het volgens frekwensie 68.11% van alle gebruikte medisyne volgens begrotingsgroepe uitgemaak. Die boonste drie farmakologiese groepe het 61.68% van die totale koste van die farmakologiese groepe uitgemaak. Die boonste drie terapeutiese kodes het volgens frekwensie 18.75% van alle terapeutiese kodes uitgemaak. Die boonste drie IKS-10-kodes het 59.35% van die totale koste van alle gediagnoseerde mediese toestande uitgemaak.

Die totale begroting vir die hospitaal vir 2007 was as R3 276 750.00 voorspel. Van hierdie begroting was 75% (R2 457 562.50) vir farmaseutiese produkte. Die totale koste vir medisyne (chirurgiese items uitgesluit) was volgens die studie R224 677.11 (vir 18.67% van die totale pasiëntbesoeke oor 6 maande) wat as R2 406 824.96 vir alle pasiëntbesoeke in 'n volle jaar bereken kan word.

Die korrelasie tussen die werklike begroting en die geprojekteerde begroting toon 'n surplus van R50 737.54 in die begroting van die hospitaal. 'n Terapeutiese begrotingsmodel kan ook help om die volgende te bereik:

- Behoorlike voorbereiding en beplanning van begrotingsbeleid in fases gebaseer op wetenskaplike getuienis;
- Evaluering van nakoming van die begroting, koste-effektiwiteit van behandeling en standaard behandelingsriglyne (SBG) / Lys van Essensiële Medisyne / nakoming van die voorskrifte;
- Beter strategieë vir verskaffing gebaseer op aanvraag, uitgawes en beheer oor die inventaris; en
- Beter lewering en onderhoud van gesondheidsorg van gehalte deur operasionele en kliniese beleid te beoordeel.

Die terapeutiese begrotingsmodel is 'n meer toepaslike manier om in die vooruitskattings van begrotings en medisyneverbruik te gebruik. Die implementering van 'n terapeutiese begrotingsmodel in die hospitale in die publieke sektor van die Noordwes-Provinsie lyk belowend.

MEDICINE USAGE PATTERNS IN A DISTRICT HOSPITAL IN SOUTH AFRICA: A THERAPEUTIC BUDGET MODEL APPROACH *(article to be submitted to the Bulletin of the World Health Organization for review)*

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ABSTRACT

Objective The general objective of this study was to develop a therapeutic medicine budget model in a district hospital in the public sector of the North-West Province in South Africa to control medicine usage. This was achieved after analysing the medicine usage patterns and developing a framework for therapeutic budgeting by evaluating appropriate systems, i.e. the International Code for Disease (ICD-10) classification system, within the therapeutic budget model framework.

Method A retrospective drug utilisation analysis of six months' data was done (January 2007 until June 2007). A stratified sample population of 25% was selected (n = 1 494). After the data collection period of 9 weeks, the actual study population was only 18.67% (only 1 166 of the 1 494 patients' files had a medicine history). All the medicine items prescribed were classified in the therapeutic budget model framework.

Findings The total number of consultations in the study period was 3 220 in which the total number of medicine items dispensed was 11 768. The average number of medicine items per consultation was 3.66 ± 1/98. The total cost of medicine items during the study was R224 677.10. The average cost per medicine item was R19.36 ± 86.79 for inpatients while the average medicine cost per consultation for inpatients was R70.80 ± 177.72.

Conclusion The therapeutic budget model can be used to improve the following:

- Actual medicine consumption is no longer monitored through the movement of stock at the provincial medical store but in the health care institution by using the therapeutic budget model.
- Provincial government can use the therapeutic budget model in their planning of budget allocations to the health care institutions in the province and to foresee a more effective budget system.
- Planning and budgeting can occur in a phased manner based on the scientific evidence from this study.

- Compliance with the Standard Treatment Guidelines (STG) and the Essential Drug List (EDL) can be evaluated and monitored, and if necessary, improved.

INTRODUCTION

The World Health Organization[1] states that "*good drug supply management is an essential component of effective and affordable health care services globally*". However, in South Africa, even though the Essential Drug List[2] helps health care professionals to treat diseases in the public sector, it does not include minimum structures for medicine supply systems.

In South Africa, with a total population of about 47 million people[3], 70% of the population relies on the public health sector for their health care needs[4], yet thousands of people do not have access to essential drugs[1].

The general objective of this study was to develop a therapeutic medicine budget model at Thusong Hospital in the North-West Province of South Africa to control medicine usage. This can be done after analysing of the current drug supply system and medicine usage patterns, and then developing a framework for therapeutic budgeting by evaluating appropriate systems, i.e. the International Code for Disease (ICD-10) classification system and the Anatomic Therapeutic Chemical (ATC) classification systems, within the therapeutic budget model framework.

METHODS

A retrospective drug utilisation review was done on data that were collected by using two structured survey forms, one for the outpatient (OPD) and one for the inpatient departments. The survey form was used to collect:

- General information, i.e. gender, date of birth, demography of patient, frequency of visits and immunisation details, etc.; and

- Stock / medicine supply information, i.e. the medicine(s) prescribed to the patient with the name and strength of the medication, indication, dosage form, quantity, dosage regimen, duration and cost, and some relevant information to prescriptions, e.g. by whom the medicine was prescribed, dispensed and whether it was prescribed according to the Essential Drug List (EDL).

Seven months' data were evaluated (January 2007 till July 2007) and six months' medicine usage (January 2007 till June 2007) were documented. The total number of patients (inpatients and outpatients) who visited the pharmacy (according to the master register) during this time was 6 243. A stratified sample of 25% was selected from the master register by choosing every fourth patient [n = 1 494] (to form the theoretical 25% study population) separately for the outpatients and

inpatients[5]. After the data collection period of 9 weeks, the actual response rate was 78.05% (1 166 of the 1 494 patients' files had a medicine history while the rest of the files did not have any medicine history or was not found in the patient administration department) (see table 1). Patient confidentially was assured by using a unique pin number on the survey form, as no names of patients or other biographical details were collected from the patient files[5]. This was in line with the ethical committee's approval conditions of the North-West University (**Ethics number: NWU-00017-07-A7**) and the requirements of the Director: Policy, Planning & Research of the North-West Department of Health.

The cost-prevalence index is an indicator of the relative expensiveness of medicine[6]. This formula is used in the analysis of medicine and drug utilisation studies. The cost-prevalence index is a relation between the total number/frequency of medicine items prescribed (prevalence) and the total medicine expenditure of the same medicine items (cost) and is calculated as follows:

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

In this study the cost-prevalence index is evaluated as follows:

- If the CPI < 1 the medicine item is relatively inexpensive
- If the CPI = 1 there is a balance between the cost and the prevalence
- If the CPI > 1 the medicine item is relatively expensive.

TABLE 1: The total frequency of the data collection process

	Total patient visits	**Study population**	**Data available**	**Response rate (%)**	**Data unavailable**	**Files not found**
Outpatients	4 335	1 026	734	71.5%	120	97
Inpatients	1 908	468	432	92.3%	81	30
Total	**6 243**	**1 494**	**1 166**	**78.05%**	**201**	**127**

The data obtained in the survey forms were captured in Excel® worksheets and analysed with SAS® 9.1 statistical programme.

FINDINGS

The therapeutic budget model was classified according to the same principle as the ATC classification system. The budget groups represent the anatomical group, the pharmacological group represents the anatomical subgroups and the therapeutic medicine item refers to the

individual medicine item. The conditions are classified according to the ICD-10 code classification system.

The total number of medicine items dispensed during the study period were 11 768. The 432 inpatients received 6 288 medicine items and 5 480 medicine items were dispensed to the 734 outpatients. The average cost per medicine item was R19.36 ± 86.79 for inpatients. The total number of consultations were 3 220. Of this 1 720 consultations were for inpatients and 1 500 for outpatients. The average number of medicine items per consultation was 3.66 ± 1.98 for outpatients and the total cost of medicine items during the study period was R244 677.11. Inpatients had a total cost of R121 711.95 during the study period and outpatients incurred a cost of R102 965.16. The average medicine cost per consultation for inpatients was R70.80 ± 177.72.

Budget groups

Budget groups are the first level of classification in the therapeutic budget model and represent the main anatomical groups like in the ATC classification system.

TABLE 2: Top budget groups according to frequency and total cost

Budget group	In- and outpatients				
	Frequency		Cost		CPI
	n	%	R	%	
Anti-infective	3094	26.29	114305.85	50.88	1.94*
Pain reliever	2670	22.69	46957.94	20.9	0.92
Gastrolyte	2251	19.13	7887.98	3.51	0.18
Cardiovascular agents	1540	13.09	21865.58	9.73	0.74

*Those CPI values indicated with * are relatively expensive budget groups needing further investigation on the scope of therapy

According to the top budget groups for frequency, anti-infectives were ranked first in the inpatient department [n = 1 737] with the highest frequency. This represented 27.62% of the total frequency for inpatients. Anti-infectives were second in the outpatient department with a frequency of 1 357. Anti-infectives in this department were 24.76% of the total frequency in the outpatient department. In total, 3 094 medicine items were dispensed from the budget group anti-infectives and they represented 26.29% of all medicine items dispensed during the study period. Pain reliever drugs were the most common medicine item for the outpatient department with 1 487 medicine items dispensed. This was 27.14% of all medicine items for outpatients. Pain reliever drugs were the third most frequently used medicine items for inpatients with 1 183 (18.81% of total medicine items). Combined, 2 670 pain reliever medicine items were prescribed and dispensed which is 22.69% of all medicine items. Gastrolytes were placed second according to the frequency in the inpatient department [n = 1 350] and were the third most frequently used medicine item in the outpatient department [n = 901] during the study period. Together, gastrolyte drugs represented 19.13% of all medicine items. The reason for the high usage of gastrolyte drugs could be due to

the inequity in health between the rural and urban areas in the country. In rural areas, like the area where Thusong Hospital is situated, the hygiene and sanitation are very poor which could lead to frequent gastroenteric infections with parasites. This conclusion was elucidated based in the general household survey[7] in the North-West Province where 9,9% of the households in 2005 were using a bucket toilet or had no toilet facility at all.

Anti-infective drugs are ranked first if both the inpatient and outpatient departments as the budget group with the highest total cost. The total cost for inpatients was R59 529.35 during the study period and amounted to 48.91% of the total cost for inpatients. The total cost for outpatients was R54 776.50 (53.20% of total cost). Anti-infective drugs thus represented R114 305.85 (50.88%) of the total expenditure for all medicine items. The CPI value of this budget group was 1.94 which indicated that medicine items in this budget group were relatively expensive due to the CPI value being greater than 1. Pain reliever medication was in second place according to the total cost for budget groups. The total cost for inpatients was R28 616.90 (23.51%) and R18 341.04 (17.81%) for outpatients. Pain reliever medicine had a total cost of R46 957.94 during the study period and represented 20.90% of all cost. Cardiovascular agents were the budget group with the third highest total cost. Although the frequency of this budget group was placed in fourth place, the total cost for inpatients was R11 815.60 (9.71% of total cost for inpatients) and for outpatients it was R10 049.98 (9.76% of total cost for outpatients). Cardiovascular agents represented 9.73% of the total cost which was R21 865.58.

Pharmacological groups

Pharmacological groups are the second level of classification in the therapeutic budget model and represent the anatomical sub-group.

TABLE 3: Top pharmacological groups according to frequency and total cost

Pharmacological group	In- and outpatients				
	Frequency		Cost		CPI
	n	%	R	%	
Analgesics, non-opioids including NSAIMs, gold & anti-gout preparations	2583	21.95	46092.52	20.52	0.93
Vitamins & mineral	1538	13.07	2162.46	0.96	0.07
Anti-bacterial (penicillins)	1209	10.27	37482.28	16.68	1.62*
Antiviral	726	6.17	55001.81	24.48	3.97*

*Those CPI values indicated with * are relatively expensive pharmacological groups needing further investigation on the scope of therapy

The top three pharmacological groups according to frequency starts with analgesics, non-opioids including non-steroidal anti-inflammatory medicine (NSAIMs), gold & anti-gout preparations which were ranked in first position for both the inpatient and outpatient departments. The frequency for inpatients was 1 110 medicine items in this pharmacological group and 1 473 medicine items for

outpatients. The total frequency was 2 583 which was 21.95% of all the medicine items dispensed during the study period. Vitamins and minerals were ranked in second position for both departments (in- and outpatients). A total of 880 medicine items were dispensed to inpatients (13.99%) and 658 to outpatients (12.01%). Combined, 1 538 vitamin and mineral medicine items were dispensed which represented 13.07% of the total frequency. Penicillin antibiotics were ranked third for inpatients with a frequency of 861 and ranked sixth with a frequency of 348 for outpatients. In total, penicillin antibiotics had a frequency of 1 209 which was 10.27% of the total frequency of medicine items according to pharmacological groups.

The total cost of the top three different pharmacological groups were as follows: Antiviral drugs were ranked fourth for inpatients but first for outpatients. Antivirals had a total cost of R9 293.36 for inpatients and R45 708.45 for outpatients. Combined, antiviral medication had a total cost of R55 001.81 during the study period. This represented 24.48% of the total cost. Antiviral drugs had a CPI value of 3.97 which indicated that medicine items in this pharmacological groups were relatively expensive. Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations were ranked second for both in- and outpatients. In the inpatients department the total cost was R27 895.35 (22.92%) and for outpatients it was R18 197.17 (17.67%). Combined, the total cost was R46 092.52 which was 20.52% of the total cost for pharmacological groups. Although penicillin antibiotics were ranked first for inpatients as the highest total cost for pharmacological groups (R32 735.43), it was in fourth place in the outpatient department (R4 746.85). When added together, penicillin antibiotics had a total cost of R37 482.28 which was 16.68% of the total cost. The CPI value of 1.62 for the pharmacological group penicillin antibiotics indicated that these medicine items were relatively expensive.

Therapeutic medicine items

Therapeutic medicine items refer to the individual medicine item which is prescribed and dispensed to patients during the study period.

TABLE 4: Top therapeutic medicine items according to frequency and total cost

Therapeutic medicine item	In- and outpatients				
	Frequency		Cost		CPI
	n	%	R	%	
Paracetamol Tabs 500mg	1063	9.03	966.04	0.43	0.05
Ibuprofen Tabs 200mg	600	5.10	881.35	0.39	0.08
Vitamin Multiple Tabs	544	4.62	241.57	0.02	0.01
Diclofenac Inj 25mg/ml 3ml	180	1.53	37809.55	16.83	11.00*
Efavirenz Caps 600mg	109	0.93	27671.02	12.32	13.25*
Ampicillin Inj 500mg	149	1.27	17889.42	7.96	6.27*

*Those CPI values indicated with * are relatively expensive therapeutic medicine item needing further investigation on the scope of therapy

The individual therapeutic medicine item which had the highest frequency during the study period of January 1st till June 30th 2008 was Paracetamol 500mg tablets. This product was dispensed 480 times to inpatients and 583 units were dispensed to outpatients. This represented 7.63% of medicine items for inpatients and 10.64% of medicine items dispensed to outpatients. Added together, Paracetamol 500mg tablets represent 9.03% of all the therapeutic medicine items dispensed. Ibuprofen 200mg tablets were ranked in third place according to frequency for inpatients and in second place for outpatients. Ibuprofen® 200mg tablets were dispensed 243 times (3.86%) to inpatients and 357 times (6.51%) to outpatients. This product was ranked second over-all because 5.10% of all individual items dispensed were Ibuprofen 200mg tablets (15s). Multivitamin tablets were dispensed 288 times in the inpatient department and were ranked second, and 256 times for outpatients which placed it in second rank for the outpatient department. Multivitamin tablets were ranked in third place when added together with a usage of 544 units and represented 4.62% of all the individual items dispensed. This was in line with the top three budget and pharmacological group results. The budget group, gastrolytes, was ranked third with a frequency of 19.18% and the pharmacological group, vitamins and minerals, was ranked second with a frequency of 13.07%.

The therapeutic medicine item which was responsible for the highest total cost per item was Diclofenac 25mg/ml injection (3ml). The total cost for this item for inpatients was R25 979.65 which was 21.35% of the total cost for all therapeutic medicine items in the inpatient department and was ranked first. Diclofenac 25mg/ml injection had a total cost of R11 829.90 (11.49%) for outpatients and that placed it in second rank in this department. The total cost for Diclofenac 25mg/ml injection was R37 809.55 when the two departments were combined. This was 16.83% of all the individual medicine items' total cost and the CPI value of 11.00 indicated that this is a relatively expensive medicine item. Efavirenz 600mg capsules had the highest total cost for outpatients and were ranked first in this department. The CPI value of 13.25 was an indication of the relatively expensiveness of the medicine item. The total cost for this individual item was R25 354.40 and it represented 24.62% of the total cost for the outpatient department. Efavirenz 600mg tablets were ranked in ninth position for inpatients with a total cost of R2316.62 (1.90%). Combined, Efavirenz 600mg capsules (30s) had the second highest total cost of all the therapeutic medicine items (R27 671.02) which was 12.32% of the cost of all the therapeutic medicine items. Ampicillin 500mg injection was ranked second in the inpatient department. During the study period, the total cost for this product added up to R17 889.42 which was 14.70% of the total cost for the inpatient department. Ampicillin 500mg injection did not appear in the top 10 therapeutic medicine items for outpatients. Despite this, Ampicillin 500mg injection was ranked as the third highest therapeutic medicine item with a total cost of R17 889.42 which was 7.96% of the total cost for all items. The CPI value of 6.27 indicated that this medicine item is relatively expensive.

ICD-10 codes

The International Code of Diseases (ICD-10) classification system was used to classify the diseases which appeared during the study.

TABLE 5: Top ICD-10 codes according to frequency and total cost

ICD-10 code	In- and outpatients				
	Frequency		Cost		CPI
	n	%	R	%	
Pain control	2490	21.16	46612.57	20.75	0.98
Vitamin deficiency	1380	11.73	1872.55	0.83	0.07
Undefined bacterial infection	1189	10.10	30350.48	13.51	1.34*
Unspecified HIV	927	7.88	56366.40	25.09	3.18*

*Those CPI values indicated with * are relatively expensive ICD-10 codes needing further investigation on the scope of therapy

Pain control (R52.9) was the ICD-10 code with the highest frequency dispensed to both in- and outpatients during the study period. A total of 1 099 cases of pain control were identified in inpatients and 1 391 cases in outpatients. This implied that 25.38% of all diagnoses made in outpatients were for pain control and 17.48% of the diagnoses for inpatients were for pain control. In total, 21.16% of all diagnoses made for both in- and outpatients were for pain control (R52.9). Vitamin supplements (E56.9) were ranked in the second position for inpatients with a total of 774 cases diagnosed and ranked third for outpatients with 606 cases diagnosed during the study period. Vitamin supplements (E56.9) were generally ranked in a second place with a frequency of 1 380 which represented 11.73% of all diagnoses made. The ICD-10 code with the third highest frequency was undefined bacterial infections (B20.1). This ICD-10 code was ranked third according to usage by inpatients (10.93%) and fourth by outpatients (9.16%). The total frequency for both in- and outpatients was 1 189 cases which is 10.10% of all diagnoses made.

Unspecified HIV (B24) had the highest total cost for outpatients at R46 992.64 which was 45.64% of the total cost for outpatients. For inpatients, the total cost was R9 373.76 and it was ranked third in this department. Unspecified HIV (B24) had the highest total cost when combining in- and outpatients together. The total cost was R56 366.40 and it represented 25.09% of all diagnoses made. The CPI value of 3.18 indicated that medicine items used in the treatment of this condition were relatively expensive. Pain control (R52.9) had the highest total cost for inpatients during the study period. The total cost for pain control was R28 382.76 and it was 23.2% of the total cost for inpatients. Pain control (R52.9) was ranked second for outpatients and had a total cost of R18 229.81 which was 17.70% of the total cost for outpatients. Combined, pain control (R52.9) was ranked second with a total cost of R46 612.57. This represented 20.75% of all diagnoses made during the study period. Undefined bacterial infections (B20.1) had the second highest total cost in the inpatient department. The total cost of R23 926.85 represented 19.66% of the total cost for inpatients. Undefined bacterial infections (B20.1) were ranked fourth for outpatients with a total

cost of R6 423.63. This was 6.24% of the total cost for outpatients. Undefined bacterial infections (B20.1) were ranked third when adding in- and outpatients' total cost and it was relatively expensive according to the CPI value of 1.34. The total cost was R30 350.48 and represented 13.51% of the total cost of all ICD-10 codes.

Budget projections

The actual hospital budget allocation for pharmaceuticals for 2007 was R2 457 562.50. The total pharmaceutical medicine cost (excluding surgical) from the study was R224 677.11 (this was for 18.67% of the total patient visits for six months) which can be calculated at R2 406 824.96 for all patients visits in a full year.

The correlation between the actual budget and the projected budget showed a R50 737.54 surplus in the budget of the hospital.

In this study, there was a surplus in the budget for the year 2007, indicating that the pharmacy manager at Thusong Hospital planned his budget well. However, this is not the case in all the public health care institutions in the North-West Province. It was found that budgets allocated to provinces in South Africa were done without guidance and statistical data which prevented the calculations of actual requirements[8]. This scenario can be prevented by implementing a therapeutic budget model.

CONCLUSION

The budget group anti-infectives at 26.29% had the highest frequency for in- and outpatients as well as the highest total cost and represented 50.88% of the total budget during the study period.

The pharmacological group analgesics, non-opioids including NSAIMs, gold and antigout preparations had the highest frequency of 21.95% but the pharmacological group antivirals had the highest total cost which represented 24.48% of the total budget.

The therapeutic medicine item Paracetamol 500mg tablets had the highest frequency of 9.03% of all medicine items. The therapeutic medicine item Diclofenac 25mg/ml injection 3ml represented 16.83% of the total cost of all medicine items used in the study period.

Pain control was the condition with the highest frequency and represented 21.16% of all conditions diagnosed during the study period but unspecified HIV had the highest total cost and represented 25.09% of the total cost of all conditions diagnosed during the study period.

Actual medicine consumption no longer has to be monitored through the movement of stock at the provincial medicine store but it could be done in the health institutions by using the therapeutic budget model.

RECOMMENDATIONS

The scope of a therapeutic budget model to be implemented in the hospitals in the public sector of the North-West Province seems to be promising due to the following reasons:

- The implementation of a therapeutic budget model at Thusong Hospital and the evaluation of the accuracy of this model in order to opimise the budgeting and procurement of medicine items for this institution.
- Based on this study, planning and budgeting can occur in a phased manner based on the scientific evidence from this study.
- Compliance with the Standard Treatment Guidelines (STG) and the Essential Drug List (EDL) can be evaluated and monitored, and if necessary, improved.
- By incorporating a therapeutic budget model and by the subsequent budgetary projections on actual medicine usage, the improvement of the current medicine supply system and budgeting system at Thusong Hospital.
- Provincial government can use the therapeutic budget model in their planning of budget allocations to the health care institutions in the province thus having a more effective and scientific budgeting system.
- Medicine usage control can assist the provincial medical stores in their procurement process and better planning of stock and medical supplies.
- The therapeutic budget model will encourage pharmacists to improve their record keeping system and data management skills in order to have more scientific evidence of the medicine usage available at that institution in order to control medicine usage.

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COMPETING INTERESTS

None declared.

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LIST OF ABRIVIATIONS

AIDS	Acquired Immunodeficiency Syndrome
ANC	African National Congress
ARV	Antiretroviral
ATC	Anatomic Therapeutic Chemical classification system
CPI	Cost-prevalence Index
DDD	Defined Daily Dose
DHA	District Health Authorities
DHS	District Health System
DUR	Drug Utilisation Review
EPO	Exclusive Provider Organization
GPP	Good Pharmacy Practice
HAART	Highly Active Antiretroviral Therapy
HIV	Human Immunodeficiency Virus
HMO	Health Maintenance Organization
IPA	Independent (or individual) Practice Association model
ICD-10	International Code of Diseases, 10^{th} edition
IM	Intramuscular
MDI	Metre Dose Inhaler
MEC	Member of the Executive Council
MTCT	Mother-to-child-transmission
NDP	National Drug Policy

NEDLC	National Essential Drugs List Committee
NGOs	Non-government organizations
NHA	National Health Advisory body
PBM	Pharmaceutical Benefit Management
PDD	Prescribed Daily Dose
PHA	Provincial health authority
POS	Point-of-service Organization
PPO	Preferred Provider Organisation
QALY	Quality Adjusted Life Years
STI	Sexual Transmitted Infection
WHO	World Health Organization

CHAPTER 1

Introduction

"Most leading causes of death and disability in developing countries can be prevented, treated or at least alleviated with cost-effective essential drugs." This is the introductory sentence of the Essential Drugs Monitor's editorial article on managing drug supply (World Health Organization, 1998:1). This indicates the need for research in medicine usage control in order to ensure the 'availability and accessibility of essential drugs to all citizens' and to 'promote the cost-effective and rational use of drugs' (Department of Health, 1996).

1.1 PROBLEM IDENTIFICATION

In South Africa, with a total population of about 48.7 million people (Statistics South Africa, 2008:3), 70% of the population rely on the public health sector for their health care needs (Doms, 2003), yet thousands of people do not have access to essential drugs (World Health Organization, 1998:1). In the scope of this study and according to the estimation of Statistics South Africa (2006a:10), the total population of North-West Province in South Africa has grown to 3 374 200; so the question is how many of this population does not have access to essential drugs? The World Health Organization states that "*good drug supply management is an essential component of effective and affordable health care services globally*" (World Health Organization, 1998:1). However, in South Africa, even though the Essential Drug List (Department of Health, 2006a) helps health care professionals to treat diseases in the public sector, it does not include minimum guidelines for medicine supply systems (Department of Health, 2006a).

According to the Annual National Health Plan 2006/2007, one of the main issues that will gain attention in the coming year is to create effective and efficient financial and asset management systems, as well as reporting and auditing systems (Department of Health, 2006c:9). In 1998 the editor of the Essential Drug Monitor, a World Health Organization periodical, wrote that

broad lessons have emerged from the experience with managing medicine supply by some countries over the last 20 years; some of the main lessons learnt included the following:

- A national drug policy provides a sound foundation for managing drug supply;
- Wise drug selection underlies all other improvements;
- Effective management saves money and improves performance;
- Appropriate drug use requires more than drug information; and
- Systematic assessment and regular monitoring are essential (World Health Organization, 1998:1).

Taking the above lessons into account, it must be noted that the public health care sector in South Africa does not provide for a proper monitoring system to measure the rate at which medicine is being distributed. Also, there is no system to scientifically determine the usage of medicines in the public sector and whether the current medicine usage is satisfactory enough to ensure access to essential medicines to the population of South Africa (John, 2004:2).

In the National Treasury's document on the evaluation of strategic and performance plans for the North-West Province in November 2005 (North-West National Treasury, 2005:1) the vision of the Department is stated as: "*Optimum health for all individuals and communities in the North-West Province*". In the department's mission statement it wants to ensure access to affordable, equitable, quality, caring health services for all in the North-West through community involvement and partnerships, Batho Pele principles, and Patient Rights charter, innovation driven performance, and by valuing our people and their diversity (North-West National Treasury, 2005:24). From these vision and mission statements, a sectoral situation analysis on health found that the North-West Department of Health identifies key issues facing

- **the service delivery environment** – the impact of the predominantly rural nature of the province and low population density on the rendering and ensuring of effective and equal access of health services to all communities; and
- **the organisational structures** – inherent limitations and weaknesses in the organisational structures (North-West National Treasury, 2005:26).

This indicates that not only does the Department of Health's Annual National Health Plan 2006/2007 make provision for effective and efficient financial and asset management systems, as well as reporting and auditing systems (Department of Health, 2006c:9), but also the Provincial Treasury in its 2005 evaluation of strategic and performance plans (North-West National Treasury, 2005:26). Such support is complementary to the annual health plan. Both plans mentioned above, intend to improve planning, budgeting, monitoring and evaluation within the next five years.

When we look at the audit objective and audit criteria of the Auditor General of the North-West Province for public health care facilities in South Africa, the objective and some of the criteria (Nel, 2007) included the following:

Audit objective

- To evaluate the measures instituted to ensure that the administration of stores and equipment is economic, efficient and effective (Nel, 2007).

Audit criteria

- Sufficient control measures should be instituted to ensure that stock and equipment are obtained, stored and utilised in an economic, efficient and effective manner.
- A proper system of purchasing, receiving, recording, storing and maintaining should be launched and established.
- Minimum and maximum stock levels, economical order quantities and turn-over rates of stock should be determined and regularly evaluated.
- Equipment and other assets should be serviced regularly to ensure availability and the economical, efficient and effective utilisation.
- Redundant, obsolete and worn-out stock and equipment should be identified regularly and be appropriately disposed (Nel, 2007).

From the above goals of the Auditor General of the North-West Province, it can clearly be seen that planning, budgeting, monitoring and control systems are very important for the public sector. Thus there is a need in the health care institutions to make sure that the

recommendations of the Auditor General of North-West Province are properly adhered to and incorporated.

1.2 RATIONALE AND MOTIVATION

In order to prevent, treat or at least alleviate diseases in specific hospitals, not only does one need the necessary drugs, facilities or health care workers, but also the correct supply system for medicines. According to the World Health Organization (1998:1) it will never be possible to state that one particular drug supply system is "the best". Each country brings its own unique political, economic and geographical factors to the equation. In the North-West Province, the department provides an elegant diagnostic analysis of its service delivery environment, focusing on such key elements as population patterns, socio-economic conditions, health profile, educational attainment, provision of infrastructure services, policy changes, and how these elements influence the delivery of health services in the province (North-West National Treasury, 2005:1). The North-West Department of Health focuses strongly on accessibility and improved quality service to rural and farm communities (North-West Department of Health, 2005:13).

Thus it would be imperative to evaluate medicine usage at public hospitals and also evaluate the demand-procurement-expenditure data of these specific institutions – especially on a rural level in the North-West Province. After evaluating the planning, budgeting, monitoring and control systems at public health sector hospitals improvement on the current systems must be considered and a unique therapeutic budget model must be developed for public health sector hospitals because of the differences between hospitals countrywide. The therapeutic budget model would standardise the expenditure-procurement of pharmaceuticals/medicines in the hospitals (John, 2004).

1.3 RESEARCH AIMS

The research aims of this study are divided into the general and specific research objectives.

1.3.1 General objective

The general objective is to develop a therapeutic medicine budget model at Thusong Hospital, North-West Province to control medicine usage.

1.3.2 Specific objectives

From the literature study and empirical investigation the following specific research objectives needed to be achieved:

1.3.2.1 Literature phase

The literature phase will be divided into two sections – chapter 2 will focus on the public health care sector in South Africa from a national, provincial and local level; and chapter 3 will focus on drug usage and Drug Utilisation Review (DUR) using the International Code of Diseases (ICD-10) classification system and the Anatomical Therapeutic Chemical (ATC) classification system.

1. Conceptualisation from literature the current situation in the public health sector of South Africa from a national perspective, narrowing it down to provincial, local and community levels including demographic details and health care facilities.

2. Identifying, from literature, certain factors affecting health in South Africa.

3. Investigation from literature and key role players, the drug supply management cycle with specific reference to drug selection, procurement, distribution and use of medicine items in the public health care sector of South Africa and the North-West Province.

4. Short description of the present medicine distribution system at Thusong Hospital, North-West Province.

5. Conceptualisation from literature as well as from Government White Papers, the financial expenditure data from national treasury, narrowing down to provincial and local levels.

6. Conceptualisation from literature a brief overview of managed health care, how managed health care systems work, the different types of managed care organisations and management components.

7. Conceptualisation from literature the concept of Drug Utilisation Review (DUR), International Code of Disease (ICD-10) classification systems and the Anatomic Therapeutic Chemical (ATC) classification systems.

8. Conceptualisation from literature a brief overview of pharmacoeconomics and pharmacoepidemiology.

This concludes the specific objectives for the literature phase.

1.3.2.2 Empirical phase

The empirical phase is broadly discussed in chapter 4 which focuses on the empirical investigation. The results of the following specific objectives of the empirical phase are discussed in chapter 5.

1. Analysis of the general and demographic data which include gender and age distribution, average age of patient, frequency of demography, visits, immunisation (outpatients) and duration of stay (inpatients).

2. Analysis of medicine usage information referring to the frequency of budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary).

3. Analysis of the average number of medicine items per consultation according to gender and age group.

4. Analysis of the average cost per consultation according to gender, age group, budget group, pharmacological group, therapeutic code and ICD-10 code.

5. Analysis of the average cost per medicine item for budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary).

6. To determine the framework for the formulation of a unique therapeutic budget model for Thusong Hospital.

This concludes the specific objectives for the empirical phase.

1.4 RESEARCH METHODS

This research method is divided into two phases, namely the literature phase and the empirical phase.

1.4.1 Phase one: Literature review

The literature review was divided into two chapters for a better structural organisation. Chapter 2 focuses on the current situation in the public health sector and includes discussion on the Department of Health, factors affecting health in South Africa, the drug supply management cycle and budgeting structures, from a national level, narrowing it down to provincial, district and community levels, where possible.

Chapter 3 focuses more on managed health care in South Africa and in particular Drug Utilisation Review (DUR), Anatomical Therapeutic Chemical (ATC) classification system, International Code of Diseases (ICD-10) classification systems and pharmacoeconomics and pharmacoepidemiology in South Africa.

1.4.2 Phase two: Empirical investigation

The empirical investigation (Chapter 4) focuses on the data collection process which include the selection of the research design, selection of the data collection period, selection of the sample population and the necessary measuring instruments, selection of data analysing techniques, investigation into the validity and reliability parameters and the discussion of the results obtained form this study (Chapter 5). At the end, conclusions and recommendations can be made from this study (Chapter 6). Ethics approval from the North-West University was received (Ethics approval number: **NWU-00017-07-A7**).

1.5 DIVISION OF CHAPTERS

The chapters are divided as follows:

Chapter 1: Introduction

Chapter 2: Public health care sector in South Africa from a national, provincial and local level

Chapter 3: Drug usage and Drug Utilisation Review (DUR)

Chapter 4: Empirical Investigation

Chapter 5: Results and Discussion

Chapter 6: Conclusions and Recommendations

1.6 CHAPTER CONCLUSION

The introduction chapter stated the general background of this study as well as the rationale. The research objectives were identified and the division of the chapters was indicated.

Chapter 2 of this study will focus on the public health sector and the general structure of the National Department of Health from a national to a community level and Factors affecting health in South Africa will be described. The supply management cycle and funding mechanisms in the Department of Health will also be discussed.

CHAPTER 2

Public health care sector in South Africa from a national, provincial and local level

In the White paper on the transformation of the health system in South Africa which is published in April 1997, "The South Africa Act" divided the government into the national level at the top, provincial administrations at second level and local authorities in the third level (Department of Health, 1997:8). By following these guidelines, the Department of Health was established with the promulgation of the Public Health Act 36 of 1919. The National Department of Health at the central government level had an overall control function over duties and tasks preformed by the provincial and local authorities (De Haan, 2005:15). Even as early as 1984, Kleczkowski et al. (1984:13) stated that a health system must be seen as a coherent whole which consists of many interrelated parts including sectoral and intersectoral components and the community, which produce a combined effect on the health of a population. All departments must work together and adjust to each other in order to create a purposeful system (Kleczkowski et al., 1984:13). In 1994, after the first democratic elections in South Africa, the Constitution of the Republic of South Africa (Act No 108 of 1996) focused more on human rights, improvement in quality of lives of all citizens and promoted the idea of a united and democratic South Africa (South Africa, 1996).

In this chapter the National Health System of South Africa were investigated by starting at national level working down to provincial, district and community level. In every level both the demographic and health care aspects will be discussed. There will also be a discussion on factors affecting health care and health delivery in South Africa. The procurement, distribution and budgetary processes of pharmaceutical products in the North-West Province, with emphasis on Thusong Hospital will briefly be discussed, as the research was done at this province and hospital.

2.1 THE HEALTH SYSTEM OF SOUTH AFRICA

The main reason for the existence of the health departments in South Africa is to ensure access of all to good-quality health care (Department of Health, 2008a). As from 1994, some changes which occurred in the Department of Health lead to decentralised health services (primary, secondary and tertiary services) delivery in South Africa *via* national, provincial, district and community levels. However, central co-ordination was still required, and that is why a multidisciplinary health team approach to health care is necessary to include the public and private sector (African National Congress, 2008:23), providing effective service delivery to the people of South Africa. In 1994 the African National Congress political party proposed an organigram of the different functions which could be performed on different levels in the health care system of South Africa as indicated in figure 1 (Dennill *et al.*, 2000:44).

2.1.1 National level

The top health structure in South Africa is the National Department of Health. The Minister of Health leads the National Department of Health, and was led by Dr. Manto Tshabalala-Msimang (Department of Health, 2007a) until September 24th 2008 when there was a change in the Presidency and Ministers of the South African Government and Ms Barbara Anne Hogen was selected as the new Minister of Health acting from September 26th 2008 (South Africa Government Information, 2008). There are many divisions in the department, e.g. legal services, human resources and communication. All departments need to work together to ensure effective and efficient functioning of the Department of Health. The White Paper on Local Government (South Africa, 1998) set out the roles and responsibilities of a national government with respect to a local government:

- Create the overall strategic framework for social and economic development and ensure that local government operates within this framework;
- Whilst local government is still in transition, national government is responsible for the co-ordination, management and oversight of this transition;
- Provide the overall legislative framework for local government including the establishment of criteria for the demarcation of municipal boundaries, the definition of categories of municipalities and types within the categories;

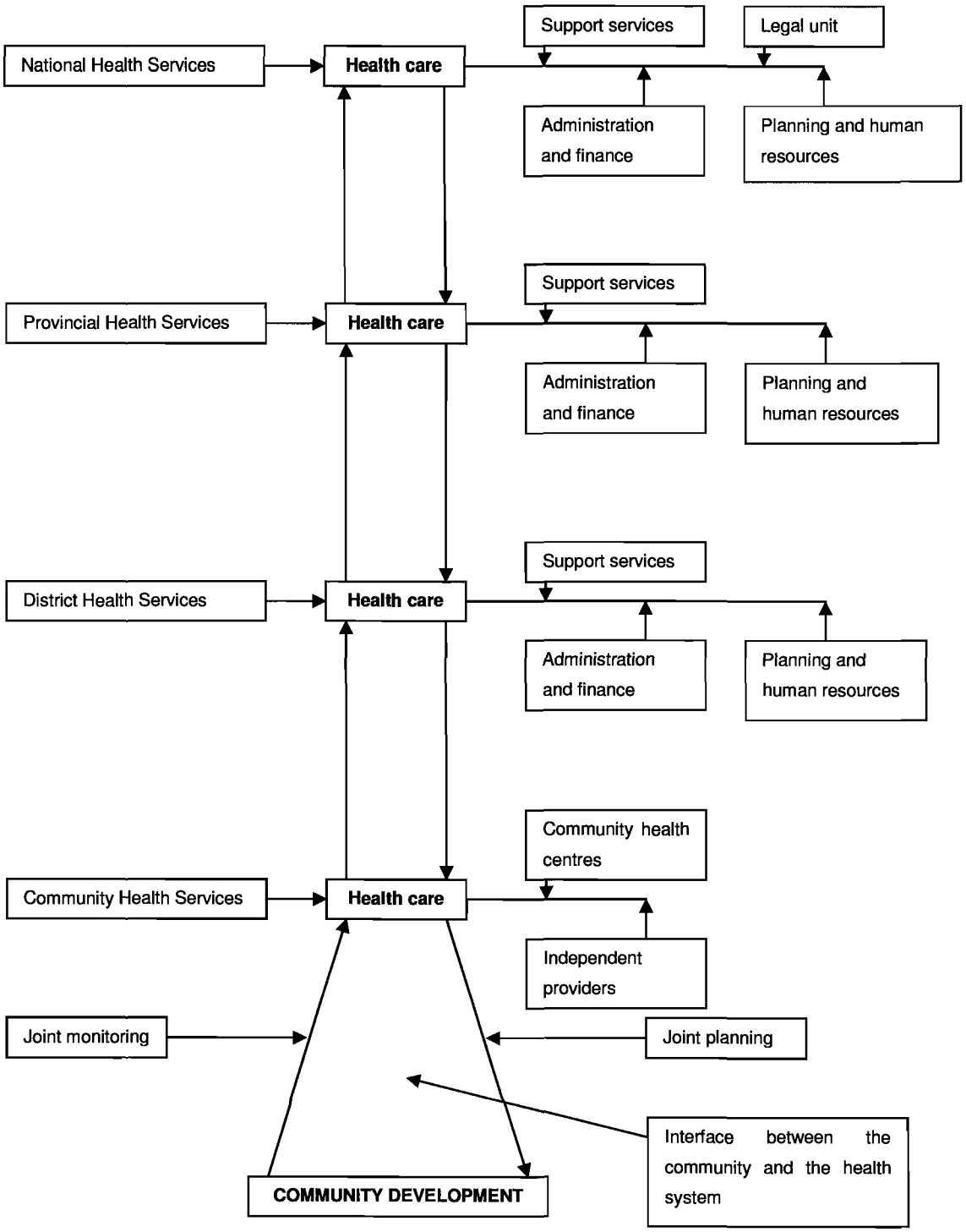


FIGURE 1: Different functions and activities of the different levels of health care in the health system of South Africa (Dennill *et al.*, 2000:44)

- Other responsibilities which include provision of a framework for intergovernmental relations between national, provincial and local governments; and
- Support institutions such as the Local Government Sector Education and Training Authority and the Local Government Bargaining Council (South Africa, 1998).

The Minister of Health's responsibility for health, according to the National Health Act No. 61 of 2003 (South Africa, 2003b:18), within the limits of available resources, is to:

- Aim to protect, promote, improve and maintain the health of the country;
- Promote the inclusion of health services in the socio-economic development plan of the country;
- Determine policies and measurement to protect, promote, improve and maintain the health of the population;
- Ensure the provision of at least primary health care to the population (after consultation with the National Health Council); and
- Prioritise the health services which the state can provide.

The vision of the National Department of Health is a caring and humane society in which all South Africans have access to affordable, good quality health care (Department of Health, 2008a). The mission statement is to improve access to health care by building on the achievements of the past five years. Reduction of inequity, improvement in quality of care at all levels of the health system and improving the overall efficiency of health care delivery in South Africa, form part of the mission of the National Department of Health (Department of Health, 2008a).

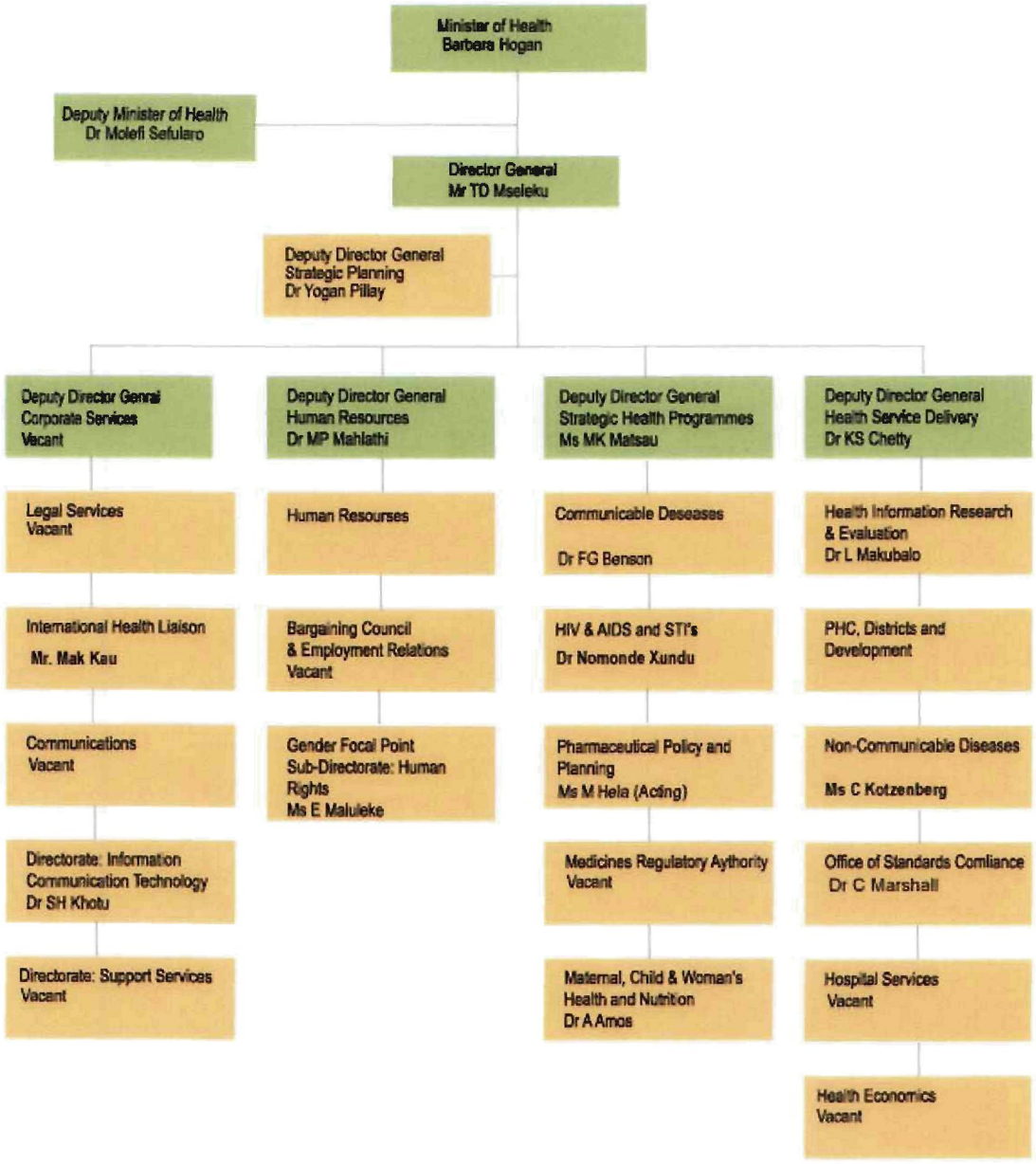


FIGURE 2: Organigram of the National Department of Health (Department of Health, 2008h)

The Minister of Health works closely with a few committees for proper functioning of the department. Firstly, the intersectoral national development committee: this committee consists of the ministers of all the sectors in the South African government that have an impact on health, e.g. water, agriculture and housing, and advises the Minister of Health (Dennill *et al*, 2000:45).

Secondly, the national health authority's responsibilities include:

- the development of national policies, standards, norms and targets;
- allocation of the health budget;
- coordination of the recruitment, training, distribution and conditions of service of health workers; and
- development and implementation of a national health information system (African National Congress, 2008:23).

Thirdly, there is the National Health Advisory body (NHA) whose primary responsibility is the coordination of both public and private health care in South Africa. The NHA consists of representatives of the statutory bodies and members of the national associations of health professionals, non-government organisations (NGOs), trade unions and national community organisations (Dennill *et al.*, 2000:45).

The National Health Act, No. 61 of 2003 (South Africa, 2003b:30) declares that a National Health Council must be established that consists of:

- The Minister of Health
- Deputy Minister of Health
- Relevant members of executive councils
- One municipal councillor (appointed by the national organisation contemplated)
- Director-general and deputy directors-general of the national Department of Health
- Head of each provincial department
- One person employed (appointed by national organisation contemplated)
- Head of SA military health service.

This council has the primary function of advising the minister on issues like policies concerning any matter that will protect, promote, improve and maintain the health of the population,

proposed legislation, norms and standards, guidelines for the management of health districts, implementation of national health policies, integrated health plans, national strategy for health research and performance of other functions (South Africa, 2003b:32). The minister must also establish a National Consultative Health Forum who is responsible to facilitate interaction, communication and sharing of information on national issues between representatives of the national Department of Health, national organisations identified and appointed by the minister as well as provincial consultative bodies. Figure 3 illustrates the lay out of the national Department of Health and the committees associated with the department (Dennill *et al.*, 2000:45).

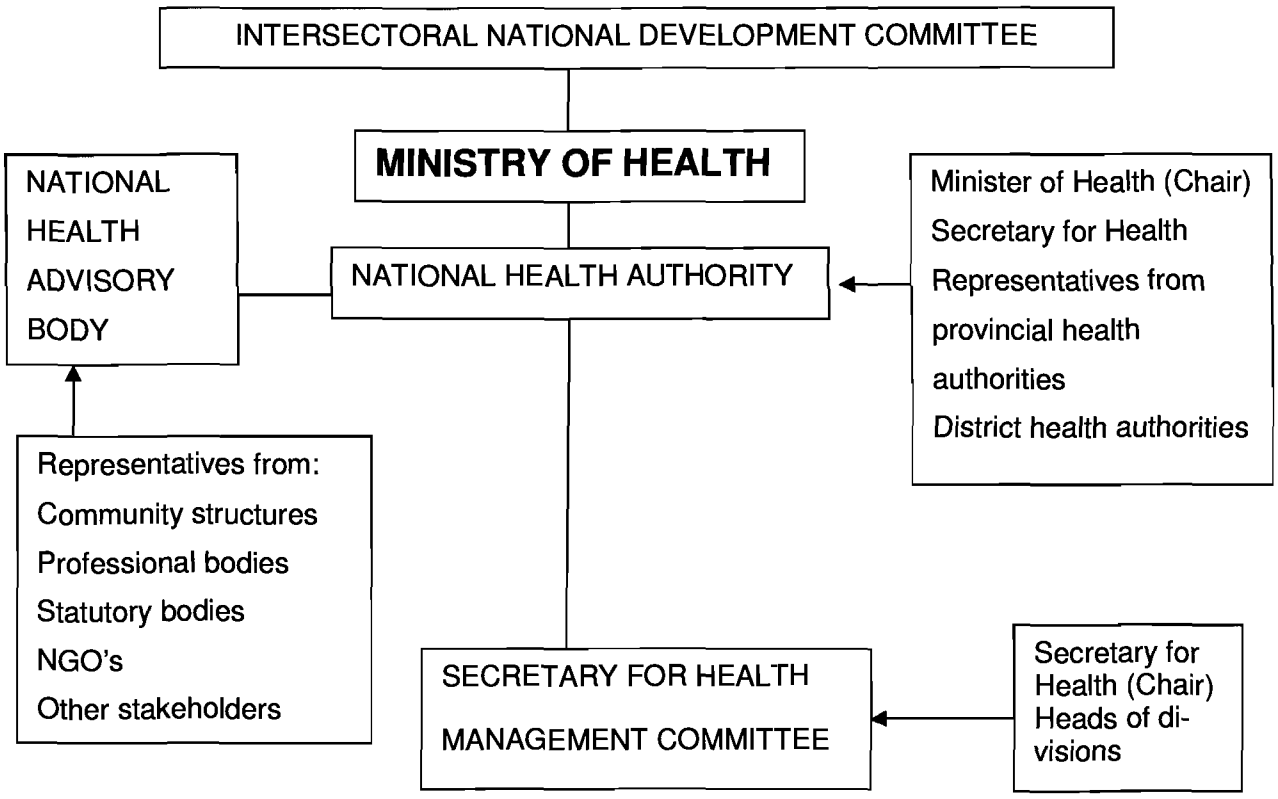


FIGURE 3: Organigram of the Ministry of Health with associated bodies (Dennill *et al*, 2000:45)

2.1.1.1 Demographic details

According to Statistics South Africa (2008:3) the medium variant (best estimate) for the 2008 mid-year population is estimated at 48.7 million people which is 800 000 more people than estimated in 2007. According to the 2007 mid-year population estimates (Statistics South Africa, 2007:1) the total population of South Africa was estimated at approximately 47.9 million

based on the latest available boundary information as available from the Demarcation board. This is 500 000 more than the 2006 mid-year estimate of 47.4 million (Statistics South Africa, 2006a:1).

Of this population of 47.9 million in 2007, 51 % (approximately 24.3 million) was female. In the mid-year population estimates for 2008, 52% (approximately 25.2 million) of the population is estimated to be female. Life expectancy, for 2006 and 2007, at birth was estimated at approximately 49 years for males which increased to 50.3 years in 2008 (Statistics South Africa, 2008:3). For females the life expectancy at birth decreased from 53 years in 2006 to 52 years in 2007 and increased again to 53.9 years in 2008 (Statistics South Africa, 2006a:1; 2007:1 and 2008:3). The 2007 survey also estimated the infant mortality rate at 45.2 per 1 000 (Statistics South Africa, 2007:1). According to Statistics South Africa (2008:3) 32% of the population is younger than 15 years and approximately 7% is 60 years and older.

Population groups are dominated by Africans who had grown from 38.079 million, who comprised 79.6% of the total population in 2007 (Statistics South Africa, 2007:1), to 38.6 million and constitutes about 79% of the total population in South Africa (Statistics South Africa, 2008:3). The white population was estimated at 4.352 million in 2007 and had grown to 4.5 million in 2008, the Coloured population grew from 4.245 million in 2007 to 4.4 million in 2008 and the Indian/Asian population from 1.173 million in 2007 to 1.2 million in 2008, according to the national population estimates in 2007 (Statistics South Africa, 2007:1) and 2008 (Statistics South Africa, 2008:3). Table 1 shows the mid-year estimates for 2008 by population and sex (Statistics South Africa, 2008:3).

TABLE 1: Mid-year estimates by population group and gender, 2008 (Statistics South Africa, 2008:3)

Population group	Male		Female		Total	
	n	%	n	%	n	%
African	18 528 000	79,0	20 037 100	79,4	38 565 100	79,2
Coloured	2 105 800	9,0	2 273 400	9,0	4 379 200	9,0
Indian/Asian	614 700	2,6	628 800	2,5	1 243 500	2,6
White	2 196 300	9,4	2 302 900	9,1	4 499 200	9,2
Total	**23 444 800**	**100,0**	**25 242 200**	**100,0**	**48 687 000**	**100,0**

Approximately 5.2 million (11%) of the population was HIV positive according to the 2006 mid-year population estimates (Statistics South Africa, 2006a:1) but it increased by 500 000 in 2007 to 5.3 million (Statistics South Africa, 2007:1). In 2008 (Statistics South Africa, 2008:3) approximately 5.35 million people in South Africa is HIV positive. The mother-to-child transmission (MTCT) rate without HIV treatment is estimated at 32%, however where a PMTCT programme is followed the chance for transmission is only 11% (Statistics South Africa, 2007:2). Such a programme includes the use of nevirapine treatment in pregnant HIV-positive woman as well as the promotion of alternative infant feeding.

Table 2 shows the estimated annual population growth rate from 2001 to 2008 (Statistics South Africa, 2008:7). As indicated in the table, the overall growth rate decreased over time. A possible explanation to this decrease in growth rate is the decline in fertility in woman from an average of 2.89 children per woman in 2001 to 2.69 children per woman in 2007 (Statistics South Africa, 2007:2).

TABLE 2: Estimated annual population growth rates, 2001 to 2008 (Statistics South Africa, 2008:7)

	2001-2002	2002-2003	2003-2004	2004-2005	2005-2006	2006-2007	2007-2008
Male	1,50	1,40	1,30	1,23	1,13	1.02	0,92
Female	1,41	1,31	1,20	1,11	0,99	0,86	0,74
Total	**1,45**	**1,35**	**1,25**	**1,16**	**1,06**	**0,94**	**0,82**

Figure 4 shows a map of South Africa with the 9 provinces of the country (South Africa, 2007b).

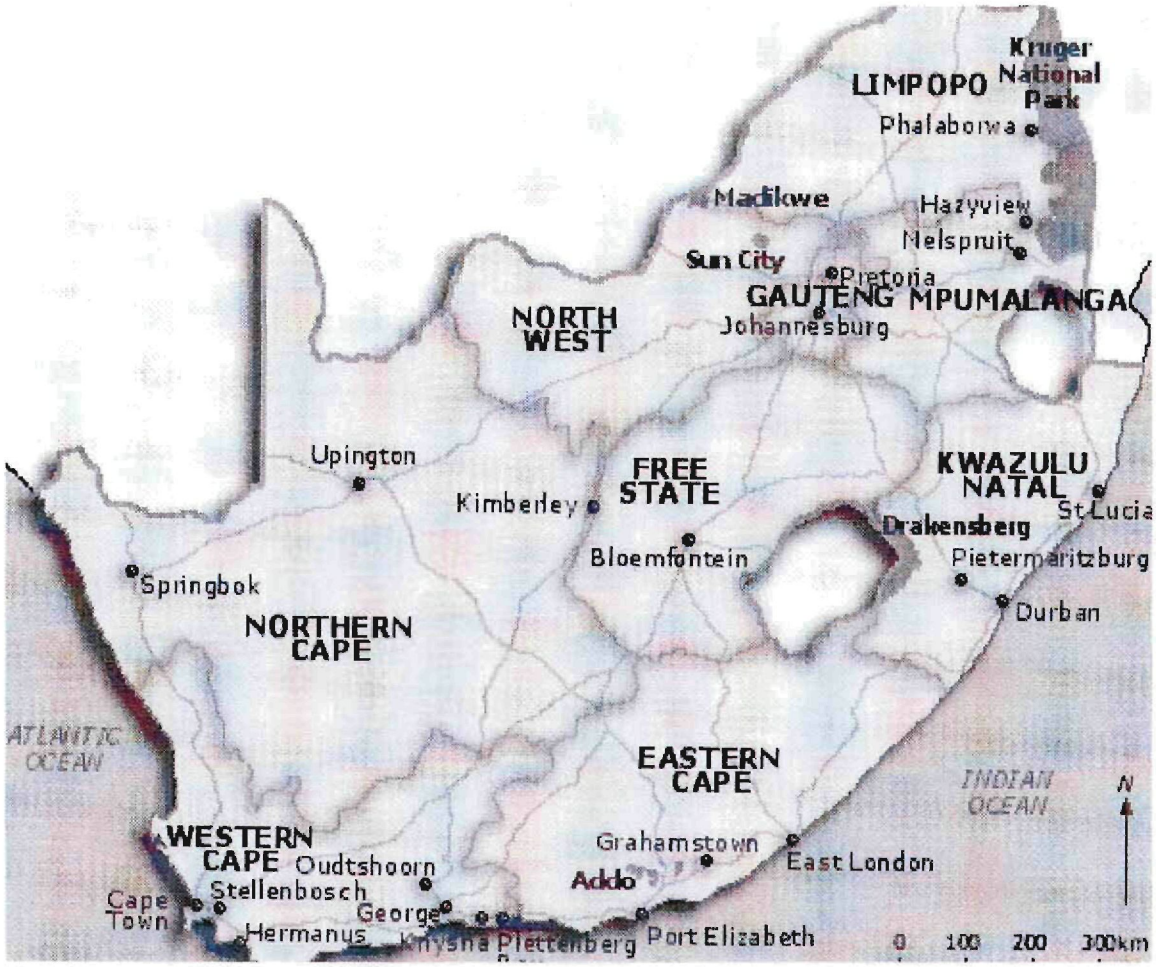


FIGURE 4: A map of South Africa (South Africa, 2007b)

2.1.2 Provincial level

"*In South Africa, there are nine provinces, each with their own provincial legislatures*" (Dennill *et al*, 2000:45). According to Dennill *et al.* (2000:45) each provincial authority is responsible for health related aspects of that province, including emergency care, hospital care, environmental safety and a suitable referral system. They are also responsible for the support, monitoring and evaluation of services given at district level. The roles and responsibilities of Provincial Government are described in the White Paper on Local Government (South Africa, 1998) and include the following:

- Develop a vision and framework for integrated economic, social and community development;

- Ensure that municipalities form a viable, integrated development framework, which give priority to the basic needs of the community;
- Establish forums and processes so that local governments can fully participate in decision-making processes;
- Reformulate and update the Provincial Ordinances according to the Constitution and the vision of a new developmental local government;
- Promote the development of local government capacity which include the training of staff and councillors;
- Extend the role of provincial government in the monitoring of municipalities' finances as well as the budget allocation for local government; and
- Intervene with municipalities to ensure the financial sustainability of a municipality to promote accountability and public trust in local government (South Africa, 1998).

The provincial Director of Health Services is the head of the department and elected by the Cabinet who consists of the premier and 9 members of the executive committee (Robb *et al.*, 1997:46). The function of this committee is to identify needs within the province and allocate resources accordingly (Dennill *et al.*, 2000:45). The day-to-day running of services is controlled by the management committee, which comprises the provincial Director of Health Services and the directors and heads of provincial departments. The provincial Health Advisory Authority is established to provide the necessary support to the different district health authorities in its province (African National Congress, 2008:23). The aim of the PHA (provincial health authority) is to encourage high-quality, efficient services through decentralised management and local accountability in its province. The responsibilities of the PHA include:

- Providing secondary and tertiary referral hospitals;
- Regulating private hospitals;
- Running training facilities and programmes;
- Evaluating and planning services; and
- Any other support the districts request (African National Congress, 2008:23).

The vision of the North-West Department of Health is *promoting healthy living for all* (North-West Department of Health, 2008b). Figure 5 shows the organigram of the provincial health systems.

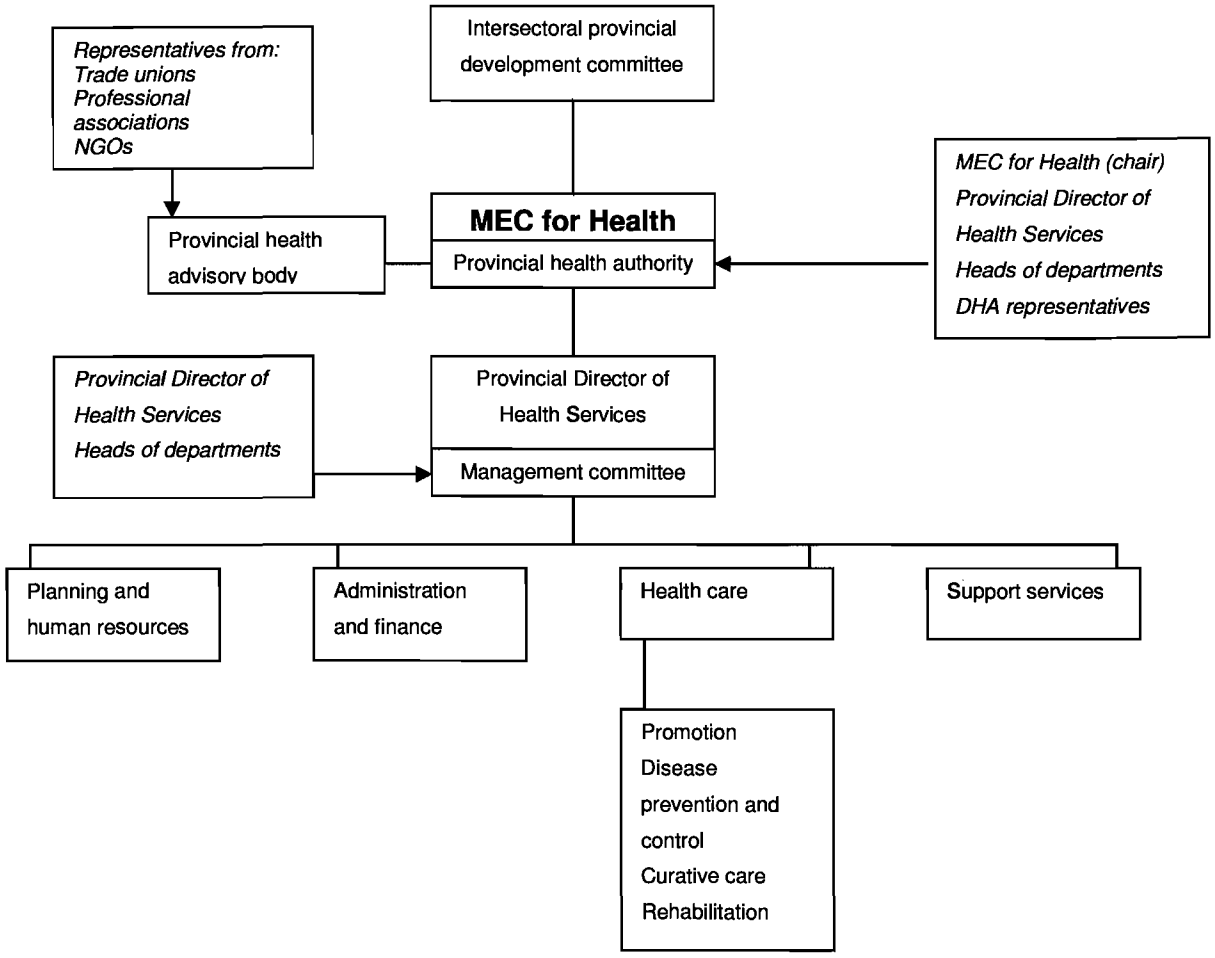


FIGURE 5: Organigram of the National Health System at provincial level (Dennill *et al*, 2000:47)

2.1.2.1 Demographic details

North-West Province is situated centrally and to the north of South Africa (North-West Department of Health, 2005:9). The province's neighbouring provinces are Limpopo to the north-east, Gauteng to the east, Free State to the south and Northern Cape to the south-west. North of North-West Province is Botswana which is the neighbouring country of South Africa (North-West Department of Health, 2005:9).

According to the 2007 provincial population estimates, KwaZulu Natal was the largest province in South Africa comprising 20.9% of the country's population, followed by Gauteng (20.2%) and the Eastern Cape (14.4%), in the year 2007, while the Northern Cape is the smallest province with a population of 2.3%. In the 2008 mid-year population estimates (Statistics South Africa, 2008:3) Gauteng has the largest population with approximately 21.5% followed by KwaZulu Natal with 20.8%. Table 3 illustrates the percentage distribution of the projected provincial share of the total population, 2001-2007 (Statistic South Africa, 2007:7).

TABLE 3: Provincial distribution of the population of South Africa (Statistics South Africa, 2007:7)

Province	2001	2002	2003	2004	2005	2006	2007	2008
Eastern Cape	14,4	14,03	14,1	14,0	13,8	13,7	13,5	13,5
Free State	6,2	6,1	6,1	6,0	6,0	6,0	5,9	5,9
Gauteng	20,0	20,2	20,5	20,7	20,9	21,2	21,3	21,5
Kwazulu-Natal	21,3	21,2	21,1	21,0	21,9	20,9	20,8	20,8
Limpopo	11,1	11,0	11,0	10,9	10,9	10,8	10,8	10,8
Mpumalanga	7,4	7,4	7,4	7,4	7,4	7,4	7,4	7,4
Northern Cape	2,4	2,4	2,4	2,4	2,4	2,3	2,3	2,3
North-West	7,1	7,1	7,1	7,1	7,1	7,1	7,1	7,0
Western Cape	10,1	10,2	10,3	10,5	10,6	10,7	10,7	10,8
Total	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,0**	**100,00**	**100,0**

Of the 48.7 million people who live in South Africa, approximately 3.4 million people (7,0 %) are living in the North-West Province according to Statistics South Africa (2008:13) released on 31 July 2008. Of the 3.4 million people living in the North-West Province, 1.668 million are males and 1.756 million are females (Statistic South Africa, 2008:13).

2.1.2.2 Health care facilities in North-West Province

The North-West Department of Health has the following health facilities under its jurisdiction:

- 2 provincial (level 2) hospital complexes that also provide specialist psychiatric services
- 1 provincial hospital
- 20 district hospitals

- 7 community hospitals
- 328 fixed clinics and health centres including local government clinics
- 77 mobile clinics (North-West Department of Health, 2005:13).

Figure 6 shows a map of the North-West Province (South Africa, 2007c).

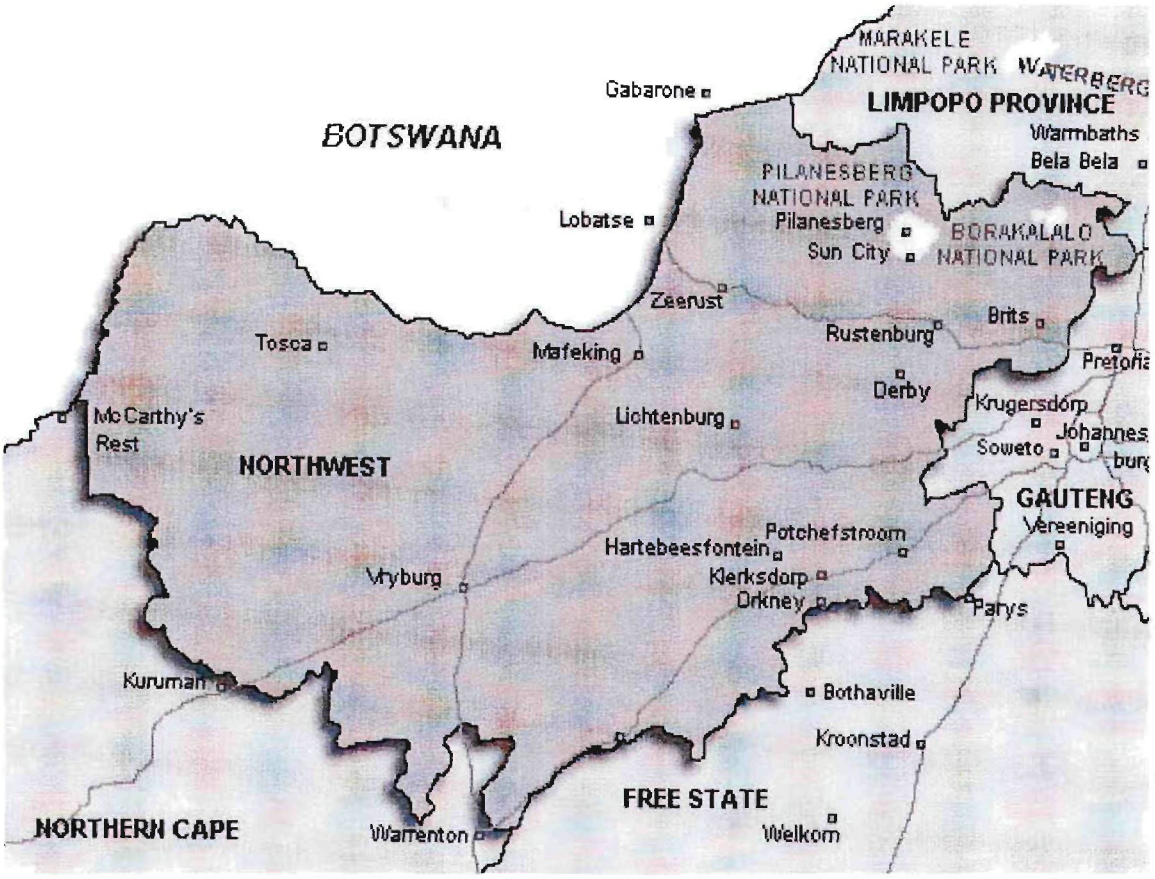


FIGURE 6: A map of North-West Province (South Africa, 2007c)

2.1.3 District level

In 1997 the White Paper on the Transformation of the Health System was adopted. A District Health System (DHS) was established because many countries found that the national and provincial governments were too far removed from the community to fulfil their health needs (Department of Health, 1997). The White Paper on Local Government sets the vision to develop local government which is committed to work with local citizens, groups and

communities to improve the quality of lives and to meet the social, material and economic needs for communities in a holistic way (South Africa, 1998). The White Paper on Local Government (South Africa, 1998:5) states that the DHS is important in the process to make health more accessible, available and affordable although the following issues still need to be resolved, namely:

- linking municipal health services with primary health care and the financial implication of this on local government;
- aligning boundaries and problems to enable the effective delivery of municipal and DHA services; and
- handling employment conditions for local government and provincial health staff (South Africa, 1998:5).

The Department of Health has created municipalities to form District Health Authorities (DHA) who perform health services at district level (South Africa, 1998:5; African National Congress, 2008:23). Each province is divided into districts according to functional and geographical determinants. A district consists of two or three local authorities and is accountable for all community health services, both public and private, in that specific district. It depends on the population and vary from 200 000 to 750 000 people in a district. The responsibility of the DHA is:

- ensuring access to and the delivery of health services;
- providing all primary health care services in its district, including independent general practitioners and community hospitals; and
- control over its budget within the national and provincial guidelines (African National Congress, 2008:23).

The managing structure of Ngaka Modiri Molema district (formally known as Central district) consists of a Chief Director: District Health Services; Director: Primary Health Care; Chief Executive Officer: Hospital Services and District Family Physician (Meyer, 2008a). Figure 7 illustrates the structure of Ngaka Modiri Molema district.

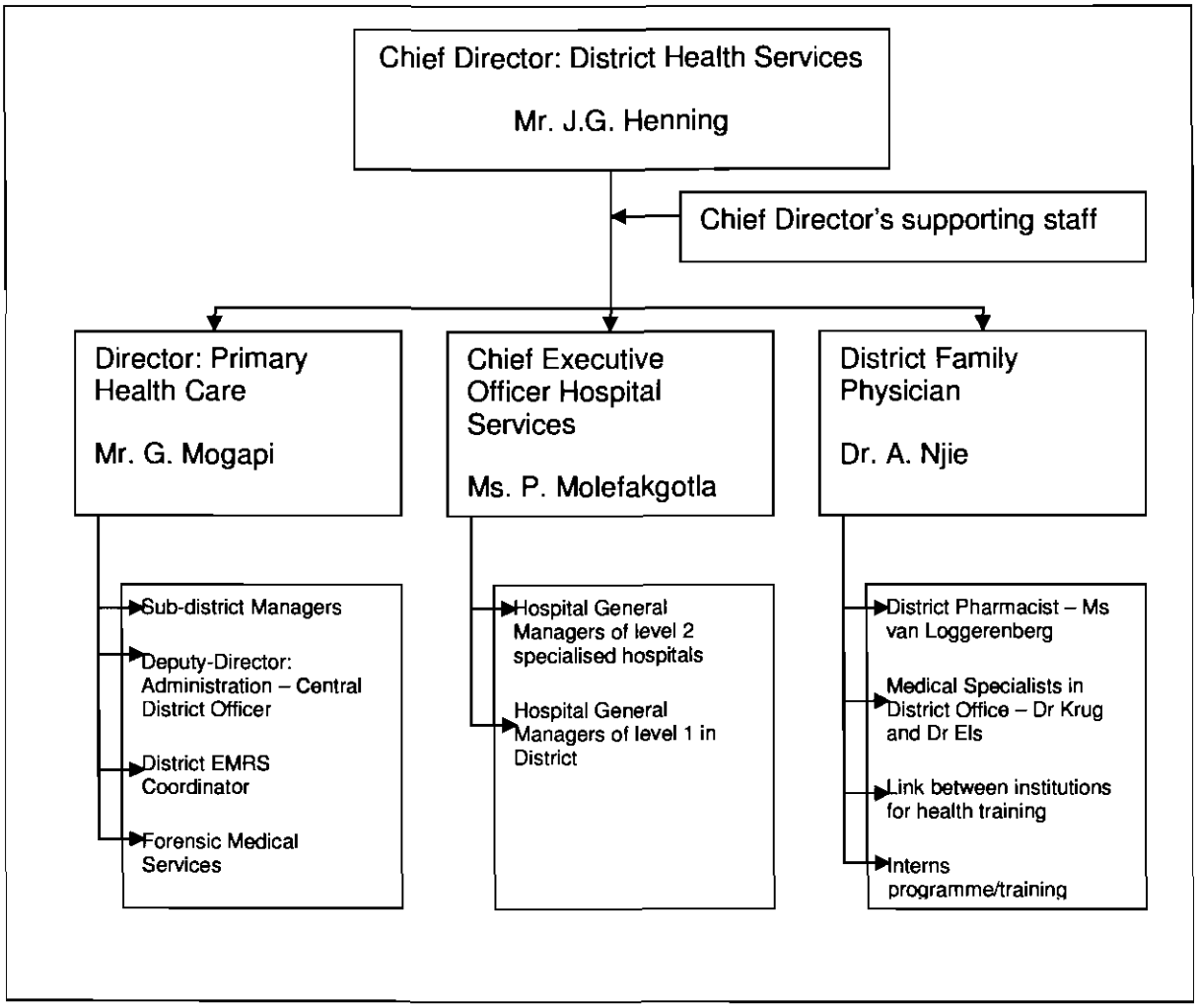


FIGURE 7: Structure of Ngaka Modiri Molema district (formally known as Central district) (Meyer, 2008)

Every DHA must appoint a District Development Committee, led by a District Health Manager, with the aim to evaluate, plan and manage the health services in the district as well as the district health budget (African National Congress, 2008:23). This committee must encourage the training, use and support of community health workers as cost-effective additional or alternative personnel, state the reconstruction and development programme (African National Congress, 2008:23).

2.1.3.1 Demographic details

The North-West Province consists of four regions, namely Bojanala Platinum district, Bophirima district, Ngaka Modiri Molema district (formally known as Central district) and Dr. Kenneth

Kaunda district (formally known as Southern district). The Ngaka Modiri Molema district is the extreme north-western district of the province. Its capital is Mafikeng, which is also the capital of the province. The Ngaka Modiri Molema district contains 5 local municipalities (North-West Department of Health, 2008a):

- Mafikeng with a population of 259 478 (34.01%)
- Ditsobotla with a population of 147 596 (19.34%)
- Zeerust with a population of 137 439 (18.01%)
- Tswing with a population of 114 150 (14.96%), and
- Setla-Kgobi with a population of 104 322 (13.67%; North-West Department of Health, 2008a).

The above population figures are based on the estimates in the 2001 census. Of this population 5% is urban and 95% rural according to the webpage of the North-West Department of Health (North-West Department of Health, 2008a).

This district covers a total of 116 320 km^2 and accommodates approximately 92 villages in the district (North-West Department of Health, 2008a).

2.1.3.2 Health care facilities in the Ngaka Modiri Molema district

In the Ngaka Modiri Molema district of the North-West Province, there are several primary health care facilities:

- 5 hospitals,
- 12 community health centres,
- 63 clinics, and
- 21 primary health care mobile clinics (North-West Department of Health, 2007c).

Figure 8 shows a map of the Ngaka Modiri Molema district (formally known as Central district) (North-West Department of Health, 2007c).

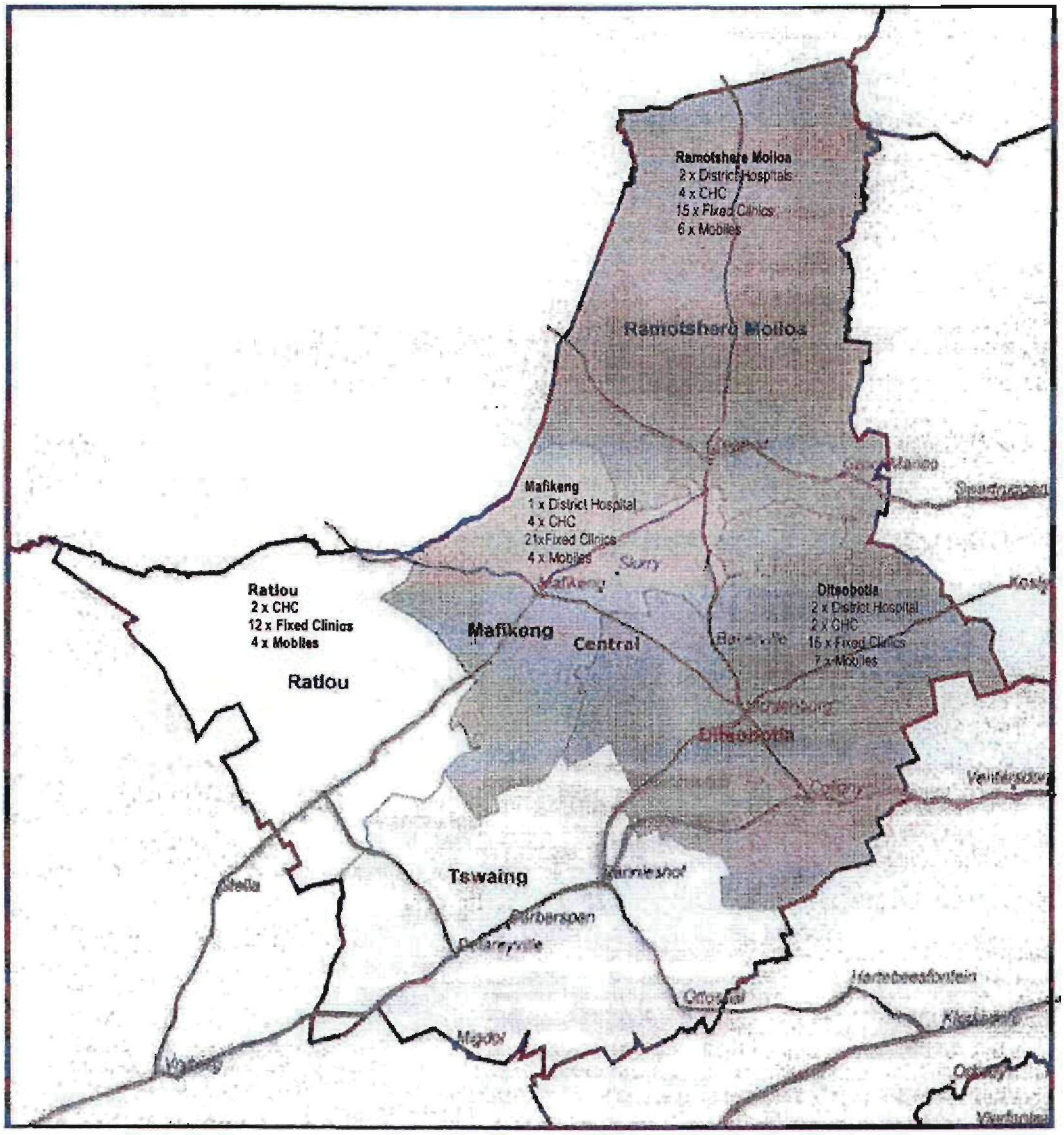


FIGURE 8: A map of Ngaka Modiri Molema district (formally known as Central district) (North-West Department of Health, 2007c)

2.1.4 Community level

Dennill *et al.* (2000:49) state that "*Each community living in a geographical area served by community health services will be encouraged to form an intersectoral community development committee who will advise and work in co-ordination with the community health committee on all development projects as well as the use of resources in the area*". Elected community members who will serve on a voluntary basis form the community health committee (Dennil *et al.*, 2000:49) include both employees and representatives from health services, non-government

organisations (NGO) and health practitioners who run all the community health centres and services in the community. Community (sub-district) health centres form the centre of the district health centres and provide preventive, promotive, curative and rehabilitative care to people in the community. Clinics will perform the same services, just less specialised. Figure 9 shows the community level health system (Dennill *et al.*, 2000:49).

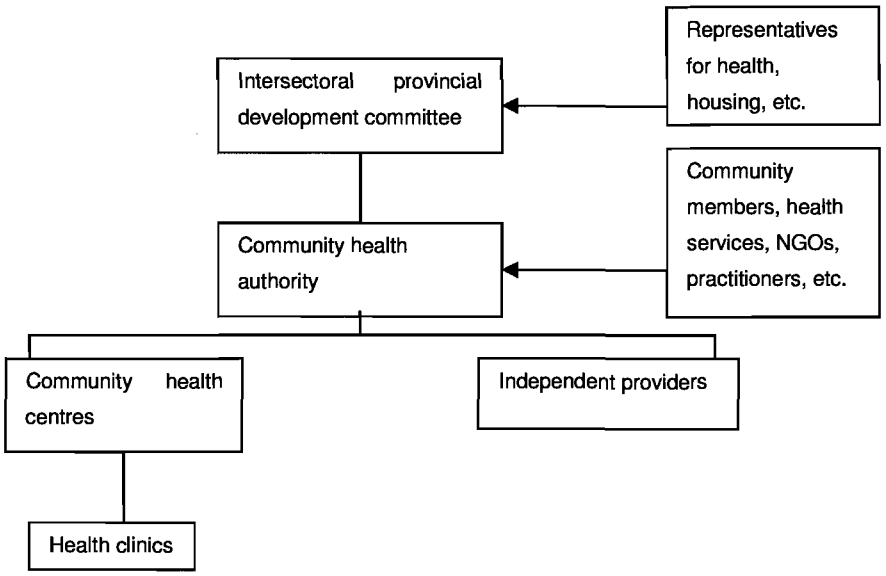


FIGURE 9: Community level health systems (Dennill *et al.*, 2000:49)

At Thusong Hospital in the Ditsobotla sub-district, the pharmacy management is indicated in the organigram in Figure 10 (Du Preez, 2008b).

2.1.4.1 Demographic details

One of the sub-districts of Ngaka Modiri Molema district is Ditsobotla sub-district which is situated on the south eastern part of the district (North-West Department of Health, 2007c). Ditsobotla sub-district comprises of Itsoseng, Lichtenburg, Coligny and Biesiesvlei.

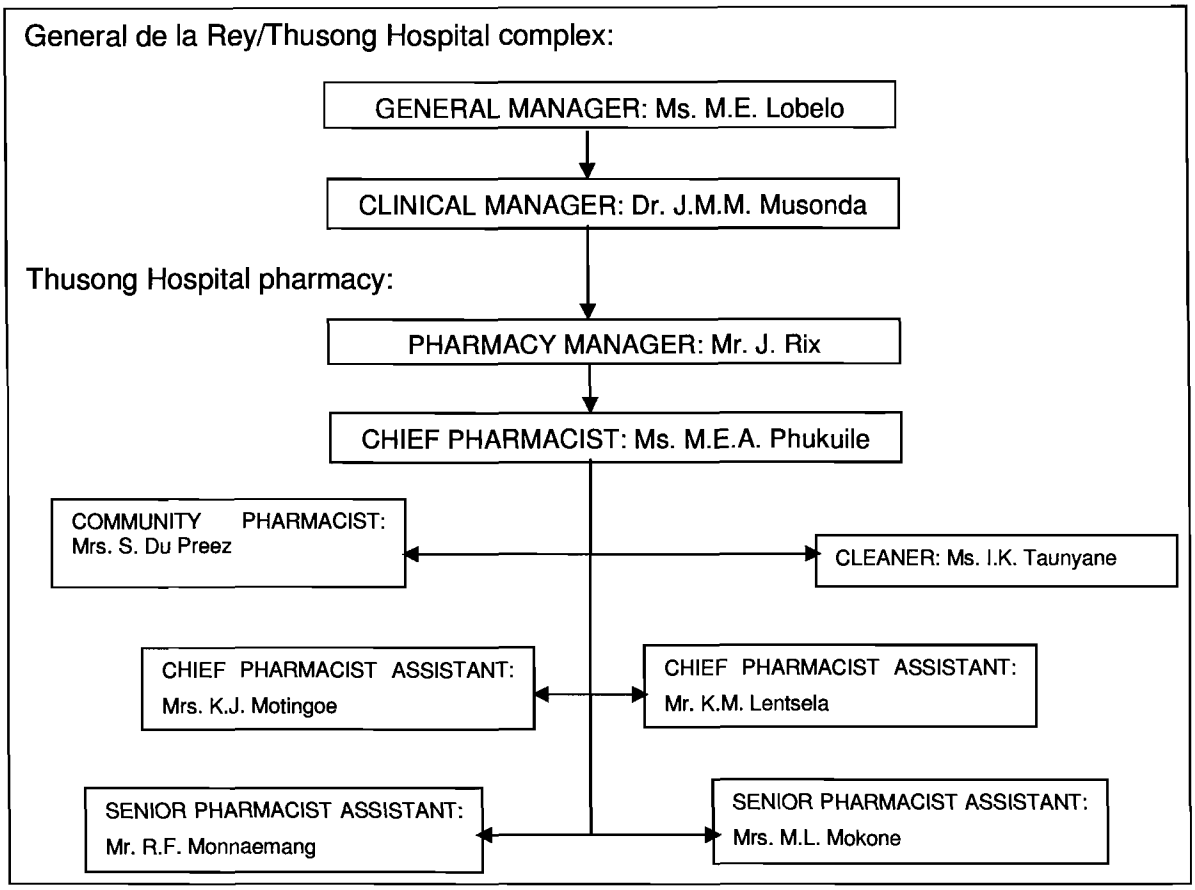


FIGURE 10: Organigram for the hospital pharmacy at Thusong Hospital (adapted and compiled from Du Preez, 2008b)

2.1.4.2 Health care facilities in Ditsobotla

In this sub-district there are a few primary health care facilities:

- 1 hospital complex (Thusong/General de la Rey),
- 15 clinics who differ from 8 hour, 12 hour and 24 hour clinics,
- 2 community health centres (Poly and Coligny), and
- 7 mobile clinics (North-West Department of Health, 2007c).

All the health care facilities in Ditsobotla provide primary health care which include the following programmes:

- Mental health,

- Nutrition,
- Tuberculosis and communicable diseases,
- Environmental health,
- HIV/AIDS and sexually transmitted diseases,
- Mother, child and woman's health,
- School health services,
- Geriatric, chronic and rehabilitation services including physiotherapy, occupational therapy, speech and hearing therapy and psychology,
- Dental services, and
- Level 1 hospital services (North-West Department of Health, 2007c).

Thusong community hospital is near Itsoseng in the Ditsobotla sub-district of North-West Province. This small hospital is approved for 300 beds with 175 active beds (North-West Department of Health, 2007c). Thusong Hospital offers i.e. surgical, orthopaedic, medical, paediatric, obstetrics, gynaecology, psychiatric care, comprehensive, care management and treatment of HIV and AIDS. There are also a well equipped operating theatre (24 h), radiology, pharmacy, laboratory, social ward, psychological and rehabilitation services (North-West Department of Health, 2007c). Figure 11 is a map of Ditsobotla local municipality and figure 12 is a picture of Thusong Hospital.

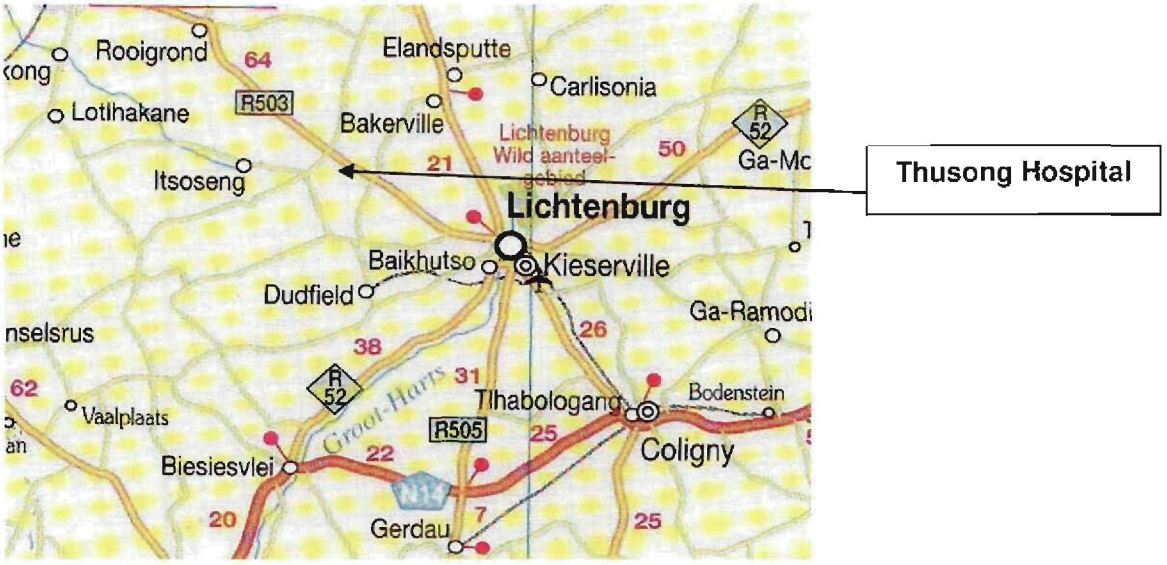


FIGURE 11: Map of Ditsobotla sub-district (Sunbird Publishing, 2000:17)

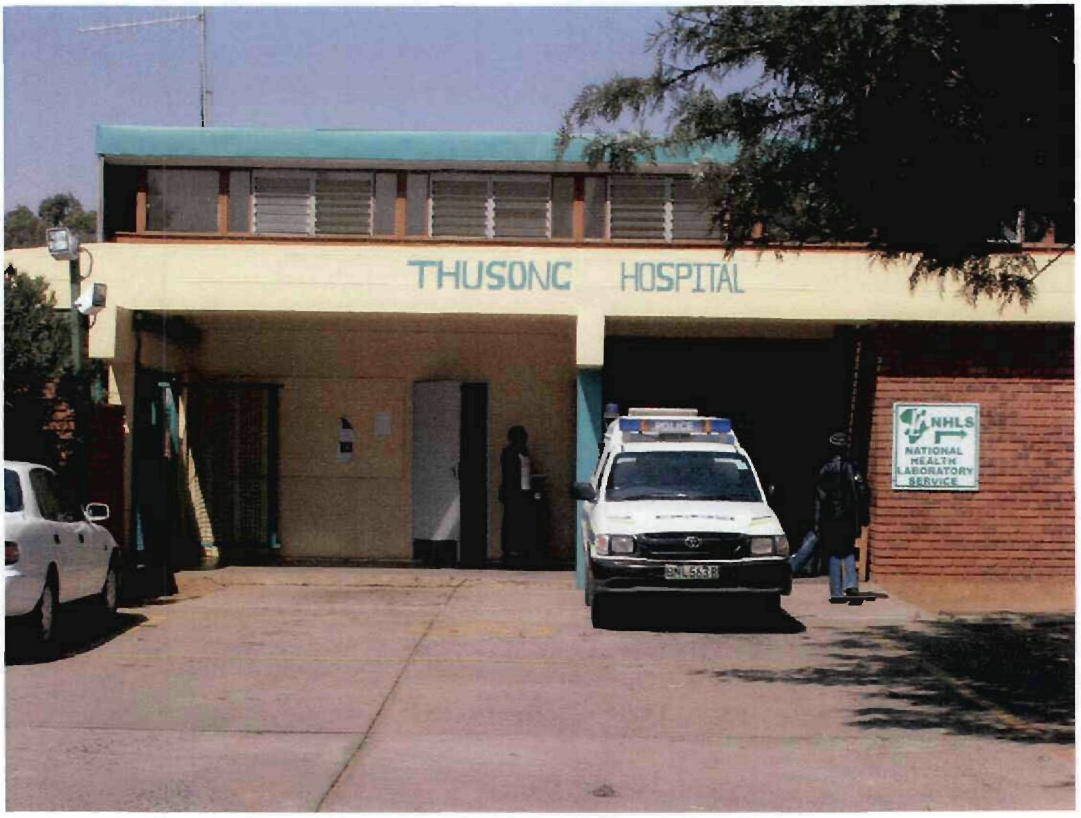


FIGURE 12: Thusong Hospital (Eksteen, 2008)

This section discussed the national, provincial, district and community levels of health care in South Africa according to demographic and health care facilities' details.

2.2 FACTORS AFFECTING HEALTH IN SOUTH AFRICA

We all want to believe that once you take medicines for a specific disease/disorder/condition, the medicine will cure the disease and we will return to a healthy status (De Haan, 2005:4). If only it was that simple! According to De Haan (2005:4) in her book, *The Health in Southern Africa*, the health status of an individual will be affected by where they live, the type of dwelling they live in, the circumstances in which they live, the food they can buy or have access to, and their position within the society. Claeson *et al.* (2002:203) state that the lack of financial resources to pay for health services, food, clean water, good sanitation and other key inputs to produce good health is a cause of ill health. Ill health, malnutrition and high fertility are three reasons why households end up in poverty because illness of the breadwinner can lead to loss of income which results in the household's poor ability to cope financially (Claeson *et al.*, 2002:203). Secondly, the health facilities serving them are often dilapidated, inaccessible, inadequately stocked with basic medicines and run by poorly trained staff. The poor are also disadvantaged due to the lack of knowledge about their health and how to prevent illness (Claeson *et al.*, 2002:203). In figure 13, the cycle of health and poverty is indicated using health and poverty linkages (Claeson *et al.*, 2002:203).

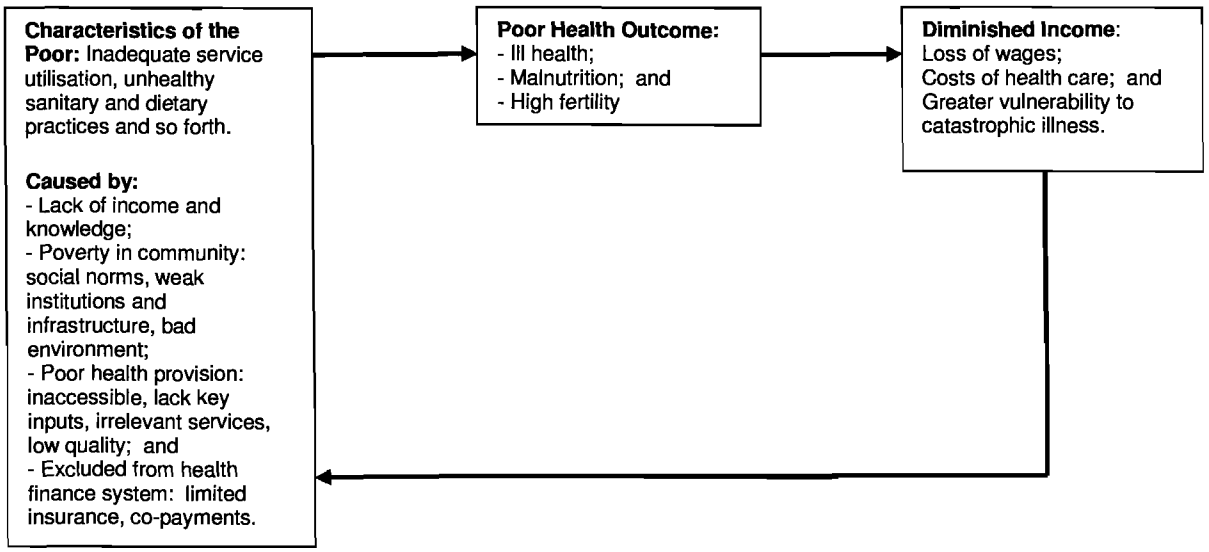


FIGURE 13: Health and poverty linkages (Claeson *et al.*, 2002:203)

According to the Constitution of South Africa (South Africa, 1996) which was approved by the constitutional court on 4 December 1996 and took effect on 4 February 2007, all individuals have fundamental human rights as specified in Chapter 2 of the Act. Specific health reference in the Constitution of South Africa declares that everyone has the right to:

- A healthy environment;
- Access to health-care services, including reproductive health care;
- Sufficient food and water;
- Social security, including, if they are unable to support themselves and their dependants, appropriate social assistance; and
- No one may be refused emergency medical treatment (South Africa, 1996).

According to the Constitution of South Africa, children have the right to basic nutrition, shelter, basic health-care services and social services. The constitution is the supreme law of the land and no other law or government action can over-rule the constitution (South Africa, 1996).

The most important factors affecting health can be divided into appropriate health service provision and environmental and psychosocial factors and are discussed in sections 2.2.1 and 2.2.2. Table 4 is an illustration of the factors affecting health care in South Africa (adopted and compiled from De Haan, 2005:5).

TABLE 4: Factors affecting health in South African (adopted and compiled form De Haan, 2005:5)

Factors affecting health care in South Africa	
3.1 Appropriate health service provision: 1. Political factors 2. Health legislation 3. Health policies 4. Inequity in health 5. Adequate health services and resources 6. Health information	3.2 Environmental and psychosocial factors: 1. Socio-economic factors 2. Cultural factors 3. Environmental factors 4. Educational factors 5. Social welfare

2.2.1 Appropriate health service provision

Appropriate health service provision consists of the following factors: political factors, health legislation, health policies, inequity in health, adequate health services and resources, and health information.

2.2.1.1 Political factors

"*Government determines legislation of laws to outline the way it wants to govern its people*" (De Haan, 2005:5). After the 1994 first democratic political elections in South Africa where the African National Congress (ANC) has won the elections for the first time, the ANC changed the current health service in South Africa by decentralizing health services in the country to form national, provincial, district and community levels to provide better and more effective health services to the citizens of South Africa (Dennill *et al.*, 2000:43; refer to section 2.2). According to this statement, Claeson *et al.* (2002:203) suggested that government can improve the health of poor people by:

- Reducing the price of health and other key goods and services for poor people;
- Improving poor people's access to and knowledge of health services;
- Improving the quality of services that poor people use; and
- Focus services more on the interventions that are related to the health profile of poor people.

This can be observed by the functioning of the national, provincial, district and local levels of the Health System in South Africa (refer to figure 1; De Haan, 2005:5).

2.2.1.2 Health legislation

"*Health legislation refers to laws that have a direct impact on health services and health care*", according to De Haan (2005:5). Regulations are developed to help with the implementation process of laws and legislation. Many acts, bills, notices, regulations and proclamations are established as legislation by the Department of Health to promote health care in South Africa (Department of Health, 2008c). Some publications or documents that play a role in health care are:

- "Batho Pele" – it means "putting people first" and is a policy document which provides a framework on how to treat patients in the public health care sector (Department of Public Services and Administration, 2008). This is an initiative to encourage communities to participate in the planning of services in order to improve and optimise service delivery to all citizens especially those previously disadvantaged (Department of Health, 2008d). There are eight principles of Batho Pele which include: Consultation; Service standards; Access; Courtesy; Information; Openness and transparency; Redress and Value for money (Department of Health, 2008d).

- National Drug Policy – was developed following a recommendation of the National Drug Policy Committee, which was established by the Minister of Health, Dr Nkosazana Dlamini Zuma, in September 1994. The goal of the NDP is to *"ensure an adequate and reliable supply of safe, cost-effective drugs of acceptable quality to all citizens of South Africa and the rational use of drugs by prescribers, dispensers and consumers"*. The NDP also provides the framework for drugs, drug supply, drug usage, etc. in South Africa (Department of Health, 1996).

  The four national development objectives of the National Drug Policy include:

  - To improve the knowledge, efficiency and management skills of pharmaceutical personnel;
  - To reorientate medical, paramedical and pharmaceutical education toward the principles underlying the National Drug Policy;
  - To support the development of the local pharmaceutical industry and the local production of essential drugs; and
  - To promote the acquisition, documentation and sharing of knowledge and experience through the establishment of advisory groups in rational drug use, pharmacoeconomics and other areas of the pharmaceutical sector (Department of Health, 1996:4).

- HIV and AIDS policy and strategy – The National Consultative Conference on the Strategic Plan on HIV, AIDS and STI (2007-2011) (Department of Health, 2007b) was held on 14-15 March 2007 and aims to reverse the course of the epidemic over the next five years. AIDS

is a world wide disease, especially in Africa. A policy on AIDS and HIV is very important due to the large part of the population (11%) suffering from AIDS and HIV (Statistics South Africa, 2006a:1). The Department of Health also has norms and standards for health clinics on HIV/AIDS (Department of Health, 2008d). This document includes the provision of services for the identification of cases, testing with pre- and post-test counselling, the treatment of secondary infections, referral, education about disease and promotion of precautions (Department of Health, 2008d);

- The Patient's Rights Charter – this document contains the twelfth rights of the patient as well as the health care professional and the ten responsibilities of the patient (Department of Health, 2008d). The purpose of the Patient's Rights Charter is to improve the quality of care, raise awareness of rights and responsibilities, raise expectations and empowerment of users, change attitudes by strengthening the relationship between providers and users, improve the use of services and develop a mechanism for enforcing and measuring the quality of health services (Department of Health, 2008d).

- Other legislation available on the National Department of Health website include:

  - Pharmacy Amendment Act (No. 1 of 2000),

  - Medicines and Related Substances Act (Amendment Act No. 59 of 2002),

  - The Traditional Practitioners Bill (No. B66 of 2003),

  - Traditional Health Practitioners Act (No. 35 of 2004), and

  - Regulations relating to a transparent pricing system for medicines and scheduled substances made in terms of Section 22g of the Medicines and Related Substances Act, 1965 (Act No. 101 of 1965) (Department of Health, 2008c).

2.2.1.3 Health policies

Policy can be defined as '*a set of ideas or a plan of what to do in particular situations that has been agreed officially by a group of people, a business organisation, a government or a political party*', according to the Cambridge Advanced Learner's Dictionary (CALD, 2008). Health policies determine the structure of the health sector and how it will operate as well as the

measure of outcomes to determine how successful a policy is (De Haan, 2005:5). Some of the recent policy documents are:

- A policy on quality in health care for South Africa (2008)
- Policy and guidelines for the implementation of the PMTCT programme (2008);
- Strategic priorities for the National Health System 2004-2009 (2004);
- Policy guidelines for Youth and Adolescent health (2001) and
- The national infection prevention and control policy & strategy (April 2007) (Department of Health, 2008e).

Although reliable and plan-of-action operations were in place at that time, unexpected policy changes in the public health sector can lead to lethal and costly repercussions, state the World Health Organization (2007c:20) in the World health report. In this report, the case in August 2003 where claims where made that the oral polio vaccine (OPV) was unsafe and could lead to the sterilisation of young children in northern Nigeria, the governments suspended the oral polio vaccine. This automatically led to the reduction in polio immunisation coverage in children. The World Health Organization (2007c:20) documented that this government decision resulted in a large breakout of poliomyelitis in northern Nigeria as well as areas that were previously polio-free. At the end of the day, thousands of children in Nigeria were paralysed (World Health Organization, 2007c:20). In 2004, a normal immunisation schedule was resumed with the collaborative effort between state and federal authorities, traditional and religious leaders, the African Union and the Organisation of the Islamic conference.

This was a result of an unexpected policy change in a public health system.

2.2.1.4 Inequity in health

There is inequity in health care in South Africa between the rural and urban areas. In the rural areas the morbidity and mortality rates are higher than in big cities. According to De Haan (2005:5), World Health Organization (2007a & 2007b) and Claeson *et al,* (2002:203) it is due to the following reasons:

- In rural areas the hygiene and sanitation is poor: since there is not always access to safe water, this easily leads to parasitic infections. According to the World Health Organization

(2007a) the difference between urban and rural populations with sustainable access to improved drinking water sources is 99% for urban and 73% for rural in 2004. According to the World Health Statistics (World Health Organization, 2008b:72) access to drinking water sources increased from 98% to 100% in urban areas and in rural areas form 62% to 82%. The total access to drinking water sources increased form 81% to 93% in South Africa. In the North-West Province 60.5% of households had access to piped water in the dwelling or on site in 2005, according to Statistics South Africa (2006b:xxviii). The World Health Organization (2007a) also indicates that populations with sustainable access to improved sanitation in rural areas are 46% compared to the 79% in urban areas for 2004. In the World Health Statistics (World Health Organization, 2008b:72) it is reported that access to sanitation improved from 64% to 66% in urban areas and form 45% to 49% in rural areas. The general household survey (Statistics South Africa, 2006b:xxvi) state that 9.9% of the households in North-West Province in 2005, is using a bucket toilet or no toilet facility at all. There is more poverty in rural areas because of less education and work opportunities, far from work and transport difficulties, thus diseases like malnutrition are common (De Haan, 2005:5).

According to the General Household Survey conducted in 2005 (Statistics South Africa, 2006b:viii), 31 053 000 citizens of South Africa were not attending any form of educational institution. At that stage it was ± 66% of the population. The most common reason for people aged between 7 and 24 years is lack of money for fees (Statistics South Africa, 2006b:xiv).

- The communities in which poor people live have weak institutions and have social norms that are not in line with good and healthy behaviour (Claeson *et al.*, 2002:203). In rural areas there are much more diseases carried by animals and insects, like malaria and yellow fever, than in cities (De Haan, 2005:5).

- There are limited medical services in rural areas because the second largest reason why ill patients do not consult a health worker is due to the fact that the health facility is too far (7.6% in 2004) (Statistics South Africa, 2006b: xvii).

Deprivation, according to the Cambridge Advance Learner's Dictionary (CALD), means "*when you do not have things or conditions that are usually considered necessary for a pleasant life such as enough money, food or good living conditions*" (CALD, 2008). In the District Health

Barometer report of 2006/2007 of the Health Systems Trust, inequity in the health sector of South Africa is judged according to deprivation (Cosser, 2007:1). According to this barometer, South Africa is categorised as an upper middle-income country, but still more than half of the population lives in poverty. Cosser (2007:4), Statistics South Africa (2006b) and the World Health Organization (2007b & 2007c) stated some of the reasons why there is a gap between the most and the least deprived districts:

- In 2005 only 14% of the South African population was covered by a medical aid scheme (Statistics South Africa, 2006b:xv) of which 64.2% were white people and only 7.1% black Africans.

- The main reason why ill patients do not consult a health worker is because it is too expensive (19.2% in 2004) (Statistics South Africa, 2006b:xvii). The average primary health care expenditure in South Africa per person without a medical aid in 2006 was R256.00 per annum. In the North-West Province, the total non-hospital primary health care expenditure was R798 million and the local government expenditure was R35 million. This budget must serve 2.7 million people. This gives you a per capita expenditure of R303 per person.

  The Ngaka Modiri Molema district (formally known as Central district) has a non-hospital primary health care expenditure of R229 million of which the local government's expenditure is R2.9 million. The per capita expenditure for the 705 676 people living in central district, is R330.00 per person (Barron, 2007:9). According to Barron (2007:18) the average proportion of a total district health expenditure in South Africa in 2006/2007 was 43.6%. In Ngaka Modiri Molema district (formally known as Central district) 40% of the district health services expenditure is on district hospitals.

- The average utilisation of a primary health care facility in 2006/2007 was 2.2 visits per person (Cosser, 2007:5);

- Immunisation is the most important and cost-effective way of preventing diseases (Department of Health, 2003:160). Immunisation was first discovered when an English physician inoculated an eight-year-old farm boy with cowpox virus and, after observing the reaction, reinoculated him with smallpox virus. He discovered that the boy did not develop smallpox, a deadly disease. This was the discovery of immunisation where inoculation with cowpox could protect against smallpox (World Health Organization, 2007c:5). The average immunisation coverage for 2006 was 80% for the most deprived areas where the average

for the least deprived areas reached 97% in 2006/2007. According to Cosser (2007:5) it seems as if more advantaged areas make more use of immunisation and therefore they stay the least deprived areas. According to the World Health Statistics (World Health Organization, 2008b:62) the immunisation coverage among 1-year olds increased form 79% to 85% for MCV, 72% to 99% for 3 DTP3 (3 doses of diphtheria-tetanus toxoid-pertussis vaccine), 88% to 99% for HepB3 (3 doses of hepatitis B vaccine) and 88% to 99% for Hib3 (3 doses of *Haemophilus influenza* type B vaccine) in 2006;

- The proportion of antenatal patients tested for HIV during 2006/2007, was averaged at 68% (Cosser, 2007:5) ;

- The TB smear conversion rate differs between the least deprived area (68%) and the most deprived area (58%) with an average of 55.8 % for 2006/2007. This measures the efficiency of the initial treatment to stop the transmission of TB. The TB cure rate measures the proportion of new TB cases and was estimated at 61% for least deprived areas and 71% for most deprived areas (Cosser, 2007:5);

- Death caused by diarrhoea in children under 5 years due to lack of access to water and hygiene, was 207 out of 1000 children in most deprived areas in 2006/2007 and only 96 out of 1000 children in least deprived areas due to better hygiene and sanitation (Cosser, 2007:6). The World Health Organization (2007b) states that in South Africa the number of deaths among children under five years of age due to diarrhoeal diseases was 0.8% in 2000. Under deaths for the same age group are neonatal causes (35.1%), HIV/AIDS (57.1%), pneumonia (0.9%) and injuries (5.0%) in the year 2000.

- The average lack of weight gain in children under 5 in South Africa for 2006/2007 was estimated at 1.3 % (Cosser, 2007:6). In 1999, the World Health Organization (2007b) stated that children under five years of age underweight for age were 9.6%. This is a decrease of 8.3% over 8 years.

- The delivery rate measures whether pregnant woman are able to get access to a primary health care facility to give birth. In the least deprived areas 86% of all pregnant women gave birth at a primary health care facility in comparison with the most deprived areas where only 70% of pregnant woman have access to primary health care facilities. The average for stillbirths in South Africa is 24.0 out of 1000 babies. Perinatal mortality rate indicates the number of deaths in babies who were live born. The least deprived areas had an average of

26 deaths per 1000 children and the most deprived areas averaged 34 deaths per 1000 children (Cosser, 2007:6).

As described above, inequity in health plays a big role in the factors affecting health care in South Africa.

2.2.1.5 Adequate health services and resources

"*Sufficient and appropriate health services must be available and staffed by adequate numbers of human resources, who are well trained and distributed, to serve both urban and rural communities*" states De Haan (2005:6). In most health care professions in South Africa, the government implements a mandatory community-service year after completing their internship programme of academic courses. That is a method to promote health service delivery in district and rural areas of the country as part of the process to give something back to the community (Department of Health, 2008g). In the chapter, Process indicators, of the district health barometer, Smith (2007:3) discussed the nurse clinical workload. The average number of patients a nurse can attend to in South Africa in a primary health care facility, is 26.9. In some districts the average is 13 which indicates that the scarce skill of the nurse is not optimally used, and in other districts the average is 51 which can lead to insignificant treatment (Smith, 2007:31). In comparison to the national statistics, the place where the study was conducted (Ngaka Modiri Molema district), the average is ± 25.

The current situation of pharmacists in South Africa is a lot different than the situation a few years ago (Hall, 2008:410). This is mainly due to factors which influence the profession to change. Five factors are identified that play a role in the changing environment of pharmacists:

- **Expansion of professional role** – the duties and professional responsibility of the pharmacist have changed from only supplying medication to a health care service provider. The new responsibilities include managing and controlling the patient's medicine usage and condition, provision of specialist services to patients with chronic diseases and prescribing.

- **Legislative changes** – after 1994, the new government made changes in the pharmacist profession which include the ownership and licensing of pharmacies, the dispensing of generic rather than patented drugs, new control regulations for scheduled drugs, new pricing regulations and dispensing doctors.

- **Community service** – In 2000 the Pharmacy Amendment Act No. 1 of 2000 introduced a one year paid community service for pharmacists in the public health sector as a method from the Department of Health to solve the shortages of health professionals in the public health sector.

- **Emigration of pharmacists** – better pay and professional prospects in other countries are the main reason why professionals apply for positions outside of South Africa.

- **Unpleasant factors** – legislation that focuses on ownership of pharmacies only by big companies and limited profit-making creates an unpleasant environment for community pharmacists (Hall, 2008:410).

Due to the shortage of skills as well as the poor service delivery in the public health sector, Hall (2008:414) claims that this will cause an increase in the demand for pharmacists as alternative healthcare providers. The approximately 5.2 million (11%) HIV positive patients in South Africa (Statistics South Africa, 2006a:1) who all need monthly ARV medication, require an additional demand for pharmacists. Hall (2008:414) reports that the government needs ± 661 additional pharmacists to participate in the providing of ARVs in the public health sector. Although there are 11 833 pharmacists currently registered with the South African Pharmacy Council (Moselakgomo, 2008a), it includes both full-time and part-time pharmacists. Of the 11 833 pharmacists, 7 983 work in the private health care sector and only 3 030 are employed in the public health sector (Moselakgomo, 2008a). Hall (2008:421) predicts that if the overall ratio in 2005 was 21 pharmacists per 100 000 of the population, an additional 423 pharmacists will be required by the year 2015. The current ratio, according to the statistics provided by the South African Pharmacy Council (Moselakgomo, 2008a) and Statistics South Africa (2007:1), is 1 pharmacist for every 4 048 citizens (11 833 pharmacists and a population of 47.9 million).

On 16 January 2004 the Minister of Health announced in the Government Gazette the first regulations to a transparent pricing system for medicines (Department of Health, 2004). This regulation implies that "*a pharmacist can charge a dispensing fee to the maximum of 24% of any medicine with an exit price of less than R100. Where the single exit price is R100 or more, the dispensing fee will not exceed R24*" (Department of Health, 2004). This announcement influences the supply of pharmacists dramatically. The number of registered second year students in the B.Pharm. course nationally (all eight pharmacy schools in the country) decreased from an average of 742 second year students in 2006 (first year students in 2005) to

564 second year students in 2007 (first year students in 2006) (Moselakgomo, 2008:b) as illustrated in table 5.

TABLE 5: Number of second year students registered with the South African Pharmacy Council (Moselakgomo, 2008b)

Registered second year students with council					
University	**2003**	**2004**	**2005**	**2006**	**2007**
Limpopo Turfloop	80	16	40	96	64
KwaZulu-Natal	33	80	59	65	62
Western Cape	126	108	128	123	76
Rhodes	75	82	107	111	92
North-West (Potchefstroom)	151	158	180	110	70
Witwatersrand	70	80	54	74	74
Nelson Mandela	105	91	101	125	70
Limpopo Medunsa	60	38	49	38	56
Total	**700**	**653**	**718**	**742**	**564**

Where all the different Schools of Pharmacy in the country produced a graduate output average of 463 pharmacist interns a year (Moselakgomo, 2008c), the decrease in pharmacy second year students of 2007 will reflect in the 2010 pharmacist intern statistics.

Hall (2008:425) projected the output for first degree B.Pharm. graduates from 2006 to 2015. In her calculations, she used 2005 as the base year for her projections. There are three scenarios which can happen in the next 10 years:

1) The average growth in first degrees for the period 1992 to 2004 was 3.4%. If the output keeps on growing at 3.4% (information based on data received form Moselakgomo, 2008a, 2008b, 2008c; Hall, 2008:426) per year until 2015, the annual graduate output will raise from 524 pharmacists in 2005 to 708 pharmacists in 2015. A total of 6 118 new pharmacists will be registered between 2005 and 2015.

TABLE 6: Scenario 1 with a growth of 3.4% (Hall, 2008:426)

2005 (base year)	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**Total**
507	524	542	560	579	599	619	640	662	685	708	6118
Percentage growth	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4		

2) The 23.1% (information based on data received from Moselakgomo, 2008a, 2008b, 2008c; Hall, 2008:426) national drop in enrolments of first year pharmacy students in 2005, reflects in the output of graduates in 2008. If it is assumed that the situation will be stable until 2015, a total of 4 402 pharmacists will be registered between 2005 and 2015.

TABLE 7: Scenario 2 with a growth of 0% after the 23.1% decrease (Hall, 2008:426)

2005 (base year)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
507	524	542	417	417	417	417	417	417	417	417	4402
Percentage growth	3.4	3.4	-23.1	0	0	0	0	0	0		

3) Scenario 3 reflects the decrease of 8.1% (information based on data received form Moselakgomo, 2008a, 2008b, 2008c; Hall, 2008:426) in enrolments for the period 2003 to 2005 which is reflected in 2007. If it is assumed that the decrease continues, the result will be a total of 3 692 new pharmacists registered between 2005 and 2015.

TABLE 8: Scenario 3 with a decrease of 8.1% (Hall, 2008:426)

2005 (base year)	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	Total
507	524	482	443	407	374	344	316	290	267	245	3692
Percentage growth	3.4	-8.1	-8.1	-8.1	-8.1	-8.1	-8.1	-8.1	-8.1		

According to Hall (2008:425) the projections of scenario 1 must succeed to meet the requirements for the projected supply of pharmacists.

2.2.1.6 Health information

Information on the health status of the people in a country must be collected *via* a census of estimation, to determine how effective health services are, and where problem areas still need improvement (De Haan, 2005:4). The Department of Health (Department of Health, 2008g) state that under-reporting is a main problem with the identification of health information. The more serious conditions are reported accurately but conditions that are clinically mild are less likely to be reported due to the fact that the patient does not seek medical attention in this case

and if they do, the health workers does not report these less severe conditions (Department of Health, 2008f).

2.2.2 Environmental and psychosocial factors

Environmental and psychosocial factors include the following factors: socio-economic, cultural, environment, educational and social welfare.

2.2.2.1 Socio-economic factors

"*It is well known that health is not high in the value system of the economically deprived section of the community and that they are not motivated to pursue those behavioural patterns that may lead to an improvement in their health status*", states De Haan (2005:6). Because of a large population in South Africa that lives in poverty, health is not an important expense every month. Money is rather used for food, shelter and transport. The North-West Province with around 3.1 million people is the 3rd poorest province in the country with a poverty rate of 56% where these households spend less than R800 per month (Moodley, 2007:187)

According to the District Health Barometer (Cosser, 2007:2) the Central district (as referred to in this document) of North-West Province is categorised in the socio-economic quintile 2 (section 2 out of 5 sections) which means that it is in the second worst-off quintile and has the second-worst socio-economical status. In quintile 1 the socio-economic status is the most deprived. Deprived means *"not having the things that are necessary for a pleasant life, such as enough money, food or good living conditions"* (CALD: 2008).

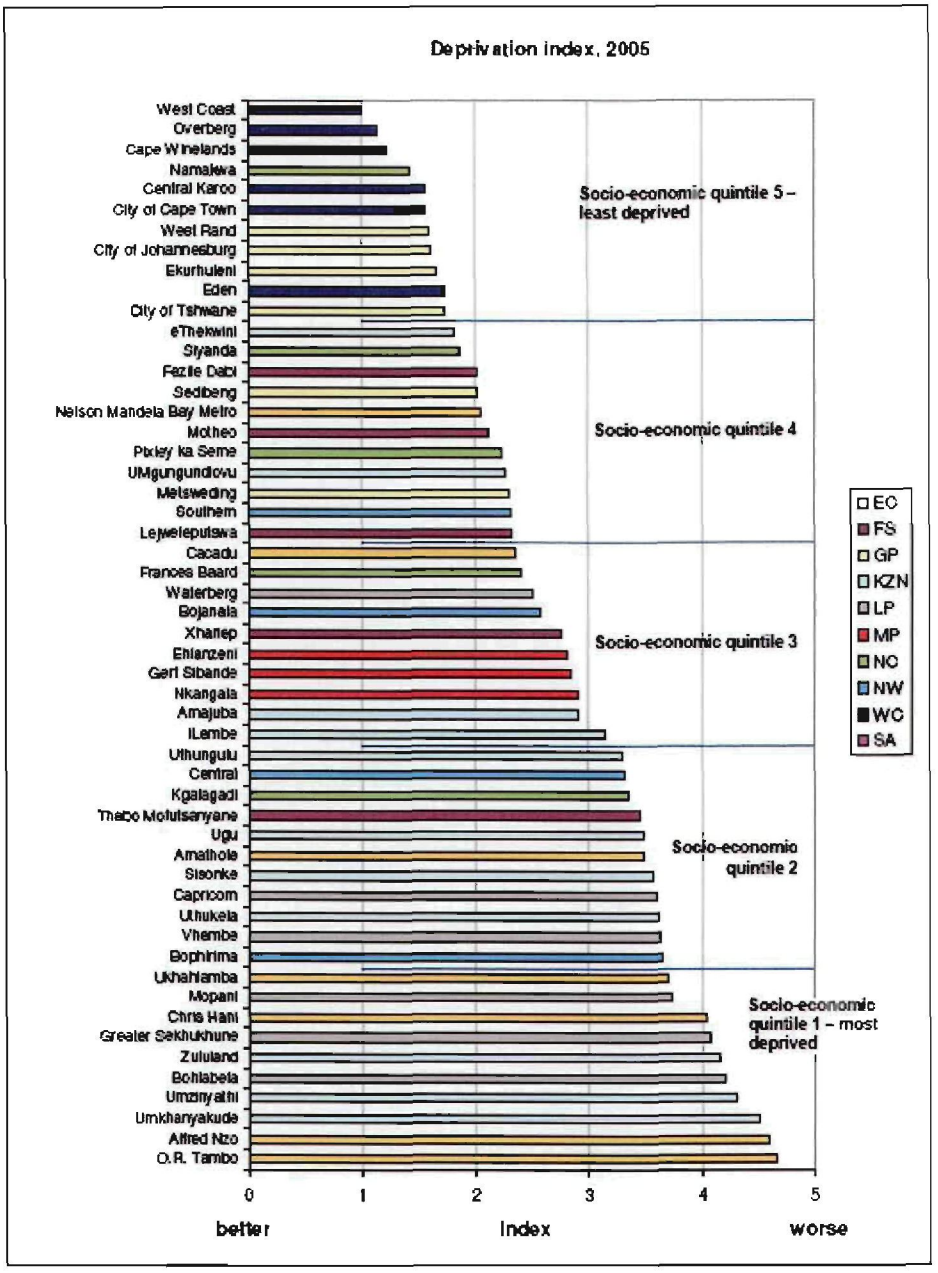


FIGURE 14: The deprivation index of the districts of South Africa (Cosser, 2007:2)

One of the reasons for the high deprivation index is access to water (Cosser, 2007:3). In the North-West Province 85.2 % of households have access to piped water (Moodley, 2007:187) and in Ngaka Modiri Molema district ± 75% has access. In 2001 the average of households who had access to piped water in South Africa was 85% (Cosser, 2007:3). According to Statistics South Africa (2006b:xxviii) 60.5% of households in North-West Province have access to piped water in the dwelling or on site in 2005 (see figure 15).

2.2.2.2 Cultural factors

South Africa's eleven official languages is proof of our multi-cultural country. Culture is a way to believe, live, work and behave. Some cultural believes that may lead to diseases are:

- Osteomalacia occurs due to a deficiency of vitamin D. Muslim woman wear clothes that cover the whole body except the eye area. This means that the body is never exposed to sunlight which is necessary for the synthesis of vitamin D to prevent osteomalacia (Katzung *et al.*, 2002:369).

- Cancer is common in countries where there is a shortage of fibre in the diet. In Japan, where a large amount of polished rice is part of the Japanese diet, carcinoma of the colon is common (De Haan, 2005:5).

- Tetanus neonatorum is a tradition in some African cultures and occurs when the umbilical cord of the new born is covered with mud (De Haan, 2005:5).

2.2.2.3 Environmental factors

The environment is one factor which plays a big role in the health of the people living in a community. Lack of sanitation, contaminated water, inadequate facilities to remove sewage and sometimes the weather conditions are all reasons why diseases occur in these communities (De Haan, 2005:5). The theme of the 2007 World Health Report was "*A safer future – global public health security in the 21st century*". In this report the World Health Organization (2007c:4) states that there is a worldwide need to provide sanitation for both drinking water and hygiene. According to this report (World Health Organization, 2007c:4) there is currently 1.1 billion people who lack access to safe drinking water and 1.6 billion people lack access to proper sanitation. Due to the above mentioned fact, more than 4 500 children under the age of five years die every day form easily preventable diseases such as diarrhoea, and both children and adults suffer from poor health, diminished productivity and missed opportunities for education (World Health Organization, 2007c:4).

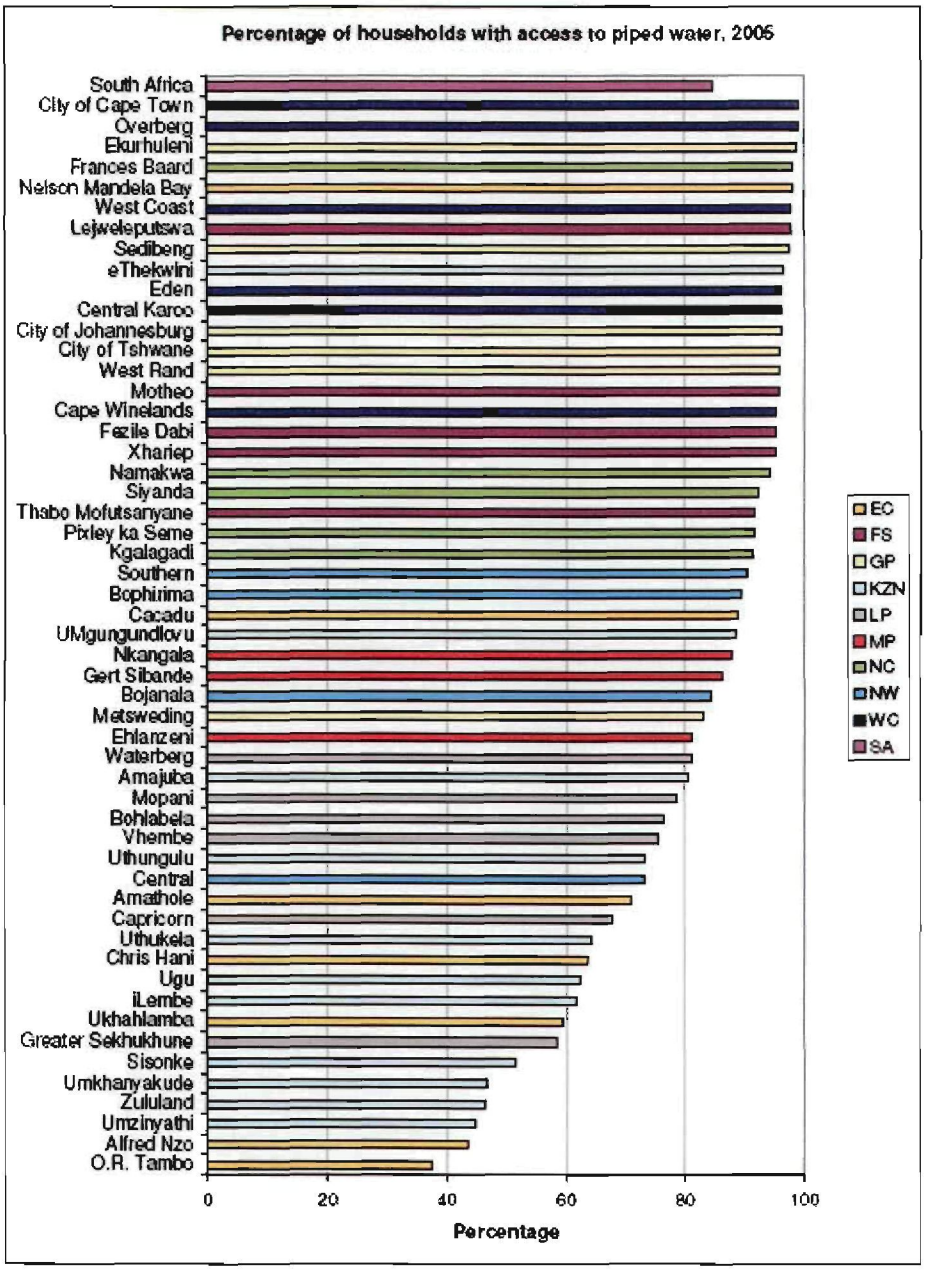


FIGURE 15: The percentage of households with piped water (Cosser, 2007:3)

Weather-related events also contribute to the outbreak of infectious diseases. The World Health Organization (2007c:25) states in the World Health Report that intensifying climatic conditions with a range of environmental, epidemiological and socioeconomic factors influence the population's exposure to infectious diseases. In December 1997, an above average high rainfall as well as warm weather lead to the breakout of Rift valley fever. These weather

conditions were ideal for the hatching of mosquito eggs and the virus was transmitted from animals to humans causing several diseases and death (World Health Organization, 2007c:25-26).

2.2.2.4 Educational factors

Due to a lack of knowledge, diseases spread easily in a community (De Haan, 2005:8). Patients are not informed about signs and symptoms of diseases and that's why diseases spread so easily in uneducated areas (De Haan, 2005:8). As stated previously, around 66% of the population of South Africa is not attending any educational institution because it is to expensive (Statistics South Africa, 2006b:viii).

2.2.2.5 Social welfare

Social workers are also part of the plan to assist patients in their struggle to a better life, e.g. developing a programme to help patients to find employment (De Haan, 2005:9).

Before concluding the section on factors affecting health care in South Africa, the World Health Report of 2007 (World Health Organization, 2007c:x) reports global public health threats in the 21st century which include:

- **Epidemic-prone diseases** – diseases like cholera, yellow fever and epidemic meningococcal diseases, acute respiratory syndrome, Avain influenza in humans, Ebola, Marburg haemorrhagic fever and Nipah virus pose threats to global public health security;
- **Food borne diseases** – include diseases due to microbial contamination, chemicals and toxins as well as trading of contaminated food between countries increase the spread of possible diseases such as Creutzfeldt-Jakob disease;
- **Accidental and deliberate outbreaks** – include toxic chemical accidents, radionuclear accidents and environmental disasters.

Early detection and rapid reporting of diseases can prevent potential cases and/or international spreads which help minimizing factors affecting health in South Africa. Figure 16 illustrates the importance of early detection and rapid reporting.

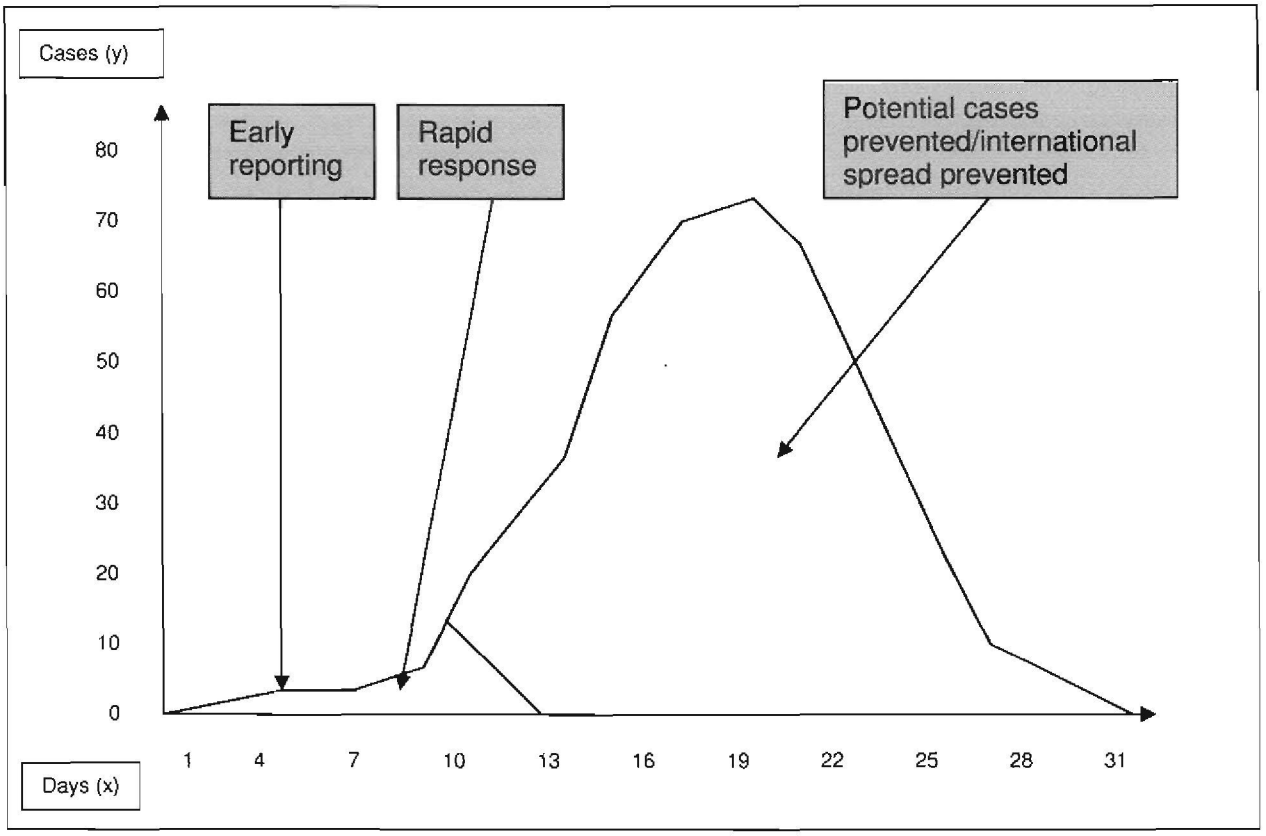


FIGURE 16: The influence of late reporting and response to global health treats (World Health Organization, 2007c:xii)

After one understands that there are factors affecting health care in South Africa, one can focus on another aspect of the health system, namely managing drug supply in the public sector of South Africa.

2.3 THE DRUG SUPPLY MANAGEMENT CYCLE

The drug supply management cycle consists of three interrelated factors:

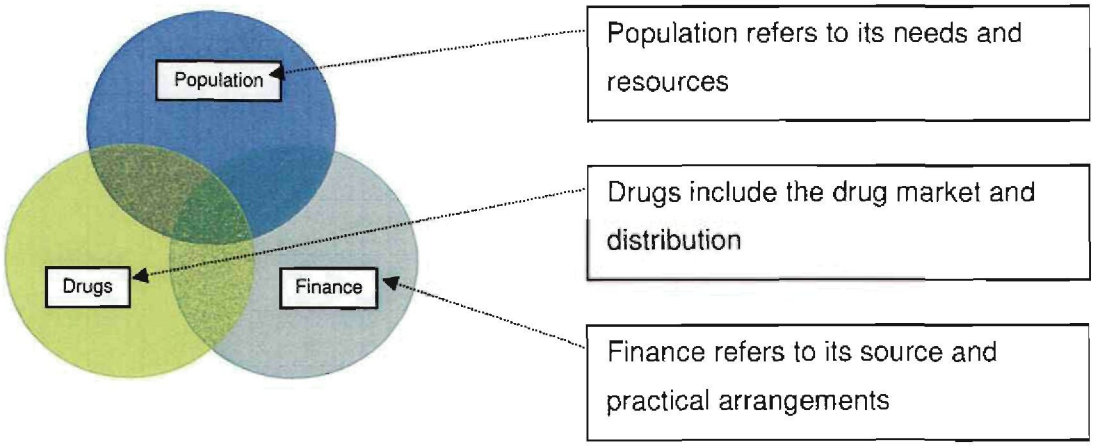


FIGURE 17: Factors affecting drug supply management (World Health Organization, 1991:ii)

In order to ensure that the patient receives the right drug on the right time in the right quantity and strength, effective inventory control is needed (North-West Department of Health, 2007a:9). The public health sector is not a computerised sector and therefore stock cards are the only way to indicate stock levels (North-West Department of Health, 2007a:9).

In the National Drug Policy (Department of Health, 1996:4) five health specific objectives are stated:

- To ensure the availability and accessibility of essential drugs to all citizens;
- To ensure the safety, efficacy and quality of drugs;
- To ensure good dispensing and prescribing practices;
- To promote the rational use of drugs by prescribers, dispensers and patients through provision of the necessary training, education and information; and

- To promote the concept of individual responsibility for health, preventive care and informed decision making (Department of Health, 1996:4)

The reason why government, according to the World Health Organization (1997:37), fails to provide adequate and efficient services in the drug supply system is not always just because of symptomatic of fundamental problems in the public health sector, but also due to:

- Public sector rigidities (particularly bureaucratic staff regulations);
- Lack of incentives for efficient behaviour;
- Unclear institutional relationships and/or responsibilities;
- Political factors;
- Lack of managerial autonomy, responsibility and accountability;
- Absence of competition; and
- Inadequate financial resources (World Health Organization, 1997:37)

The drug supply system currently used by any government aims to achieve the following three main objectives:

- **High level of service** – measured by low rates of shortages and stockouts;
- **Efficiency** – measured by having low total costs for a given level of service; and
- **Quality** – delivery of drugs of satisfactory quality (World Health Organization, 1997:37).

In order to prevent the failure of government drug supply systems, they use the drug supply management cycle which is a logical illustration of the procedures in the medicine usage cycle. Firstly, the Department of Health decides on which medication they will supply in the public health care institution. The Minister of Health in 1998, Dr Nkosazana C Dlamini-Zuma, and the national essential drug list committee of that time, set the guidelines for therapy in the public health sector by publishing the Standard Treatment Guidelines and Essential Drug List with the prior reason to "*address the major health problems in South Africa and set the stage for ensuring equity in health care delivery, as well as providing for rational prescribing and*

dispensing" (Department of Health, 1998:iii). Secondly, they need to buy the medicine from the suppliers, both nationally and internationally by using a tender system. Thirdly, distribution needs to take place from the supplier to the provincial warehouses (in North-West it is the Mmabato Medical Store [MMS]) who then distributes the medicine to the different health care institutions in the North-West Province. Finally in the chain, the medicine will be prescribed, dispensed and used to conclude the cycle by meeting the health needs of the community. In figure 18 the drug supply management cycle is indicated (North-West Department of Health, 2007a:9).

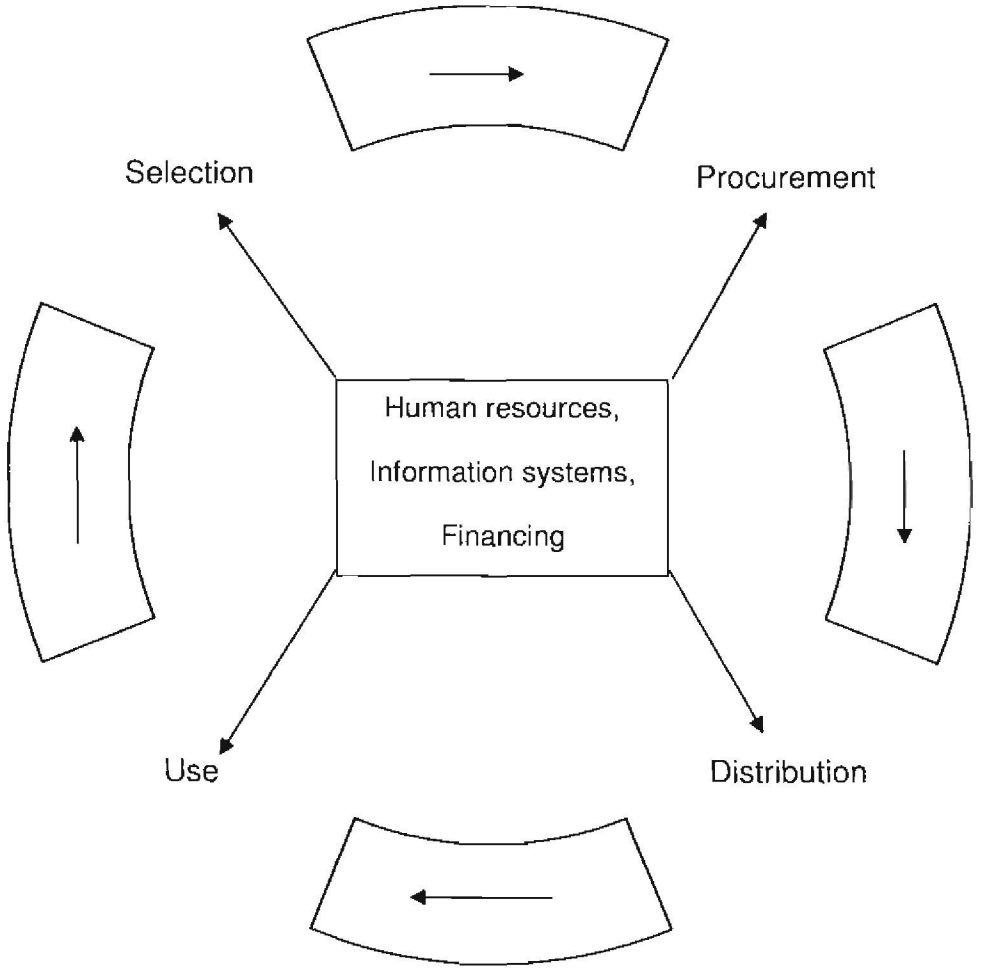


FIGURE 18: The drug supply management cycle (North-West Department of Health, 2007a:8)

The drug supply management cycle also needs the help of support systems which are contributing to the process of medicine supply, like human resources, information systems and financing (North-West Department of Health, 2007a:10).

The basic principles from economics can be used in the drug supply management of medicine items (Lyles, 2008). If the demand for medicine items is low then the product price is high. When the price decreases the demand for medicine items will increase. Demand is indicated in red in figure 19. Suppliers want to supply large volumes of medicine items when the product price is high but when the price decreases, they want to supply and sell smaller volumes of medicine items. Supply is indicated in blue in figure 19. An equilibrium occurs where demand and supply of medicine items meet and the right quantity at the right price is met. Figure 19 illustrates this supply and demand equilibrium curve (Lyles, 2008).

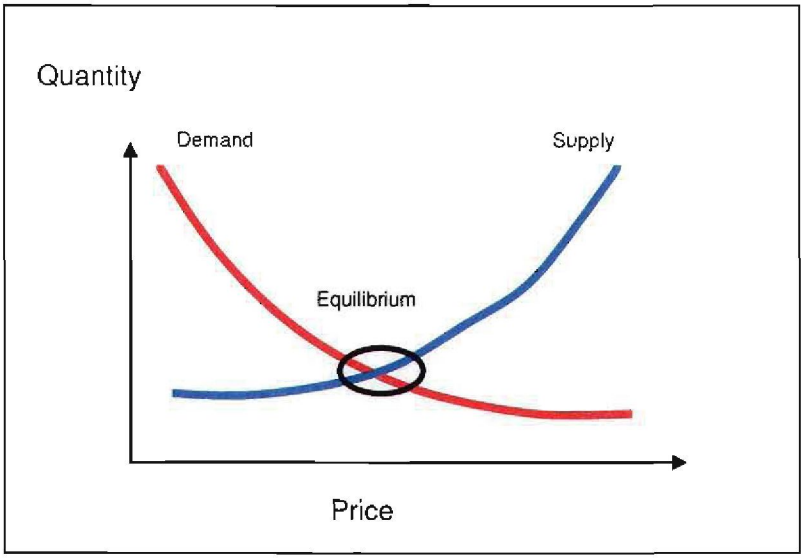


FIGURE 19: Supply and demand curve (Lyles, 2008).

2.3.1 Drug selection in South Africa

According to the National Drug Policy (Department of Health, 1996:11) the aim for drug selection is "*to promote the rational choice of drugs and associated items to be used in South Africa, in accordance with the essential drugs concept*". The National Essential Drugs List Committee (NEDLC), which is selected by the Minister of Health, is responsible for the selection

of drugs which are used in the public health sector. This essential drugs list is based on generic names and is reviewed periodically every two years, according to the National Drug Policy (South Africa, 1996:11). According to the World Health Organization (1991:20) the use of generic names when putting out to tender could lead to lower prices. There are currently three essential drugs list manuals:

- standard treatment guidelines and essential drugs list for primary health care 2003 edition (green manual; Department of Health, 2003);
- standard treatment guidelines and essential drugs list for hospital level for adults 2006 edition (yellow manual; Department of Health, 2006a), and
- standard treatment guidelines and essential drugs list for hospital level paediatrics 2006 edition (purple manual; Department of health, 2006b).

The selection of medicines for the National Essential Drugs List is, according to the National Drug Policy (Department of Health, 1996:11), based on the following criteria:

- The list must meet the health related needs of the majority of the population;
- Sufficient proven scientific data must be available for the drugs selected for the list to evaluate the effectiveness of the medicine;
- Medicines selected should have a substantial safety and risk/benefit ratio;
- The list will only include medicines with single pharmacologically active ingredients. Combination products (as an exception) will be included where patient compliance becomes an important factor or two pharmacologically active ingredients are synergistically active in a product; and
- When two or more drugs are equivalent in the above respects, the following aspects are considered:

  - The best cost advantage;

  - Best pharmacokinetic properties;

  - Best patient compliance;

- Most reliable local manufacturer; and

- Best researched (Department of Health, 1996:11).

These aspects are in line with the World Health Organization's (1991:19) guidelines for drug selection. The World Health Organization (1991:19) states that the drugs selected should be in line with the health requirements of the country as well as the state of the health care system. Drugs should be:

- safe,
- of proven effectiveness, and
- of guaranteed quality (World Health Organization, 1991:19)

For a small selection of drugs whose therapeutic properties are of dubious relevance, economic costs are reduced, larger quantities can be ordered and management cost can be lower (World Health Organization, 1991:19).

This National Essential Drugs List (EDL) is the foundation for several aspects in the public health care system:

- The EDL is the basic health care package of the National Health System for universal primary care;
- It is used for the procurement (see section 2.3.2) and use of drugs (see section 2.3.4);
- It is essential for treatment guidelines and training in rational prescribing;
- It provides information to both health care providers and the national formulary;
- The EDL supports local pharmaceutical manufacturers; and
- It serves as a foundation for drug donations (Department of Health, 1996:12).

2.3.2 Procurement

2.3.2.1 Procurement according to the World Health Organization

The World Health Organization (1991:30) illustrates the movement of drugs by using a procurement account. There are two main sources of drugs (indicated in blue in figure 20): National production by national or foreign firms and imports which include purchases, public aid donations and NGO donations; and five destinations (indicated in red) where the drugs are going - central pharmacies of health services (procurement centres), wholesalers, commercial pharmacies, health services and consumers. Figure 20 illustrates the movement of drugs, as described by the World Health Organization (1991:30).

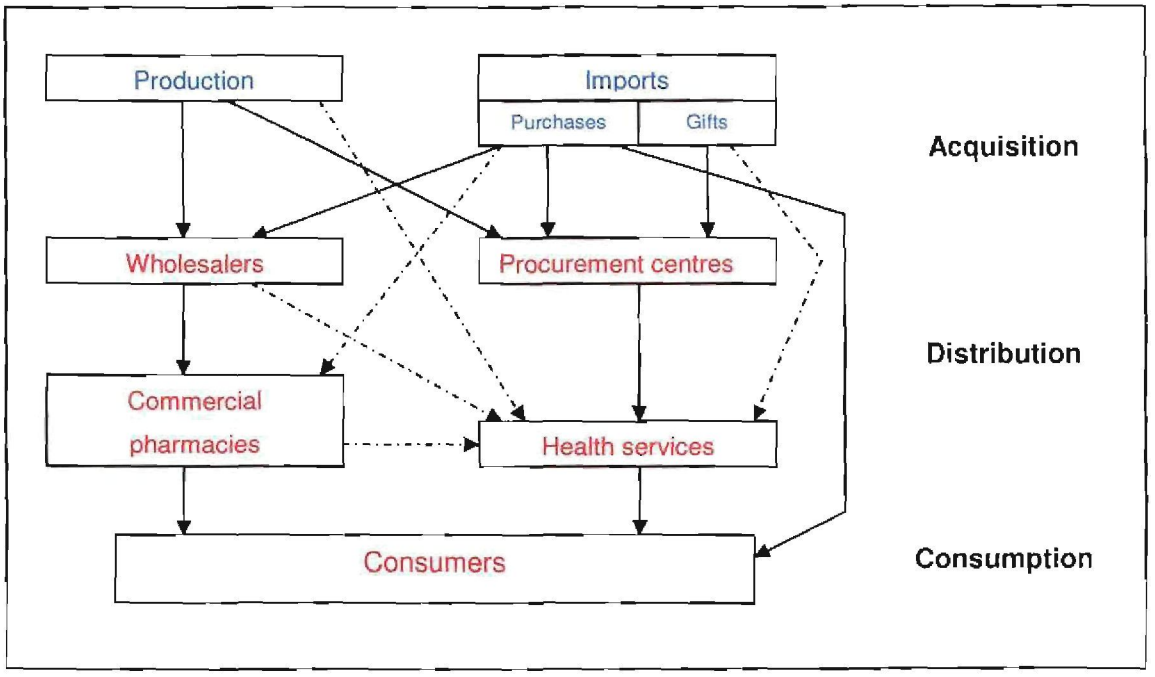


FIGURE 20: Movement of drugs (World Health Organization, 1991:30)

2.3.2.2 Procurement in South Africa and the North-West Province

According the National Drug Policy (Department of Health, 1996:13) the aim is to "*ensure an adequate supply of effective and safe drugs of good quality to all people in South Africa*". In the National Drug Policy, the government promises to ensure the availability of essential drugs to all people in South Africa, and at primary health care level, this service will be provided free of

charge. The public sector coordination body for procurement uses national and international tendering to supply the public sector of essential drugs and medical supplies on a national level (Department of Health, 1996:13). The department procures medical supplies through national tenders which are managed by National Treasury. National Treasury advertises the tenders which are followed by sample evaluation by the provinces, recommendation and adjudication. Tenders are awarded based on the points given to the suppliers (Mokgatlha, 2008). The department provides National Treasury with estimates of the medical supplies requirements on an annual basis or when the tenders are to be renewed (Mpaka, 2008). After the tenders are awarded, the depot managers of the provinces receive the copies (Mokgatlha, 2008). The provincial authorities, e.g. the Mmabato Medical Store (MMS), purchase drugs directly from the suppliers which had been awarded with a contract from the public sector coordination body for procurement. National tenders will still be compared with international tenders to ensure procurement takes place at the lowest available prices. According to Mpaka (2008) the department makes use of national tenders for the procurement of pharmaceutical and surgical supplies. The National Drug Policy also states that procurement and distribution are limited to the drugs on the national list of essential drugs and to products registered for use in South Africa (Department of Health, 1996:14). Mpaka (2008) confirms that almost 90% - 95% of the medicine procurement is according to the essential drug list. When a doctor or a pharmacist needs a specific drug for a specific patient which does not occur on the national list of essential drugs, their therapeutic committee in the hospital or clinic needs to complete a motivational form with a recommendation from the hospital or clinical manager at the hospital before it is sent to the provincial office for approval (Mpaka, 2008).

In the manual on managing drug supply for health institutions (North-West Department of Health, 2007a:91) a procurement card is designed for use in all public health care institutions in the North-West Province. A procurement card is completed for every medical product and contains information like the product's generic name, strength and dosage form, pack size, stock code and the minimum and maximum stock levels. When an order is placed, the date, the order number and the quantity ordered are filled in on the procurement card of the specific product. When the order is received, the date, invoice number, quantity received and the unit price are filled in on the procurement card for that specific product. In case of a back order, the quantity on back order is filled in and when the back order is received, the receipt date, invoice number and quantity received are completed on the procurement card (see appendix A.1).

2.3.2.3 The procurement cycle

According to Quick *et al.* (1997:165) there are several steps in the procurement cycle which is illustrated in figure 21. The procurement cycle contains most of the decisions and actions in terms of drug quantities, prices and distribution.

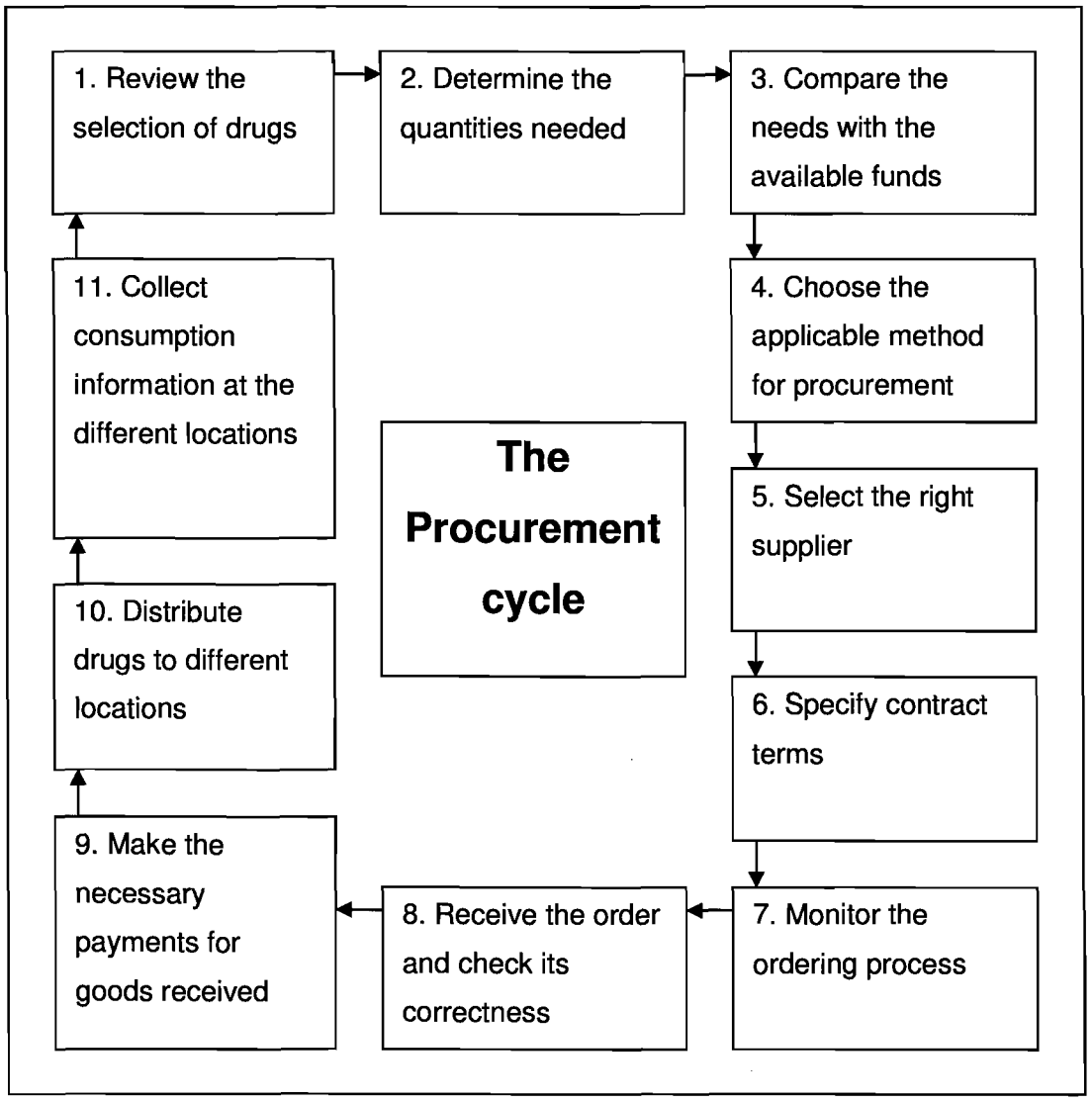


FIGURE 21: The procurement cycle (Quick *et al.* 1997:166)

2.3.2.3.1 Review the selection of drugs

At Thusong Hospital orders are placed once a week (Smit, 2007). This means that once a week the requisitioning officer check the stock levels and determines which drugs to order.

Before medicines can be procured from the provincial warehouse, an order should be placed with the medicine quantity that each health care institution requires. The amount needed can be calculated using stock levels and monthly consumption (North-West Department of Health, 2007a:45). Monthly consumption is a simple way to calculate the medicine usage in a given period. Monthly consumption is calculated as follows (North-West Department of Health, 2007a:46):

Monthly consumption =	(Stock in stock at the beginning of the month + stock received through the month) – Stock in stock at the end of the month

Monthly consumption does not include expired medicine, broken or damaged products, stock adjustments or where medicine is lend to another health care facility because it does not reflect the amount of medicine used in a particular institution (North-West Department of Health, 2007a:46). By using monthly consumption, the requisitioning officer can predict the amount of each product to order (the drug requirements) to minimise the chances that the health care facility will be out of stock (North-West Department of Health, 2007a:45).

According to the manual, Managing Drug Supply for Health Institutions by the Department Pharmaceutical Services of North-West, the rule of thumb is never to have more than three month's stock supply at a time (North-West Department of Health, 2007a:50). The manual also states many factors that could influence an order:

- **Constant factors** that can influence the stock quantity include average monthly consumption, supplier lead time, safety stock, quantity on order, stock balance, quantity back ordered, procurement period/order frequency and storage capacity at the institution.
- **Variable factors** include campaign, outbreak of particular diseases, stock out periods, statistics, seasonal factors like flu in winter, shelf life, new prescribers who prescribe unknown medicines/dosage regimes and the allocated budget for stock (North-West Department of Health, 2007a:51-53).

2.3.2.3.2 Determine the quantities needed

When quantification of need is not done properly, it could lead to overbuying of drugs which can expire and then can't be used. This value equals the savings that could be made if the quantification process were controlled better (World Health Organization, 1991:19).

In the public health sector of North-West, the manual for managing drug supply for health institutions use, a "saw teeth" diagram to illustrate stock variations. Figure 22 illustrates the "Saw teeth" stock variation graph.

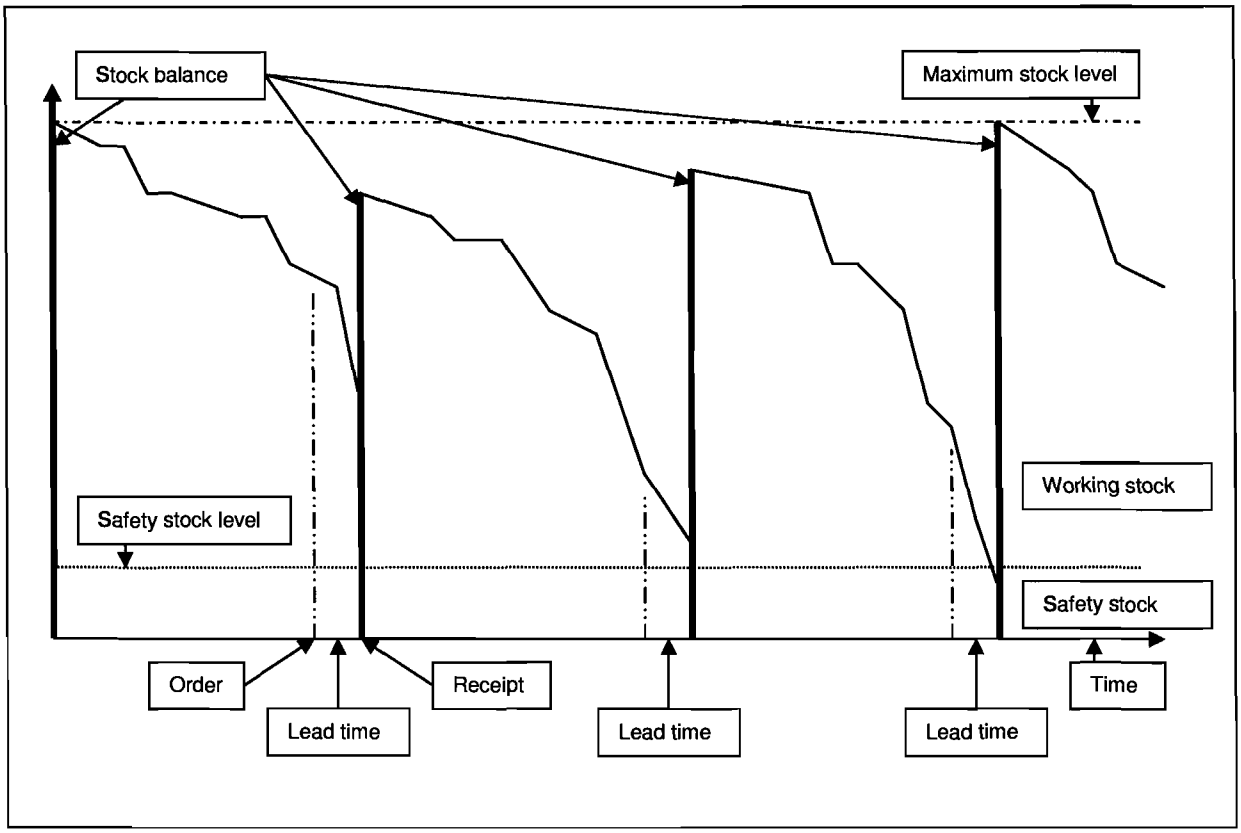


FIGURE 22: The saw teeth stock variation graph used to calculate the quantity to order (North-West Department of Health, 2007a:54)

In the illustration above, the saw teeth indicates the stock levels that go up and down as the stock is received and then used/dispensed again (North-West Department of Health, 2007a:54). The manual, Managing Drug Supply for Health Institutions (North-West Department of Health, 2007a:54-55) describes the use of the saw teeth stock variation graph. In the beginning of the month, after new stock is received, the stock level is at its maximum stock level. As the time goes by, the stock level decreases as the medicines are dispensed to the patients. If the lead time of the suppliers is one week and the order interval is one month, the requisitioning officer should order in week three so that the new stock arrives at the beginning of the next month. During the lead time of the supplier, stock levels should not go below the safety stock levels. The safety stock levels are unique for each product and are the amount of that particular

product that should always be available for emergencies. The stock between the safety stock level and the maximum stock level of a product is the working stock that are used during the month (North-West Department of Health, 2007a:54-55). If the order size is determined by subtracting the current stock level from the maximum stock level, by the time the stock arrives the current stock would have decreased during the lead time and the maximum stock level will not be reached. Therefore the Department of Pharmaceutical Services creates a reorder factor table as illustrated in Table 9 (North-West Department of Health, 2007a:60).

TABLE 9: Reorder factor table (North-West Department of Health, 2007a:60)

Reorder Factor Table

Order Frequency	Lead time			
	1 week	2 weeks	4 weeks	6 weeks
Once a week	0.75	1.5		
Every 2 weeks	1.25	1.5	3	
Once a month	1.75	2.5	4	5.5
Every 6 weeks	2.25	3.5	5	6.5
Every 2 months	3.25	4.5	6	7.5
Every 3 months	4.25	5.5	8	9.5

To identify the reorder factor, draw an imaginary line horizontally on the corresponding order frequency and a vertical line on the lead time column, explains the manual (North-West Department of Health, 2007a:60). Thusong Hospital pharmacy orders once a week and the lead time is one week (indicated in bold print in table 10), thus their reorder factor is 0.75 (indicated in bold print and underlined; Du Preez, 2008a).

TABLE 10: Reorder factor table for Thusong Hospital (Du Preez, 2008a) (adapted and compiled from North-West Department of Health, 2007a:60)

Reorder Factor Table

Order Frequency	Lead time			
	1 week	2 weeks	4 weeks	6 weeks
Once a week	**0.75**	1.5		
Every 2 weeks	1.25	1.5	3	
Once a month	1.75	2.5	4	5.5
Every 6 weeks	2.25	3.5	5	6.5
Every 2 months	3.25	4.5	6	7.5
Every 3 months	4.25	5.5	8	9.5

After determining the reorder factor the quantity of the order can be calculated as follows:

Quantity to order = (average monthly consumption x reorder factor) – stock on hand

The quantity to order is measured in units issued.

This is a guideline for the ordering of medication in the North-West Province (North-West Department of Health, 2007a).

2.3.2.3.3 Compare the needs with the available funds

The responsible pharmacist at Thusong Hospital is responsible for the overall control of the pharmaceutical budget (Smit, 2007). In 2006, a total of R4 587 150.00 was spend on medicines at Thusong Hospital. The total budget allocated for 2007 was R4 082 250.00 where pharmaceuticals comprised 75% of the budget. This study is conducted retrospectively from January to July 2007 to evaluate the medicine usage in this period. The monthly turn-over during this period is shown in table 11.

TABLE 11: Monthly turn-over from January 2007 till June 2007 at Thusong Hospital (Smit, 2007)

Month	Turn-over
January 2007	R294 488.73
February 2007	R290 253.95
March 2007	R321 688.66
April 2007	R279 292.08
May 2007	R296 435.23
June 2007	R284 784.77
Total	R1 766 943.42

2.3.2.3.4 Choose the applicable method for procurement

In the public health sector of South Africa, the government procures drugs by using a centralised procurement system (North-West Department of Health, 2007a:9). This usually falls into one of four basic categories (Quick *et al.*, 1997:168):

- **Open tender** – any manufacturer, manufacturer's representative or industry on a local or international basis is invited to submit a tender for the supply of medicine to the government. Open tenders are subject to certain terms and conditions specified by the tender invitation. According to Mpaka (2008) 95% of the tenders in the North-West Province are open tenders.

- **Restricted tender** – interested suppliers must first go through a prequalification process in order to be allowed to place a bid on a tender. Any supplier can apply for the prequalification process.

- **Competitive negotiation** – a limited number of suppliers, usually three, are approached for quotations of medicine. This sometimes occurs when there is a shortage of medicine

in the provincial warehouses and the hospital needs the stock or when there is a certain drug that is not supplied by the warehouse. The pharmacy managers must write a risk report for medicine that is out of stock and send the report to the depot with copies to the regional pharmacist.

- **Direct procurement** – this happens when the buyer purchases directly from the supplier. This is the most expensive method but the simplest way of buying stock. According to Mpaka (2008) 5% of the tenders in the North-West Province are direct procurement.

International open tenders usually produce the most competitive offers and potentially the lowest prices, state Quick *et al.* (1997:168).

2.3.2.3.5 Select the right supplier

Mpaka (2008) states that suppliers are selected by National Treasury together with the National Department of Health. National Treasury handles the tenders for medical supplies at national level and select the right suppliers according to the estimates provided by the Department of Health for medical supply requirements, states Mpaka (2008).

2.3.2.3.6 Specify contract terms

In the North-West Province the specific contract terms are done by the National Treasury along with head office as well as a therapeutic committee (Mpaka, 2008).

2.3.2.3.7 Monitor the ordering process

The ordering process in North-West Province is monitored by head office as well as the Mmabato Medical Store (Mpaka, 2008). Mokgatlha (2008) reports that follow up inspections are done on a regular basis especially if the order has passed the lead time. The orders are placed well in time because the ordering system alerts the officers of the re-order level.

2.3.2.3.8 Receive the order and check its correctness

A pharmacist receives the order and checks the correctness of the order both at the Mmabato Medical Store and at the health care facility (Mpaka, 2008). Procurement and distribution is outsourced to a contractor. On arrival, the stock "goes straight to the contractor in the receiving section, where the stock is checked for batch numbers, expiry date, quantity and finely checked before it is packed on the shelves" states Mokgathla (2008).

2.3.2.3.9 Make the necessary payments for goods received

In the North-West Province the Director of Pharmaceutical Services, who is currently Prof. Sello Leeuw, must approve the claim submitted by the contractor managing the Mmabato Medical Store (MMS) for goods received which are then paid by finance department at head office (Mphaka, 2008). Makgatlha (2008) confirms that the contractor prepares a claim, the departmental staff verify it against the original supplier's invoices and send the claim to head office where a cheque is made for the contractor who will then pay the individual suppliers.

2.3.2.3.10 Distribute drugs to different locations

Mpaka (2008), the Deputy Director of Pharmaceutical Services in North-West Province, states that the department has outsourced the procurement warehousing and distribution of stock from the suppliers to a private company. Makgatlha (2008) states that there is a delivery schedule to hospitals. Each hospital receives their stock weekly as scheduled. For any emergencies arrangements are made – the hospital will either send transport or the depot will send the stock.

2.3.2.3.11 Collect consumption information at the different locations

Consumption information from the different locations is collected by the Mmabato Medical Store as well as from the pharmacists at the different health care facilities (Mpaka, 2008).

2.3.2.4 Effective procurement process

In order to have an effective procurement process, one should (Quick *et al.*, 1997:164):

- Always ensure that the right drugs in the right quantities are bought,
- Settle for the lowest purchase price,
- Make sure the drugs meet the necessary standards of quality,
- Plan the supply and delivery of drugs in order to prevent shortages,
- Chose a reliability supplier,
- Create a schedule for order quantities and safe stock levels, and
- Meet these objectives in the most efficient manner possible.

2.3.3 Distribution

Distribution is the process by which medicines are:

- Received at the port of entry;
- Cleared through customs; and
- Transported from central warehouse to storage depots and health facilities (Anon, 2007a).

2.3.3.1 Distribution according to the World Health Organization

The World Health Organization (1997:38) described five different methods for supplying drugs to health services.

- **Central medical stores** – this is a conventional drug supply system where drugs are procured and distributed by a central medical store. This system can also be decentralised to create provincial medical stores to supply stock at a provincial level. In this system the government is the owner and the manager of the entire supply system which has the advantage that the government has control over the whole supply system and bulk procurement is likely to occur with resulting lower costs.

- **Autonomous supply agency** – can be used as an alternative to central medical stores but is managed by an autonomous or semi-autonomous drug supply agency. The aim is to achieve the efficiency and flexibility provided by the private company while the government can still maintain sufficient public sector supervision to ensure the cost and quality of the drugs.

- **Direct delivery system** – the supplier delivers directly to the facility or district. The government is still in charge of the procurement of the medicine but not for the distribution and/or storage. Every supplier contracted by the government supplies the required drugs to the different districts or health care facilities which can lead to inefficient transport cost because different suppliers make separate journeys to deliver to the same district or health care facility.

- **Primary distributor ('prime vendor') system** – the government contracts a single primary distributor who receives stock from suppliers, stores and distributes all drugs in that district.

When using the primary distributor system, the extra transport cost as identified in the direct delivery system, is excluded.

- **Fully private supply** – drugs are received from private institutions. Measures are required to ensure equity of access for the poor and those with the greatest medical need (World Health Organization, 1997:38).

The supply system of South Africa is based on one or more of the above mentioned systems and is discussed below.

2.3.3.2 Distribution in South Africa and the North-West Province

According to the National Drug Policy (Department of Health, 1996:14) the objective with distribution is "*to ensure the prompt, efficient, timely and equitable distribution of essential drugs and medical supplies to all health care institutions*". Each province has their own distribution arrangement depending on their needs. Distribution should take place at least once a month (Department of Health, 1996:15). Distribution in the North-West Province is a combination between central medical stores and a primary distributor system. According to Mpaka (2008) the procurement warehousing and distribution of stock is from the suppliers outsourced to a private company who distributes all the medical supplies which include pharmaceutical and surgical products to all the health care institutions in the districts in the North-West Province.

2.3.3.3 The distribution cycle

According to Quick *et al.* (1997:316) the design of a system particular for storing and distribution of medicine, equipment as well as medical supplies is a complex and important part of the drug management cycle. A well-designed and well-managed distribution system should meet the following requirements (Quick *et al.*, 1997:317):

- Maintain a continuous supply of medicine;
- Maintain the condition of the medicine throughout the distribution process;
- Restrict the loss of medicine due to spoilage and expiry;
- Ensure accurate stock control and record keeping;
- Minimise the amount of storage facilities;

- Use the current and available transport system as efficiently as possible;
- Avoid theft and fraud; and
- Make information needed for the forecasting of drug needs available.

Figure 23 illustrates the distribution cycle (Quick *et al.*, 1997:317):

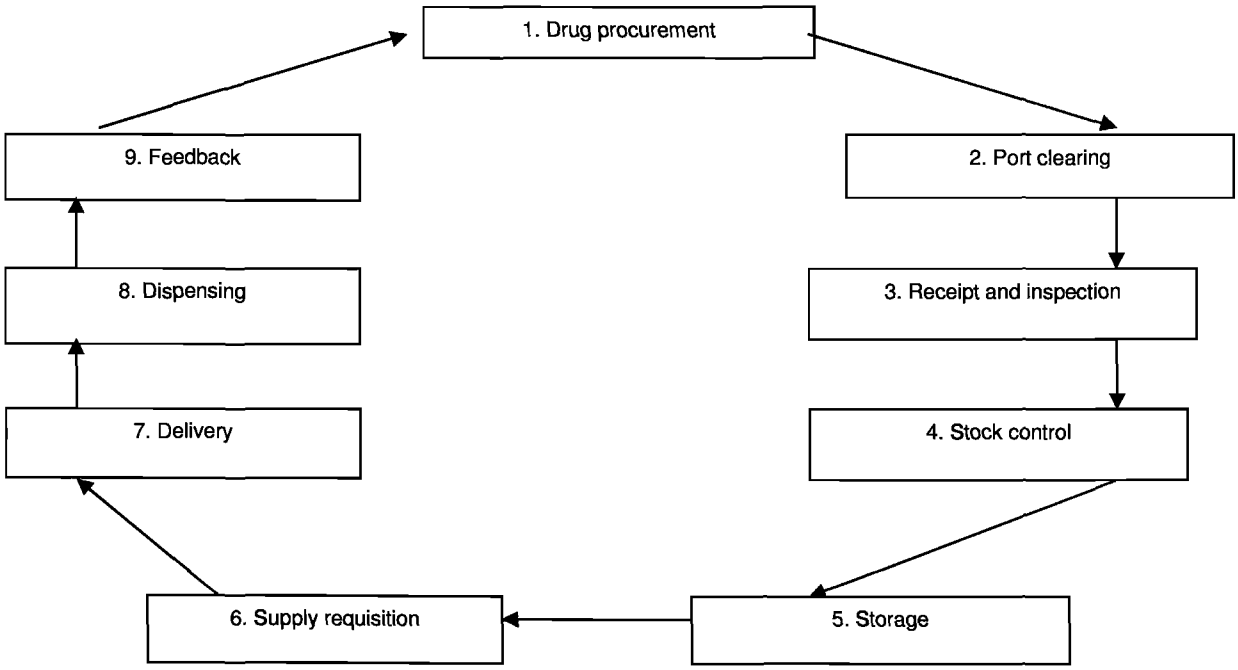


FIGURE 23: The distribution cycle (Quick *et al*, 1997:319)

A typical distribution cycle is one that begins at the manufacturers and ends where feedback on medicine usage patterns are submitted to the supply unit. There are 9 standard steps in the distribution cycle. The first seven steps are performed by the Mmabato Medical Store according to Makgatlha (2008). The standard steps include (Quick *et al*, 1997:317):

1. **Drug procurement** – the process starts when medicines are ready for delivery to health care institutions where there is a shortage of or need for supplies.
2. **Port clearing** – some administrative procedures must take place in order to evaluate the quality and state in which the supplies arrive.

3. **Receipt and inspection** – an inspection should be carried out to determine if there are any damaged or missing items, and also to check the drug type, quantity, percentage, packaging, labelling and other requirements that could be of importance. Compare the supplier invoice with the original purchase order. It is stated (Anon., 2007a) that a sample for quality control can be taken if required to check that the general characteristics of the product, e.g. colour, consistency and form, are correct. Makgatlha (2008) states that the hospital checks the number of boxes on arrival to see if it corresponds with the delivery notes. Unfortunately, they open the boxes later and only then they can know if the correct stock is supplied.

4. **Stock control** – a good control system is needed for coordinating the flow of drugs through the distribution system. It also serves as a stock balance report. Record keeping should be "audited" in order to accurately trace the flow of drugs and funds through the system.

5. **Storage** – storage facilities varies form large warehouses at national and provincial level to a small storeroom in the back of a health care facility. A good stock control system helps to maintain regular supply of medicine. The cost of storage and transport should not be more than 35% of the average inventory value (Anon., 2007a). Good distribution practice includes stock rotation on the 'first in, first out' principle, enhances security by limiting the access to the storage area, arranges medicine alphabetically or in therapeutic categories and creates a separate quarantine space for damaged, expired, dangerous and restricted use products. Good storage practices (Anon., 2007a), includes temperature and humidity control, cleanliness, pest control, security during and after work hours, inventory records, samples for quality control testing, staging for delivery to other units and repackaging.

6. **Supply requisition** – this key part in the inventory control system may function either as a push or a pull system and may vary from country to country and from one level to another within the same country. The 'push system' is where central level decides how much to deliver to each unit based on past deliveries and a 'pull system' is where each unit determines quantities they need (Anon., 2007a).

7. **Delivery** – transport is needed for delivery and collection of drugs and should be selected economically to ensure an effective and efficient system. The more frequent the deliveries are done, the smaller the capacity of storage space is needed at the health institution, and the less frequent deliveries occur, the bigger the capacity for storage needs to be (Anon, 2007a).

8. **Dispensing** – the main aim for the distribution process is that the medicine reaches the patient in the hospital, clinic, community health centre or pharmacy in order to treat or prevent diseases.

9. **Feedback** – the feedback of information from the hospital, clinic, community health centre or pharmacy to the procurement office or warehouse is important so that procurement needs can be determined so as to ensure sufficient stock. Makgatlha (2008) states that no consumption information is collected from the health care facilities. They monitor the stock movement from the system to know the consumption.

North-West Province's distribution cycle for medicines is based on the above typical illustration as indicated in figure 23. Figure 24 indicates a diagram of a typical public sector drug distribution system that illustrates from international to national, provincial and district and community level of distribution.

2.3.3.4 Designing a distribution system

Managing Drug Supply (Quick *et al.*, 1997:318) states what designing a distribution system requires systematic cost-effectiveness analysis and operational planning. There are major design characteristics for designing a distribution system which include basic design features, distribution network and resupply interval.

Level	Public Sector
International	International Procurement Agencies *Mpaka (2008) indicates that only national tenders are used in the procurement of medical supplies in North-West Province.*
National	Government Supply Services *This includes product cards, procurement unit (department provides estimates of medical supply requirements), import unit, inventory control unit, finance unit (National Treasury) and medical stores (Mmbato Medical Store)*
Regional	Medical Stores and Hospitals
District	Medical Stores, Hospitals and Health Centres *Thusong Hospital distributes on district level medical supplies to the nine clinics in the surrounding area of Ditsobotla*
Community	Community health workers *Health personnel and pharmacists prescribe and dispense medical supplies to patients is the community*
Individual	Patient

FIGURE 24: Public sector drug distribution system (adapted and compiled from Quick *et al.*, 1997:318, Mpaka (2008) and Du Preez (2008a))

2.3.3.4.1 Basic design features

South Africa has a decentralised health system since 1994 due to the changes in the democracy of this country (Dennill *et al.*, 1999:43). This implicates that the districts or regions are responsible for receiving, storing, distributing and re-ordering of medicine supplies (Quick *et al.* 1997:319). In order to design or redesign a distribution system, the following steps according to Quick *et al.* (1997:320), have to be taken:

- Establish the amount of storage levels in the distribution system,
- Establish the location of storage facilities,
- Decide at which level in the supply chain decisions are made,
- Determine resupply internals or frequency,
- Select a method for distributing drugs,
- Select method of transport,
- Develop a delivery schedule as well as delivery route, and
- Determine operating costs.

In the North-West Province the North-West Department of Health must create the amount of storage levels in the province as well as the locations of storage facilities in the province and the four districts in the province. As Mpaka (2008) indicates, decisions are made at national level regarding the supply chain. The resupply internals, resupply frequency, method of distribution, method of transport, delivery schedule and delivery routes must be selected in the best cost-effective way.

2.3.3.4.2 Distribution network

The distribution system consists of several layers of storage with slightly different functions (Quick *et al.*, 1997:321). There are mainly three levels of distribution:

- **Primary stores** normally serve a whole province. The warehouse supplies all the medicine, equipment as well as medical supplies to the hospitals and sometimes directly to clinics as well. In the North-West Province, the Mmabato Medical Store is the primary store serving the whole province (Smit, 2007).
- **Intermediate stores** are located by/in the hospitals. The hospitals not only receive stock for themselves but also for the clinics and community health centres close to the hospital. Thusong Hospital in the Ditsobotla district is an intermediate store which receives medical supplies for hospital use as well as for the nine surrounding clinics in the Ditsobotla district and Itsoseng sub-district (Smit, 2007).

- **Individual health facility stores**, such as clinics, receive their stock from either the hospital located near the clinic or sometimes directly from the warehouse if there is not a hospital close to the clinic. Thusong Hospital is also an individual health facility because the hospital receives their stock directly from the medical store. Poly clinic in Itsoseng is another example of a individual health facility store who receives their stock from a hospital (Thusong Hospital) located nearby (Smit, 2007).

In order to determine the number of storage levels in a distribution network, one needs to take the following factors into account:

- The geographical factors of the area,
- The population of that region,
- The availability of storage space,
- The availability of human resource and staff,
- The transport facilities in the area, and
- Political and other resource constraints (Quick *et al.*, 1997:321).

2.3.3.4.3 Resupply interval

In the last step in ensuring the sufficient supply of medicine, an appropriate resupply interval should be selected. This can vary from quarterly, monthly, weekly or what ever time is convenient. However, there are some factors to consider before choosing an interval (Quick *et al.*, 1997:323):

- The capacity for storage space in each level of the distribution network,
- The carrying capacity, cost and size of orders,
- Seasonal factors that influence transport reliability,
- Availability of human resources and staff, and
- Any other factors such as expiration dates and security.

Refer to section 2.3.2.3.1 (review the selection of drugs) and 2.3.2.3.2 (determine the quantities needed) for drug procurement and the process of drug selection for further information.

2.3.4 Usage of medicine

Medicine usage from a global perspective (World Health Organization) as well as local level (South Africa) is included in this section.

2.3.4.1 Rational drug use according to the World Health Organization

Irrational drug use may exist for the prescribers, the dispenser and the consumer who receive and use the drugs. This can be due to the over-treatment of mild illness, inadequate treatment of serious illness, misuse of anti-infective drugs and overuse of injections, usually to please the patient or for profit motives (World Health Organization, 1997:62).

The World Health Organization (1997:62) states that the government of a country plays an important role in ensuring that rational drug use activities are planned and implemented as part of their national drug policies. Different activities aim to promote rational drug use which include the involvement of universities, professional associations, media, educational institutions, consumer organisations, etc.

The World Health Organization (1997:63) created measures for the promotion of rational drug use for professionals, patients and consumers:

a) Aimed at professionals

- Training in essential drugs concepts, good prescribing and good dispensing techniques;
- Continuing education on rational drug use;
- Ethical criteria and legal aspects of drug promotion;
- Regulating and training of pharmacy staff and other drug sellers;
- Setting standards of practice and developing national treatment guidelines; and
- Discouraging conflict of interest

b) Aimed at patients and consumers

- Creating a supportive environment for consumer information and education;
- Orientation of journalists to drug policy and drug use issues;
- Media and other public information campaigns; and
- Patient education at health facilities (World Health Organization, 1997:63).

It is essential that governments regulate the promotion of drugs by pharmaceutical companies to prevent misleading messages (World Health Organization, 1997:63).

At the Second International Conference on Improving Use of Medicines (Laing, 2005:4), the aim was focused on improving the use of medicines globally. At the conference, the need to move from small scale research projects towards implementing large scale programmes that will achieve public health impact, was highlighted.

2.3.4.2 Medicine usage in South Africa and the North-West Province

The National Drug Policy (Department of Health, 1996:17) states that the aim of the rational use of drugs is "*to promote the rational prescribing, dispensing and use of drugs by medical, paramedical and pharmaceutical personnel and to support the informed and appropriate use of drugs by the community*". In South Africa, the government regulates the promotion and advertising of drugs by Act 101 of 1965 and this is discussed in section 2.3.4.2.7 (South Africa, 2003a).

The National Drug Policy (Department of Health, 1996:17) described several factors which contribute to rational usage of medicine in the public health sector of South Africa:

2.3.4.2.1 Education for health workers and patients

Education and training of health care workers is necessary to ensure that all the personnel involved in the diagnosis, prescribing and dispensing of drugs are well trained in both theoretical and practical fields. The relevant health workers need to have sufficient exposure to primary health care, essential drugs lists, the rational usage of medicine, relevant non-medicinal therapies, patient counselling and communication (Department of Health, 1996:17). The

Standard Treatment Guidelines and Essential Drugs List (Department of health, 2003:viii) provides notes on prescribing in chronic conditions for prescribers:

- Do not change doses without good reason;
- Never blame anyone or anything for non-adherence if not fully investigated;
- If the clinical outcomes are not satisfying, investigate compliance;
- Remember side effects and screen for them from time to time;
- When prescribing a new drug for an additional problem, check if the drug wasn't being used to manage a side effect;
- A 'once a day' dosage regime is the best for compliance; and
- Keep the total number of tables/capsules prescribed to a minimum to avoid medication dosing errors (Department of health, 2003:viii),

In the Standard Treatment Guidelines and Essential Drugs List (Department of Health, 2003, 2006a, 2006b) the list is published with the correlating dosage regimes for all patients and all conditions as well as the relevant non-medicinal treatments. The national essential drugs list committee reviews the Essential Drugs List regularly. Four chapters of the Standard Treatment Guidelines and Essential Drugs List for primary health care were reviewed in June 2008: Endocrine system (chapter 3), Gynaecology and obstetrics (chapter 7), Renal and urinary tract conditions (chapter 9) and Immunisation (chapter 11) (Department of Health, 2008b). This manual, as previously stated, are used by doctors and nurses in clinics, community health centres and gateway clinics at hospitals "*to provide access to pharmaceuticals to manage common conditions at this level*" (Department of Health, 2008b).

In order to educate the general public, collaboration between the Department of Health and other bodies responsible for school, adult literacy, etc. is needed to ensure better appreciation of the benefits and limitations of the role of drugs in health care. For example: immunisation is a low-cost way of reducing major infectious diseases like measles, polio, diphtheria, pertussis, neonatal tetanus, tuberculosis and yellow fever. The usage of immunisation is proven to be very successful (Dennil *et al.*, 2002:11-12). The Standard Treatment Guidelines and Essential

Drugs List provide education points to consider for patients with chronic conditions (Department of Health, 2003:vii):

- Focus on the positive outcomes of the therapy and offer support and encouraging regarding the negative aspects;
- Provide realistic expectations regarding the normal progression of the illness and the improvement drug and non-drug therapy can add;
- Establish therapeutic goals and discuss them with the patient;
- Plan of action when side effects occur;
- Where the condition is asymptomatic, assure the patient that it indicate the success of the therapy; and
- Explain the side effects to the patient focusing on the risk vs. the benefit and quality of life (Department of Health, 2003:vii).

2.3.4.2.2 Drug information

The Department of Health produces an annual national formulary of essential drugs for distribution to all health care workers including nurses, doctors, pharmacists, etc. This publication will include guidelines to good prescribing and dispensing as well as information on drug interactions (Department of Health, 1996:18). Medical journals, like the South African Pharmaceutical Journal (SAPJ), which is a monthly journal, have a regular section in the journal where new medicines are reviewed so that pharmacists can familiarise themselves with the new medicines on the market (Anon., 2008:52).

Information for the patients and the general public is usually in the hands of the government, industry, health care workers like the nurses, doctors and pharmacists, professional associations, the public/consumers and academic institutions. Subjects for information include disease prevention, appropriate and inappropriate self-medication, limited self-diagnosis as well as communication with health care providers (Department of Health, 1996:18).

2.3.4.2.3 Appropriate prescribing

All prescribing must be based on the three Standard Treatment Guidelines and Essential Drugs List manuals for both primary health care and hospital level for adults and paediatrics (Department of Health, 1996:18). When prescribing for a patient, the patient's occupation, daily routine, recreational activities, past experiences with other medicine and expectations of the therapeutic outcome (Department of Health, 2003:vii). This information should be used to choose between different therapeutic alternatives identified based on clinical findings. Clashes with therapy should be discussed with the patient in order to motivate the patient to conform to a lifestyle change because education through the identification of problems is more successful than an approach towards the condition and/or medicine (Department of Health, 2003:vii). Another method to enhance appropriate prescribing is the South African Medicines Formulary which is produced by the Division of Pharmacology in the Faculty of Health Sciences at the University of Cape Town (Gibbon, 2008).

2.3.4.2.4 Dispensing

The National Drug Policy (Department of Health, 1996:19) wants to ensure that all drugs are dispensed according to regulations and good dispensing practice. The Good Pharmacy Practice (GPP) manual published by the South African Pharmacy Council (2008:59), describes the minimum standards for the dispensing of medicine or scheduled substances on the prescription of an authorised prescriber and divide the dispensing procedure into three phases:

- Phase 1: Interpretation and evaluation of the prescription
- Phase 2: Preparation and labelling of the prescribed medicine
- Phase 3: Provision of information and instructions to the patient to ensure the safe and effective use of medicine (South African Pharmacy Council, 2008;59).

These guidelines for the dispensing activity of medicine or scheduled substances are discussed in full in the GPP (South African Pharmacy Council, 2008:59-71).

2.3.4.2.5 Hospital therapeutic committees

The reason for a hospital therapeutic committee in both private and public hospitals is to ensure the rational, efficient and cost-effective supply and usage of medicine and they will have the responsibility of:

- Accurate estimation, prompt procurement and optimal storage and supply of medicine as well as medical supplies;
- Compilation and preparation of a unique hospital formulary;
- Cost-effective drug use; and
- Proper staff establishments to carry out these functions (Department of Health, 1996:19).

2.3.4.2.6 The role of the pharmacist

The National Drug Policy (Department of Health, 1996:19) declares that pharmacists have an important centralised role in educating and instructing patients in the correct use of drugs. The *Good Pharmacy Practice in South Africa* (GPP; *South African Pharmacy Council*, 2008:foreword) aims to ensure that all pharmacists and other health care professionals who provide medicine to the public, provide a service of high quality for both the private and public health sector. In the GPP (South African Pharmacy Council, 2008:3-4) the scope of practice of a pharmacist, in terms of Section 35A of the Pharmacy Act, is stipulated as follows:

- Provision of pharmaceutical care to patients by taking responsibility for their heath-related needs, and being accountable for meeting these needs which include but are not limited to the following:
    i. Evaluating the health-related needs of the patients which include the identification of the indication, safety and effectiveness of the therapy;
    ii. Dispensing prescribed medicine/scheduled substances to authorised patients;
    iii. Advise patients with information about the effective use of the medicine;
    iv. Determine patient compliance with the therapy and use follow-up visits to ensure that the patient's medicine-related needs are met; and
    v. Provision of pharmacist-initiated therapy.
- Compounding, manipulation, preparation or packaging of medicine/scheduled substances or supervision thereof;
- Manufacturing of any medicine/scheduled substances or supervision thereof;

- Purchasing, acquiring, importing, keeping, possessing, using, releasing, storage, packaging, re-packaging, supplying or selling of medicine/scheduled substances or the supervision thereof;
- Application for registration of medicine (according to medicines act.);
- Formulation of medicine for the purpose of registration of that medicine;
- Distribution of medicine/scheduled substances;
- Re-packaging of medicine; and
- Initiating and conducting of research in the field of pharmaceutical development (South African Pharmacy Council, 2008:3-4).

As stated in iii, the direct scope of practice of a pharmacist includes "*furnishing of information and advice to any person with regard to the use of medicine*". It is clear that a pharmacist is one of the members involved in a multi-disciplinary approach to the rational utilisation of drugs and should be consulted in the choice of drugs and treatment protocols (Department of Health, 1996:19).

2.3.4.2.7 Advertising and marketing of drugs

The object, according to the National Drug Policy (Department of Health, 1996:21), is to ensure that advertising and marketing of medicine will proceed according to national regulations and industry standards. Act 101 of 1965, the Act on Medicines and Related Substances (South Africa, 2007a) forbids the publishing or distribution of misleading or false advertisement involving medicine or claims made about the effectiveness of medicine therapy other than stated by the council. Regulation 45 of the general regulation 510 of 10 April 2003 states the following guidelines for the advertising of medicines (South Africa, 2003a):

- *(2) (a, b, c) "Medicine containing no scheduled substance or substance appearing in schedule 0 and 1 may be advertised to the public; other substances appearing in schedule 2, 3, 4, 5 and 6 may only be advertised to other health care professionals but information about the price, name, pack size and strengths may be communicated to the public".*

- *(3) "No advertisement may contain information other than that that appears in the application for registration of the product regarding the safety, quality or efficacy of the product that have been accepted by the council".*

These regulations provide a safe environment for the advertising of medicine to the public. This is an important factor which influences the rational medicine usage.

This concludes the discussion on the drug supply management cycle which includes drug selection, procurement, distribution and medicine use by the patients. In every section the method according to the World Health Organization is discussed and compared with the current situation in South Africa and more particular the North-West Province. In the next section the funding and cost of health care is discussed.

2.4 FUNDING

In the National Drug Policy (Department of Health, 1996:4) four economic objectives are stated as follow and should be the baseline for funding and budgeting in South Africa and in the North-West Province.

- To lower the cost of drugs in both the private and public sector;
- To promote the cost-effective and rational use of drugs;
- To establish a complementary partnership between government bodies and private providers in the pharmaceutical sector; and
- To optimise the use of scarce resources through cooperation with international and regional agencies.

According to the Department of Health's annual report of 2005/2006 for the North-West Province, the total budget for the sub-programme was R2 986 712 000.00 (North-West Department of Health, 2006:27). In this budget R1 569 716 000.00 was allocated for district health services and R781 350 000.00 for provincial hospital services. The Department of Health in North-West Province states in the annual report of 2005/2006 that they continued to provide free primary health care services in all the primary health care facilities in North-West (North-West Department of Health, 2006:40). According to this statement the Department of

Health should have alternative sources of income because patients are not paying for services or medication.

In the budget speech of 2007/2008 as delivered on 21 May 2007 (North-West Department of Health, 2007b:20), the MEC for health in North-West Province announced the allocation for 07/08 at R176 966 million. The HIV/AIDS budget grew 9% from 06/07 financial year to R156 400 000.00 which means that 13 000 more people can receive treatment. The programme allocation for 2007/2008 and 2005/2006 is as follows:

TABLE 12: Programme allocation for 2007/2008 and 2005/2006 (adapted and compiled from North-West Department of Health (2006:27) and North-West Department of Health (2007b:21)

Programme	2007/2008	2005/2006
1. Administration	R163 956 000.00	R128 849 000.00
2. District Health Services	R1 844 067 000.00	R1 569 716 000.00
3. Emergency Medical Services	R142 035 000.00	R98 491 000.00
4. Provincial Hospital Services	R984 063 000.00	R781 350 000.00
5. Central Hospital Services	R81 409 000.00	-
6. Health Sciences and Training	R116 226 000.00	R86 163 000.00
7. Health Care Support Services	R120 555 000.00	R103 453 000.00
8. Health Facilities Management	R302 207 000.00	R218 690 000.00
TOTAL ALLOCATION	**R3 754 518 000.00**	**R2 968 712 000.00**

2.4.1 Sources of finance in health care

In the annual report of 2005/2006 (last report available) the report of the auditor-general to the members of the North-West Provincial Legislature on the financial statements of Vote 3 – Department of Health for the year ended 31 March 2006 (North-West Department of Health, 2006:121), the chairperson, Mr. J van Rooyen, signed on 17 August 2006 the vote 3 document on behalf of the audit committee. In this document, the audit committee identified the following sources of revenue in the North-West Department of Health (North-West Department of Health, 2006:131):

- **Appropriate funds** - According to the statement of financial performance for the year which ended 31 March 2006 (North-West Department of Health, 2006:153), the total revenue for the financial year 2005/2006 was R2 986 712 000.00. This is calculated from the annual appropriation earned from the different programmes of the North-West Department of Health (administration, district health services, emergency medical service, provincial hospital services, health sciences and training, health care support services and health facilities management) which is R2 986 712 000.00 and which includes the conditional grants of R379 015 000.00.

- **Departmental revenue** - In the notes to the annual financial statements for the year which ended 31 March 2006 (North-West Department of Health, 2006:156) the total departmental revenue to be surrendered to the revenue fund was zero. The total revenue collected (R25 649 000.00) consists of the sales of goods and services other than capital assets as well as fines, penalties and forfeits. The departmental revenue budget used during that financial year is also R25 649 000.00 which leaves the total on a zero balance and thus the accounts were reconciled.

- **Tax revenue** - Tax revenue includes casino taxes, horse racing taxes, liquor licences and motor vehicle licences. Motor vehicle licence fees are estimated to be the largest source of revenue at 48.3 per cent in 2007/2008 (South Africa, 2005:17). The estimate for 2007/2008 for tax receipts is a total of R4 115 million.

- **Sales of goods and services other than capital assets** - Part of the departmental revenue is the sale of goods and/or the provision of services. The total for 2005/2006 financial year is R24 395 000.00 (North-West Department of Health, 2006:156).

- **Fines, penalties & forfeits** - A total of R1 254 000.00 was earned by fines, penalties and forfeits (North-West Department of Health, 2006:156).

- **Sale of capital assets** - Sale of capital assets forms part of own revenue (South Africa, 2005:17). R55 million is estimated for 2007/2008.

McIntyre and Doherty (2004:380) also identified four sources of finance in health care:

- **Government** funds are derived from income, company, sales and other taxes, licences, sales and utilities such as electricity and water, and other income such as fees charged at public health care facilities;

- **Households** are the second largest source of funds for health care through their contribution to medical schemes and premiums for other forms of private health insurance or out-of-pocket payments for health services.

- **Employers** can fund health care services for their employees either by providing health care at the workplace, e.g. a clinic or by contribution fully/partly to the premium of the employee's health insurance.

- **Donor** funding is a small fraction of the total health care financial source but is growing as donors gain interest in new government policies to extend health care services to the disadvantaged (McIntyre & Doherty, 2004:380).

2.4.2 Expenditure

2.4.2.1 Expenditure according to the World Health Organization

In the World Health Statistics (World Health Organization, 2007d:64) the 194 member states of the World Health Organization were compared according to their health expenditure ratios and health expenditure aggregates. This report is based on the statistics of 2004. According to the World Health Organization (2007d:70) the government covers 40.4% of the total expenditure on health in the country. This is 10.8% of the total government expenditure. The total per capita expenditure on health in US dollars was 390, of which $158 is the per capita government expenditure on health (World Health Organization, 2007d:71).

2.4.2.2 Expenditure in South Africa

The slightly more that R100 billion South Africa spent on health care in 2005, is equivalent to 7.7% of the gross domestic product (GDP) for 2005, stated McIntyre & Thiede (2007:36). This health care expenditure as % of GDP of 2002 was in line with other high and middle income countries but the health status indicator (life expectancy at birth for 2003 and infant mortality rate per 1000 live births for 2003) was far worse in comparison with the same high and middle income countries (McIntyre & Thiede, 2007:36).

The flow of funds in the health care expenditure of South Africa is mainly between key financing intermediaries and health care providers. Key financing intermediaries include organisations who receive funding and who use that available funds to purchase health services (McIntyre & Thiede, 2007:36). Figure 25 illustrates the flow of funds (McIntyre & Thiede, 2007:37).

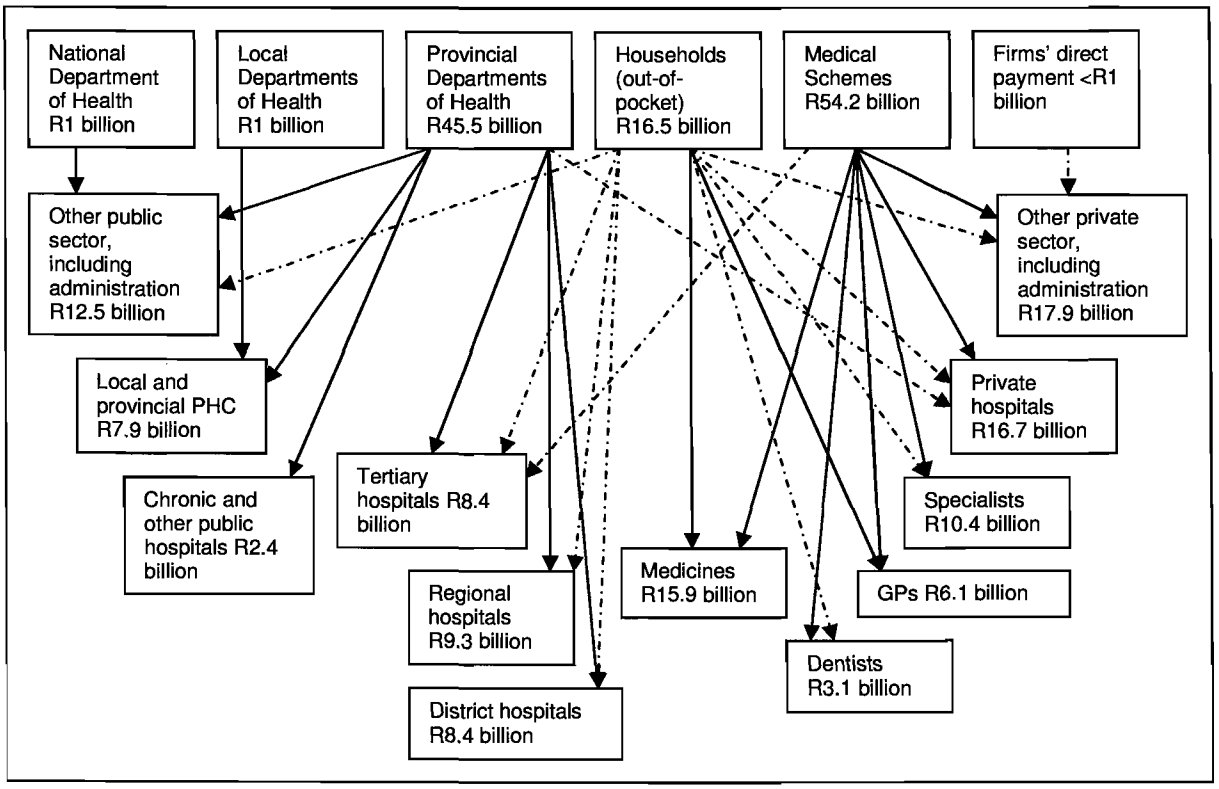


FIGURE 25: Flow of funding (McIntyre & Thiede, 2007:37)

McIntyre & Thiede (2007:36) indicated that 40% of the total health care funds flows through the public health sector and 60% of the funds through the private health sector. According to figure 25, medical schemes are the largest financing intermediaries, accounting for ± 46% of health

care expenditure followed by provincial health departments with 38% of funds flowing *via* this system. Fourteen percent of all health care expenditure is contributed by households' out-of-pocket payments (McIntyre & Thiede, 2007:38). The distribution of total government health care expenditure in 2005 is indicated in figure 26.

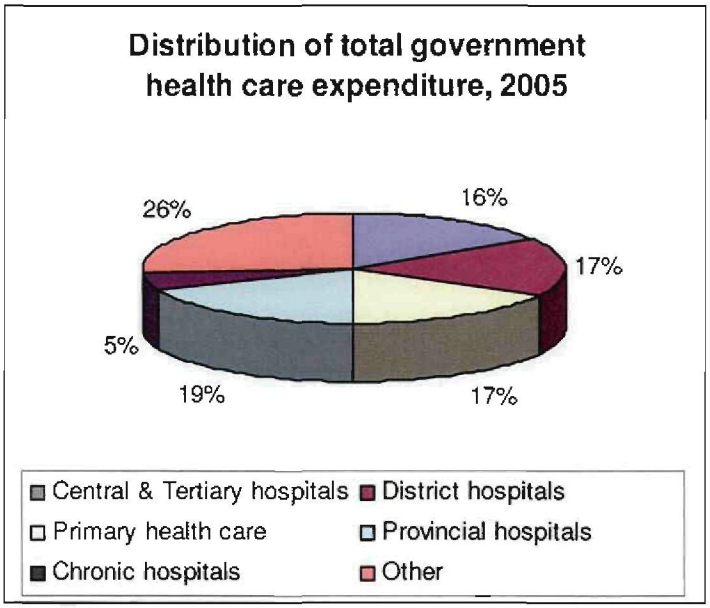


FIGURE 26: Distribution of health care expenditure (McIntyre & Thiede, 2007:39)

The most recent budget and expenditure report is the Third quarter year-to-date provincial budget and expenditure report on the 2007/2008 financial year for provincial budgets which was released on 6 February 2008 (National Treasury, 2008:1). This document covers the spending for the first nine months of the 2007/2008 financial year which ended 31 December 2007. According to the consolidated presentation on provincial budgets and expenditure review 2001/02 – 2007/08, the medium-term estimates for 2007/2008 was R494.894 million which is divided into national departments (R157.817 million), provinces (R248.236 million) and local government (R21.461 million) (South Africa, 2005:9). Provincial budgets consist of:

- Concurrent functions (education, health, housing, social welfare services);
- Social services; and

- Non-social services (agricultural support to farmers, construction & maintenance of provincial roads, provincial administrations & governance functions).

According to the provincial budget and expenditure review (South Africa, 2005:20) the estimated provincial expenditure for North-West Province is R20 769 million. In a press release of 6 February 2008 on the third quarter year-to-date provincial budgets and expenditure report the adjusted budget for 2007/2008 is R15 558 million (National Treasury, 2008:2). Of this budget, 82% is for social services which include education, health and social development. The total social services for 2007/2008 are estimated at R157 159 million where health contributes R60 812 million of the total social services budget (National Treasury, 2008:2). In 2005, the health funding was divided between provincial departments of health (92,8 %), local government health services (4.8 %) and the national department of health (2.4 %). The North-West provincial health expenditure for 2007/2008 was estimated at R3 433 million in 2005 but the adjusted budget for North-West according to the third quarter report is R3 916 million (National Treasury, 2008:3).

2.5 CHAPTER CONCLUSION

In chapter 2 the focus was on the public health sector of South Africa starting at a national level with the minister of health in the leading position, narrowing it down to provincial, district and local level of health care delivery. The focus was also on factors affecting health in South Africa. Because the public health sector has a unique drug supply management cycle, the researcher investigated the drug selection and procurement as well as the distribution and use of medicine in the North-West Province. To be able to perform this task of drug procurement and delivery, funding is essential as well as budgeting, as discussed in section 2.4. In this literature chapter the first five specific research objectives of the literature phase have been achieved (see section 1.3.2.1).

Chapter 3 focuses on conceptualisation from literature, a brief overview of managed health care, how managed health care systems work, the different types of managed care organisations and management components. The chapter will also includes articles on Drug Utilisation Review (DUR) with focus on the features of the International Code of Disease (ICD-10) classification systems and the Anatomic Therapeutic Chemical (ATC) classification systems. A brief overview of pharmacoeconomics and the different research methods, as well as pharmaco-epidemiology will also be included.

CHAPTER 3

Drug usage and Drug Utilisation Review (DUR)

"Economics is the science of scarcity and choice" state Walley et al. (2004:1). Individuals structure and prioritise their consumption in every day life, in order to maximise welfare and according to this welfare, decisions need to be made. Decisions are needed because resources, like money, time and people, are scarce and one wants to make the best of limited resources. That's when we compare and evaluate the cost and the benefit before making decisions (Walley et al., 2004:2).

In chapter 3 the focus will be on managed health care and the components thereof. This includes a brief overview of the four components of managed health care, namely case management, component management, outcome management and disease management. Disease management is an important part of managed health care because it focuses on the patient suffering from the disease and the necessary interventions (Macgregor, 2003:115). Drug utilisation review has the main objective to evaluate the appropriateness of medicine usage (Fulda et al., 2008:1). This forms an important part of the research done in this dissertation as the study focuses on the medicine usage at a public health care hospital. Pharmacoeconomics and pharmacoepidemiology are also discussed in the chapter.

3.1 MANAGED HEALTH CARE

According to Rognehaugh (1998:134) managed care is a system of seamless delivery which aims to reduce unnecessary service delivery while promoting high quality, cost-effective health care. It is a system that attempts to manage cost and quality of health care and still make it accessible to patients (Rickel & Wise, 2000:34). Managed health care has been developed in response to ever increasing healthcare cost and dysfunctional fragmented services and covers a range of activities carried out in different organisational settings (Fairfield *et al.*, 1997). According to Fairfield *et al.* (1997) managed care has the following specific characteristics:

- Managed care is not a discrete entity;
- Managed care is a spectrum of activities carried out in a spectrum of organisational settings;
- Managed care is continually evolving;
- Managed care works through changing clinical practice; and
- Managed care has not yet been fully evaluated, so the claims made for it cannot yet be substantiated (Fairfield *et al.*, 1997).

3.1.1 How do managed care systems work

Managed care had its appearance in the 1930s when medical care was always on a fee-for-service basis which means that a patient is charged a fee for every health care provider or service he/she visits/uses (Woodside & McClam, 2003:51). According to Woodside and McClam (2003:51) physicians started to implement a 'pre-paid' plan for health care where patients pay a monthly payment in order to get access to a pre-defined set of services.

Managed care, according to Iglehart (1994:1167), is a *system that integrates the financing and delivery of medical care through contracts with selected physicians and hospitals that provide comprehensive health care services to enrolled members for a predetermined monthly premium.* Health services must be obtained from the professionals and health care facilities that are part of the health plan. There is usually a small co-payment for each appointment and drug prescription which must be paid by the patient. Kiel (2003:16) describes the managed care model as a five part model as is indicated in figure 27. The employer/employee (1) negotiates with the managed care organisation (2) for a health plan which is most affordable for the patient with expansive coverage. The managed care organisation (2) negotiates with the provider (3) which includes hospitals, physicians, specialists, etc. (4) who provides medical services to the enrolled population, which is the patient (5), within the guidelines stated in the contract between the managed care organisation and the employer/employee. Managed care organisations are not private, unorganised, one-to-one relationships between an individual patient and the physician where the patient pay the physician a fee after a certain service is provided (Clifford, 1999:16).

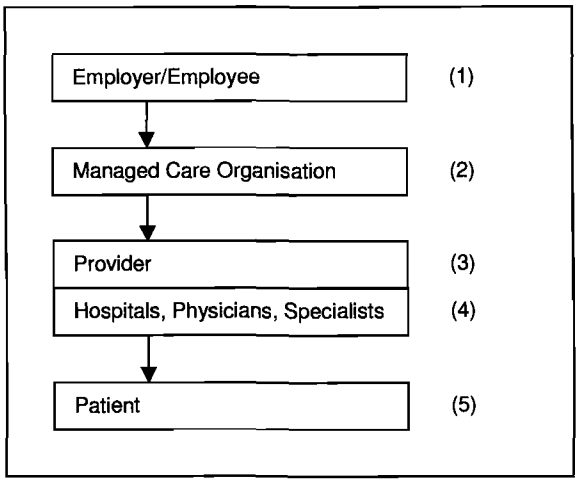


FIGURE 27: The managed care model (Kiel, 2003:17)

There are several reasons why patients join managed care plans due to the advantages and disadvantages. Some of the advantages why people will join a managed health care organisation are (Anon., 1996):

- Its is easier to get all the necessary services e.g. doctors' services, hospital care, laboratory tests, X-rays, etc., through one source;
- The quality of care may be enhanced because of the coordination of services;
- It is easier to budget for medical costs because you know the amount of any premiums in advance and the total of other out-of-pocket expenses is likely to be less than under the fee-for-service system;
- You generally pay only a nominal copayment when you use a service. Some plans do not charge copayments for certain specified services;
- In many cases, benefits beyond those covered by a managed health care provider, are available at either no additional cost or a nominal charge (Anon., 1996).

Some of the disadvantages of enrolling in a managed health care plan include:

- You are not free to go to any physician or hospital you choose except for emergency or unforeseen out-or-area urgent care services;

- Sometimes, you may need to have the prior approval of your primary physician to see a specialist, have elective surgery or obtain equipment or other medical services;
- It takes some time to disenrol and you must continue to use the Health Maintenance Organisation providers until you are disenroled (Anon., 1996).

3.1.2 Types of managed care organisations

There are several systems of managed health care. There are contracted providers who take the responsibility for the financial risks of the health care services (Rickel & Wise, 2000:34; Wagner & Kongstvedt, 2007:24). In this section the Health Maintenance Organisations (HMOs), Preferred Provider Organisations (PPOs), Exclusive Provider Organisations (EPOs) and Point-of-service (POS) are included.

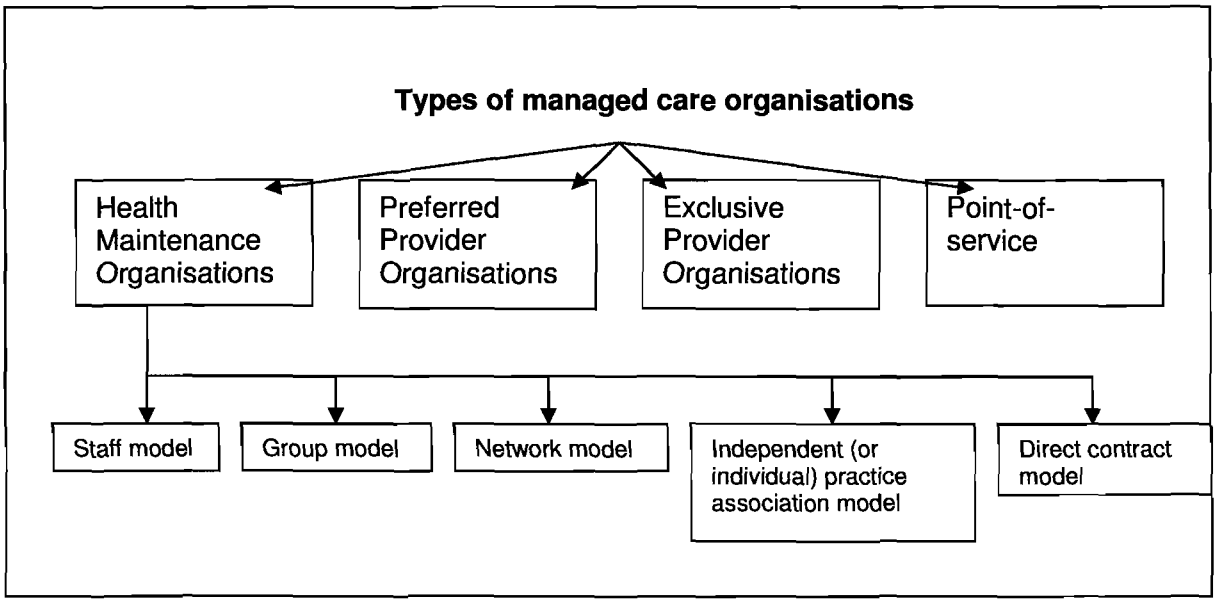


FIGURE 28: Types of managed care organisations (adapted and compiled from Wagner & Kongstvedt, 2007:24)

3.1.2.1 Health Maintenance Organisations (HMOs)

Health Maintenance Organisations (HMOs) are organisations who are responsible for both the financing and the delivery of a broad range of health services to its members. Fairfield *et al.* (1997) define a health maintenance organisation as *a prepaid "organised delivery system"* where a fixed amount of money is available to cover the health needs of members. HMOs are

responsible for the access to health care facilities for their members and for the quality and appropriateness of care for their members. Other health insurance organisations are responsible for reimbursing members for the cost of their health care but HMOs are responsible for providing or coordinating health care services to their members through affiliated providers who are reimbursed under various methods (Wagner & Kongstvedt, 2007:27).

There are five health maintenance organisation models, *viz.* staff model, group model, network model, independent (or individual) practice association model and direct contract model. The differences between these models are discussed in the following section.

3.1.2.1.1 Staff model

According to Wagner & Kongstvedt (2007:28) a staff model HMO is one where the clinicians are employees of the HMO (Fairfield *et al.*, 1997) and where community physicians are unable to participate in this HMO. The HMO must ensure that it employ clinicians from every common specialty in order to meet all the health care needs of the beneficiaries. The disadvantages of such a model are that it is very costly due to the larger variety of clinician staff that are employed and that expanding of their service is very expensive. Although a large variety of clinicians contracted is beneficial to the staff model, there is a limited choice between clinicians within the same specialty.

3.1.2.1.2 Group model

The difference between a group model and a staff model is that the clinicians are employed by the group practice and not by the HMO like in the case of staff models. These clinicians may treat other patients outside the HMO also but their primary focus must be the HMO members. Community clinicians cannot be part of the group model. The advantage of a group model is that is requires a lower capital need due to the fact that it does not have to pay large fixed salaries as in the staff model. The disadvantages are the same as the staff model because it provides a limited choice of clinicians (Wagner & Kongstvedt, 2007:29).

3.1.2.1.3 Network model

In the network model, the HMO contracts with different group practices that provide physician services to the HMO's members. These groups are, according to Wagner & Kongstvedt (2007:30), a broad-based, multispecialty group and are responsible for providing all the physician services to the members in the HMO. Both physicians within the network as well as

physicians outside the network who meet the HMO's criteria, may be contracted. The advantage of a network model is that it has a broader physician participation for the members to choose from.

3.1.2.1.4 Independent (or individual) practice association model (IPA)

The contract is between the HMO and an association of physicians (IPA) who will service the members of the HMO. The IPA is a separate legal entity in which individual practitioners remain with separate offices and identities and who can still give medical attention to members outside the HMO. The big advantage of an IPA is the broad choice of participating physicians. The disadvantage is that drug utilisation management is not always possible because the location of the physicians is geographically distributed (Wagner & Kongstvedt, 2007:31).

3.1.2.1.5 Direct contract model

In a direct contract model, the HMO contracts directly with individual physicians to provide the services to the HMO's members. The HMO has a variety of clinicians to choose from and can recruit a variety of clinicians for their members to use. Because the HMO contracts individual members, it reduces the cost due to mass termination of higher salaries. It is a more difficult and time-consuming process to contract the clinicians (Wagner & Kongstvedt, 2007:32).

3.1.2.2 Preferred Provider Organisations (PPOs)

In a preferred provider organisation, the employer is contracted to purchase medical services from a selection of participating providers within this PPO network. Fairfield *et al.*, (1997:1823) state that a preferred provider organisation is an intermediary between the purchasers of health care and the selected preferred providers who agree to provide services on a discounted fee basis. These providers are contracted to the organisation and agree to the payment levels. In return the organisation limits the size of the participating providers for the individuals to use. Individuals may use other providers outside the organisation but at higher levels of coinsurance (Wagner & Kongstvedt, 2007:24).

3.1.2.3 Exclusive Provider Organisations (EPOs)

Unlike PPOs exclusive provider organisations (EPOs) limit their beneficiaries to only use the services of the participating providers for any medical and health care services. If the service of providers outside the EPO is used, it will not be covered by the organisation. The main reason why employers chose EPOs is for the cost savings benefit (Wagner & Kongstvedt, 2007:25).

3.1.2.4 Point-of-service Organisations (POS)

Point of service organisations are a combination between an HMO and a PPO (Wagner & Kongstvedt, 2007:27). The beneficiaries have the choice to use either the preferred provider and use the HMO benefits or make use of any out-of-plan service but usually at a higher coinsurance payment (Hagen, 1999:7).

This concludes the overview of the different types of managed health care organisations currently available. In the next section, the four types of management are discussed.

3.1.3 Types of management components of managed health care

The goals of managed care are summarised in two short points: cost containment and quality enhancement (Hagen, 1999:5). The components of managed health care are illustrated in the figure below.

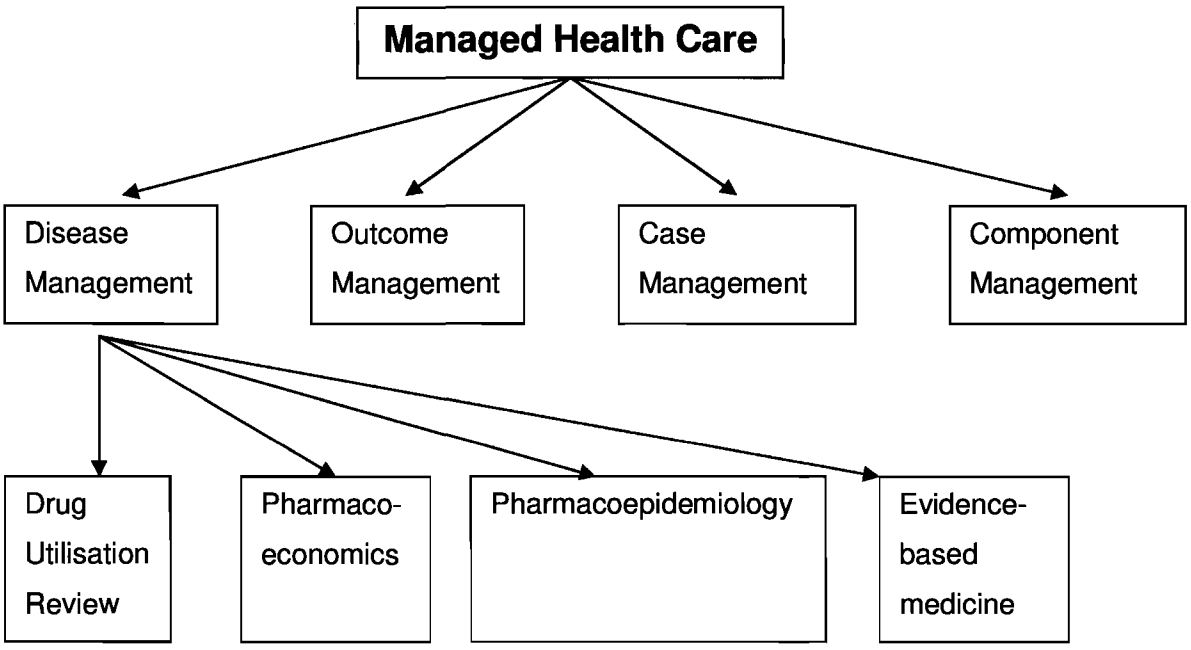


FIGURE 29: An illustration of the lay out of managed health care [adapted and compiled from Serfontein, 2008]

From the illustration above, there are four types of management which form part of managed health care and it is discussed in the section below.

3.1.3.1 Case management

Rognehaugh (1998:40) defines case management as the efficient and medically correct use of health care services for enrolled members to ensure optimal patient outcome in the most cost-effective way. Summers (2006:38) defines case management as firstly to create an individual plan for every patient and to monitor the effectiveness of the plan, and secondly to ensure that the patient's money is spend wisely and in a cost-effective way. Metzger (2007:248) states that case management has the aim to manage patients at their maximum level of comfort, functionality and independence but at the same time at the lowest level of intensity of service.

3.1.3.2 Component management

Sager (1996:593) defines component management as the individual focus on each component of the health care system where emphasis is laid on the components of treatment rather than diseases in the determination of the unit cost.

3.1.3.3 Outcome management

Outcome management, according to Rognehaugh (1998:170), is a system used for monitoring patient intervention and non-intervention therapy outcomes, for example emergency room visits and hospital stays (Edgren, 1999:128). Burgay and Sanchez (2003:27) define outcomes research as the identification, measure and evaluation of the end result of health care services for a patient. There are three main components in outcomes management:

- Clinical effects
- Economic outcomes like cost-of-illness, cost-minimisation analysis, cost-benefit analysis, cost-effectiveness analysis and cost-utility analysis, and
- Humanistic outcomes like quality of life, patient preferences, patient satisfactions and willingness-to-pay (Burgay & Sanchez, 2003:27).

3.1.3.4 Disease management

Macgregor (2003:115) defines disease management as "*a system which has the potential to benefit patients, provided they can deliver important continuity of care, decrease inappropriate treatment and encourage more effective interventions*". This is needed so that more cost-effective therapy occurs and patients received more quality care. Disease management views the patient who is experiencing the clinical course of a disease (Hunter & Fairfield, 1997).

Disease management is an important extension of drug utilisation review that focuses on patient-specific data. These data can be clinical (e.g. a test result), functional (e.g. the patient can walk more easily) or involve general well-being (e.g. the patient has an improved perception of general health), explains Thomas (1996:12). Armstrong and co-workers (Fulda *et al.*, 2008:2) also see disease management as a form of expanded drug utilisation and by using this approach, disease management can:

- Identify different patients with the same disease processes;
- By using multidisciplinary processes, coordinate care;
- Develop treatment guidelines;
- Disseminate information to improve patient care;
- Improve the efficiency of patient care; and
- Use interventions to measure appropriate outcomes (Fulda *et al.*, 2008:2).

But in order for this disease management system to be successful, the following points are important (Macgregor, 2003:115 & 116; Hunter & Fairfield, 1997; McConnell & Conyea, 2004):

- **Patient-centred** – health care services focus more on multidisciplinary teamwork with the appropriate skills as well as understanding how the patient sees his/her illness and/or treatment. McConnell & Conyea, (2004) describe member-centred disease management as a more effective form of disease management which focuses more on the participants rather than just on the medical condition and that patients benefit more from an ongoing relationship with their case manager who helps them to progress to a more healthier condition and state;
- **Outcome focused** – disease management aims to gain the best outcome by combining clinical evidence, patient education, patient consultation and the correct use of medicine;
- **Evidence-based** – one needs to remember that evidence-based medicine was created from a defined population especially put together for the purpose of the study and that in every day living one deals with individual patients;
- **Credible, acceptable, flexible and dynamic**;

- Based on what **happens in the real world** and not on what ought to be happening; and
- Designed to minimise difficulties and **maximise benefits**.

One of the biggest challenges and opportunities for disease management is to develop and identify early interventions that better reduce cost and improve quality of life (McConnell & Conyea, 2004). Because member-centred disease management is more proactively than reactively focused, early intervention is a key component in achieving optimal outcomes for patients with chronic diseases.

According to Edgren (1999:127) there are three main programs which are currently part of disease management:

- **Compliance enhancement** is where something, i.e. vaccination, is good for the pharmaceutical industry and also good for the health plan. Vaccination can help health care achieve their vaccination goal and the industry provides the resources to help the health plans.
- Secondly, **guidelines adherence** is important for disease management due to two reasons: guidelines must be more cost-effective and the responsibility of guidelines adherence lies primarily with the physician because noncompliance with drug regimens is a major cause of guideline failure (Edgren, 1999:128).
- The third program is **outcome management,** as discussed in 3.1.3.3.

Disease management has three main key players: the health system, the clinicians and the patients. These key players each have their own benefits as well as disadvantages as discussed in the table below (Hunter & Fairfield, 1997).

TABLE 13: Benefits and disadvantages of key players (Hunter & Fairfield, 1997)

	Benefits	Disadvantages
Health system	• Cost effectiveness • Consistency of treatment • Greater cooperation between the parts of the system • Seamless care • Less stressful for professionals involved • Improve system overall • Improved allocation of resources • Better outcome • Outcome measurement • Introduction of best practices	• May cost more • Takes time and commits start up resources • Upheaval while being introduced • May be difficult to win over staff • Difficult to change once established • Could be a passing fashion • Could lead to rigidities and block innovation
Clinicians	• Opportunity to work effectively and collaboratively • Good, stable relationships with others • Good access to information • Increased professionalism	• Threat to clinical freedom • Reduction in status • Under closer managerial supervision • Conflict of interest between demands of patient and protocol • Changes the dynamics of doctor-patient relationship and the trust underpinning it
Patients	• Better outcome • More informed patients • Greater involvement • Continuity and consistency of care • Health system more patient centred • Preventive treatment • May speed up treatment • Guidelines are patient driven	• Restriction of treatment • May perceive some treatment to be unnecessary • Increased responsibility and decisions which they would rather not shoulder

According to above mentioned benefits and disadvantages, it is clear that disease management has more benefits than disadvantages. Some of the advantages mentioned like clinicians having to work under closer managerial supervision, can be a benefit to the patient.

This concludes the discussion on managed health care and the four types of management. Armstrong *et al.* (2000) conclude in their study on 'Drug utilisation review: mechanisms to improve its effectiveness and broaden its scope' that the combination of DUR and disease management in evaluating health systems will improve the effectiveness and efficiency of pharmacists' health care interventions. In the next section, drug utilisation reviews will be discussed.

3.2 DRUG UTILISATION REVIEW

A drug utilisation review (DUR) programme is one of the requirements of the federal Omnibus Budget Reconciliation Act of 1990 in order to improve the quality and cost-effectiveness of care for outpatients in the Medicaid program (Wisconsin, 2001:1). The pioneers of research on DUR understand how to interpret the data on patient level and in order to perform DUR, the following questions need to be answered (World Health Organization, 2003):

- Why drugs are prescribed;
- Who the prescribers are;
- For whom the prescribers prescribe;
- Whether patients take their medicines correctly; and
- What the benefits and risks of the drugs are.

Implementation of a DUR program in a hospital has three main aims: to *optimise treatment*, to make *essential drugs available* and to *control the cost* of the therapy in the hospital (Moore *et al.*, 1997:1). Erwin (1991:596) states that the goal of DUR is to enhance the use of pharmaceuticals through quality control and quality assurance. Quality control refers to process-orientated criteria that measure factors such as appropriateness of dose or duration of therapy while quality assurance relates to measuring outcomes of therapy with drugs (Erwin, 1991:596).

3.2.1 Definition

According to Armstrong (Fulda *et al.*, 2008:1) DUR can be defined as a process designed to evaluate the appropriateness of medicine usage against predefined interventions by evaluating drug therapy. The World Health Organization (2003:8) has defined drug utilisation research as early as 1977 as controlling the process of marketing, distribution, prescriptions and usage of medicine as well as evaluate the resulting medical, social and economic consequences. Edgren (1999:119) differentiates between drug utilisation review as the process that focuses on patterns of drug use, and drug use evaluation (DUE) as the appropriate utilisation of drugs to achieve certain clinical outcomes. Jones (1991:620) illustrated the system view of drug utilisation review as an evolving management system applied to an underlying health care system. This illustration consists of three components:

- Input which refers to the health care system and data structure;
- Process which include the criteria, application, intervention and evaluation; and
- Output which is the preferred outcome of the study, e.g. percentage decrease in costs, hospitalisation or drug per patient.

Figure 30 illustrates the system view of DUR (Jones, 1991:621).

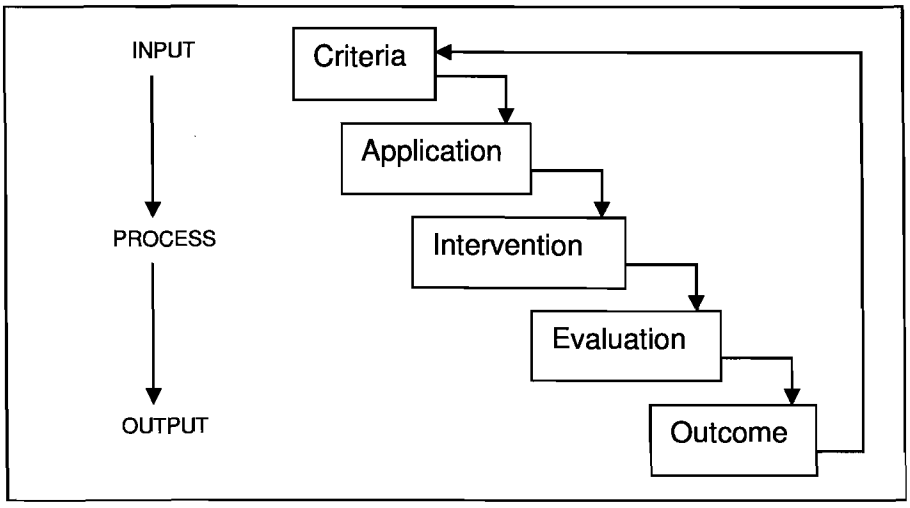


FIGURE 30: System view of DUR (Jones, 1991:621)

Moore *et al*, (1997:1) state that the degree of success of any drug therapy depends on some aspects: the ability of the physician to make the correct diagnosis, to select the correct and appropriate drug for the therapy with the appropriate dosage form and route of administration, to predict possible adverse reactions as well as possible drug interactions and to, lastly but not the least, prevent wrong or duplicated therapy. But, although a drug is approved for usage in a hospital-setup, it does not imply that the drug is correctly prescribed and used. This is when drug utilisation reviews (DUR) are useful because it is a mechanism to ensure the correct prescribing and usage of medicine by identifying inappropriate and/or costly drug therapy, explain Moore *et al.* (1997:1). The advantage of DUR is that it can monitor individual drugs, drugs in different therapeutical classes as well as drugs used in different diseases (using the ICD-10 classification system). If DUR should identify inappropriate medicine usage, interventions are created and implemented to correct those errors.

3.2.2 Classification of DUR studies

There are five different DUR studies as described below.

3.2.2.1 Quantitative studies

The objective of quantitative studies is to quantify the present state, developmental trends and the time course of drug usage at different levels of the health care system, including national, regional, local or institutional level (Lee & Bergman, 1994:380). The results of drug utilisation studies can be used to estimate drug utilisation in populations by age, sex, social class, morbidity and other characteristics in order to identify areas of over- and underutilisation.

3.2.2.2 Qualitative studies

Kreling and co-workers (Fulda *et al.*, 2008:3) identified the following qualitative tools:

- Retrospective DUR;
- Concurrent or prospective DUR;
- Formularies;
- Prior authorisation;
- Disease management; and

- Prescribing through the internet (E-prescribing).

Kreling and co-workers (Fulda *et al.*, 2008:4) also explained that qualitative research is sometimes challenging due to tools and strategies which overlap, incomplete and inconclusive literature and shortcomings of tools and strategies.

3.2.2.3 Prospective studies

For the purpose of the Omnibus Budget Reconciliation Act of 1990 requirements (Wisconsin, 2001:1), Wisconsin Medicaid, a medical aid for patients older than 65 years (Doucette, 2008), developed a system to screen certain drug categories in order to evaluate the clinical significant potential drug therapy problems that can occur before the prescription is dispensed to the patient. Wisconsin (2001:1) and Fulda *et al*, (2008:1) named the following characteristics referring to prospective DUR studies:

- A study is done before the prescription is dispensed;
- Prospective studies identify potential problems before they occur, like drug-drug interactions, dosage problems, duration, etc.;
- The study provides immediate response to a potential problem; and
- It has a preventive/corrective action.

The advantage of prospective DUR programs is that it can be used to prevent inappropriate medicine usage before the patients receive the therapy and can be used by physicians as a 'double-check' mechanism. Prospective DUR can also be used to prevent various drug use problems form occurring, which includes (Moore *et al.*, 1997:19):

- Incorrect dosage;
- Inappropriate dosage form/route of administration;
- Incorrect duration of therapy;
- Drug-drug interactions;
- Therapeutic duplication;

- Drug-disease contraindications;
- Drug-allergy and other side effects; and
- Incorrect laboratory/monitoring orders.

For example, if a patient is already on gentamicin therapy and the pharmacist receives a prescription for erythromycin, the prospective DUR intervention should warn the pharmacist of a possible nephrotoxic effect due to the gentamicin and that the physician should be contacted to change the prescription.

3.2.2.4 Concurrent studies

A DUR study can also be run concurrently with the intervention, state Grégoire *et al.*, (2006:2). The appropriateness of this kind of study is that the problem is identified after the prescription is dispensed but while the patient is still hospitalised, which means that the patient will still benefit from a corrective change in therapy. It is a process of continually monitoring a client's progress once rehabilitation (therapy) has commenced for the purpose of determining whether continued rehabilitation is medically necessary (Hagen, 1999:142). Continued treatment for a patient is based on whether the treatment is still reasonable and necessary for the patient's condition, states Hagen (1999:142). It is reasonable and necessary when it is consistent with the diagnosis and when its omission would adversely affect the patient's condition or quality of life (Hagen, 1999:142).

Grégoire *et al.* (2006) explain the role of concurrent DUR in their study. During the study period, at the end of every day the designated pharmacist had to screen all prescriptions containing cisapride for appropriateness. When the prescription was deemed inappropriate, the pharmacist had to communicate directly with the physician to discuss the deviation from criteria and propose alternative solutions. This is an example of the advantage of a concurrent study.

Thus, concurrent review is performed during the course of drug therapy where interventions to correct problems may have a greater benefit to the patient when they are initiated early in the sequence of dispensing and medication administration, states Kubacka (1996:257).

3.2.2.5 Retrospective studies

Retrospective studies occur after the therapy is prescribed, dispensed and used but one of the major drawbacks is that no interventions can be used to correct inappropriate therapy (Moore *et*

al., 1997:19). Statistically, retrospective studies can also be used to identify prescribing frequencies, compare drug prescribing patterns, compare prescribing standard treatment guidelines and monitor the therapy of high cost drugs (Moore *et al.*, 1997:19). The aim of retrospective studies is to identify areas of inappropriate or suboptimal drug use which may result in preventable drug-related morbidity (Fulda *et al.*, 2004:434). It is not used to alert practitioners of current potentially avoidable problems.

Wisconsin Medicaid reviews drug utilisation retrospectively on a monthly basis (Wisconsin, 2001:5). If a potential drug problem occurs, Wisconsin Medicaid has develop an intervention consisting of an informational letter, a response form, pre-addressed return envelope and the drug profile of the particular patient. This is sent to all providers where the same problem was identified (Wisconsin, 2001:6). Interventions (discussed in section 3.2.9) are used to prevent the same kind of errors. A retrospective study can be identified according to the following characteristics stated by Wisconsin (2001:1):

- A retrospective study is performed after the prescription was dispensed;
- It shows when a potential problem has occurred;
- It is mainly used to detect problems;
- It has a corrective action; and
- This study is useful for designing targets for interventions.

Retrospective studies are also used in population pattern studies (Fulda *et al.*, 2008:1).

3.2.3 Objectives of DUR studies

Drug utilisation review is, according to the World Health Organization (2003:23), a system of continuous, systematic, criteria-based drug evaluation that ensures the correct drug usage. Drug utilisation can influence the actual administration/dispensing process (indication, strength, dosage form, dosage regimen, duration and drug interactions) and the outcome of the therapy (prevention and/or cure of disease) and have the following objectives:

- DUR ensures that medicine therapy is in line with standards of care;
- DUR controls cost of medication;

- DUR intents to prevent disease/medicine related problems due to current therapy;
- DUR evaluates the effectiveness of current therapy; and
- DUR identifies the areas in the drug-use chain where further education is needed (World Health Organization, 2003:23).

3.2.4 Relevant and importance of DUR studies

The World Health Organization (2003:9) named the following uses for research in drug utilisation on how it can increase our understanding of medicine usage:

- DUR can measure the number of patients using a specific drug at a specific time. One can differentiate between prevalence which is based on all the medicines used, regardless of when treatment is started, and incidence, where treatment is started at a certain point in time;
- DUR can measure the extent of medicine usage at a certain point in time or in a specific area;
- DUR can be used to evaluate whether certain drugs are properly used and if there is any overuse or underuse;
- DUR can measure the extend to which alternative medication is used for a specific condition as well as the profile of the drug;
- Compare drug use patterns and recommended guidelines; and
- DUR can be used in the application of quality indicators.

Moore *et al.* (1997:7) identify certain aspects of drug usage that can be evaluated by a DUR study. These aspects differ from health care institution to health care institution due to factors like difference in disease problems, patients, laboratories, specialties and budget. There are three aspects according to which usage can be classified:

- **Justification for use** – is the drug which is evaluated being used for the correct indication;
- **Process indicators** – they are indicators which should be monitored during standard therapy and include aspects like correct indication according to documentation, adverse

effects, management of overdose, dosing, preparations, administration, drug-drug as well as drug-food interactions, monitoring laboratory tests and patient education; and

- **Outcome indicators** – these differ from drug to drug and disease to disease; an example is that with hypertension medication a decrease in blood pressure must be achieved within two hours.

For every drug selected to form part of the program, the following aspects must be selected to ease the managing of the DUR program: indications, contraindications, side/adverse effects, management of overdose, dosing, duplicate therapy, preparation, administration, drug-drug and drug-food interactions, monitoring/laboratory tests, patient education/instructions, anticipated results of therapy and the cost of the therapy (Moore *et al.*, 1997:14).

In this research study, the data were analysed according to the use of DUR as stated by the World Health Organization (2003:9).

1. The number of patients using a specific drug during the research period was determined which refers to the prevalence (see section 5.5). The frequency of the different individual drugs was compared with gender, age groups and ICD-10 code. The incidence does not form part of this study;

2. The proper use of certain drugs was evaluated by comparing the indication (ICD-10 code) with the different drugs (therapeutic code) prescribed for that disease (see section 5.5.6.4);

3. No alternative medicine was prescribed during the study period;

Drug utilisation is also used to justify the use of the medicine by evaluating the proper use of the medicine for the right indication (see section 5.5.6.4) as described by Moore *et al.* (1997:7).

3.2.5 Steps in a DUR study

According to Edgren (1999:120) there are three main steps in performing a DUR study.

The **first step** is to design an organisational structure that is responsible to determine the DUR study's objectives. The pharmacy department is at the top of the organisational structure with the help of the medical director as well as the pharmacy and therapeutic committees and the objectives usually include the analysis of patterns in drug use (Edgren, 1999:121).

The **second step** is to determine the interventions (see section 3.2.9).

The **third step**, according to Edgren (1999:121) is to reapply the criteria to evaluate the effect of the intervention.

After the follow-up study, criteria must be kept up to date with the changing times and changes in health care. This can be done by contacting prescribers in newsletters, direct physician communications or individual physician report cards. Feedback is important for an ongoing DUR process (Edgren, 1999:122).

Moore *et al.* (1997:3) have another approach for implementing drug utilisation review programs and specifically in hospitals. The steps of a DUR program can be divided into four phases, each with several steps for the different phases of the DUR program. The phases are as follows (Moore *et al.*, 1997:3):

1. Phase 1: Planning
2. Phase 2: Data collection and evaluation
3. Phase 3: Intervention
4. Phase 4: Program evaluation

This study fits into phase 2 of the drug utilisation review process. The data were collected and evaluated and results are presented in chapter 5 and 6 of this dissertation. The final results report will be presented to the North-West Department of Health before publication. The researcher plans to proceed with this research study at a later stage to complete phase 3 of the drug utilisation review process, as described by Moore *et al.* (1997:3).

3.2.6 Sources of data for DUR studies

According to the World Health Organization (2006b:1-2) there are a variety of sources for the collection of data for drug utilisation studies by using the ATC/DDD system:

- **Sales data** – from different wholesalers and/or companies;
- **Dispensing data** – In South Africa the private health sector is computerised and linked to the different medical aids in the country. Prescriptions are submitted to the intermediate

company, called a claim, and recorded for reimbursement to the pharmacy. These data from medical aids, like Mediscor® and Interpharm data systems®, are used in DUR studies in the private health sector;

- **Patient encounter based data** – this is mainly used by market research organisations who want to analyze the PDD (prescribed daily dose), duration, patient demographics, indications, etc.;

- **Patient survey data** – In the public sector computerised services are seldomly used with no medical aid connections, thus survey forms based data collection methods are used. By using survey forms, the actual medicine usage can be evaluated by actually examining the prescriptions, patient demographics, etc. on patient charts.

- **Health facility data** – as from health care institutions, hospitals, pharmacies, etc.

Other sources of drug data also defined by the World Health Organization (2003:20) include:

- **Large databases** – containing information on drug sales, drug movement on several levels of the distribution chain, pharmaceutical and medical billing and samples of prescriptions;

- **Data from drug regulatory agencies** – these companies have the responsibility to ensure save, effective and quality medicines in their country;

- **Supplier (distribution) data** – information can be obtained from importers, wholesalers and/or local manufacturers (World Health Organization, 2003:20).

For the purpose of this study which was performed in a public health care institution in the North-West Province of South Africa, survey forms were used as a method to collect the data. The survey form was created to contain all the relevant data from the patient files which included the general information, e.g. gender, age, immunisation and demographics, and the medicine related information e.g. individual drug, indication and cost of therapy. This process was manual because the prescribing and dispensing of medicines at this health care institution, is a manual hand writing process.

3.2.7 Medicine classification systems

Drugs are usually classified according to:

- Their mechanism of action;
- Their indication; or
- Their chemical structure (World Health Organization, 2003:33).

According to Inesta (1992:353) drug classification systems are a uniform method for drug utilisation studies to allow a comparison with other studies. Of all the different systems created over the years, there are four main classification systems which are still in use (World Health Organization, 2007e):

- **Anatomical therapeutic (AT) classification** which was developed by the European Pharmaceutical Market Research Association (EPhMRA). This classification system is divided into groups of three or four levels of classification.
- **Anatomical therapeutic chemical (ATC) classification** which was developed by the Norwegian researchers. This classification system is divided into five levels including therapeutic/pharmacological/chemical classifications and the last level the individual chemical substance.
- **ATCvet classification** is the anatomical therapeutic chemical classification for veterinary medicinal products.
- **ATC herbal classification** is a classification system created for herbal remedies.

3.2.7.1 Classification based on therapeutic classification and pharmacological action of the drug

3.2.7.1.1 Anatomical Therapeutic Chemical (ATC) classification

The drugs which appear in the ATC classification system were named based on their International Non-proprietary Names (INN), United States Adopted Name (USAN) or British Approved Name (BAN; Sketris, 2004). Drugs are classified according to the organ or system in which they act as well as their chemical, pharmaceutical and therapeutic characteristics (World Health Organization, 2007f). Every drug has only one ATC code. The purpose of the ATC classification system is to serve as a tool to improve quality of life by using drug utilisation research (World Health Organization, 2008a). Enalapril is used to illustrate the World Health

Organization's anatomical therapeutic chemical classification system (World Health Organization, 2008c). There are five levels of classification in the ATC system. The first level is the main groups. There are 14 main groups and they are indicated in the table below (Anon., 2005).

TABLE 14: Main groups of the Anatomical Therapeutic Chemical Classification system (Anon., 2005)

Category	Main group
A	Alimentary tract & metabolism
B	Blood & blood forming organs
C	Cardiovascular system
D	Dermatological
G	Genitourinary system & sex hormones
H	Systemic hormonal preparations (excluding sex hormones)
J	General anti-infectives for systemic use
L	Anti-neoplastic & immune-modulating agents
M	Musculoskeletal system
N	Central nervous system
P	Anti-parasitic products
R	Respiratory system
S	Sensory organs
V	Various

The main group represents the anatomical group. In the case of enalapril it is 'C' for *cardiovascular system*. The main group is then sub-divided into four more levels. The second level of the classification is a code for the pharmacological/therapeutic subgroup, for example, 'C09' representing *agents acting on the rennin-angiotensin system*. Thirdly, a pharmacological/therapeutic subgroup, namely *ACE inhibitors, plain* (classification is C09A) and a fourth level of classification according to the chemical/therapeutic subgroup (classification is C09AA for *ACE inhibitors, plain*), is determined. The last level of the ATC classification is based on the chemical substance of the drug, which is in this case enalapril. The ATC code for enalapril is thus C09AA02 (World Health Organization, 2008c).

The therapeutic budget model used in this study was based on the same principle as the Anatomical Therapeutic Chemical (ATC) classification system. Here the first level is the budget group which represents the anatomical main group under which the drug falls. The second

level is the pharmacological/therapeutic subgroups under which the therapeutic entity is listed. The third level refers to the therapeutic subgroup with the chemical substance (individual medicine item) as well as the dose, dosage form and pack sise. The fourth level indicates the level of health care, i.e. 1 = primary health care (clinics), 2 = secondary health care (hospital level) and 3 = tertiary health care. Enalapril is classified according to the therapeutic budget model as follows:

2 *First level – Budget group: Cardiovascular agents*

02 Second level – Pharmacological/therapeutic subgroup: Antihypertensives

010 Third level – Therapeutic subgroup: Enalapril 5mg tablets (28s)

2 Fourth level – Level of health care: hospital health care

The proposed classification system classified enalapril 5mg tablets (28s) with the code:

2-02-010-2.

It can happen that the same drugs being available in different strengths or dosage forms have different ATC codes due to different indications (World Health Organization, 2003:34). Any product in the ATC classification system with more than one equally important indication or strength can have more that one ATC code due to the different indications. Cross-references must be given in guidelines containing the ATC classification system (World Health Organization, 2007b). An example is bromocriptine. At low levels, bromocriptine is used as a lactic inhibitor with the code G02 and at high levels it is used in Parkinson's disease with the classification of N04 (World Health Organization, 2003:34).

TABLE 15: Example of a product with more than one equally important indication or strength (World Health Organization, 2003:34)

Dose of bromocriptine	Usage
Low dosage (2.5 mg bd for two weeks)	Suppression of lactation
High dosage (10-40 mg daily)	Parkinson's' disease

The same applies for prednisolone in different dosage preparation forms. Prednisolone has different formulations (dosage forms) and different ATC classifications for the different indications (World Health Organization, 2003:34).

TABLE 16: Example of a product with more than one dosage form (World Health Organization, 2003:34)

Usage of prednisolone	Dosage form	ATC code
Intestinal anti-inflammatory agent	enemas and rectal foams	A07E A01
Antihaemorrhoidals for topical use	rectal suppositories	C05A A04
Dermatological preparations	creams, ointments, lotions	D07A A03
Corticosteroids for systemic use	tablets, injections	H02A B06
Nasal decongestants	nasal spray, drops	R01A D02
Ophthalmologicals	eye drops	S01B A04
Otologicals	ear drops	S02B A03

The World Health Organization stated that the main purpose for developing the ATC/DDD classification system is so that drug utilisation studies can be done nationally and internationally and that the general objective is to improve drug usage. The ATC/DDD system is in use from as early as the 1970s to compare DUR studies for evaluating long term trends in medicine usage, to calculate the impact of certain events on medicine usage and to provide sufficient information for drug safety investigations (World Health Organization, 2006:1).

3.2.7.1.2 International Code of Diseases (ICD-10) code classification

The World Health Organization took over the responsibility of the ICD-list (International Code of Diseases list) in 1948 from the International Statistical Institute. Today, the tenth edition of the ICD list is available, which came in use in 1994 (World Health Organization, 2008d)

The International Code of Diseases (ICD) is a global and international classification to report and categorise diseases, health-related conditions and external causes of disease and injury in order to get internationally recognised health information relating to deaths, illness and injury (World Health Organization, 2008e). This system is used to classify diseases as well as health related problems for universal use on medical cards, death certificates and hospital record cards (World Health Organization, 2008d).

The next edition, ICD-11, is in progress and there will be three distinct versions: a succinct version for use in primary health care, a detailed version for use in a speciality workplace and an advanced version for the purpose of research (World Health Organization, 2008e).

In this study the indication for medicine usage was identified by using the ICD-10 code classification system because it is an international code of diseases and is more relevant to use this classification system.

3.2.7.2 Classification based on intrinsic value

Intrinsic value refers to the reasonable intrinsic evaluation of a pharmaceutical specialty of the product or products (Laporte *et al.*, 1983:301). Intrinsic value can be divided into 5 groups:

- **High value** includes products where controlled clinical trials exist which support their immediate and obvious effect, e.g. insulin for type 1 diabetes;
- **Relative value** refers to products which contain one or more chemical entities with pharmaceutical specialties that are irrational from a pharmacological and therapeutic point of view, e.g. vitamins and coenzymes. There is no supportive clinical data obtained by an adequately controlled clinical trial to support this practice.
- **Doubtful value** exists for medication used in chronic conditions where controversy is present about their long-term efficacy.
- **No value** includes those products where there is no adequate clinical trials to support their clinical efficacy and include medicine with high value active ingredients but formulated in insufficient doses.
- **Unacceptable value** refers to medicine with a clearly unfavourable benefit and/or risk in any circumstances (Laporte *et al.*, 1983:301).

3.2.7.3 Classification based on expected degree of use

Classification based on expected degree of use refers to the expected potential use of a drug, e.g. the majority of cancer chemotherapeutic agents are not of general use but are effective in some cases (Laporte *et al.*, 1983:302). Medicine can be divided into four groups according to expected degree of use:

- **High potential of use** includes drugs with a recognised activity in frequent prescription situations.

- **Relatively high potential of use** refers to products with recognised activity but in one of three possible situations: where a better alternative exists, the product is basically for hospital use only, and the product can only be prescribed and monitored by health consultants.

- **Limited potential of use** refers to situations where a product is rarely used in very particular circumstances, e.g. vitamin C for scurvy.

- **Not considered** includes all the medicines with intrinsic values in the 'no value' or 'unacceptable value' groups and accordingly it can not be examined to determine the expected degree of use (Laporte *et al.*, 1983:302-303).

3.2.8 Criteria for DUR

According to Moore *et al.* (1997:2) criteria are "*a predetermined parameter of drug prescribing and use established in a DUR program for comparison to the actual practice*". These criteria should be selected and determined by health care professionals, and should contain the official drug compendia, valid drug information and approved peer review literature. The aim of DUR criteria is to increase the appropriateness of drug therapy by determining whether the product is used correctly, e.g. appropriate dose, duration of therapy, drug-drug interactions, therapeutic duplication, over- and underutilisation, etc. (Anon., 2000:539). The success of any drug review program depends on the calibre of its criteria and the ease with which they can be evaluated, states Kubacka (1996:259).

3.2.8.1 Types of criteria

Hennessy *et al.* (2003) describe one criteria violation from data claims. Criteria, according to Hennessy *et al.* (2003), are rules or expectations to which actual practice is compared, e.g. a typical criterion is that a patient may only receive one opioid analgesic at a time. Exceptions (violations of the specific criteria) represent the prescribing errors which are reviewed manually in order to determine if a physician alert or intervention should be issued.

Kubacka (1996:259) recommend the following resources for developing DUR criteria:

- Compendia;

- Information from other DUR programs and clinicians with practical experience in therapeutic drug monitoring;
- Literature supplied by pharmaceutical manufacturers;
- Peer-reviewed literature published in professional journals; and
- Prescribing guidelines derived by consensus from clinical specialty societies (Kubacka, 1996:259).

3.2.8.2 Requirements for development and implementing of criteria

A variety of resources can be used to develop criteria for interventions. Resources can include some of the following: scientific literature, health care experience, guidelines form professional societies and/or authorities, etc. (Moore *et al.*, 1997:8).

In a hospital health care environment, the hospital's Pharmacological and Therapeutic Committee may use one of the following methods, as indicated by Moore *et al.* (1997:16), to develop a criterion for the different programs:

1. Use existing criteria developed by the government or global organisations. Examples include the Standard Treatment Guidelines and Essential Drug Lists developed by the Department of Health, South Africa.
2. Adapt existing criteria and change it to fit the specific health care institutions' needs.
3. Select/create own criteria according to the health care institutions' standard treatment guidelines.

3.2.8.3 Define Daily Dose (DDD)

The World Health Organization (World Health Organization, 2007f) defines the DDD (defined daily dose) as *"the assumed average maintenance dose per day for a drug used for its main indication in adults"*. A DDD will only be assigned for drugs that already have an ATC code (World Health Organization, 2008f). The average adult dose used for the main indication as reflected by the ATC code, refers to a person of 70kg when the recommended dose refers to

body weight. It should be emphasised that even special pharmaceutical forms mainly for children are calculated to a DDD for an adult person. There are some principles followed when assigning DDDs:

- The DDD usually refers to the maintenance dose and not the initial dose.
- A DDD is usually established according to the declared content (strength) of the product.
- The DDD is calculated for the main indication of the product (World Health Organization, 2008f).

3.2.8.4 Prescribed Daily Dose (PDD)

The PDD (prescribed daily dose) can be defined as the average daily dose prescribed, as obtained from a representative sample of prescriptions (World Health Organization, 2003:14). The PDD differs in different countries, ethnic groups, health facilities and indications.

3.2.8.5 Daily Habitant Dose (DHD)

There are three terms associated with the DHD:

- The World Health Organization (2006b:2) and Inesta (1992:353) defined DHD as the "*number of DDDs/1000 inhabitants/day*" and the result is a rough estimate of the proportion of the population within a defined area, which include national, regional, local and institutional levels, treated daily with certain drugs. For example, the figure 10 DDDs/1000 inhabitants/day indicates that 1% of the population on average gets a certain treatment daily, according to the World Health Organization (2006:2). This equation is mainly used for chronic medicine.
- In the case of antibiotics which are used for short term treatment and not chronically, the figures are presented as DDDs/inhabitant/year and the result will be an estimated number of days each inhabitant on average is treated annually. For example, 5 DDD/inhabitant/year means that the consumption of medicine per patient is the same as a five day course of antibiotics during a certain year (World Health Organization, 2006:2).
- DDDs/100 bed-days apply to inpatients in a hospital setup. 70 DDDs/100 bed-days of hypnotics provide an estimate of therapeutic intensity and suggest that 70% of the inpatients

might receive a DDD of a hypnotic every day, according to the World Health Organization (2003:38).

3.2.8.6 Daily Consumer Dose (DCD)

The DCD indicates the *defined daily dose/100 consumers/day* and is used for the determination of drug utilisation from community pharmacies allocated in big cities where it is difficult to estimate the population served by each pharmacy in the city (Inesta, 1992:353).

3.2.9 Interventions

Interventions are selected activities determined by the DUR organisational committee and the aim of interventions is to correct drug therapy problems which are identified by using DUR monitoring and evaluation (Moore *et al.*, 1997:2). Simoens (2008) states that when identifying interventions, the following should be specified:

- To whose advantage is the intervention.
- What the number of interventions will be.
- What actions form part of the intervention.
- Who is going to do the administration of the interventions.

3.2.9.1 Types of interventions

Moore *et al.* (1997:8) list several interventions which may be used to correct inappropriate use of medicine:

- In-service/continuing education programs;
- Written guidelines for drug use;
- Development of special drug order forms;
- Changes in hospital policies and procedures;
- Formulary additions and deletions;
- Prescribing restrictions, and

- Formal and informal counselling.

Peng *et al.* (2003:513) used alert letters sent *via* mail to prescribing clinicians as a method of interventions on potential drug-drug interactions. Such a letter did not only inform the clinician about the potential drug-drug interaction but also the underlying mechanism of that interaction, the possible consequences of such an interaction and possible adverse drug events, and the necessary recommendations in order to avoid the same drug-drug interaction in the future. In the conclusion of their study, Peng *et al.* (2003:520) suggest that future research is needed to determine how prescribers respond to this kind of interventions about apparent medication errors.

Thomas (1996:11) states that Pharmaceutical Benefit Management (PBM) companies use prescription databases as an educational tool to create an intervention to help physicians become aware of their prescribing habits.

The second international conference on improving use of medicine (Laing, 2005:4) made it clear that the misuse of medicine has serious health and financial implications. The research question at this conference was: "How do we achieve large scale and sustained improvements within health systems?" The conference suggested the following interventions to improve the use of medicine (Laing, 2005:4):

- Interventions which include outreach, peer process, regulatory enforcement and incentives can be used to improve pharmacy practice in situations where drugs are purchased in drugstores without the help of a trained medical provider;

- Children can contribute to the improvement of medicine usage by considering school-based education programmes for children in order to reach parents;

- Governments should regulate and monitor the quality of advertising and promotions of medicine because it has a negative impact on prescribing and consumer choice;

- Countries should implement systems to ensure that adherence to therapy becomes an integral part of treatment programmes as well as monitoring of resistance to treatments;

- Policies on complementary and alternative medicines must be in order according to quality, safety and efficacy.

Simoens (2008) illustrates a practical example of an intervention. When a cost-savings intervention is needed the following interventions can be considered:

- Discontinue unnecessary drugs in the health care institution;
- Switch the dosage form to oral which is cheaper; or
- Switch to the least expensive generic on the market.

3.2.10 Limitations to DUR and DUE studies

As mentioned previously, drug usage evaluations/reviews monitor and evaluate prophylactic, therapeutic and empiric use of drugs. The goal is to ensure safe, appropriate and effective drug use. Yet, the greatest limitation of these studies is that in many cases the drug usage evaluation/review ends after the study is conducted and the results are concluded. No interventions or improving of the quality of drug use are done, state Enright & Flagstad, (1991:1910). Another limitation is that results and findings are often confusing, incomplete and nonspecific, making it difficult to formulate a corrective action plan (Enright & Flagstad, 1991:1910).

In this study the evaluation of medicine usage was done at a specific public health care hospital which makes the results and findings more specific in order to improve on the current medicine usage patterns. As mentioned above, the researcher plans to proceed with the results of this study by implementing interventions to improve the medicine usage at this hospital by using the therapeutic budget model and to minimise the limitations as described by Enright and Flagstad, (1991:1910).

Sacristán and Soto (1994:307) state that the final purpose of a drug utilisation study is not only the detection of problems, but also the establishment of measures or interventions to solve them. Pharmacoeconomic studies can be used to compare the efficiency of different types of interventions (educational and/or administrative). By using drug utilisation review as well as pharmacoeconomic studies, this information would enable comparison of the situation before and after the intervention (type I cost-effectiveness studies), comparison of the cost and efficacy of two different interventions aimed at solving the same problem (type II cost-effectiveness studies) or comparison of interventions (equal and different) used to solve different problems (type III cost-effectiveness studies). Figure 31 indicates pharmacoeconomic studies as tools for drug utilisation research.

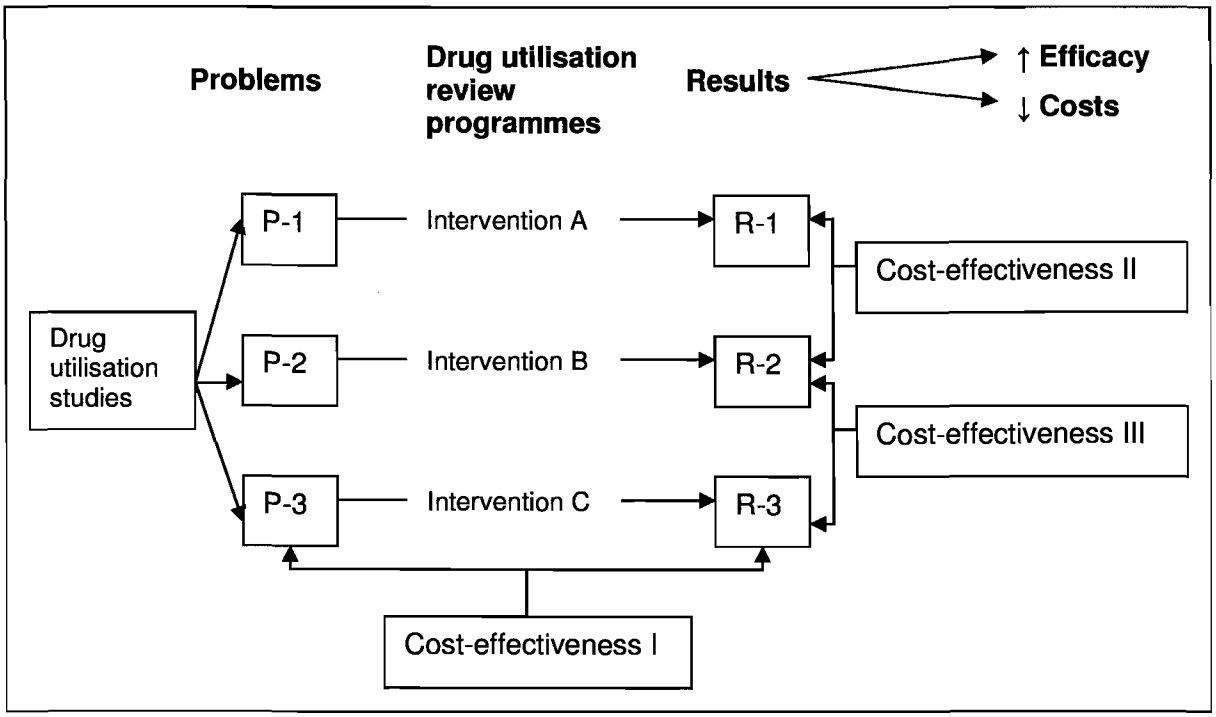


FIGURE 31: Usage of pharmacoeconomic studies to evaluate the efficiency of different interventions (Sacristán & Soto, 1994:308)

This concludes the discussion of disease management as well as certain factors, e.g. classification of DUR studies, objectives, steps in performing a DUR study, sources of data as well as medicine classification systems which include ATC classification system and ICD-10 codes.

Although there were no interventions done in this study, interventions like education, written guidelines and counselling could be used to improve the medicine usage.

3.3 PHARMACOECONOMICS

Economic evaluations are necessary when there are alternatives to consider for programmes. When there are more than one option to choose from, a choice must be made between the alternatives and all choices include economic evaluations (Brent, 2003:4). The concept on which economic evaluations work is based on input and output. Health care take input such as labour, research, etc. which can be converted into monetary units, and transform them in into output which can be measured in either natural units (cost-effectiveness analysis), quality adjusted life years (cost-utility analysis) or monetary units (cost-benefit analysis; Brent, 2003:5-

6). Lyles (2008) stated at the 68th International congress of FIP in Basel Switzerland that there are three major outcomes in performing a pharmacoeconomic survey namely economic, clinical and humanistic outcomes which refer to quality of life.

3.3.1 Definition

It is important to differentiate between health economics and pharmacoeconomics. Health economics analyses the demand and supply of healthcare and provides a structure for understanding the choices made therein. Pharmacoeconomics, on the other hand, adopts and applies the different principles and methodologies created by health economics and uses it in the pharmaceutical policies (Walley *et al.*, 2004:1).

3.3.2 Steps in the pharmacoeconomic analysis

A ten-step method is developed in order to perform a pharmacoeconomic analysis (Cox, 2003b:106):

1. Defining the pharmacoeconomic program;
2. Determining the study's perspective;
3. Determining the alternatives and outcomes;
4. Selecting the appropriate pharmacoeconomic method;
5. Placing monetary values on the outcomes;
6. Identifying resources;
7. Establishing the probabilities of the outcome event;
8. Use of decision analysis;
9. Discounting costs, or performing a sensitivity or incremental cost analysis; and
10. Presenting the results.

3.3.3 Research methods in pharmacoeconomics

Sometimes the different research methods are confused and not used correctly. For example, a cost-minimised analysis is used to find the least expensive alternative between two or more

alternatives where the therapeutic effect is equivalent. On the other hand, is a cost-benefit analysis is used to find the alternative with the lowest net cost and highest net benefit (Cox, 2003b:106). Lyles (2008) emphasises that in a cost-effectiveness analysis one treatment must be compared with another treatment. Figure 32 illustrates when the different analyses are used (Cox, 2003b:107).

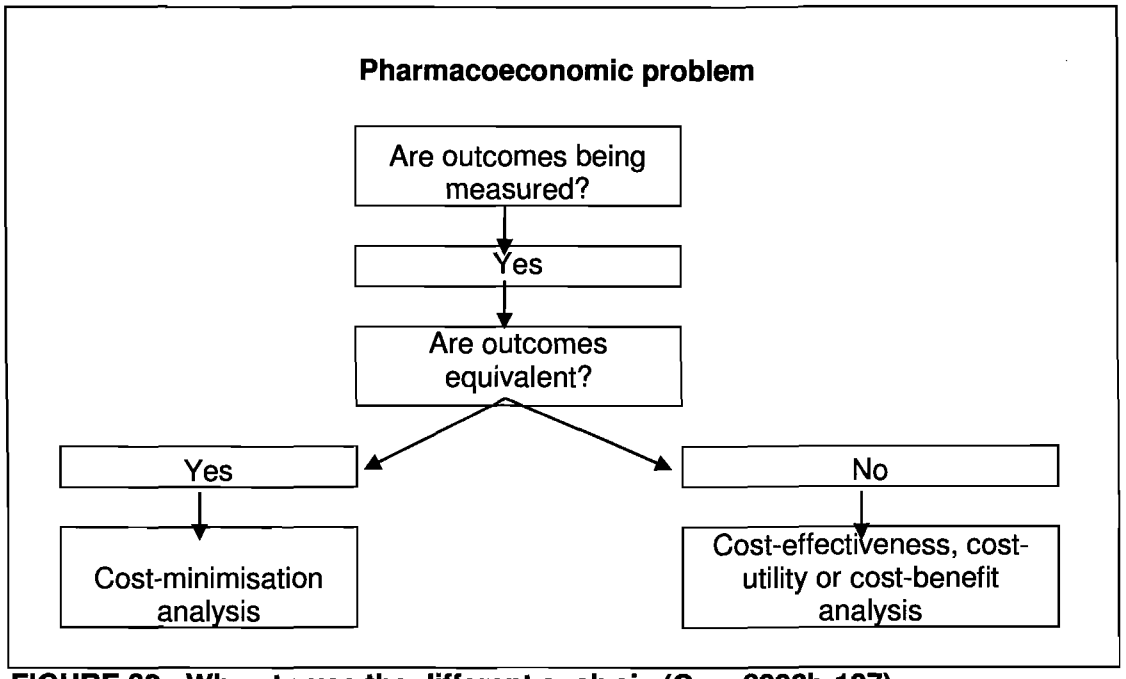


FIGURE 32: When to use the different analysis (Cox, 2003b:107)

TABLE 17: The different outcome units for different analyses (Bungay & Sanchez, 2003:32)

Economic Evaluation Methodologies		
Methodology	**Cost Unit***	**Outcome Unit**
Cost-of-illness	Rand	Not assessed
Cost-minimisation	Rand	Assumed to be equivalent in comparative groups
Cost-benefit	Rand	Rand
Cost-effectiveness	Rand	Natural units or units of effect
Cost-utility	Rand	Quality-adjusted life years or other utility

*Cost unit in South Africa is Rand.

TABLE 18: Advantages and disadvantages of different analysis (Barner & Rascati, 2003:119-120)

Advantages and disadvantages of different pharmacoeconomic analysis		
	Advantages	**Disadvantages**
Cost-benefit	* Both cost and benefit is measured in monetary units * Use CBA to see if value of benefit is worth the effort and cost * Can compare different programs with similar outcomes or unrelated outcomes	
Cost-effectiveness	* Most popular analysis * Measure in natural units like: symptom -free days, mmHg, cholesterol levels, etc. * Analysis is easy to compare results	* Cannot compare outcomes with different types of outcomes
Cost-utility	* Incorporate patient and/or society's preference for health care	* Validity and reliability cannot be measured for these preferences or utilities
Cost-minimisation	* First study to conduct because outcomes are assumed to be equivalent and only cost are compared	* Can only use analysis if the outcomes of therapy is equivalent to alternative

The different pharmacoeconomic analyses have different outcome units but the same cost unit, as illustrated in the table 17 below (Bungay & Sanchez, 2003:32). The different types of analysis used in pharmacoeconomic research, each have their separate advantages and disadvantages. In table 18, the cost-benefit, cost-effectiveness, cost-utility and cost-minimisation analysis is compared according to their advantages and disadvantages.

The four types of pharmacoeconomic analysis, e.g. cost-benefit, cost-effectiveness, cost-utility, cost-minimisation and cost-of-illness analysis, are discussed in the following section.

3.3.3.1 Cost-benefit analysis

Lyles (2008) explains that a cost-benefit analysis is an analytic toll for estimating the net social benefit of a program or intervention as the incremental benefit of the program less the incremental cost. Both incremental cost and outcome of therapy (calculated in monetary terms) are used in calculating cost-benefit analysis (World Health Organization, 2003:27). All the costs associated with the therapy as well as all the benefit resulting from the therapy are identified, calculated and converted into a monetary unit, in South Africa it is the Rand (Bungay & Sanchez, 2003:32). The aim of a cost-benefit analysis, according to Barner and Rascati (2003:119), is to see if the outcome/benefit from the therapy outweighs the input/costs.

Brent (2003:12) explains that cost-benefit analysis incorporates the 'efficiency ratio behind markets' and correct market errors. Barner and Rascati (2003:120) identified five steps in performing a cost-benefit analysis and it is illustrated in figure 33.

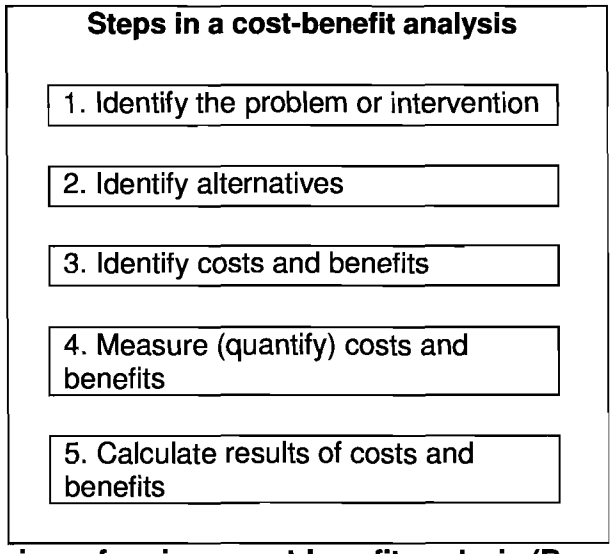


FIGURE 33: Steps in performing a cost-benefit analysis (Barner & Rascati, 2003:120)

Benefit is measured according to the patients' willingness to pay for quality of life benefits (World Health Organization, 2003:27). The result of the CBA (cost-benefit analysis) is expressed in a cost-benefit ratio or a net cost/benefit. The treatment with the greatest cost-benefit ratio or greatest net benefit, is considered the most efficient use of the resource (Bungay & Sanchez, 2003:32). An example of a cost-benefit analysis will explain the concept in table 19.

TABLE 19: Example of a cost-benefit analysis (Bungay & Sanchez, 2003:32)

A cost-benefit analysis	
Cost of therapy (in monetary terms)	R100
Benefit from therapy (in monetary terms)	R1000
Cost-benefit ratio (benefit divided by the cost)	10:01
Nett benefit (subtract cost form benefit)	R900

All the different components which form part of a cost-benefit analysis are illustrated in the diagram below (Barner & Rascati, 2003:121):

The drug would be worth buying if the amount of benefits (B_1) exceeded that of the cost (C_1), explains Brent (2003:7) and the basic cost-benefit ratio is:

$$B_1 > C_1$$

The benefit (B_1) consists of two elements: first the effect of the intervention/therapy (E_1) which includes transforming the treatment from an input to an output, and secondly the price (P_1) of the effect. The effect of the intervention as well as the price of it forms the benefit, and can be rewritten as:

$$E_1.P_1 > C_1$$

3.3.3.2 Cost-effectiveness analysis

A cost-effectiveness analysis aims to measure the clinical outcome of therapy and is measured in units like number of lives saved, complications prevented or diseases cured (World Health Organization, 2003:26-27). This analysis can be used as an analytical tool in which costs and effects of a programme and at least one alternative are calculated and presented in a ratio of incremental cost in incremental effect (Lyles, 2008). Cost-effectiveness is useful when comparing different programmes with different costs and different outcomes to find the most cost-effective treatment (Bungay & Sanchez, 2003:33). Lee *et al.* (2003:137) explain that cost-effectiveness studies identify, examine and compare cost to consequences of medicine usage. The outcomes of the drugs compared in the cost-effectiveness study are not equal, but the outcome of the analysis is measured in a common unit which makes it possible to measure

drugs with the same indication but not exactly the same effect. Cost-effectiveness measures the incremental cost due to an incremental health benefit which results in a particular incremental health outcome for a specific indication. Examples of incremental cost-effectiveness analysis include:

- The cost per extra patient achieving a 10mm Hg fall in blood pressure;
- The cost per extra asthmatic patient achieving a reduction in oral corticosteroid use;
- The cost per extra episode of febrile neutropenia avoided; or
- The cost per extra acute rejection episode avoided in patients with kidney transplants (World Health Organization, 2003:26-27).

However, cost-effective does not always mean the less expensive alternative. Cost-effectiveness is obtained when alternatives are compared to each other and one of the following conditions is met (Bungay & Sanchez, 2003:33; Lee *et al.*, 2003:137):

- A cost-effective alternative is found that is less expensive and have the same effectiveness as the comparator;
- A cost-effective alternative is more expensive with more benefits that is worth the extra costs; and
- A cost-effective alternative is less expensive and not so effective and the extra benefits are not worth extra costs.

The results of a cost-effectiveness analysis can be expressed in either average cost-effectiveness ratio or incremental cost-effectiveness ratio (Bungay & Sanchez, 2003:33). In the average cost-effectiveness ratio the average cost in order to achieve a specific outcome is spread over a large population. The incremental cost-effectiveness ratio represents the additional cost and additional benefits compared between treatments. Bungay and Sanchez (2003:33) explain cost-effectiveness analysis in the next example:

A cost-effectiveness analysis		
	Drug A	Drug B
% efficacy/cure rate	90%	95%
Total treatment cost for 100 patients	R50 000.00	R100 000.00
Average cost-effectiveness ratio (cost divided by outcome)	R555.55 per cure	R1052.63 per cure
Incremental cost-effectiveness ratio (cost of drug B - cost of drug A divided by cure rate of B - cure rate of A)	= R100 000.00 – R50 000.00 95% - 90% = R50 000.00 5% =R10 000.00 per cure	

The primary requirement, according to Lee *et al.* (2003:137), is that alternative programs must have a primary, measurable effect on one case-specific health outcome as the result is measured in terms of a natural unit, for example two antihypertensive drugs are compared in a cost-effectiveness study with the main indication to lower blood pressure, measured in mmHg.

The first step in a cost-effectiveness analysis is the same in all the studies performed in pharmacoeconomics. The steps are listed below (Lee *et al.*, 2003:138-141):

1. Define the problem
2. Identify treatment alternatives and outcome
3. Select a study design
4. Select and measure costs and outcomes
5. Report the results – costs and consequences considered, cost-effectiveness ratios, limitations in interpreting cost-effectiveness ratios, and application of sensitivity analysis.

Lyles (2008) illustrates the principle of cost-effectiveness according to the grid indicated in figure 34. As stated above cost-effectiveness is an analytical tool in which cost and effects of a program (option A) and at least one alternative (option B) are calculated and presented in a ratio of incremental cost to incremental effect. Effects are health outcomes such as cases of a

disease prevented, years of life gained, or QALYs (quality adjusted life years), rather than monetary measures (Lyles, 2008).

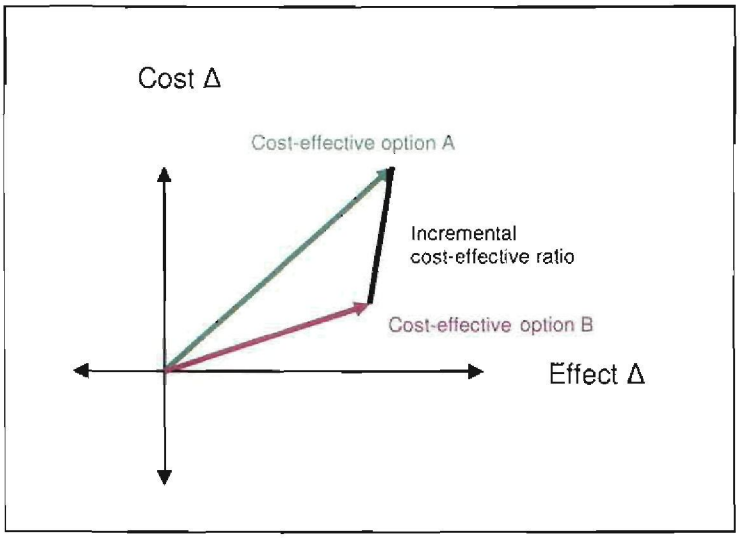


FIGURE 34: Cost-effectiveness grid (Lyles, 2008)

3.3.3.3 Cost-utility analysis

Cost-utility also determines cost factors but in units of quality of life and quantity of life. The cost-utility analysis compares two products to calculate the benefit of each as QALY (quality adjusted life years) and the cost in monetary terms (Bungay & Sanchez, 2003:33). The result is expressed in cost per QALY which represents the number of full health years that are valued equivalently to the number of years as experienced, explain Bungay and Sanchez (2003:33). Cost-utility analysis measures the final outcome in terms of change in life expectancy which includes number of symptom-free days, number of life years gained or reduction in disability days (Franic *et al.*, 2003:154).

There are certain scenarios when a cost-utility analysis is the most appropriate study method to use. A cost-utility analysis is recommended when the following situations occur (Franic *et al.*, 2003:154):

- A cost-utility analysis is used when quality of life is the most important outcome of therapy, for example arthritis where the patient's psychological well-being, physical and social functioning is important;

- Also use cost-utility analysis when quality of life is an important outcome, for example chemotherapeutic regimen where survival increases but the patient's well-being is decreased;

- Where the analysis includes morbidity as well as mortality and the result must be a common unit including both factors, for example estrogen is used to treat menopausal symptoms and so improves the patient's quality of life, but at the same time increases the mortality risk due to endometrial cancer or hip fracture;

- Where the components that are compared, have such a wide range of outcomes and a common unit for the outcome of the analysis is needed, for example building a hypertensive clinic at the hospital or extending the neonatal intensive care unit.

QALY varies between zero (death) and one (perfect quality of life). An increase in duration of life of one year, or increase in quality of life from 0.5 to 0.7 utility units for five years, both result in gain of one QALY (World Health Organization, 2003:27). Franic *et al.*, (2003:155) explained quality adjusted life years according to figure 35.

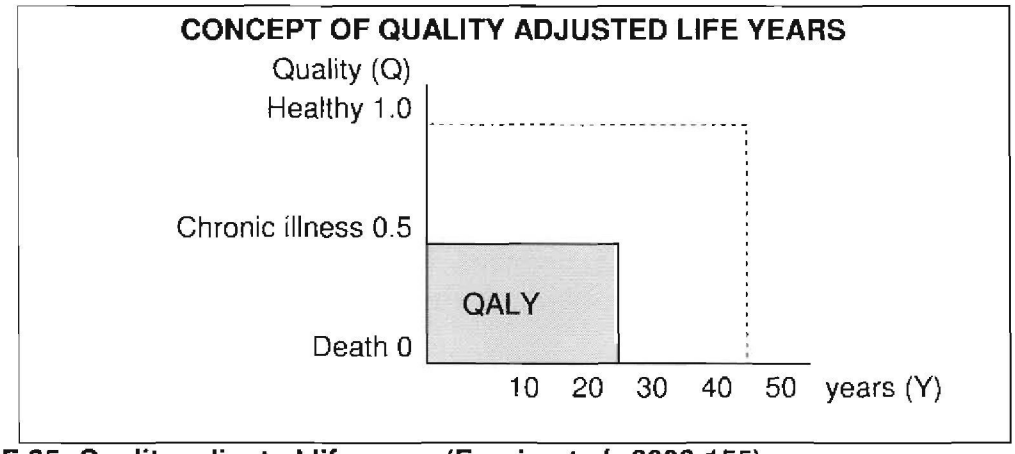


FIGURE 35: Quality-adjusted life years (Franic *et al.*, 2003:155)

On the y-axis is quality indicated with a 'Q' and stretchs from zero (0) which indicates death to one (1) which represents perfect health. In some cases where health is considered worse than death, a negative value can represent the quality of health for that particular patient. On the x-axis the period of time is indicated. Although it is indicated in years, quality of life can also be measured in months, days, hours or other units of time. Y represents life expectancy for a patient with a chronic disease or the duration of the intervention for a patient with an acute disease.

Example:

A healthy person will live for 20 years [Y=20] with a quality of life of one [Q=1]. The multiplication of the two factors results in the QALY.

QALY = Y x Q
= 20 years x 1.0 healthy quality of life
= 20

If this healthy person were suffering from a chronic disease such as arthritis or cancer, the health status is expected to be less than one because the person no longer has a perfect health. Suppose the quality of life is now 0.5 and the person will still life 20 years, the result is slightly different:

QALY = Y x Q
= 20 years x 0.5 healthy quality of life
= 10 (as indicated in the grey area of the figure)

This indicates that a person with arthritis who will live for 20 years is equivalent to a person living for 10 years with full health.

3.3.3.4 Cost-minimisation analysis

According to the World Health Organization (2003:36) cost-minimisation is a method to minimise the cost of a drug or cost of therapy. This analysis method can also be used to compare products that are equivalent in dosage, administration and efficacy but not in cost. Thus, the outcome of the treatment is not evaluated because of the underlying assumption that the treatment is equivalent (Bungay & Sanchez, 2003:32; Cox, 2003b:106). This is used to compare a brand name and a generic product in the same therapeutic class. Lyles (2008) indicates that a cost-minimisation analysis or cost identification analysis is an analytical tool to compare the net costs of programs that achieve the same outcome and is useful in comparing dosage forms of the same drug.

3.3.3.5 Cost-of-illness analysis

The cost of illness evaluation is, according to Bungay and Sanchez (2003:32), used to measure the total cost-implication of the specific illness/disease in a defined population. After estimating the total cost of a specific illness, the cost of treatment to prevent and cure that specific disease can be calculated and compared to the cost of the illness.

Cost-of-illness analysis is different from pharmacoeconomics for the following reasons (Cox, 2003a:95):

- The unit for measuring cost-of-illness analysis is a illness/disease/condition and not an intervention; and
- The purpose for the analysis for cost-of-illness is to measure the total cost for a specific disease/illness for a large population where in pharmacoeconomics the aim is to select the most cost-effective alternative therapy.

The purpose of cost-of-illness analysis is to help policy makers identify certain diseases/illnesses which need to be evaluated and investigated due to high prevalence and where prevention strategies are needed. It is a study of the total cost incurred by a society due to a specific disease (Lyles, 2008). Cost-of-illness does not indicate the most cost-effective or cost-benefit alternative (Cox, 2003a:95). It is simply used to gain information about the economic impact of prevention of the disease/illness in order to perform a cost-effectiveness or cost-benefit analysis, e.g. in the cost-benefit analysis of immunisation, the cost-of-illness of a specific disease (like tetanus) must first be calculated.

As discussed before, prevalence and incidence are the two methods to calculate cost-of-illness (Cox, 2003a:96). Both terms represent disease frequency. Prevalence indicates the proportion of a population who suffers from a specific disease/illness at a specific time where incidence measures the number of new cases of a specific disease/illness that developed over a certain time period. The prevalence based approach estimates the cost of a disease/illness for a certain time period including all patients who are newly diagnosed as well as advanced stages of the disease/illness. Incidence based approach calculates all the costs associated with the disease/illness from diagnosis till cure/death (Cox, 2003a:96-97).

3.3.3.6 Costs

Bungay and Sanchez (2003:28) define cost as *the value of the resources consumed by a program or treatment alternative*. There are different types of cost categories as discussed below:

1. Directs costs

Directs costs are cost associate directly with the prevention, detection and/or treatment of specific diseases and/or illnesses. There are two types of direct costs:

1.1. Direct medical costs are costs directly associated with the medical care of the patients and include costs such as hospitalisation, medicine, medical supplies, x-rays, etc. Direct medical costs can be divided into fixed and variable costs:

1.1.1.1. Fixed costs are costs which are relatively constant overhead costs and not necessarily influenced by the level of therapy. Fixed costs include examples like water and electricity and rent. Fixed costs are not included in a pharmacoeconomical study.

1.1.1.2. Variable costs vary accordingly with the level of treatment and therapy. The more doctor appointments, the higher the cost, the more medicines used, the higher the cost, the more days in hospital, the higher the cost. Variable costs are important when evaluating the cost-effectiveness of a treatment regimen.

1.2. Direct nonmedical costs include all the costs created because of the illness/disease but are not directly associated with the illness/disease. Examples of direct nonmedical costs are transport to and from the hospital, accommodation for the family during the patient's hospital stay, special diets, etc.

2. Indirect costs

Indirect costs include morbidity and mortality. Morbidity is cost due to missed work and loss of productivity. Mortality is cost due to death.

3. Intangible costs

Intangible costs are very difficult to measure because it includes costs that represent nonfinancial outcomes of diseases/illnesses and which are not properly expressed in monetary terms. Intangible costs include terms such as pain, suffering and inconvenience (Bungay & Sanchez, 2003:29). According to Cox (2003a:95), intangible costs are associated with the change in the quality of the patient's life due to the disease/illness.

4. Incremental costs

   Incremental costs represent the extra costs needed to purchase/gain an additional unit of effect. Sometimes, expenditures increase over time and the benefits stay constant or even decrease. Thus, the extra costs represent an extra benefit or better outcome (Bungay & Sanchez, 2003:29).

5. Opportunity costs

   Opportunity costs refer to the lost opportunity to purchase something else with the available sources that was used to purchase an alternative treatment/therapy.

This concludes the discussion on pharmacoeconomic analysis as well as different types of costs.

3.4 PHARMACOEPIDEMIOLOGY

The word pharmacoepidemiology consists of two parts: "pharmaco" and "epidemiology" (Strom, 2006a:3). The first part, "pharmaco" refers to pharmacology, which means study of medicine, and clinical pharmacology, which means study of medicine in humans. Pharmacoepidemiology can be used in clinical pharmacology to give prescribers a better idea of the benefit or harmful effects of a specific drug when therapy is individualised and used in individual patients with unique cases (Strom, 2006a:4). Epidemiology is the study of diseases in a population. Because pharmacoepidemiological studies are performed in large populations, epidemiology forms part of this definition because the effect of drugs for chronic disease epidemiology, which usually refers to large populations (Strom, 2006a:4-5).

3.4.1 Definition

The World Health Organization (2003:8) defines pharmacoepidemiology as *"the study of the use and effects/side-effects of drugs in large numbers of people* (Strom, 2006a:3) *with the purpose of supporting the rational and cost-effective use of drugs in the population thereby improving health outcomes".*

3.4.2 Methods of pharmacoepidemiological studies

There are three main focuses of sophisticated utilisation-orientated pharmacoepidemiology, namely:

- **Drug** – dosage regimen, duration, dose, concentration, strength, etc.;
- **Prescribers** – quality and reliability of prescription; and
- **Patient** – dosage form, age, selection of drug and dose, drug metabolism, etc.

3.4.3 Reasons to perform pharmacoepidemiological studies

In order to perform a pharmacoepidemiological study, the aim must be one or more of the following (Strom, 2006b:56):

3.4.3.1 Regulatory

- A pharmacoepidemiological study can be required before a drug will be released for marketing;
- A manufacturer can offer to perform a pharmacoepidemiological study if it will mean an earlier release of the drug for marketing;
- Questions and concerns arising from reports on adverse reactions and other clinical tests, can lead to a pharmacoepidemiological study to confirm the facts stated in previous reports; and
- A pharmacoepidemiological study can be performed in other countries to assist the application of marketing in that country (Strom, 2006b:56-57).

3.4.3.2 Marketing

- A pharmacoepidemiological study clarifies the advantages and disadvantages of the drug as well as the safety of the drug;
- Further studies, as a pharmacoepidemiological study, improve the name recognition by prescribers and the public, which will increase sales in pharmacies;
- Pharmacoepidemiological studies are useful for the reposition of an existing drug, i.e. exploring the different outcomes of the drug, different types of patients, other indications as the premarketing reports, and less restrictive labelling; and

- In order to protect the drug from not being approved, pharmacoepidemiological studies are done to provide all the answers to questions arising about, for instance, drug toxicity (Strom, 2006b:57-58).

3.4.3.3 Legal

- Pharmacoepidemiological studies' results are documented in order to determine all the toxic effects of the drug if the post-marketing studies reveal adverse reactions that were not mentioned in the pre-marketing studies (Strom, 2006b:58).

3.4.3.4 Clinical

- Hypothesis testing is the main reason for pharmacoepidemiological studies. The hypothesis can be tested on the structure/clinical class of the drug, on pre- and post-marketing human data, from spontaneous reports by patients or to improve the quantification of the frequency.

- Hypothesis generation studies are used for studies on drugs from new chemical entities, safety profile of the drug, the relative safety of a drug in its class, the formulation of the drug, and the disease to be treated (Strom, 2006b:58-59).

3.5 CHAPTER CONCLUSION

In this chapter, the third outcome of the literature phase of the research method is achieved by conceptualisation from literature, Drug Utilisation Review (DUR) articles on the features of the International Code of Disease (ICD-10) classification systems and the Anatomical Therapeutic Chemical (ATC) classification systems. This chapter focused on the relevance of disease management and drug utilisation reviews to this study. It is clear that this study made use of drug utilisation review methods to analyse the data collected from the public health care institution.

The method of data analysis is described in chapter 4, methodology and the results of the data analysed using drug utilisation review, are presented in chapter 5.

CHAPTER 4

Empirical Investigation and Methodology

In this chapter, the empirical investigation process will be discussed. A review of literature regarding the art of doing research as well as methods to prove the validity and reliability of the study are also included in this chapter.

4.1 OBJECTIVES OF THIS STUDY

As discussed in chapter 1 of this dissertation, the research aims are divided into general and specific research objectives:

4.1.1 General objectives

The general objective, as stated in chapter 1, is the development of a therapeutic medicine budget model for Thusong Hospital in the North-West Province to control medicine usage.

4.1.2 Specific objectives

The specific objectives for this research study consist of two phases, namely the literature review (phase 1) and the empirical investigation (phase 2):

4.1.2.1 Literature review (phase 1)

The literature review was divided into two separate chapters for organisational purpose.

The first literature chapter, which is chapter 2 of this dissertation, focuses on the health system of South Africa from national level down to provincial, district and community level. It focuses on the management structure and lay-out in every level, the demographic profile of every level and the number of health care facilities in the particular province, district and community. Further, the factors which affect health and health care in South Africa are discussed as it forms

a very important aspect of health care delivery in the country. These factors are divided into two main categories, namely:

- Appropriate health service provision (see section 2.2.1); and
- Environmental and psychosocial factors (see section 2.2.2).

It also includes an overview of the drug supply management cycle which includes drug selection, procurement, distribution and usage of medicines. The last aspect covered in chapter 2 is funding, budgeting and expenditure aspects of the North-West Department of Health and National Treasury.

Chapter 3 forms the second part of the literature review and focuses on managed health care as a background and more specifically on disease management and drug utilisation review (DUR) with specific reference to the International Code for Diseases (ICD-10) classification system and the Anatomic Therapeutic Chemical (ATC) classification system, within the therapeutic budget model. Pharmacoeconomics also forms part of the scope of the study and is discussed in the chapter.

The following were the specific research objectives, which were achieved in phase 1:

1. Conceptualisation, from literature, of the current situation in the public health sector of South Africa from a national perspective narrowing it down to provincial, local and community level including demographic details and health care facilities.
2. Identifying, from literature, certain factors affecting health care in South Africa.
3. Investigation, from literature and key role players, the drug supply management cycle with specific reference to drug selection, procurement, distribution and use of medicine items in the public health care sector of South Africa and North-West Province.
4. Short description of the present medicine distribution system at Thusong Hospital, North-West Province.
5. Conceptualisation, from literature as well as from Government White Papers, of the financial expenditure data from national treasury, narrowing down to provincial and local levels.

6. Conceptualisation, from literature, of a brief overview of managed health care, how managed health care systems work, the different types of managed care organisations and management components.

7. Conceptualisation, from literature, of articles on Drug Utilisation Review (DUR) with focus on the features of the International Code for Disease (ICD-10) classification system and the Anatomic Therapeutic Chemical (ATC) classification system.

8. Conceptualisation, from literature, of a brief overview of pharmacoeconomics and pharmacoepidemiology.

4.1.2.2 Empirical investigation (phase 2)

In the empirical investigation, the data were collected by using a set of survey forms as research instrument (see appendix B.1 and B.2): one for the outpatient department and another for the inpatients who were hospitalised. According to Neuman (2006:14), there are a few steps to follow when using survey forms as a method of research:

Step 1: Select a research topic

Step 2: Design a focus question

Step 3: Design the research study and the method of data collection

Step 4: Collect the data

Step 5: Analyse the data

Step 6: Interpret the data

Step 7: Inform other researchers of the outcome of the study (Neuman, 2006:14).

These steps are discussed in-depth later in this chapter.

The following specific objectives were achieved during the empirical investigation (phase 2):

1. Analysis of the general and demographic data which include gender and age distribution, average age of patient, frequency of demography, visits, immunisation (outpatients) and duration of stay (inpatients).

2. Analysis of medicine usage information referring to the frequency of budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary).

3. Analysis of the average number of medicine items per consultation according to gender and age group.

4. Analysis of the average cost per consultation according to gender, age group, budget group, pharmacological group, therapeutic code and ICD-10 code.

5. Analysis of the average cost per medicine item for budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary).

6. To determine the framework for the formulation of a unique therapeutic budget model for Thusong Hospital.

4.2 RESEARCH METHODOLOGY

The researcher is going to use the above stated general and specific objectives to create the research methodology in order to collect and analyse data from Thusong Hospital. Neuman (2005:23) emphasises that before a researcher can start with a study, the researcher must decide which type of research they are going to perform.

4.2.1 Research approach

Neuman (2006:13) identified two types of approaches in research, namely quantitative and qualitative approaches. These two approaches use several specific and different research techniques to perform the research. In table 20 quantitative and qualitative approaches are compared.

TABLE 20: Quantitative and qualitative approaches (Neuman, 2006:13)

Quantitative approach	Qualitative approach
Measure objective facts *(e.g. medicine usage)*	Measure social reality or cultural meaning
Focus on variables *(e.g. monthly usage of medicine, usage in different age groups, usage in different gender, etc.)*	Focus on interactive processes or events
Reliability is key *(e.g. survey form is approved by statistical analyser as reliable)*	Authenticity is key
Value free	Values are present and explicit
Theory and data are separate *(e.g. quantitative techniques condense data in order to see the big picture)*	Theory and data are fused e.g. qualitative methods are data enhancers
Independent of context	Situationally constrained
Many cases or subjects *(e.g. budget groups, pharmacological groups, therapeutic codes and ICD-10 codes)*	Few cases or subjects
Statistical analysis *(e.g. using SAS® 9.1)*	Thematic analysis
Researcher is detached e.g. usually makes use of a survey form *(see appendix B.1 and B.2)*	Researcher is involved e.g. usually makes use of interviews

Leedy and Ormrod (2005:95) also distinguished between a quantitative and a qualitative approach.

In table 20 (adapted form Neuman (2006:13)) it is clear that the quantitative approach is relevant for this study due to the fact that this study focuses on the measurement of objective facts (like medicine usage), different variables to measure (budget groups, pharmacological groups, therapeutic codes and ICD-10 codes) and data are analysed using statistical analysis methods. Leedy and Ormrod (2005:95) confirm this in the following statements:

- The purpose of quantitative research is to explain and predict, confirm and validate and test the theory;
- The nature of the process is based on the establishment of guidelines, predetermined on methods, known variables and a partly context-free approach;

- The identification and collection of data consist of a few variables that are included in the study and form the specific related data. Attention is given to validity and reliability of the data which are collected from mainly a large population and are presented as numeric data;

- The analysis of data is done by using a statistical analysis programme. In quantitative studies the researcher tries to maintain objectivity in the study and uses objective criteria to evaluate the outcome of the study;

- The report or outcome of the research study is presented in a statistical and numeric format using means, medians, correlations and other statistical elements (Leedy & Ormrod, 2005:96).

According to the above mentioned statements from Leedy and Ormrod (2005:96) and Neuman (2006:13), it can be concluded that the approach of this study is a quantitative approach.

4.2.2 Research design

The design of a proposed research study is a very broad and complicated one. There are certain criteria for the research design e.g. defining the use, identifying the purpose and the time dimensions of the particular research proposal. The research design will be discussed in detail in the following pages.

4.2.2.1 Criteria for a research study

Leedy and Ormrod (2005:88) set a group of guidelines to form the general criteria for a research project:

- **Universality** - The study must be designed so that any researcher can perform the study;

- **Replication** – The study must be repeatable in the future;

- **Control** – Control is important in those factors central to the research problem;

- **Measurement** – Key to research is the measurement of data.

This study is universal for any researcher, easy repeatable in future and data are controllable and measurable.

4.2.2.2 Define the use for research

There will always be a reason for research – either to solve a problem or to enhance the human knowledge about a certain aspect. According to Neuman (2006:24) researchers who seek the understanding of social reality perform basic research and are known as basic researchers (can also be called academic or pure researchers). Basic research can be defined as research done to promote knowledge about how things work and why, to understand the fundamental nature of science. Applied research is done in order to find a solution or answer for a specific problem, research question or need by using previous knowledge. Neuman (2006:25) named some examples, i.e. government offices, health care facilities, social service agencies, who usually conduct applied research. In table 21 basic and applied research are compared in terms of some aspects (Neuman, 2006:26).

TABLE 21: Comparison between basic and applied research (Neuman, 2005:26)

Aspect	Basic research	Applied research
Primary audience	Scientific community and other researchers	Non-researchers
Evaluators	Researcher peers	Supervisors, practitioners
Autonomy of researcher	High	Low-moderate
Research rigor	Very high	Varies, moderate
Highest priority	Verified truth	Relevance
Purpose	Create new knowledge	Solve a problem
Success indicated by...	Publication and impact on knowledge/scientists	Direct application to address a specific concern/problem

Applied research can be divided into three types: evaluation research, action research and social impact assessment research. Evaluation research evaluates how well a program, system or policy is working in order to reach the stated goals and objectives (Neuman, 2006:26). Action research is where 'action' took place and where the goal is to bring positive change in the program, system or policy (Neuman, 2006:28). Social impact assessment determines the implication and consequences of change to a programme, system or policy (Neuman, 2006:29).

In the proposed study, the researcher uses an applied research design because the primary audience is not researchers but the North West Department of Health. The purpose of the study is to solve a problem, namely to evaluate medicine usage patterns in a district hospital in North-West Province with a therapeutic budget approach in order to improve medicine usage at that institution. The success of this study will be indicated by the direct application to address the specific concern/problem, namely medicine usage patterns. The aim of the study is to improve the existing policy implementation strategies and medicine usage patterns at Thusong Hospital.

4.2.2.3 Identify the purpose of research

Why do we do research? As stated above, is it to solve a problem or to gain knowledge. It differs depending on what the researcher is planning to accomplish. The purpose for research consists of three groups: Exploration – to explore a new field or interest; Description – to describe a certain process; or Explanation – to explain the process examined. Table 22 gives a brief description of the major differences of the three dimensions (Neuman, 2006:34).

TABLE 22: Purpose of research (Neuman, 2006:34)

Exploratory	Descriptive	Explanatory
Become familiar with the basic facts, setting and concerns	Provide a detailed, highly accurate picture	Test a theory's predictions or principle
Create a general picture of conditions	Locate new data that contradict past data	Elaborate and enrich a theory's explanation
Formulate and focus research questions	Create a set of categories or classify types	Extend a theory to new issues or topics
Generate new ideas, conjectures or hypotheses	Clarify a sequence of steps of stages	Support or refute an explanation or prediction
Determine the feasibility of conducting research	Document a causal process or mechanism	Link issues or topics with a general principle
Develop techniques for measuring and locating future data	Report on the background or context of a situation	Determine which of several explanations is best

In this study, the purpose was firstly an exploration dimension because the current medicine usage patterns were investigated and the factors that influence the provision of medicine usage

were taken into consideration when a better and more effective budgetary policy and demand-procurement-expenditure system is planned. Secondly, a descriptive dimension was followed in the literature review where the background of the situation was investigated.

4.2.2.4 Time dimension

When performing a quantitative research study (as indicated in section 4.2.2), there are two different types of time dimensions: single point in time and multiple time point. A single point in time research or cross-sectional research, is done when research focuses on many objectives but only on one point of time (Neuman, 2006:36). Cross-sectional research can be used for the purpose of exploratory, descriptive or explanatory research.

Contrast to that is multiple time point or longitudinal research, that also focuses on many objectives but on more than one point of time (Neuman, 2006:37). Longitudinal research is for the purpose of descriptive and explanatory research. Longitudinal research can be sub-classified into three types of research: time-series, panel and cohort analysis:

- **Time-series research** studies are those in which the same type of information on a group or groups of people on more than one point of time is investigated (Neuman, 2006:37);
- **Panel research** studies focus on the same type of information on identical groups of people on more than one point of time (Neuman, 2006:38);
- **Cohort studies** is "longitudinal research in which information about a category of cases or people that shared a common experience" at one time period is traced on more than one point of time, states Neuman (2006:40).

In this study, the researcher used the time-series research in the multiple/longitudinal time dimension as a survey form was used as data collection tool to collect the medicine usage data from 1 166 different patients over a 7 month period (January 2007 to July 2007).

4.2.2.5 Geographical area of research

As discussed in section 2.1.4.2 on health care facilities in Ditsobotla, there is one hospital complex in that area. The General de la Rey/Thusong Hospital complex is based in Lichtenburg (General de la Rey Hospital) and near Itsoseng (Thusong Hospital). For this study, data were only collected at the Thusong Hospital in the Ditsobotla municipality.

4.2.2.6 Study population

The study population is based on seven months' (January 2007 till July 2007) patient visits at Thusong Hospital. Because the total number of patient visits to the hospital during the study period was larger than 1 000 patient visits [n = 6 243] for the study period, a 25% study population instead of 10% as indicated in literature, was selected to improve the validity of the study (Leedy & Ormrod, 2005:201). In the master register which the pharmacy uses to fill in all the file numbers of the patients who visit the pharmacy, every fourth patient was selected, outpatient and inpatients were categorised separately. Every patient's medicine history was evaluated and the medicine usage of six months (January 2007 till June 2007) of every patient was documented. The researcher collected the data retrospectively during August, November and December 2007.

4.2.2.7 Data collection tool

Two separate survey forms, one for inpatients and one for outpatients, were used to collect the data (see appendix B.1 and B.2). Survey forms are one of the most popular methods to collect data for research in health care (Sim & Wright, 2000:74). The researcher transferred the details personally from the patient files to the survey forms. This has eliminated the problem of misinterpretation of the form and the problem of training field workers. Self-completed survey forms have the following advantages (Sim & Wright, 2000:77):

- A survey form is easy to complete if it is well structured;
- Ideal for research where fixed response options can be predetermined;
- Suitable to gather much the same information from all respondents;
- The form facilitates comparative analysis across respondents because the information gained is the same;
- Economical form of data collection from large numbers of individuals;
- Includes a retrospective time frame for the response;
- Language and terminology are standardised for all respondents;
- Anonymity of the respondent is easy to guarantee; and

- Data are relatively easy to analyse.

In the measurement process, there are two processes all researchers use: conceptualisation and operationalisation. Conceptualisation involves thinking, observing, consulting, reading and trying all possible definitions to find a clear, explicit and specific meaning definition (Neuman, 2006:182). Operationalisation links the conceptual definition created in conceptualisation process to a specific set of measurement techniques or procedures which are investigated (Neuman, 2006:184).

A selection of contingency (two or more part question), open-ended (unstructured, free response) and closed-ended (structured, fixed response) questions were included into the questionnaire, as recommended by Neuman (2006:286).

4.2.2.8 Data collection techniques

Neuman (2006:41) defines that there are two different categories of data collection techniques: Quantitative techniques focus on collection data in the form of numbers, and qualitative techniques which collect data in the form of words and/or pictures. Both of these techniques require skill, practice and creativity in order to match the specific research question with the appropriate data collection technique.

4.2.2.8.1 Quantitative data collection techniques

According to Neuman (2006:41) there are three methods to collect quantitative data:

- **Experiments** can be conducted in either a laboratory or in real life. The researcher divided the research participants in different groups where some groups are the control groups (receive no 'treatment) and the other groups receive a 'treatment' for the common disease/condition all the people have. The researcher studies the different reactions on both the experimental and control groups.

- **Surveys**, whether it is written questionnaires or formal oral interview, are used in a large number of research participants where the same questions are asked to all the people and the answers are recorded/documented. The researcher does not manipulate the situation or the questions or answers, the results are a true indication of the situation.

- **Nonreactive research** is experimental research but where the research participant does not know they are part of a study due to the fact that they can react differently if they are aware of the study. They are not aware that their information is used in a study.

4.2.2.8.2 Qualitative data collection techniques

Neuman (2006:46) states two different types of qualitative data collection techniques:

- **Field research** is done where the researcher directly observe a small group of research participants for a long time. The researcher record detailed notes of the participants in a natural setting.

- **Historical-comparative research** focuses on both a past historical era and on different cultures. The researcher examines a mixture of these two components.

As previously stated, this study has a quantitative approach and would use quantitative data collection techniques. The method used in this study is survey forms where the same questions are answered using a large number of research participants' patient files to record/document the needed information. All survey forms were completed by the researcher. The results of the study are a true indication of the situation.

4.2.2.9 Data analysis techniques

The data analysis was done by SAS® 9.1 (Statistical Analysis System, 2008). In this particular study, the following statistical measures and formulas were used to analyse the data:

4.2.2.9.1 Average value

The average value, also known as the *mean* or *arithmetic average*, is a summarised statistic and is the measure of the centre of a distribution (Jones, 2008:9). The average is the sum of all the values divided by the number of values (Bolton & Bon, 2004:12; Rubin, 2007:44). The equation for the average value is as follow (Bolton & Bon, 2004:12; Swanepoel *et al.*, 2006:59):

$$\bar{x} = \frac{\sum_{i=1}^{N} Xi}{N}$$

where

$\bar{x}$ = Average (mean)

N = Number of values

Xi = The total of all the values for all the categories where *i* represent the different values (1, 2, 3, ..., N*)

Σ = Sum of all the values

The average value has three main characteristics: the average value is the sum of all the values which make it suitable for further calculations, because the average include all the values, it is very sensitive to deviations, and the average is real for all quantitative data and is unique for every set of data (Swanepoel *et al.*, 2006:60). This calculation is not appropriate to find a mean for normal-level variables such as gender (Rubin, 2007:44).

4.2.2.9.2 Frequency distribution

The frequency distribution is a list or total of the number of observations in each class or category (Bolton & Bon, 2004:4). Swanepoel *et al.* (2006:29) define frequency as the amount of values which appear in a certain category. The relevancy of frequency distribution is that it presents results in a more manageable and meaningful way which is easily understood and interpreted. Frequency distribution can be calculated as follows:

$f = n$

where

f = frequency

n = amount of values

Frequency (f) is obtained by adding all the number of observations in each class or category to form a total number of observations per class or category.

4.2.2.9.3 Standard deviation

Standard deviation indicates the average distance of each value from the statistical average (Swanepoel *et al.*, 2006:79; Jones, 2008:21). Bolton & Bon (2004:16) calculated the standard deviation as follows:

$$S = \sqrt{\frac{\sum (X - \overline{X})^2}{N - 1}}$$

where

S = Standard deviation

Σ = Sum of all the values

$(X - \overline{X})^2$ = square of the difference between each value from the mean

N = Number of values

Standard deviation has three characteristics: it is a trusting measurement of the distribution of values because it includes all the values, standard deviation is influenced by deviations, and has analytic-mathematical qualities (Swanepoel *et al.*, 2006:83). The variance is based on squared deviations from the mean, its square root indicate how far the score in a distribution are deviating from the mean, on average (Rubin, 2007:57).

4.2.2.9.4 Cost-prevalence index (CPI)

The cost-prevalence index is an indicator of the relative expensiveness of medicine (Serfontein, 1989:180). This formula is used in the analysis of medicine and drug utilisation studies. The cost-prevalence index is a relation between the total number/frequency of medicine items prescribed (prevalence) and the total medicine expenditure of the same medicine items (cost) and is calculated as follows:

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

In this study the cost-prevalence index is evaluated as follows:

- If the CPI < 1 the medicine item is relatively inexpensive
- If the CPI = 1 there is a balance between the cost and the prevalence
- If the CPI > 1 the medicine item is relatively expensive (Serfontein, 1989:180).

The CPI is used to evaluate the balance between the cost and the prevalence of the individual medicine items in chapter 5.

4.3 MEASUREMENT OF RELIABILITY AND VALIDITY

According to Sim and Wright (2000:123) data are said to be valid when they represent what they purported to represent. They also state that reliable means that they are reproducible or consistent (Sim & Wright, 2000:123).

4.3.1 What is the difference between reliability and validity?

One can easily think of reliability and validity as the same thing or close to the same thing. It is easy to distinguish between reliability and validity when using an analogy of a diagram of a dart board where the target represents the entity of the interest and the shots represent the individual data points (Sim & Wright, 2000:123).

When one looks at target a.) one sees that all the dots are closely centred south-east of the centre of the diagram. The fact that it is closely centred indicates that the shots on target a.) is highly consistent and thus reliable (Sim & Wright, 2000:123). Target a.) is not valid because the dots range is south-east of the centre and not in the centre of the diagram. When we look at target b.), one can see that the dots are widely distributed around the centre of the diagram. This makes target b.) valid but not reliable because the range of dots are too far apart from each other and from the centre of the diagram. But target c.) is the ultimate illustration of reliability and validity. The dots range are closely centred (reliable) on the centre of the diagram (valid), where one wants it [analogy adapted from Sim & Wright, 2000:123-124].

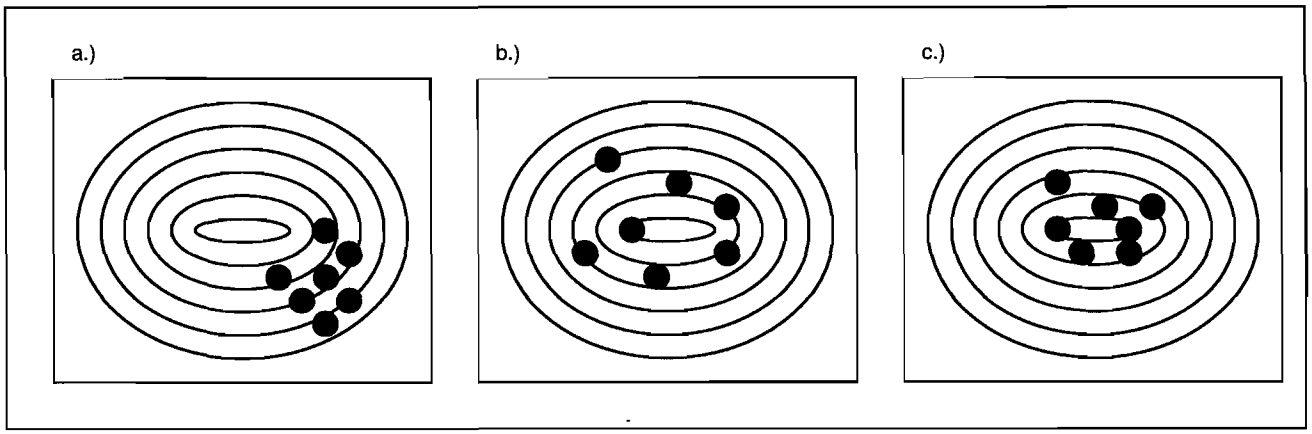


FIGURE 36: Diagram to illustrate reliability and validity (Sim & Wright, 2000:124)

4.3.2 Validity

According to Neuman (2006:188) validity indicates truthfulness and refers to how well the idea or data "fits" within the specific research question and research study. There are six descriptions of measurement validity which is indicated in figure 37 and discussed below:

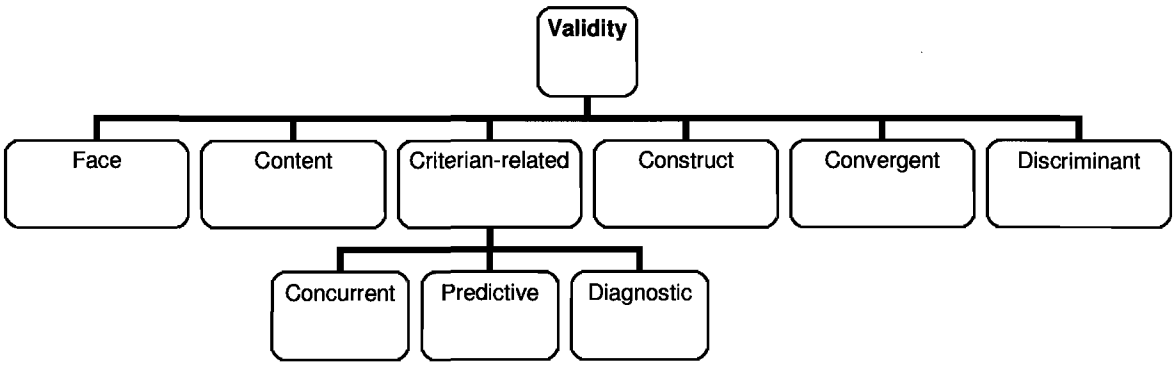


FIGURE 37: Lay out of validity [compiled and adapted from Neuman, (2006:192-194) and Sim & Wright (2000:126-194)]

4.3.2.1 Face validity

Face validity is the judgment by the scientific community that the indicator really measures the construct (Neuman, 2006:192). Face validity is the extent to which data appear to be valid for either the researcher or the subject (Sim & Wright, 2000:126).

4.3.2.2 Content validity

Neuman (2006:193) defines content validity in the following question: "*Is the full content of a definition represented in a measure?*" In content validity one must make sure that all the parts or areas of the research study are included in the measure (Sim & Wright, 2000:126).

4.3.2.3 Criterion-related validity

There are three types of criterion-related validity.

4.3.2.3.1 Concurrent validity

To have concurrent validity, an indicator must be associated with a pre-existing indicator that is already judged to be valid, states Neuman (2006:193). It's when a new instrument is used and it gives the same results as an instrument which is stated as valid.

4.3.2.3.2 Predictive validity

Predictive validity is an indicator which predicts future events that are logically related to a construct (Neuman, 2006:194). The validity of a test can be determined by seeing whether the future course of events is in line with predictions generated by these tests (Sim & Wright, 2000:128).

4.3.2.3.3 Diagnostic validity

Sim and Wright (2000:128) define a third type of criterion-related validity, namely diagnostic validity. It is used in epidemiological testing and consists of two specific terms:

- **Sensitivity of the test** – it indicates those patients who do have the disease; and
- **Specificity of the test** – the extent to which it fails to pick up those without the disease.

4.3.2.3.4 Construct validity

Construct validity is for the measuring of multiple indicators, states Neuman (2006:194). Sim and Wright (2000:130) also explain construct validity as when adjustment is measured with a questionnaire and/or survey form (empirical investigation) and compared with the theoretical relationships of the adjustment, and the results match.

4.3.2.5 Convergent validity

Neuman (2006:194) describes convergent validity as a multiple way to measure the same construct, i.e. if you want to determine if a patient had a certain disease before, you can ask the patient if he had it or you can check the patient's record for a prescription for the related medicine or check the patient's record for specific screening tests.

4.3.2.6 Discriminant validity

Sim & Wright (2000:194) define discriminant validity as "*a type of measurement validity for multiple indicators based on the idea that indicators of different constructs diverge*".

In this study two types of validity, namely construct and convergent validity, are clearly recognisable. The survey forms were evaluated by a statistical analyst for validity and correctness. The survey form was already tested for reliability & validity based on a previous project on therapeutic budgeting model in public clinics in Potchefstroom health district (John *et al*, 2007:40).

4.3.3 Reliability

Reliability can be explained as when an indicator is used to measure a result and does not vary after repeatable measurements with the same indicator under the same conditions. There are three types of reliability as indicated in figure 38:

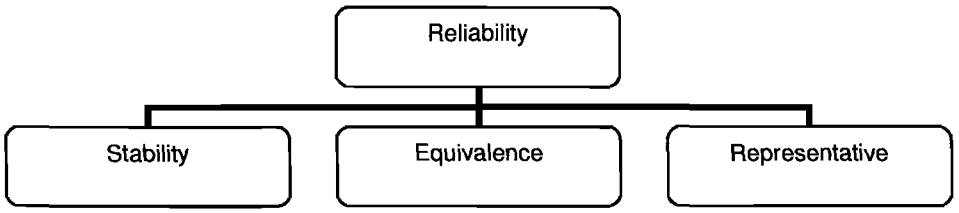


FIGURE 38: Different types of reliability [compiled and adapted from Neuman (2006:189) and Sim & Wright (2000:133-134)]

4.3.3.1 Stability reliability

"*Stability reliability is reliability across time*" states Neuman (2006:189). He implicates that the indicator delivers the same answer to the measure over time.

4.3.3.2 Equivalence reliability

Equivalence reliability uses the same principle as stability reliability but the concept focus shifts to the use of multiple indicators to measure the same outcome. Sim and Wright (2000:133) define it as "*consistency across raters*".

4.3.3.3 Representative reliability

Representative reliability according to Neuman (2006:189) indicates reliability of the indicator when measured on a large and broad scale. Sim and Wright (2000:134) refer to representative reliability as internal consistency reliability and is the extent to which its constituent items are all measuring the same underlying construct.

The survey form was already tested for reliability & validity based on a previous project on therapeutic budgeting model in public clinics in Potchefstroom health district (John *et al*, 2007:40).

In this study stability reliability appear as the indicator (survey form) delivers the same answer (same type of information) over time.

It can be believed that, according to the above mentioned theoretical information, this study is valid and reliable due to above mentioned reasons.

4.4 RELIABILITY AND VALIDITY OF THIS STUDY

The selection, development, implementation and carry out of the study as well as the relevance of the study will be discussed in the next section.

4.4.1 The general idea

The researcher's supervisor is busy with his PhD with the research title *Medicine usage in the public health sector: A therapeutic budget approach.* The researcher focuses on the medicine usage of North-West Province and tries to build a control model for rendering and managing budgetary allocations effectively and efficiently in the public health sector (John, 2006:3). Because this study focuses on the whole North-West Province and data were going to be collected from every public health care institution in the province, a study on masters' degree level will be performed at only one public health care institution in the North-West Province which will also serve as the pilot study for the PhD study which form part of the larger objective of compiling of medicine usage database in the public sector in North-West Province.

A public health care institution is chosen in stead of the private health sector due to the fact that the public health sector serves 80% of the population of South Africa. The choice of the public health care institution is based on location close to and convenient for the researcher, availability of data to collect, the co-operation of the staff at the health care institution as well as availability of funds. Thusong Hospital near Itsoseng in the Ditsobotla sub-district of the Ngaka Modiri Molema district is ± 25 km north of Lichtenburg on the way to Mafikeng. It is ±160 km from Potchefstroom where the researcher is located at the North-West University, Potchefstroom campus. The researcher has relatives in Lichtenburg who had accommodation available for the researcher. The pharmacy manager has a good organised record system in his pharmacy. This eased the burden of collection of data. The staff in the pharmacy was very willing to let the researcher perform her study there as they will benefit from the study as well.

4.4.2 Planning the data collection process

After the research topic, the literature review, the study population as well as institution for data collection were identified and the applicable ethical committee's applications were successful, planning the process of collection data is a very important step in the research program. Leedy

and Ormrod (2005:104) indicate four questions which will help with the planning process and the research design:

- **What data are needed?**

The first most important aspect of data collection is the identification of *what* data to collect. In a study on *medicine usage control in a district hospital,* it is obvious that data relating to the medicine usage of patients are being evaluated. Not only should prescribed outcome, e.g. medicine prescribed, indication, dosage form, quantity, dosage regimen, duration and cost be evaluated but also secondary factors like gender, age, demography of the patient, frequency of visits and immunisation must also be evaluated.

- **Where are the data located?**

For this study the data which were needed were located in the pharmacy and administration department of Thusong Hospital in Itsoseng, in the Ditsobotla sub-district of the Ngaka Modiri Molema districts of the North-West Province (various factors why this institution is chosen are discussed in 4.4.1).

- **How will the data be secured?**

In Thusong Hospital, the patient records are not supposed to leave the hospital, which is also in line with the patients' rights charter (Department of Health, 2008e). The patient receives his/her file from the patient administration department. After visiting the doctor, the patient takes it to the pharmacy for dispensing the necessary medication. The pharmacist keeps the record, documents the file number in the master register and returns it by the end of the day to the administration office. This method ensures the availability of the patient record all the time. The researcher collected on average 50 patient records every day selected by using statistical methods as discussed in section 4.2.2.6, from the administration department and gave them a list of the records the researcher take so that the administration staff know where the patient records is al the time. Patient confidentially was assured by using a unique pin number on the survey form, as no names of patients or other biographical details were collected from the patient files onto the survey form. Another measure was taken to improve the confidentiality of the patients. A NWU (North West University) ethics application form was completed for approval for scientific projects with human participants, biological samples of human origin or vertebrates. This ethics application was investigated by the North West University ethics committee and was approved on the 13th of August 2007. **The NWU ethics number for this**

study is NWU-00017-07-A7. See the official letter from the ethics committee in the appendix (see appendix A.4).

- **How will the data be interpreted?**

Before the collection of data will take place, a plan for the capturing of the data must be developed. Plans on how the data/responses on the survey form should be recorded into numerical data so that they can be statistically analysed must also be done (Leedy & Ormrod, 2005:191).

Data were collected using two survey forms: one for the outpatient department (OPD) and one for the inpatients (see appendix B.1 and B.2). The *medicine usage survey form* were designed to obtain the medicine related information from the patient cards. A record with the file numbers and the unique survey form numbers were kept in confidentiality, in case of further clarification or a problem occurs. The survey form is used to collect:

- **General information** i.e. gender, date of birth, demography of patient, frequency of visits, immunisation (outpatients) and duration of stay (inpatients); and

- **Stock / medicine supply information** i.e. the prescription(s) prescribed to the patient with the name and strength of the medication, indication, dosage form, quantity, dosage regime, duration and cost, and some relevant information to prescriptions, e.g. by whom the medicine was prescribed, by whom it was dispensed and if it was prescribed according to the EDL.

Information on the funding and expenditures of the pharmacy at Thusong Hospital was identified after a verbal conversation (transcript of conversation in possession of author) with the pharmacy manager (Smit, 2007) and included the following:

- **stock information** i.e. how often orders are placed, are controls in place for issuing ward stock, information on the temperature control of the refrigerator, etc.;

- **storage information** i.e. are all goods stored off the floor, does the FEFO/FIFO system apply, etc.; and

- **budget information** i.e. is the budget subject to provincial approval, what are the monthly turn-over, who is responsible for the pharmacy budget, etc.

The survey form was already tested for reliability & validity based on a previous project on therapeutic budgeting model in public clinics in Potchefstroom health district (John *et al*, 2007:40).

The *medicine usage survey form* is in line with representative reliability because the same survey form is used to measure different patient records (refer to 4.3.3.3). The same survey form is also a mixture of face validity (it measures exactly the medicine usage of the patient) and content validity (it measures all aspects of medicine usage) (see section 4.3.2).

Different types of questions are asked in the survey form (see appendix B.1 and B.2). Note that no survey forms were handed out to patients to complete but that the researcher personally collected the data from the patient's files. The questions are a combination of:

- **Contingency question** – Neuman (2006:286) describes contingency questions as a two-part survey question in which a respondent's answer to a first question determines whether he should complete the more specific second question or skip to the next question. Question 7 of the *medicine usage survey form* for inpatients and question 6 on the outpatients survey form are examples of a contingency question (appendix B.1 and B.2).

- **Open question** – An open question appears in the *medicine usage survey form* on page 3 where the prescription / consultation outcome should be completed. Open questions are unstructured or free response questions (Neuman, 2006:286).

- **Closed-ended** questions are questions where the survey form gives fixed responses from which a respondent must chose one option (Neuman, 2006:286). The respondent is not allowed to answer something else but the provided options. Questions 1, 3, 5 and 7 in both survey forms (appendix B.1 and B.2) are examples of closed-ended questions.

- **Partially open questions** – A type of question where there is a fixed question in part (a) of the question with an option named 'other' and in part (b) asks the respondent to specify the 'other' and give a free response (Neuman, 2006:288). Questions 7 on the inpatients survey form and question 5 and 6 on the outpatient survey form have an 'other' option listed among the options (appendix B.1 and B.2).

Leedy and Ormrod (2005:190) state in their guidelines for constructing a questionnaire that one should use simple and uncomplicated language so that the questionnaire is easily understood. Questions must not be ambiguous and should not indicate whether there is a preferred answer. Because the researcher is going to collect the data herself, no instructions were necessary due to the fact that the researcher clearly understood the survey form.

Neuman (2006:292) set some guidelines for the length of a survey form. The length of a survey form depends on the format of the form and the characteristics of the respondent which is in this case the researcher. The type of information needed for the research study was enough to form a 3 page survey form and is in line with Neuman's guidelines. Leedy and Ormrod (2005:190) recommended keeping it short and as brief as possible; only collect data relevant and essential to the research program.

Now that the survey form is approved as reliable and valid, the study population and time frame can be designed.

4.4.3 Selecting the study population and sample

The sampling design is very important in the research program due to the fact that it has a direct influence on the outcome of the study. Leedy and Ormrod (2005:201) state the basic element of determining the sample size when the study population is less than 100 ($n \leq 100$) , one will need a two-digit number for the sample and when the study population is less than 1 000 ($n \leq 1$ 000), one will need a three-digit number. Further Leedy and Ormrod (2005:207) state that if the population size is around 1 500 (number of patients visiting the pharmacy per month is ± 1 300), 20 % should be sampled. This is a rough figure of 250 patients per month for the sample. This figure includes outpatients, inpatients, ARV patients, after-hour cupboard and psychiatric patients. For the purpose of this study, only the data from the in- and outpatient visits were evaluated. The total number of patients who visited the pharmacy at Thusong Hospital (according to the master register) for the seven month period January 2007 till July 2007, [n = 6 243] forms the study population. A sample of 25% was selected [n = 1 494] and formed the sample population.

4.4.4 Selecting time period of data collection

Medicine usage was investigated from January 2007 to June 2007 (a six month period is picked to include acute as well as chronic prescriptions). Every fourth patient was selected from the master register (equals a sample of 25%). The researcher spent three weeks in August from

the 13th till the 31st at Thusong Hospital. According to the statistics from the master register, the study populations consisted of 979 patients visited the pharmacy during July 2007. This gives a sample of 244. But after one week the researcher had gone through all 244 files and only found 75 files where patients had a medicine usage history. That showsed only a 31% response rate. After telephonic correspondence with the supervisor, they decided to use June 2007's statistics as well. In June 2007, 502 patients visited the pharmacy. The sample of 125 showed a 94% response rate based on the 117 of the 125 patients selected who had a medicine history. The reason for the increase in response rate from 31% to 94% was that the other 69% of the patients visited Thusong Hospital for the first time in July 2007 and July did not form part of the months investigated. That's why in June, the response rate was so good because 93% of the patients had at least one visit during June 2007.

But still the average of July and June's data collection showed only a 62% response rate. The researcher decided to include January till May 2007 also in the study scope. Now seven months in 2007 (January 2007 to July 2007) were selected and six months' (January 2007 to June 2007) medicine usage was investigated. The total number of patients who visited the pharmacy from January 2007 till July 2007 was 6 243 and the sample was 1 494 (25% of the total visits). This obviously indicated that more time was needed to collect the data of the other five months.

After the data collection period of 9 weeks (including August, November and December), the response rate was 84.7% (1 166 of the 1 494 patient files had a medicine history). There were 201 files who had no medicine history and 127 files the researcher couldn't find in the patient administration department. The reasons the personnel provided were that the patients could be inpatients at the very moment; they could take their file home without going after doctor consultation to the pharmacy or the patient could be dead. There were thus only a 18.67% sample taken form the study population, but it was still an acceptable sample size according to statistical calculations with the statistical analyst. Table 23 indicates the total frequencies obtained during the data collection process.

TABLE 23: The total frequency of the data collection process

	Total patient visits: Study population	25% Sample	Data available	Response rate of sample (%)	Data unavailable	Files not found
Outpatients	4 335	1 026	734	71.5%	120	97
Inpatients	1 908	468	432	92.3%	81	30
Total	**6 243**	**1 494**	**1 166**	**78.05%**	**201**	**127**

The total response rate was calculated according to the percentage weight every department (out- and inpatients) takes up of the grand total [n = 6 243] of patient visits. That fraction is then multiplied with the corresponding success rate and the sum of the two totals form the total success rate. The 1 166 patient files (18.67%) which had sufficient information available were regarded as the study population and had 100% response (all 1 166 files had data available).

4.4.5 The process of data collection

In the early planning stages of the study, the researcher accompanied the supervisor of the study and paid a visit to Thusong Hospital to explain the purpose of the study and to get permission to perform this study at Thusong Hospital. During this visit, the responsible pharmacist of Thusong Hospital and the chief pharmacist of the Ngaka Modiri Molema district were present. After they agreed to the study, the clinical manager of the hospital as well as the Director of Pharmaceutical Services in North-West Province, were both approached and the proposal of the study was also accepted by the provincial research committee. The Director of Policy, Planning & Research gave a written letter of approval from the North-West Department of Health accepting the study for research purposes (see appendix A.3).

The basis for the data collection is on the master register of the pharmacy where they record the file numbers of all patients who visit the pharmacy every day. This master register contains only the outpatients and inpatients. The ARV (antiretroviral) patients' records are kept in a different file and do not form part of this study although some anti-retroviral prescriptions information

were part of the data selected. The researcher took the master register and selected every fourth patient (to form a 25% study population) separately for the outpatients and inpatients. If the fourth file number is already part of the study, or is missing or not having sufficient information, that file number is ignored and the next file (fifth file becomes fourth file) is selected. If that file is also selected or is missing or not having sufficient information, the researcher skips to the next file (sixth file becoming fourth file) and so on.

In August, the researcher picked the files and gave it to the administration personnel to select the files. After the files were selected, the researcher took one file at a time and went through it and documented all the relevant information as discussed into the survey form. After all the information in the files was collected, the researcher returned the files to the filing department where the person on nightshift put it back in its place in the shelves. An average of 50 files a day were done.

4.4.6 Data import into the statistical analysis programme

Between the data collection and data capturing, the administrative duties like those of completing and filling of the therapeutic codes (see appendix C.1), the ICD-10 codes (see appendix C.4) and the cost per pack onto the survey forms, must be done. As stated above, the researcher did not find the time to complete these fields during the day as it required a search in a separate reference. This was done during December 2007 and January 2008.

The data obtained in the survey forms were captured in Excel® worksheets, one worksheet titled 'Outpatients Spreadsheet' and the other 'Inpatients Spreadsheet'. These spreadsheets were approved by the researcher, the supervisor as well as the data analyst who handled the SAS® programme. During the data capturing process, all the data collected using words had to be rewritten in numbers by using codes to be compatible with the SAS® programme. There were codes for gender, demography, immunisation, classification of stay medicine supply or not, dosage form, quantity, dosage regimen, duration, reason for no medicine, prescriber, dispenser and guidelines with EDL. Some of the data like the date of birth, date of admission, date of discharge, frequency of out- and inpatient visits, date of prescription, therapeutic code, ICD-10 code, cost per pack size, amount of packs and total cost were already in numeric values and did not need coding. This process was followed after the data collection was done and as the data capturing went on.

Firstly, all the outpatients were captured. After a survey form was captured, it was signed at the bottom of the first page to ensure that survey forms are not captured in duplicate. All the survey forms were filed numerically to ensure that it does not disappear. After the outpatients, all the inpatient files were captured. This process was completed at the end of January 2008.

The researcher did some cross-checking to ensure the validity and reliability of the data. Checks were performed to check the therapeutic codes (to ensure that all the codes existed and are typed correctly); dates (to ensure that the dates existed), dates of prescriptions (all prescriptions varied from 1 January 2007 to 30 June 2007); ICD-10 codes (to ensure that there were no typing errors), and for duration, dosage regimen and dosage form (to ensure that there were no duplicate coding for the same value).

4.4.7 The final report

The final data capturing spreadsheets were imported into the SAS® programme and the data were analysed by writing the necessary programmes to enable the availability of the data. All the data appear in the appendix (see appendix D.1 to D.32) and the results and interpretations are discussed in chapter 5.

4.5 CHAPTER CONCLUSION

In this chapter, the empirical investigation was discussed according to the general and specific objectives of this study. It emphasised the importance of both a literature study and an empirical investigation. Furthermore, the research methodology, measurement of validity and reliability as well as the relevance of both to the study were discussed.

In chapter 5: Results and Discussions, the results obtained in the empirical investigation are discussed in detail.

CHAPTER 5

Results and Discussion

This chapter focuses on the results of the data collection process in the Thusong Hospital in Ditsobotla district based on patient visits from January 1st 2007 to July 31st 2007 and the medicine prescribing patterns for these patients from January 1st 2007 to June 30th 2007. The general objective of this study was to develop and implement a therapeutic medicine budget model at Thusong Hospital to control medicine usage (section 1.3.1).

5.1 INTRODUCTION

All the results of the investigation are discussed in this chapter. The major summary is indicated in a box to highlight the important facts. Sections 5.3.1.4 (p. 185); 5.3.2.4 (p. 194); 5.3.3.4 (p. 215); 5.3.4.3 (p. 223); 5.5.4.5 (p. 254); 5.5.5.5 (p. 275); 5.5.6.5 (p.313) and 5.5.7.4 (p.334) are the comprehensive summaries of the major discussion and to facilitate ease to the reader they are marked in a text box.

5.1.1 Glossary of terms used

In this discussion the following terms were used:

- **Age groups** – Patients were classified in six groups according to their age. The age was calculated from their date of birth till the date of the prescription. These six age groups are mentioned in section 5.2.2. There were five patients whose date of birth was not indicated in the patient file and the age of these patients were not calculated.

- **Average cost per medicine item** – refers to the average cost for any single, individual medicine item prescribed and dispensed to patients during the study period.

- **Average medicine cost per consultation** – refers to the average cost of medicine items on a specific prescription which were prescribed during a consultation but does not include screening tests and doctor consultation fees as well as any surgical medicine items or instruments.

- **Average number of medicine items per consultation** – refers to the average number of individual medicine items that were prescribed during a consultation and dispensed to a patient.

- **Budget groups** – the budget groups are the main groups in which each medication is categorised according to the organ or system in which the medicine works. The classification of budget groups is based on the anatomical group in the Anatomical Therapeutic Chemical (ATC) classification system, *e.g. Anti-infective budget group.*

- **Consultation** – a consultation refers to where the patient 'visit' the district hospital during the study period. It includes the doctor consultation as well as all medicine items prescribed and dispensed to the patient on that particular day during that particular visit.

- **Cost-Prevalence Index** – as discussed in section 4.2.2.9.4.

- **Demography** – the demography refers to the 'reason' or 'type' for a hospital visit which the patient had during the study period and could differ from visit to visit if a patient had more than one visit.

- **Duration of stay** – this refers to the number of days inpatients stayed hospitalised. A patient could be hospitalised more than once during the study period.

- **Frequency** – as discussed in section 4.2.2.9.2.

- **Frequency of consultation** – the frequency of consultations refers to the number of consultations a patient had at the district hospital during the study period. A patient could visit the hospital more than once during the study period.

- **Gender groups** – the gender of the patient which appeared on the patient file was transferred to the survey form and was either male or female.

- **Medicine item** – a medicine item refers to an individual, single, chemical substance product dispensed from the pharmacy and which appears in the therapeutic budget mode (see appendix C.3). Patients received medicine items for the treatment of conditions.

- **Patient** – it refers to an individual patient who visited the hospital once or more than once during the study period, who presented a patient file with medicine related information and whose data were used in the study. A patient was categorised according to gender and age.

- **Pharmacological groups** – the pharmacological group is the second level of classification in the therapeutic budget model and represents the pharmaceutical subgroup of the different budget groups, e.g. *Antiviral.*

- **Prevalence** – *see* Frequency.

- **Therapeutic code** – this code represents the individual medicine item which is based on the chemical and therapeutic characteristics of the single chemical substance and refers to medicine items used in the treatment of medical conditions, *e.g. Efavirenz 600mg capsules (30s).*

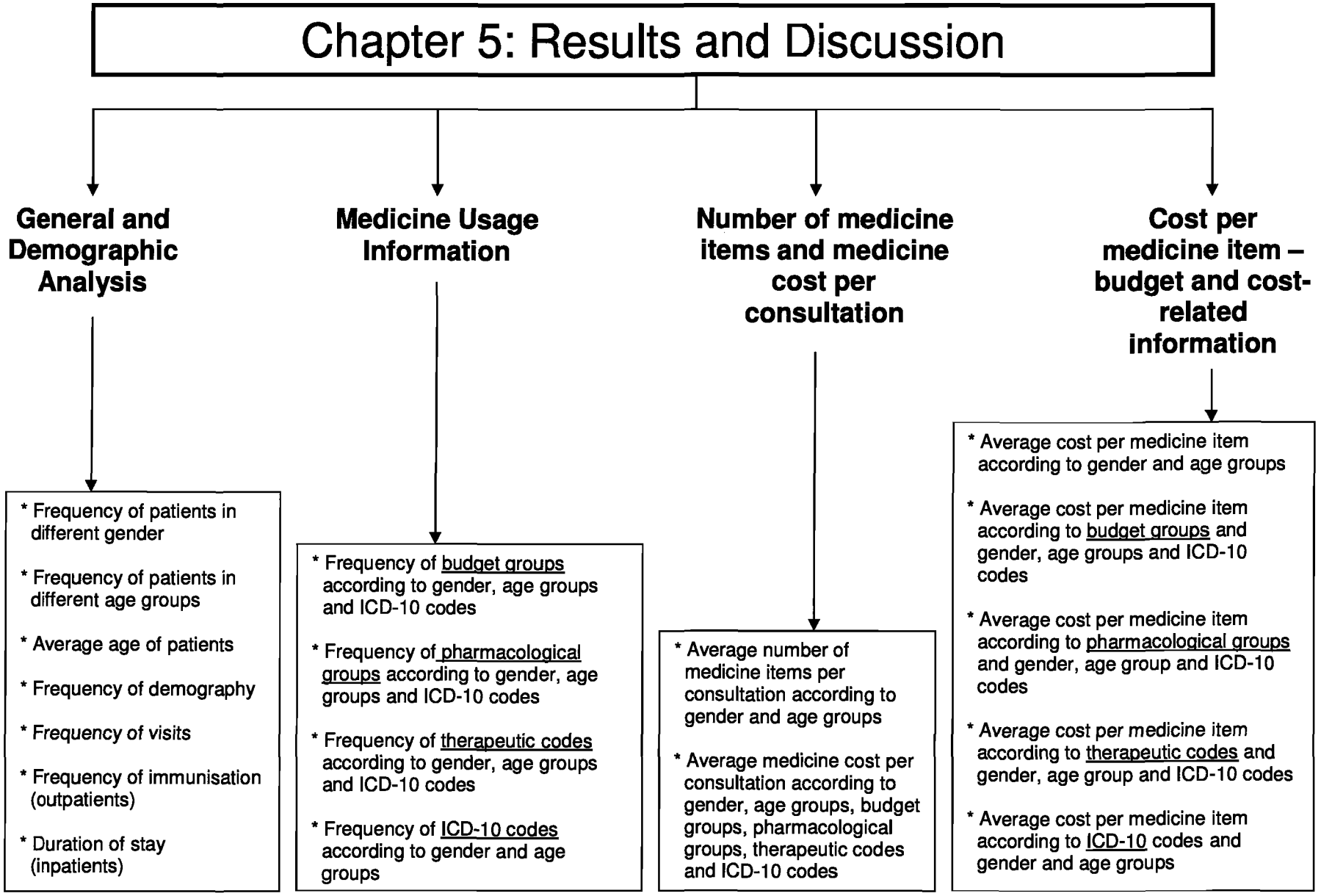
Please note:

- No personal interviews were conducted with patients. The data were obtained from patients' files retrospectively.

- Some of the tables will not add up to 100% because percentages were rounded off to two decimals of the nearest rand.

Figure 39 illustrates the organigram of the lay out of results included in this chapter.

FIGURE 39: Organogram of the lay out of results



5.2 GENERAL AND DEMOGRAPHIC ANALYSES

The general and demographic analyses are described in the first of four sections. It includes an overview of the gender and age group distribution, average age of patients, frequency of demography, visits, immunisation information (only for outpatients) and the duration of stay (only for inpatients).

5.2.1 Frequency of patients in different gender

According to the master register, the total number of patients who visited Thusong Hospital during the study period (January 2007 to July 2007) was 6 243. Unfortunately, only 1 166 patient files had available data for the time frame of January 1st 2007 to July 31st 2007 (see section 4.4.4). Five patient files did not specify the age or the date of birth of the patient. For both in- and outpatients the majority of visits were for female patients (54,17% for inpatients and 53,95% for outpatients). The male visits for inpatients represented 45,83% and was slightly more for outpatient visits (46,05%). The total number of female patients was 630 and the male patients were 536.

TABLE 24: Frequency of patients in different gender

Gender	Inpatients		Outpatients		Total per gender
	n	%*	n	%*	
Male	198	45.83	338	46.05	**536**
Female	234	54.17	396	53.95	**630**
Total	**432**	**100**	**734**	**100**	**1166**

* Percentage was calculated for male and female inpatients and outpatients respectively

Figure 40 illustrates the distribution (%) of the gender between in- and outpatients for the study period of 1st January 2007 till 31st July 2007.

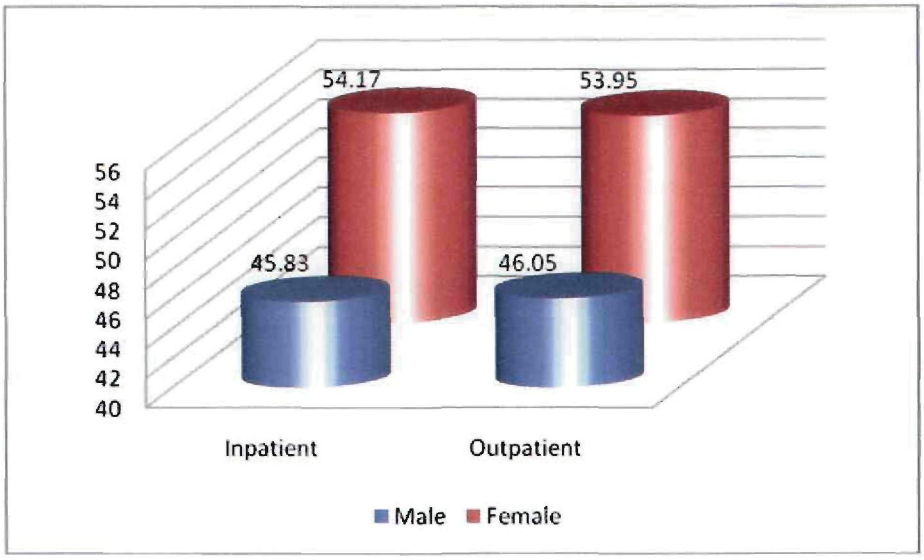


FIGURE 40: Gender distribution between male and female for in- and outpatients

5.2.2 Frequency of patients in different age groups

Patients were divided into the following six age groups:

< 0 ≤ 6 years	Paediatric patients include all patients from birth up to the age of 6 years, including the age of 6 years.
> 6 ≤ 12 years	Children patients include all patients above the age of 6 years which does not include 6 years, up to the age of 12 years, including the age of 12 years.
> 12 ≤ 19 years	Teenager patients include all patients above the age of 12 years which does not include 12 years, up to the age of 19 years, including the age of 19 years.
> 19 ≤ 40 years	Junior adult patients are all patients above the age of 19 years which does not include 19 years, up to the age of 40 years, including the age of 40 years.
> 40 ≤ 60 years	Senior adult patients are all patients above the age of 40 years which does not include 40 years, up to the age of 60 years, including the age of 60 years.
> 60 years	Elderly patients are all patients above the age of 60 years which does not include the age of 60.

The results in table 25 reveal that most (38.41%) patients (N = 1 161) who visited the hospital were in the age group between 19 and 40 years with a total of 446 patients. Paediatric inpatients (aged between 0 and 6 years) had the second largest number of patients who visited the inpatient department with 24.65% (n = 106) of all inpatients. For outpatients, the age group between 40 and 60 years (senior adults) represented the second largest group of patients which represents 26.81% (n = 196) of all outpatients (N = 1 166). This group is the senior adults and a possible explanation for the large number of visits is the use of chronic medication at this age. Lakes (2008) reports that senior Americans (ages 65 years and up) show the highest

prevalence of chronic medication use and that 28 per cent of females and 22 per cent of males take five or more chronic medications. The age group between 6 and 12 years had the least number of patients visiting as in- and outpatients with a total of 4.29% (n = 50).

TABLE 25: Frequency of patients in different age groups

Age group (years)	Inpatients		Outpatients		Total per age group
	Frequency (n)	%*	Frequency (n)	%*	
< 0 ≤ 6	106	24.65	69	9.44	**175**
> 6 ≤ 12	17	3.95	33	4.51	**50**
> 12 ≤ 19	20	4.65	55	7.52	**75**
> 19 ≤ 40	144	33.49	302	41.31	**446**
> 40 ≤ 60	87	20.23	196	26.81	**283**
> 60	56	13.02	76	10.4	**132**
Total	**430**	**100**	**731**	**100**	**1161**

*Percentage was calculated of inpatients and outpatients respectively according to the different age groups

For five patients their age was not specified and the date of birth was not recorded. For the inpatients, two patient files had no date of birth and for outpatients there were three files without a date of birth. Figure 41 illustrates the distribution between the six age groups for in- and outpatients.

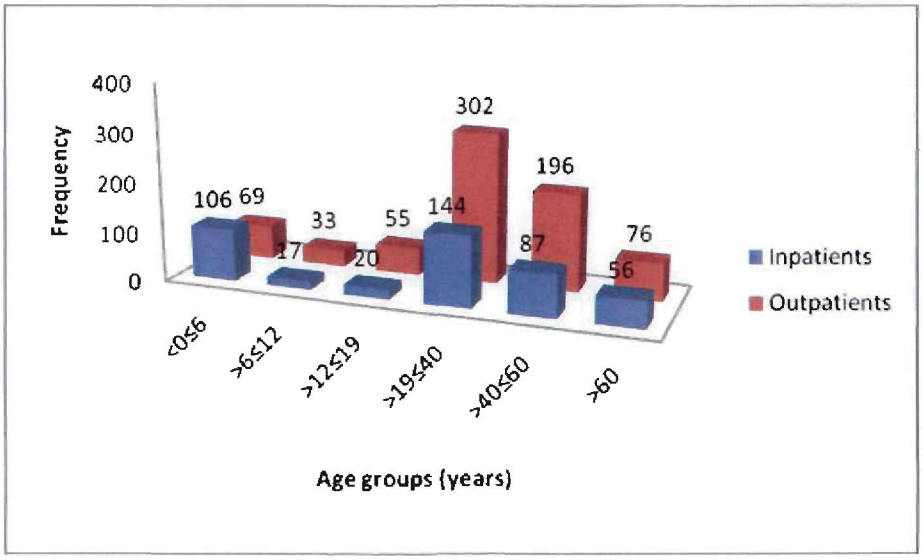


FIGURE 41: Frequency of patients in different age groups

5.2.3 Average age of patients

The average age of inpatients was 30 years and 7 months (30.61 ± 23.68). The maximum age for an inpatient was 92 years and 1 month and the minimum age was 2 months. The average age for the outpatients was slightly higher at 33 years and 10 months (33.91 ± 19.16) but the maximum age for outpatients was only 88 years and 11 months. The minimum age was still 2 months.

The average age of patients was calculated from 1 161 (N = 1 166) patients whose age and/or date of birth were available. As mentioned in section 5.2.2, two inpatients' and three outpatients' information were not available.

TABLE 26: Average age of patients

	Frequency			
	n	Total	%*	Mean ± std dev
Inpatients	430	432	99.54	30.61 ± 23.68
Outpatients	731	734	99.59	33.91 ± 19.16
Total	**1161**	**1166**	**99.57**	

*Percentage was calculated for inpatients and outpatients respectively

5.2.4 Demography

The demographic profile refers to the 'reason' why the inpatient was admitted or the outpatients visited the hospital during the study period. There were eight different standard criteria with combinations between these criteria to form different and sub-criteria. The seventeen types of demographic sub-criteria for inpatients are as follows:

Code	Demography
1	Inpatient - Maternity ward
2	Inpatient - Paediatric ward
3	Inpatient - Male surgical ward
4	Inpatient - Female surgical ward
5	Inpatient - Maternity & Paediatric ward
6	Inpatient - Female surgical ward & Outpatient - Chronic
7	Inpatient - Female surgical ward & HIV/AIDS
8	Inpatient - Female surgical ward & Outpatient - Acute
9	Inpatient - Paediatric ward & TB
10	Inpatient - Male surgical ward & Outpatient Acute
11	Inpatient - Male surgical ward & Outpatient Chronic
12	Inpatient - Male surgical ward & TB
13	Inpatient - Female surgical ward & HIV/AIDS & TB
14	Inpatient - Female surgical ward & TB
15	Inpatient - Paediatric ward & HIV/AIDS
16	Inpatient - Male surgical ward & HIV/AIDS &TB
17	Inpatient - Female ward & outpatient chronic & HIV/AIDS

For the outpatient visits there were only combinations between outpatients, TB and HIV/AIDS. There were no inpatient visits in files identified as outpatients. For outpatients there were ten different types of demographic sub-criteria as indicated below:

Code	Demography
1	Outpatients - Acute
2	Outpatients - Chronic
3	HIV/AIDS
4	TB
5	Outpatient - Chronic & HIV/AIDS
6	Outpatient - Acute & Outpatient - Chronic
7	Outpatient - Acute & HIV/AIDS
8	Outpatient - Chronic & TB
9	Outpatient - Acute & TB
10	Outpatient - Chronic & HIV/AIDS & TB

In table 27 the frequency of the different demographics for in- and outpatients are classified.

TABLE 27: Frequency of demography

Code of demography	Inpatients		Code of demography	Outpatients	
	Frequency (n)	%*		Frequency (n)	%*
Inpatient - Maternity ward	3	0.69	Outpatients - Acute	562	76.57
Inpatient - Paediatric ward	97	22.40	Outpatients - Chronic	100	13.62
Inpatient - Male surgical ward	128	29.56	HIV/AIDS	2	0.27
Inpatient - Female surgical ward	145	33.72	TB	0	0
Inpatient - Maternity & Paediatric ward	1	0.23	Outpatient - Chronic & HIV/AIDS	42	5.72
Inpatient - Female surgical ward & Outpatient - Chronic	5	1.15	Outpatient - Acute & Outpatient - Chronic	8	1.09
Inpatient - Female surgical ward & HIV/AIDS	10	2.31	Outpatient - Acute and HIV/AIDS	3	0.41
Inpatient - Female surgical ward & Outpatient - Acute	1	0.23	Outpatient - Chronic & TB	7	0.95
Inpatient - Paediatric ward & TB	9	2.08	Outpatient - Acute & TB	8	1.09
Inpatient - Male surgical ward & Outpatient Acute	6	1.39	Outpatient - Chronic & HIV/AIDS & TB	2	0.27
Inpatient - Male surgical ward & Outpatient Chronic	3	0.69			
Inpatient - Male surgical ward & TB	6	1.39			
Inpatient - Female surgical ward & HIV/AIDS & TB	4	0.92			
Inpatient - Female surgical ward & TB	9	2.08			
Inpatient - Paediatric ward & HIV/AIDS	2	0.46			
Inpatient - Male surgical ward & HIV/AIDS &TB	1	0.23			
Inpatient - Female ward & Outpatient chronic & HIV/AIDS	2	0.46			
Total	**432**	**99.99**	**Total**	**734**	**99.99**

*Percentage was calculated for the different demographics which add up to 100% for inpatients and outpatients respectively

5.2.5 Frequency of visits

In table 28, the frequency of visits for inpatients with in- and outpatient visits and outpatients with in- and outpatient visits is indicated.

TABLE 28: Frequency of visits

Number of visits	Inpatient				Outpatients			
	Inpatient visits		Outpatient visits		Inpatient visits		Outpatient visits	
	Frequency (n)	%*	Frequency (n)	%*	Frequency (n)	%*	Frequency (n)	%*
No Visits			317	73.38	734	100		
1 visit	377	87.27	56	12.96			406	55.31
2 visits	48	11.11	21	4.86			141	19.21
3 visits	2	0.46	10	2.31			70	9.54
4 visits	3	0.69	11	2.55			40	5.45
5 visits	1	0.23	6	1.39			38	5.18
6 visits	1	0.23	4	0.93			24	3.27
7 visits			3	0.69			10	1.36
8 visits			1	0.23			1	0.14
9 visits			1	0.23			3	0.41
10 visits			1	0.23			1	0.14
11 visits			1	0.23				
Total	**432**	**99.99**	**432**	**100**	**734**	**100**	**734**	**100.01**

*Percentage was calculate for inpatient and outpatient visits respectively for inpatients and outpatients

Inpatients were classified as patients who had inpatient- and outpatient visits during the study period. Of the 432 inpatients, 377 patients only had one inpatient visit during the study period. This indicates that 87.27% of the inpatients were only once hospitalised during the study period of six months. Further more, 48 inpatients were hospitalised twice which represent 11.11% of all inpatients. The maximum number of hospital visits was six and only one patient (0.23%) had six inpatient visits during the study period. Of the 432 inpatients, 317 patients had no outpatient visits during the study period. This means that this 73.38% of all inpatients visited the hospital only as an inpatient and had no record of outpatient visits to this hospital. Fifty-six inpatients had one outpatient visit which represents 12.96% of all inpatients. Only one inpatient had 11 outpatient visits which was the maximum number of outpatient visits for an inpatient.

Outpatients were classified as patients who only had outpatient visits during the study period. The outpatients had no inpatient visits. For outpatients, 406 patients (55.31%) had only one outpatient visit during the study period and 19.21% of the patients (n = 141) had two outpatient visits during the study period. Only one patient had the maximum frequency of outpatient visits during the study period which was 10 visits.

5.2.6 Frequency of immunisations

Very limited immunisation was done in the hospital during the study period. A possible explanation is that the hospital serves nine clinics in the surrounding area that provide the service of immunisation as part of the primary health care setting to the patients (Smit, 2007a). During the study period, two types of immunisation were provided: tetanus toxoid (TT) (n = 20) and a rabies vaccine to one patient (n = 1). Of all outpatients, 713 patients did not receive any form of immunisation at the hospital during the study period.

TABLE 29: Frequency of immunisations

Immunisation	Outpatients	
	Frequency (n)	%*
Tetanus toxoid (TT)	20	2.72
Rabies	1	0.14
No vaccination	713	97.14
Total	**734**	**100**

*Percentage was calculated for each vaccination respectively which adds up to 100%

5.2.7 Duration of stay

The duration of stay for inpatients varied from zero days (where the patient was admitted and discharged on the same day) to 91 days. Although there were 432 inpatients during the study period, a patient could be hospitalised more than once during this time. Table 30 indicates the frequency of patient stays in hospital during the study period.

According to the table below, there were nine inpatients who were admitted to the hospital during the study period and who were discharged form the hospital on the same day. The highest frequency was for inpatients who stayed for two days in the hospital (n = 100). Inpatients who stayed for two days formed 20.62% of all lengths of stay. The longest stay in hospital was one inpatient who were an inpatient for 91 days consecutively. The average duration of stay for inpatients in the hospital was ± 5 days (5.56 ± 8.08).

TABLE 30: Frequency of duration of stay

Duration of stay (days)	Prevalence		Duration of stay (days)	Prevalence	
	Frequency (n)	%*		Frequency (n)	%*
Zero	9	1.86	16	2	0.41
1	64	13.20	18	2	0.41
2	100	20.62	19	4	0.82
3	75	15.46	20	2	0.41
4	48	9.90	21	1	0.21
5	43	8.87	22	1	0.21
6	26	5.36	23	1	0.21
7	31	6.39	27	1	0.21
8	18	3.71	28	1	0.21
9	9	1.86	35	1	0.21
10	7	1.44	50	1	0.21
11	9	1.86	51	1	0.21
12	9	1.86	52	1	0.21
13	8	1.65	56	1	0.21
14	3	0.62	81	1	0.21
15	4	0.82	91	1	0.21

*Percentage was calculated according to the frequency of the different durations of stay

5.3 MEDICINE USAGE INFORMATION

This section focuses on medicine usage information (prevalence and frequency) excluding the cost and budgeting factors. All pharmaceuticals at Thusong Hospital were divided into budget groups, pharmacological groups and individual therapeutic numbers (see appendix C.1, C.2 and C.3). This classification forms part of the therapeutic budget model. In this section the frequency of the different budget groups, pharmacological groups and therapeutic codes is discussed according to gender, age groups and ICD-10 codes. The frequency of ICD-10 codes according to gender and age groups is also included.

The total number of medicine items dispensed during the study period was 11 768. Inpatients received the most medicine items during the study period with a cumulative frequency of 6 288 (N = 11 768) medicine items and outpatients received only 5 480 (N = 11 768) medicine items although there were more patients visiting the outpatients department (n = 734) than the inpatient department (n = 432) during the study period. Male patients received 4 356 medicine items and female patients received 7 412 medicine items (N = 11 768).

TABLE 31: Number of medicine items dispensed to male and female in- and outpatients

Number of medicine items dispensed	Inpatients		Outpatients		Total
	Male	Female	Male	Female	
	2260	4028	2096	3384	
Total	6288		5480		11768

In the next sections the medicine usage information for budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to age and gender is discussed. In every section the relevant table in the appendix is mentioned.

5.3.1 Budget groups

There were eleven budget groups according to the therapeutic budget model (see appendix C.1). During the study period, medicine items were prescribed and dispensed from nine budget groups, namely

- Anti-infective (budget group 1);
- Cardiovascular agents (budget group 2);
- Dermatological (budget group 3);
- Endocrine (budget group 4);
- Functional (budget group 5);
- Gastrolyte (budget group 6);
- Pain reliever (budget group 7);
- Immunological (budget group 8); and
- Respiratory agents (budget group 9).
- No medicine items were dispensed from the budget groups urogenital drugs (budget group 10) and miscellaneous (budget group 11).

The frequency of these budget groups was analysed according to the gender and age distribution as well as the ICD-10 code prevalence. This information was used to determine the top three groups or codes according to frequency for budget and pharmacological groups, therapeutic codes and ICD-10 codes. In this section budget groups with a prevalence >10.00% is included in the discussion.

5.3.1.1 Frequency of budget groups according to gender

The frequency of budget groups according to gender was divided into four groups: male inpatients, female inpatients, male outpatients and female outpatients. In total (N = 11 768) the group with the highest frequency was female inpatients with a prevalence of 34.23% (n = 4 028). Female outpatients had the second highest frequency of 28.76% (n = 3 384). In total, the female patients received 62.98% of all medicine items (N = 11 768) from the budget groups indicated in table 32 below. Male inpatients had a frequency of 2 260 which was 19.20% of total prevalence (N = 11 768) and male outpatients received the least number of items (17.81%). In total the male patients received 37.02% of the total number of medicine items (N = 11 768).

TABLE 32: Frequency of budget group according to gender

Budget group	Inpatients				Outpatients				Total	
	Male		Female		Male		Female			
	n	%*	n	%*	n	%*	n	%*	n	%*
Anti-infective	624	27.61	1113	27.63	475	22.66	882	26.06	3094	26.29
Cardiovascular drugs	236	10.44	720	17.87	174	8.3	410	12.12	1540	13.09
Dermatological	36	1.59	48	1.19	88	4.2	112	3.31	284	2.41
Endocrine	77	3.41	233	5.78	97	4.63	163	4.82	570	4.84
Functional	123	5.44	218	5.41	145	6.92	204	6.03	690	5.86
Gastrolyte	462	20.44	888	22.05	339	16.17	562	16.61	2251	19.13
Pain reliever	553	24.27	630	15.64	651	31.06	836	24.7	2670	22.69
Immunological	8	0.35	2	0.05	25	1.19	6	0.18	41	0.35
Respiratory drugs	141	6.24	176	4.37	102	4.87	207	6.18	626	5.32
Total	**2260**	**99.97**	**4028**	**99.99**	**2096**	**100**	**3384**	**100.01**	**11768**	**99.98**

*Percentage was calculated according to male and female inpatients and outpatients respectively

According to table 32 the anti-infective budget group had the highest frequency for male inpatients (n = 624), female inpatients (n = 1 113) and female outpatients (n = 882), and the second highest frequency for male outpatients (n = 475). The total frequency of 3 094 for anti-infectives represents 26.29% of the total prevalence (N = 11 768) for all budget groups and was

the budget group with the highest prevalence. According to Jones and Jones (2008:38) bacterial infections are a leading cause of mortality and morbidity in both hospital and community settings in South Africa. This is an explanation why anti-infectives are the budget group with the highest frequency. Bacterial infections are effectively treated with antibiotics, however Jones and Jones (2008:38) warn that treatment options are becoming increasingly limited and complicated due to the ability of the bacteria to develop resistance to these antibiotic agents.

The cardiovascular budget group had a higher prevalence in female inpatients (17.87%) than in male inpatients (10.44%) and female outpatients (12.12%) of all medicine items dispensed. The frequencies are indicated in table 32.

The gastrolyte budget group had the second highest frequency in female inpatients at 22.05% (n = 888). Gastrolytes overall has the third largest prevalence in male inpatients (20.44%), male outpatients (16.17%) and female outpatients (16.61%) of all medicine items. Gastrolytes had a combined frequency of 2 251 which was 19.13% of the total budget group prevalence (N = 11 768) as indicated in table 32.

The pain relievers budget group had the highest frequency in male outpatients (n = 651) which represented 31.06% of the total number of medicine items as indicated in table 32. Pain relievers had the second highest frequency in male inpatients (24.27%) and female outpatients (24.70%). Female inpatients had the lowest frequency percentage of pain relievers at 15.63%. Pain relievers had a total frequency of 2 670 which was 22.69% of all budget groups (N = 11 768).

In figure 42 the frequency of the top four budget groups according to gender is illustrated.

The budget group with the lowest frequency for all categories was immunological. This budget group mainly includes vaccinations and immunologicals. A possible reason for the low frequency is the fact that vaccinations were done at the surrounding local clinics as part of primary health care delivery (Smit, 2007).

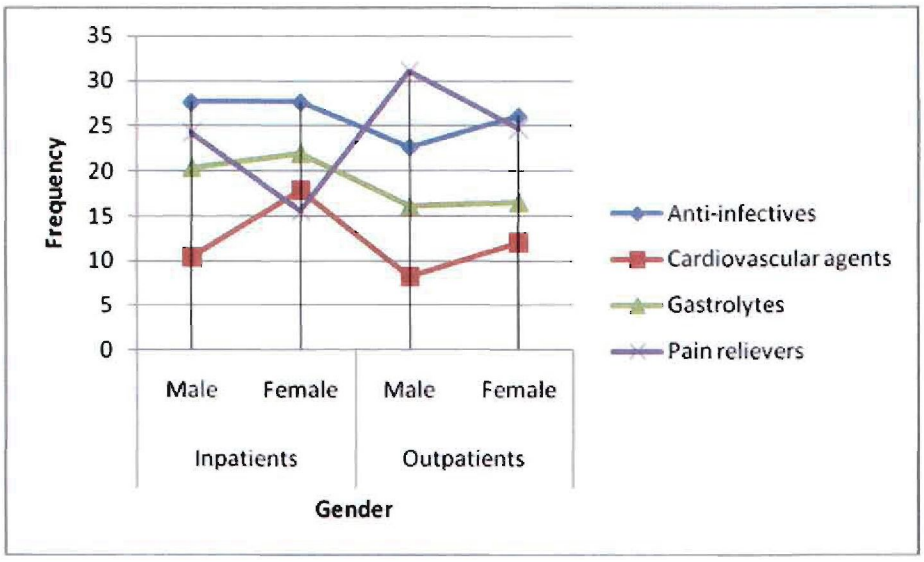


FIGURE 42: Frequency of budget groups anti-infectives, pain relievers, cardiovascular agents and gastrolytes

5.3.1.2 Frequency of budget groups according to age groups

There were six age groups as indicated in section 5.2.2 of this chapter. The frequency of the budget groups differs between the age groups. The age group with the highest frequency was > 19 ≤ 40 years. The frequency was 17.81% (n = 2 096) for inpatients and 17.01% (n = 2 002) for outpatients. This was in line with the average age of patients who visited the hospital during the study period which was 30.61 ± 23.68 years for inpatients and for outpatients it was slightly higher at 33.91± 19.16 years. The frequency distribution is illustrated in figure 43.

According to table 33 the budget group anti-infective had the highest frequency for inpatients in the age groups < 0 ≤ 6 years (n = 426), > 6 ≤ 12 years (n = 97), > 19 ≤ 40 years (n = 656) and > 40 ≤ 60 years (n = 350) and for outpatient in the age group < 0 ≤ 6 years (n = 87), > 6 ≤ 12 years (n = 86) and > 19 ≤ 40 years (n = 634). The highest frequency (N = 11 763) was in the age group > 19 ≤ 40 years (n = 4 098) which was in line with the average age of an inpatient during the study period. The age group with the lowest total frequency is the age group > 12 ≤ 19 years (n = 364) and a possible explanation can be the fact that this age group is mainly teenagers whose immune system is fully developed and who is relatively health and active people.

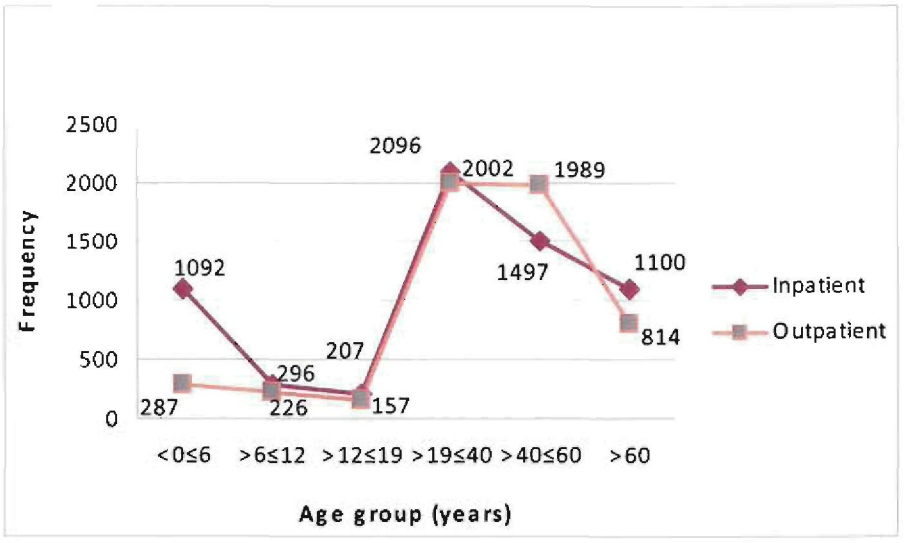


FIGURE 43: Total frequency of different age groups

In this particular age group (teenager), pain reliever, were the most frequently used budget group for both inpatients (28.99%) and outpatients (49.68%). Outpatients in the age group > 40 ≤ 60 years also used the budget group pain reliever (24.74%).

In an older age group, > 60 years, the inpatients had the highest prevalence (24.00%) of cardiovascular agents. This can be due to the fact that, as Kredo and Blockman (2007:444) describes, cardiovascular risk factors such as diabetes, hyperlipidaemia, sedentary lifestyles, smoking and obesity, are more common in the elderly. Van Schoor (2008b:22) states that the most common risk factor for cardiovascular disease is patients over the age of 50 years.

Table 33 indicates the frequencies of the different budget groups according to the different age groups.

TABLE 33: The frequency of the different budget groups according to age groups

Budget group	< 0 ≤ 6				> 6 ≤ 12				> 12 ≤ 19			
	Inpatients		Outpatients		Inpatients		Outpatients		Inpatients		Outpatients	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*
Anti-infective	426	39.01	87	30.31	97	32.77	86	38.05	54	26.09	33	21.02
Cardiovascular drug	102	9.34	10	3.48	64	21.62	1	0.44	28	13.53	2	1.27
Dermatological	10	0.92	17	5.92	12	4.05	8	3.54	1	0.48	7	4.46
Endocrine	22	2.01	4	1.39	13	4.39	5	2.21	7	3.38	3	1.91
Functional	16	1.47	4	1.39	10	3.38	12	5.31	15	7.25	2	1.27
Gastrolyte	286	26.19	65	22.65	55	18.58	43	19.03	38	18.36	16	10.19
Pain reliever	125	11.45	67	23.34	40	13.51	46	20.35	60	28.99	78	49.68
Immunological	1	0.09			1	0.34	1	0.44	1	0.48	3	1.91
Respiratory drug	104	9.52	33	11.5	4	1.35	24	10.62	3	1.45	13	8.28
Total	**1092**	**100**	**287**	**99.98**	**296**	**99.99**	**226**	**99.99**	**207**	**100**	**157**	**99.99**
Budget group	> 19 ≤ 40				> 40 ≤ 60				> 60			
	Inpatients		Outpatients		Inpatients		Outpatients		Inpatients		Outpatients	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*
Anti-infective	656	31.30	634	31.67	350	23.38	464	23.33	154	14.00	53	6.51
Cardiovascular drug	235	11.21	67	3.35	263	17.57	286	14.38	264	24.00	218	26.78
Dermatological	33	1.57	71	3.55	19	1.27	71	3.57	9	0.82	26	3.19
Endocrine	84	4.01	68	3.4	98	6.55	127	6.39	86	7.82	53	6.51
Functional	137	6.54	113	5.64	95	6.35	174	8.75	68	6.18	44	5.41
Gastrolyte	424	20.23	381	19.03	309	20.64	305	15.33	238	21.64	91	11.18
Pain reliever	423	20.18	527	26.32	279	18.64	492	24.74	256	23.27	273	33.54
Immunological	7	0.33	18	0.9			2	0.1			6	0.74
Respiratory drug	97	4.63	123	6.14	84	5.61	68	3.42	25	2.27	50	6.14
Total	**2096**	**100**	**2002**	**100**	**1497**	**100**	**1989**	**100**	**1100**	**100**	**814**	**100**

* Percentage was calculated according to the frequency for in- and outpatients respectively in the different age groups.
Light shaded areas indicate where medicine items was only used in either inpatients or outpatients

Please note: for the overall total frequency per budget groups, refer to table 32.

5.3.1.3 Frequency of budget groups according to ICD-10 codes

The budget groups can also be classified according to the ICD-10 code of each medicine item in the particular budget group. In this section, all budget groups according to ICD-10 codes with a frequency n > 100 were included in this discussion and were indicated in appendix D.1.

For the disease infective diarrhoea / food poisoning 81.91% (n = 154) of the inpatient cases were treated with anti-infectives. This can be due to the fact that in rural areas the hygiene and

sanitation is poor since there is not always access to safe water and this easily leads to parasitic infections (see section 2.2.1.4).

Respiratory agents (which include medicine items for TB treatment) were 70.87% of the time (n = 146) the required treatment to inpatients with tuberculosis. The results are indicated in appendix D.1.

For the disease undefined bacterial infections 686 medicine items from the budget group anti-infectives (99.85%) were dispensed to inpatients and for the same condition 494 medicine items (98.41%) were dispensed to outpatients from the same budget group as indicated in table D.1. Jones and Jones (2008:39) confirm this statement in their article 'antibiotics' where they state that antibiotics are one of the most prescribed medicines today.

Unspecified HIV were treated with medication from the budget group anti-infectives which includes antiretroviral treatment. From the budget group anti-infectives 241 medicine items (100%) were dispensed to inpatients and 685 medicine items (99.85%) to outpatients in order to treat unspecified HIV.

Unspecified folate deficiency anaemia was treated with medication from the budget group cardiovascular agents which includes drugs affecting the blood. Inpatients received 221 medicine items (100%) from this budget group to treat unspecified folate deficiency anaemia. Anaemia in pregnancy is pallor plus a haemoglobin (Hb) of less than 10g/dL, mostly due to either iron deficiency, folic acid deficiency or a combination of both (Department of Health, 2003:103).

Unspecified anaemia was treated in 96.72% of the cases (n = 177) with medicine items from the budget group cardiovascular agents in inpatients as indicated in appendix D.1.

Vitamin deficiency was treated with vitamin supplements which form part of the budget group gastrolyte. Inpatients received 772 medicine items from this budget group (99.74%) and outpatients 605 medicine items (99.83%) for the treatment of vitamin deficiency. The standard treatment guidelines indicate five types of vitamin deficiency which commonly occur in South Africa: Vitamin A deficiency in children 1 to 5 years, vitamin B deficiency which occurs commonly in malnutritions, nicotinic acid deficiency (pellagra) which is usually accompanied by other vitamin deficiencies, vitamin B6 deficiency (pyridoxine) which is related to malnutrition,

alcoholism and TB treatment, and thiamine deficiency which is associated with multiple vitamin deficiencies (Department of Health, 2003;60-65).

Mineral deficiency was treated with mineral supplements also from the budget group gastrolytes and 99.12% (n = 113) of the cases is treated with this budget group in inpatients as indicated in appendix D.1. Van Schoor (2008a:26) indicates than deficiencies in certain minerals and trace elements are common in certain populations throughout the world, including South Africa. Calcium, iron, zinc, copper, chromium, fluoride, selenium and iodine deficiencies are the most prevalent mineral deficiencies (Van Schoor, 2008a:26).

Other disorders of fluid and electrolyte balance commonly caused by conditions like dehydration, were normally considered seriously and patients were admitted as inpatients (Department of Health, 2003:29). In this case, 94.20% of the treatment (n = 130) for inpatients included medicine items from the budget group gastrolyte.

Major depression disorders appeared more frequently in outpatients and 100% of the cases (n = 103) was treated with medication from the budget group functional drugs. Fainman (2006:24) states that both anxiety disorders and depressive disorders are common. The lifetime prevalence of any anxiety disorder is 1 in 4 and that of major depressive disorder 1 in 6. Depression as a symptom may be defined as psychopathological feelings of sadness but must be distinguished from ordinary misery or from grief, which is sadness appropriate to loss as part of the bereavement process (Fainman, 2006:24).

Inflammation was a symptom which commonly appears with several other symptoms. Corticosteroids from the budget group endocrine were used to treat 82.71% of all inpatient cases (n = 110) and 69.64% of all the outpatient cases (n = 117) of inflammation. The results are indicated in appendix D.1.

Epilepsy was also a disease which appeared very regularly during the study period. The prevalence for epilepsy treatment with medicine items from the functional budget group was 97.44% (n = 114) in inpatients and 100% (n = 181) in outpatients.

Hypertension was a very common cardiovascular disease and during the study period 99.15% of inpatients and 100% of outpatients received medication from the budget group cardiovascular drugs as treatment for hypertension. Van Schoor (2008b:22) states that hypertension represents a major public health concern and that it affects about a billion people worldwide.

Asthma was a serious airway disease. The prevalence of asthma treated with medicine items from the budget group respiratory agents was 78.38% (n = 116) in inpatients and 84.21% (n = 128) in outpatients as indicated in appendix D.1.

Nausea was treated with medicine in the budget group gastrolyte which includes anti-emetic drugs and represents 98.25% of all treatments for nausea received by inpatients. Truter (2008,12) states than nausea and vomiting are common and most people at some point in time will experience these symptoms.

Pain control was definitely one of the most prevalent conditions diagnosed during the study period. For inpatients 1 091 medicine items from the budget group pain relievers were dispensed (99.27%) and 1 389 medicine items (99.86%) to outpatients.

This concludes the discussion on budget groups according to gender (table 32), age groups (table 33) and ICD-10 codes (appendix D.1).

5.3.1.4 Comprehensive summary of frequency of budget groups

The total frequency (N = 11 768) of all budget groups is indicated in appendix D.2. In table 34 the top three budget groups according to frequency are indicated.

TABLE 34: Top three budget groups according to frequency

Budget group	In- & outpatients		
	Rank	n	%*
Anti-infective	1	3094	26.29
Pain reliever	2	2670	22.69
Gastrolyte	3	2251	19.13
Total of top three budget groups		**8015**	**68.11**

*Percentage was calculated for each budget group respectively according to frequency

Anti-infective was ranked first in the inpatient department (n = 1 737) and represent 27.62% of the total frequency for inpatients (n = 6 288). Anti-infective was second in the outpatient department with a frequency of 1 357 and represent 24.76% of the total frequency in the outpatients (n = 5 480).

In total, 3 094 medicine items were dispensed from the budget group anti-infective and represent 26.29% of all medicine items dispensed during the study period (N = 11 768).

Pain relievers were the most popular medicine item for the outpatient department with 1 487 medicine items which represent 27.14% of all medicine items for outpatients (n = 5 480). Pain relievers were the third most frequently used medicine item for inpatients with 18.81% of total medicine items (n = 6 288). Combined, 22.69% (n = 2 670) pain reliever medicine items were prescribed and dispensed.

Gastrolyte achieved a second place according to the frequency in the inpatient department (n = 1 350) and was the third most frequently used medicine item in the outpatient department (n = 901) during the study period. Together, gastrolyte drugs represent 19.13% of all medicine items (N = 11 768). The reason for the high usages of gastrolyte drugs can possible be due to the inequity in health between the rural and urban areas in the country. In rural areas the hygiene and sanitation was very poor which lead to frequent infections with parasites (see section 2.2.1.4).

The top three budget groups for both in- and outpatients were anti-infective (26.29%), pain reliever (22.69%) and gastrolyte (19.13%) and they represent 68.11% of all medicine items (N = 11 768) dispensed during the study period. The rest of the budget groups are in the same order for both in- and outpatients as indicated in appendix D.2.

Cardiovascular agents had a frequency of 956 for inpatients and 584 for outpatients. The total frequency was 1 540 which were 13.09% of all medicine items (N = 11 768). Functional were dispensed 341 times for inpatients and 349 times for outpatients. The total of 690 represents 5.86% of the total of all budget groups (N = 11 768). Respiratory agents were ranked in sixth position and represented 5.33% of the total medicine items (N = 11 768) dispensed (317 items for inpatients and 311 items for outpatients). Endocrine have a frequency of 310 items in the inpatient department and 260 items for outpatients. The total number of items is 4.84% (N = 11 768). Dermatological represent 2.41% of all the medicine items (N = 11 768) dispensed. Immunological have a frequency of 41 items and are 0.35% of the total medicine items (N = 11 768).

5.3.2 Pharmacological groups

Pharmacological groups are a sub-classification of the budget groups. There were 118 pharmacological groups according to the therapeutic budget model but only 63 pharmacological groups were used during the study (see appendix C.2). Pharmacological groups' classification focuses more on the specific pharmacological working mechanism. In this section, all pharmacological groups with a frequency >8.00% were included in the discussion.

5.3.2.1 Frequency of pharmacological groups according to gender

In appendix D.3 the frequency of pharmacological groups according to gender for in- and outpatients was shown. Table 35 summarises the pharmacological groups according to gender with frequencies >8.00%.

TABLE 35: Pharmacological groups with frequencies > 8.00% according to gender

Pharmacological group	Inpatients				Outpatients			
	Male		Female		Male		Female	
	n	%*	n	%*	n	%*	n	%*
Antibacterial (penicillins)	354	15.66	507	12.59	150	7.16	198	5.85
Antibacterial (chloramphenicol, erythromycins)	179	7.92	374	9.29	147	7.01	309	9.13
Antiviral	42	1.86	164	4.07	168	8.02	352	10.40
Antihypertensive	107	4.73	359	8.91	132	6.30	307	9.07
Vitamin and mineral	286	12.65	594	14.75	257	12.26	401	11.85
Analgesics, non-opioids including NSAIMs, gold and antigout preparations	518	22.92	592	14.70	642	30.63	831	24.56

*Percentage was calculated male and female inpatients and outpatients respectively

Penicillin antibiotics had a significant high frequency for both male and female inpatients. The frequency for male inpatients was 354 (15.66%) and for female inpatients 507 (12.59%) of all medicine items (N = 11 768). Penicillin antibiotics were widely used in the public health sector due to its broad spectrum for treatment (Department of Health, 2003:359). Benzyl penicillin is active against gram-positive organisms, state Jones and Jones (2008:39).

Antibacterial (chloramphenicol, erythromycins) was more used by female in- and outpatients than male patients according to this study. The frequency for female inpatients was 374 (9.29%) and for female outpatients 309 (9.13%). Erythromycins were frequently used due to the similar spectrum of activity to the broad spectrum penicillins and are an alternative for penicillin-allergic patients (Jones & Jones, 2008:40). Chloramphenicol was mainly used in diseases of the conjunctiva, e.g. viral infections or acute conjunctivitis.

Antiviral medication had a frequency of 10.40% (n = 352) for female outpatients which indicates that the most ARV medication was dispensed to female outpatients according to table 35.

The frequency of antihypertensive was also higher for female in- and outpatients than for male patients. Female inpatients had a frequency of 359 (8.94%) and a slightly higher frequency for female outpatients at 307 (9.07%) of all medicine items (N = 11 768). Mabuza (2007:10) states than men and postmenopausal woman are non-modifiable primary risk factors for cardiovascular diseases.

The pharmacological group, vitamin and mineral, had a high frequency in al four groups. The frequency was the highest for female inpatients (14.75%) and the lowest for female outpatients (11.85%) although the frequency was still high at 401 (N = 11 768). Refer to table 35 and appendix D.3.

Analgesics, non-opioids including NSAIMs, gold and antigout preparations had the highest overall prevalence of all pharmacological groups. The highest frequency was for the female outpatients (n = 831) at 24.56% according to number and for male outpatients (n = 642) at 30.63% according to percentage. The total frequency of this pharmacological group for inpatients were 1 110 (9.43%) and 1 473 (12.52%) for outpatients (N = 11 768). Raff (2002:35) indicated in his study on the efficacy of combination analgesic preparations that 54.4% of the patients who participated in the study were female patients and only 45.6% were male patients.

These results were in line with the results of the frequency of the budget groups according to gender (see section 5.3.1.1). The four budget groups with frequencies > 10% was anti-infective, cardiovascular agents, gastrolyte and pain reliever. The pharmacological groups with high frequencies were penicillin antibiotics, antibacterials (chloramphenicol, erythromycins) and antivirals from the anti-infective budget group, antihypertensive drugs from the cardiovascular budget group, vitamin & mineral which is part of the gastrolyte budget group and analgesics, non-opioid including NSAIMs, gold and antigout preparations which are pain relievers.

See table 35 for pharmacological groups with a frequency of > 8.00% according to gender and appendix D.3 for frequencies of all pharmacological groups according to gender.

5.3.2.2 Frequency of pharmacological groups according to age groups

The frequency of pharmacological groups according to age groups for in- and outpatients is indicated in appendix D.4. Five patient files did not specify the date of birth or the age of the

patient. Table 36 summarises the pharmacological groups with frequencies > 8.00% according to age groups.

TABLE 36: Frequency of pharmacological groups > 8.00% according to age groups

Pharmacological group	Inpatients											
	< 0 ≤ 6		> 6 ≤ 12		> 12 ≤ 19		> 19 ≤ 40		> 40 ≤ 60		> 60	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*
Antibacterials (penicillins)	250	22.89	31	10.47	31	14.98	295	14.07	157	10.49	97	8.82
Antibacterials (chloramphenicol, erythromycins)	113	10.35	25	8.45	17	8.21	231	11.02	122	8.15	45	4.09
Antiviral	21	1.92	34	11.49			86	4.10	64	4.28	1	0.09
Antihypertensive	2	0.18	45	15.20	4	1.93	52	2.48	158	10.55	205	18.64
Drugs affecting the blood	100	9.16	19	6.42	20	9.66	167	7.97	58	3.87	39	3.55
Vitamin and mineral	215	19.78	38	12.84	23	11.11	293	13.98	178	11.89	132	12.00
Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations	125	11.45	40	13.51	59	28.50	390	18.61	260	17.37	236	21.45
Pharmacological group	**Outpatients**											
	< 0 ≤ 6		> 6 ≤ 12		> 12 ≤ 19		> 19 ≤ 40		> 40 ≤ 60		> 60	
	n	%*	n	%*	n	%*	n	%*	n	%*	n	%*
Antibacterials (penicillins)	36	12.54	20	8.85	18	11.46	158	7.89	81	4.07	35	4.30
Antibacterials (chloramphenicol, erythromycins)	34	11.85	22	9.73	13	8.28	216	10.79	157	7.89	14	1.72
Antiviral	12	4.18	43	19.03	2	1.27	252	12.59	211	10.61		
Antihypertensive	1	0.35					11	0.55	232	11.66	195	23.96
Drugs affecting the blood	9	3.14	1	0.44			51	2.55	19	0.96	5	0.61
Vitamin and mineral	51	17.77	32	14.16	8	5.10	283	14.14	220	11.06	64	7.86
Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations	66	23.00	45	19.91	78	49.68	522	26.07	490	24.64	268	32.92

*Percentage was calculated for inpatients and outpatients respectively according to the different age groups

The pharmacological group, antibacterial (penicillins) was used in every age group for inpatients. The frequency varies from 22.89% for the age group < 0 ≤ 6 years (n = 1 091) to 8.82% for the age group < 60 years (n = 1 100). For outpatients, penicillin antibiotics represent 12.54% (n = 287) of all medicine items dispensed to patients in the age group < 0 ≤ 6 years,

8.85% (n = 226) for patients in the age group > 6 ≤ 12 years and 11.46% (n = 157) for patients between > 12 ≤ 19 years. Refer to table 36. Penicillin remains the agent of choice for many infections caused by gram-positive organisms and anaerobes, states Gibbon, 2008:255).

Antibacterials (chloramphenicol, erythromycins) were also a very frequent used antibiotic possible due to the fact that erythromycins were administrated to patients who were allergic to penicillins (Department of Health, 2003:79). In the age group < 0 ≤ 6 years, the frequency for inpatients was 10.35% (n = 1 092) and 11.85% (n = 287) for outpatients. The highest frequency for inpatients was 11.02% in the age group > 19 ≤ 40 years (n = 2 096).

Antiviral medication had a frequency of 11.49% in the inpatient age group > 6 ≤ 12 years (n = 296). In the same age group, the frequency for outpatients was 19.03% (n = 226). Antivirals were also significant in the age groups > 19 ≤ 40 years (12.59%) and in the age group > 40 ≤ 60 years (10.61%). Refer to table 36 and appendix D.4.

Antihypertensive drugs had the highest frequency in the older age groups. In the age group > 40 ≤ 60 years the prevalence for inpatients were 10.55% (n = 1 497) and for outpatients 11.66% (n = 2 002). For the patients in the age group > 60 years, the prevalence was higher at 18.64% for inpatients (n = 1 100) and 23.96% for outpatients (n = 814). Mabuza (2007:8) states that it is an established fact that blood pressure tends to increase with age, is more prevalent in patients of African descent and runs in families. Interesting is that hypertension was also diagnosed in inpatients in the age group > 6 ≤ 12 years with a frequency of 15.20% (n = 296).

Drugs affecting the blood only had a frequency >8.00% in the age group < 0 ≤ 6 year (9.16%) and in the age group > 12 ≤ 19 year (9.66%). Refer to table 36.

Vitamin and mineral was a very popular pharmacological group in inpatients which varied from 11.11% (n = 207) to 19.78% (n = 1 092). This pharmacological group was also popular in the outpatient department particular in the age group < 0 ≤ 6 year (n = 287) with a prevalence of 17.77%.

Another popular pharmacological group was the non-opioid analgesics which include NSAIMs, gold and antigout preparations. This pharmacological group was used in all the age groups for both in- and outpatients. The prevalence varied from 49.68% (n = 157) to 11.45% (n = 1 092). In his study Raff (2002:36) found that the age group with the highest frequency of pain was patients between the ages of 31 to 40 years with a frequency of 26.4% of all patients.

5.3.2.3 Frequency of pharmacological groups according to ICD-10 codes

When looking at the frequency of pharmacological groups according to the ICD-10 codes, the results are presented in appendix D.1. In this section, pharmacological groups with a prevalence n > 75 are included in the discussion.

For the condition infective diarrhoea / food poisoning 98 inpatients cases (52.13%) were treated with penicillin antibiotics. The standard treatment guidelines (Department of Health, 2003:29) suggest that it is very important to maintain adequate hydration during diarrhoea and that oral hydration solutions should form part of the treatment.

Tuberculosis was treated with the pharmacological group antituberculotics in 146 inpatient cases (70.87%). There are four fixed dose drug combinations available in the treatment of tuberculosis: rifampicin 150mg and isoniazid 75mg; rifampicin 150mg and isoniazid 150mg; rifampicin 300mg and isoniazid 150mg; and rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg and ethambutol 275mg. These fixed medicine combinations are recommended to avoid the development of antimicrobial resistance (Department of Health, 2006a:249).

Undefined bacterial infections were treated with antibiotics from different pharmacological groups. The first pharmacological group, penicillin antibiotics, treated 371 undefined bacterial infections (54.00%) in inpatients and 272 cases (54.18%) in outpatients were treated with medication from this pharmacological group. The same condition was also treated with antibiotics from the pharmacological groups containing chloramphenicol and erythromycins. In inpatients, 272 cases (39.59%) were treated and 206 cases (41.04%) in outpatients were treated.

Unspecified HIV were treated with antibiotics from the pharmacological group chloramphenicol & erythromycins. This was particularly dispensed to HIV patients with their ARV medication in order to prevent opportunistic infection due to a low immune system. For outpatients, 166 medicine items (24.20%) from this pharmacological group were dispensed. The ARV medication was classified in the pharmacological group, antiviral, and 202 medicine items (83.82%) were dispensed to inpatients and 515 medicine items (75.07%) were dispensed to outpatients.

Unspecified folate deficiency anaemia was treated with medication from the pharmacological group of drugs affecting the blood which includes folate. During the study period 221 medicine

items (100%) were dispensed to patients suffering from dietary folate deficiency anaemia. Refer to appendix D.1.

The condition, unspecified anaemia was also treated with medication from the pharmacological group of drugs affecting the blood. Inpatients received 177 medicine items (96.72%) form this pharmacological group for this particular condition.

Medication for pain was also dispensed to patients suffering from unspecified coagulation defects. Inpatients received 81 medicine items (57.45%) for pain and outpatients received 93 pain medicine items (75.61%) as indicated in appendix D.1.

Diabetes mellitus type 2 (non-insulin dependent) was treated with oral antidiabetic drugs from the pharmacological group antidiabetic (oral). Ninety-four medicine items (98.95%) were dispensed to inpatients during the study period. In the public health care sector two groups of oral treatment are included in the standard treatment guidelines and essential drugs list (Department of Health, 2003:48). This is biguanides (metformin) and sulphonylureas (glibenclamide and gliclazide).

Vitamin deficiency was treated with medication from the pharmacological group vitamins & minerals. During the study period 771 vitamins (99.61%) were dispensed to inpatients and 605 vitamins (99.83%) to outpatients in order to treat vitamin deficiency. Van Schoor (2008a:26) states that under-nutrition and a lack of varied and quality food sources are major problems in developing countries, including South Africa, and demand the need for mineral and trace element supplements.

Mineral deficiency was treated with minerals from the pharmacological group vitamins & minerals. Inpatients received 107 mineral supplements (93.86%) during the study period to treat mineral deficiency.

In the condition disorder of acid-base balance the treatment includes anti-acids/anti-ulcus drugs (Department of Health, 2006a:11). From this pharmacological group 96 medicine items (92.31%) were dispensed to inpatients. Refer to appendix D.1.

Other disorders of fluid and electrolyte balance were treated with medicine items from the pharmacological group electrolyte and acid-base disturbances (parental). Seventy-eight

medicine items (56.52%) were dispensed to inpatients during their stay in the hospital because the pharmacological group had a parental route of admission.

The condition major depression disorders was treated with medication from the pharmacological group mood disorders which include antidepressants. During the study period 93 medicine items (100%) for the pharmacological group mood disorders were dispensed to inpatients with major depression disorders and 103 medicine items (100%) to outpatients. Fainman (2006:26) states that the overlap between the effective treatments for anxiety disorders and depression is increasing. SSRIs (selective serotonin reuptake inhibitors) were effective for depression at lower dosages and for anxiety at higher doses.

Inflammation was a common disease and was treated with antipruritic and anti-inflammatory agents in this pharmacological groups (Gibbon, 2008:347). Inpatients received 110 anti-inflammatory agents (82.71%) and outpatients received 117 anti-inflammatory agents (69.64%) for inflammation during the study period.

Epilepsy was treated with anti-epileptics as categorised in the pharmacological group anti-epileptics. Medicine items from this pharmacological group were dispensed with a frequency of 114 (97.44%) to inpatients en 181 medicine items (100%) to outpatients as indicated in appendix D.1.

Medicine items in the pharmacological group antihypertensive were used to treat hypertension. Inpatients had a frequency of 466 antihypertensive medicine items (98.94%) dispensed during the study period and outpatients had a frequency of 439 (99.77%) in order to treat hypertension.

Acute and chronic persistent asthma was treated with 116 medicine items (78.38%) for inpatients and 128 medicine items (84.21%) for outpatients from the pharmacological group anti-asthmatic and mucolytic.

Nausea was treated with 106 anti-emetics (97.25%) for inpatients as indicated in appendix D.1. Truter (2008:59) concluded that the treatment of nausea and vomiting ideally involve the correcting of the underlying cause of these condition. Anti-emetics play an important role in the symptomatic relief of this condition but the cause of the condition must be identified so that patients with more serious conditions can be referred.

Pain control was a popular condition and analgesics, non-opioids including NSAIMs, gold and antigout preparations were the most popular pharmacological group. Pain was treated with 1 018 medicine items (92.63%) dispensed from this pharmacological group in inpatients and 1 377 medicine items (98.99%) dispensed to outpatients for the same condition.

Appendix D.1 contains all the information on the frequency of budget group, pharmacological group and therapeutic codes according to ICD-10 codes.

5.3.2.4 Comprehensive summary of frequency of pharmacological groups

The top 10 pharmacological groups with the highest frequency are indicated in appendix D.5. Table 37 summarises the top three pharmacological groups according to frequency.

TABLE 37: Top three pharmacological groups according to frequency

Pharmacological group	In- and outpatients		
	Rank	n	%*
Analgesics, non-opioid including NSAIMs, gold & antigout preparations	1	2583	21.95
Vitamin & mineral	2	1538	13.07
Anti-bacterial (penicillins)	3	1209	10.27
Total of top 3 pharmacological groups		**5330**	**45.29**

*Percentage was calculated for each pharmacological group according to frequency

Analgesics, non-opioids including NSAIMs, gold & antigout preparations were ranked in first position for both the inpatient and outpatient departments. The frequency for inpatients was 1 110 medicine items in this pharmacological group and 1 473 medicine items for outpatients. The budget group, pain reliever, also had a higher frequency for outpatients (refer to appendix D.2 and 5.3.1.4). The total frequency was 2 583 which represents 21.95% of all the medicine items dispensed during the study period (N = 11 768).

This was in line with the top three budget groups according to frequency. The budget group, pain reliever, had the second highest frequency (22.69%) of all the budget groups. Raff (2002:34) states that combination analgesic therapy starts with paracetamol and adding a NSAIMs e.g. ibuprofen and an opioid if necessary to the regime. Raff (2002:38) also found that this combination analgesic means that less of each agent needs to be used to get good pain relief and is effective to treat mild to moderate pain.

Vitamin and mineral was ranked in second position for both departments (in- and outpatients). During the study period 880 medicine items were dispensed for inpatients (13.99%) and 658 to outpatients (12.01%). Combined, 1 538 vitamin and mineral medicine items were dispensed which represents 13.07% of the total frequency (N = 11 768). This was in line with the top three results of budget groups according to frequency (see appendix D.2 and 5.3.1.4) which states that gastrolytes (vitamins and minerals are included in this budget group) represent 19.18% of all budget groups and was ranked as the third highest frequency.

Penicillin antibiotics were ranked third for inpatients with a frequency of 861 and ranked sixth with a frequency of 348 for outpatients. In total, penicillin antibiotics had a frequency of 1 209 which represented 10.27% of the total frequency of medicine items according to pharmacological groups (N = 11 768). Penicillin antibiotics were part of the budget group anti-infectives. This budget group was ranked first according to frequency (26.29%) and the results of the pharmacological group's frequencies are in line with these results (refer to appendix D.2 and 5.3.1.4).

The top three pharmacological groups are analgesics, non-opioid including NSAIMs, gold and antigout preparations, vitamin & mineral and penicillin antibiotics. Together these three pharmacological groups represent 45.29% of the total frequency with 5 330 medicine items dispensed form these three pharmacological groups (N = 11 768).

Other pharmacological groups which appear in both the in- and outpatient departments were: anti-infective (chloramphenicol and erythromycins) which represented 8.57% of the total frequency of medicine items, antihypertensive drugs had a total frequency of 7.69%, antiviral medication which include antiretroviral drugs had a total of 6.17% of the total frequency,

corticosteroids for systemic use were dispensed only 2.52% of all the medicine items dispensed during the study period, and anti-asthmatic & mucolytics represented 2.07% of the medicine items (refer to appendix D.5).

The top 10 pharmacological groups for inpatients represent 77.70% (4 886 items) of all items dispensed for inpatients and 81.33% (5 480 items) of all items dispensed for outpatients.

5.3.3 Therapeutic codes

Therapeutic codes are the third level of classification after the budget and pharmacological group classifications in the therapeutic budget model. The therapeutic codes represent the individual medicine items as prescribed to the patients. In this section all therapeutic codes with a frequency >1% are included in the specified tables, but in the discussion the therapeutic codes with frequencies of less than 30 were excluded.

5.3.3.1 Frequency of therapeutic codes according to gender

All results of therapeutic code frequency according to gender are presented in appendix D.6. Table 38 summarises the therapeutic codes with frequencies >1.00%.

Amoxycillin 500mg capsules (15s) had a frequency of 1.19% (n = 48) for female inpatients, 2.19% (n = 46) for male outpatients and 1.63% (n = 55) for female outpatients.

Amoxycillin with clavulanic acid 250mg/125mg tablets (15s) had a frequency for female outpatients at 1.21% (n = 41) and 1.49% (n = 60) for female inpatients.

The ampicillin 250mg injection only had a frequency for inpatients – the prevalence was 2.12% for male patients (n = 48) and 1.07% (n = 43) for female patients. Refer to table 38.

Ampicillin 500mg injections had a frequency was 2.52% for males (n = 57) and 2.23% for females (n = 90). A possible explanation for the usage of ampicillin 250mg and 500mg injection only for inpatients was because of the dosage form (injection). It can't be dispensed to outpatients at an antibiotic regime to be administered at home. Jones and Jones (2008:39) state that ampicillin has a similar spectrum to amoxicillin (gram positive and gram negative organisms) but has poor oral bioavailability. Refer to appendix D.6.

The same applies for gentamicin 40mg/ml injection which had a frequency of 1.77% (n = 40) for male inpatients and a frequency of 1.12% (n = 45) for female inpatients. See appendix D.6.

Gentamicin 80mg/ml injections were dispensed to the inpatient at a frequency of 2.17% (n = 49) for male patients and 1.91% (n = 77) for female patients. Refer to table 38.

Co-trimoxazole 480mg tablets (20s) had a frequency of 2.06% (n = 83) for female inpatients.

The combination co-trimoxazole, sulphametoxazole and trimethoprim tablets (56s) had a significant prevalence for female outpatients with a frequency of 3.63% (n = 45) and decreased to 2.62% (n = 55) for male outpatients and 1.12% (n = 123) for female inpatients.

TABLE 38: Therapeutic codes with frequencies > 1.00% according to gender

Therapeutic code	Inpatients				Outpatients			
	Male		Female		Male		Female	
	n	%*	n	%*	n	%*	n	%*
Amoxycillin Caps 500mg 15s	22	0.97	48	1.19	46	2.19	55	1.63
Amoxycillin with clavulanic acid Tabs 250mg/125mg 375mg 15s	27	1.19	60	1.49	25	1.19	41	1.21
Ampicillin Inj 250mg	48	2.12	43	1.07				
Ampicillin Inj 500mg	57	2.52	90	2.23	2	0.10		
Gentamicin Inj 40mg/ml 1ml	40	1.77	45	1.12			2	0.06
Gentamicin Inj 80mg/2ml 2ml	49	2.17	77	1.91			2	0.06
Ceftriaxone Inj 1g	25	1.11	32	0.79	3	0.14	7	0.21
Co-trimoxazole Tabs 480mg 20s	28	1.24	83	2.06	20	0.95	21	0.62
Co-trimoxazole, sul 400mg, trim 80mg Tabs 56s	17	0.75	45	1.12	55	2.62	123	3.63
Co-trimoxazole Susp 200/40mg/5ml 50ml	51	2.26	52	1.29	14	0.67	8	0.24
Doxycycline Caps 100mg 14s	5	0.22	15	0.37	14	0.67	56	1.65
Metronidazole IV Inj 500mg/ml 100ml	36	1.59	79	1.96	4	0.19	7	0.21
Metronidazole Tabs 200mg 21s	30	1.33	81	2.01	17	0.81	70	2.07
Efavirenz Caps 600mg 30s	5	0.22	7	0.17	42	2.00	55	1.63
Lamivudine Tabs 150mg 60s	5	0.22	52	1.29	43	2.05	112	3.31
Nevirapine Tabs 200mg 60s			34	0.84			53	1.57
Stavudine d4T Caps 30mg	1	0.04	26	0.65	14	0.67	47	1.39
Stavudine d4T Caps 40mg	4	0.18	13	0.32	29	1.38	69	2.04

TABLE 38: Therapeutic codes with frequencies > 1.00% according to gender

(continue form page 196)

Therapeutic code	Inpatients				Outpatients			
	Male		Female		Male		Female	
	n	%*	n	%*	n	%*	n	%*
Hydrochlorothiazide Tabs 25mg 28s	26	1.15	45	1.12	37	1.77	79	2.33
Perindopril Tabs 4mg 28s	27	1.19	66	1.64	11	0.52	48	1.42
Ferrous sulphate Co Tabs eq 65mg Fe 28s	27	1.19	111	2.76	7	0.33	23	0.68
Folic acid Tabs 5mg 28s	65	2.88	158	3.92	15	0.72	27	0.80
Prednisone Tabs 5mg 28s	22	0.97	75	1.86	44	2.10	82	2.42
Carbamazepine Cr Tabs 200mg 30s	17	0.75	18	0.45	30	1.43	33	0.98
Carbamazepine Cr Tabs 400mg 30s	3	0.13	6	0.15	36	1.72	29	0.86
Amitriptyline Tabs 25mg 28s	10	0.44	58	1.44	21	1.00	59	1.74
Metoclopramide inj 5mg/ml 2ml	16	0.71	47	1.17	3	0.14	5	0.15
Vitamin A, D, E, folic acid, riboflavin Tabs for adults 30s	2	0.09	9	0.22	18	0.86	58	1.71
Vitamin B Co Strong Tabs 28s	14	0.62	108	2.68	31	1.48	49	1.45
Vitamin B6 Tabs 25mg 28s	36	1.59	66	1.64	16	0.76	47	1.39
Vitamin C Tabs 250mg 100s	9	0.40	10	0.25	24	1.15	18	0.53
Vitamin Multiple Syr 100ml	78	3.45	78	1.94	37	1.77	21	0.62
Vitamin Multiple Tabs 28s	88	3.89	200	4.97	102	4.87	154	4.55
Aspirin Soluble Tabs 300mg 14s	26	1.15	55	1.37	27	1.29	66	1.95
Diclofenac Inj 25mg/ml 3ml	36	1.59	41	1.02	51	2.43	52	1.54
Diclofenac Tabs 25mg 42's	11	0.49	5	0.12	21	1.00	37	1.09
Ibuprofen Tabs 200mg 15s	112	4.96	131	3.25	170	8.11	187	5.53
Methyl salicylate in Vaseline Oint 10% 25g	7	0.31	9	0.22	39	1.86	46	1.36
Paracetamol Syr 120mg/5ml 50ml	48	2.12	45	1.12	36	1.72	32	0.95
Paracetamol Tabs 500mg 10s	217	9.60	263	6.53	243	11.59	340	10.05
Rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg 100s	32	1.42	39	0.97	5	0.24	19	0.56
Theophylline Syr 200ml	18	0.80	33	0.82	22	1.05	25	0.74
Chlorpheniramine mal Tabs 4mg 30s	8	0.35	15	0.37	22	1.05	42	1.24

*Percentage was calculated according to male and female inpatients and outpatients respectively

The co-trimoxazole 200mg/40mg/5ml suspension (50ml) had a frequency of 2.26% (n = 51) for male inpatients and a frequency of 1.29% (n = 52) for female inpatients.

Doxycycline 100mg capsules (14s) had a frequency of 1.65% (n = 56) for female outpatients. Refer to table 38 and appendix D.6.

Metronidazole 500mg/ml IV injection (100ml) which is a bolus administration for both in- and outpatients but only the prevalence of the inpatients meets the requirement for this discussion. The frequency for male inpatients was 1.59% (n = 36) and for female inpatients it was 1.96% (n = 79).

Metronidazole 200mg tablets (21s) had a frequency of 1.33% (n = 30) for male inpatients and 2.01% (n = 81) for female inpatients. The frequency is slightly higher for female outpatients at 2.07% (n = 70). See table 38.

The prevalence for efavirenz 600mg capsules (30s) had a higher prevalence for outpatients than for inpatients possibly because ARV therapy is not a hospitalised condition except when complications occur. The patients use the medicine for this chronic condition daily at home. The frequency for male outpatients was 2.00% (n = 42) and slightly lower for female outpatients at 1.63% (n = 55). Not all patients on ARV medication were included in this study. The ARV patient record is kept in a separate filing system which does not form part of the study.

Lamivudine 150mg tablets (60s), which is also part of the ARV regime, had a relatively high frequency for female outpatients at 3.31% (n = 112) and slightly lower for male outpatients at 2.05% (n = 43). Female inpatients also had a frequency of 1.29% (n = 52) during the study period. Refer to table 38 and appendix D.6.

Nevirapine 200mg tablets (60s) had a prevalence for female patients only. The reason was that nevirapine is part of the regime for the drug treatment to prevent the transmission of HIV from mother to child (Department of Health, 2003:116) and is also part of the ARV treatment for pregnant women because nevirapine is not teratogenic. The frequency for outpatients was 1.57% (n = 53).

Stavudine d4T 30mg capsules (60s) had a frequency of 1.39% (n = 47) for female outpatients. Refer to table 38.

Stavudine d4T 40mg capsules (60s) had a frequency of 2.04% (n = 69) for female outpatients. Wood (2006:6) states that d4T (stavudine) has been used successfully in the public health ARV programmes because it is cheap and initially very well tolerated. Although stavudine has major toxicities, e.g. lactic acidosis, the generic combination of d4T (stavudine) / 3TC (lamivudine) / NVP (nevirapine) constitutes the cheapest available ARV regime in South Africa. Geddes *et al.* (2006:724) states that d4T (stavudine) is one of the first-line HAART regimens in South Africa and that it is essential that all health care providers and patients be trained to recognise the symptoms and signs of lactic acidosis early on and that protocols for management of the condition should be readily available due to their research that indicates a higher incidence rate of lactic acidosis in obese female patients.

Hydrochlorothiazide 25mg tablets (28s) was a popular drug in the treatment of hypertension due to the relative low cost of the product. The frequency was 1.12% (n = 45) for female patients. The prevalence was slightly higher in outpatients at 1.77% (n = 37) for male patients and 2.33% (n = 79) for female patients. Mpe (2007:35) states that low doses of thiazide diuretics, e.g. 25mg hydrochlorothiazide indicates a low rate of metabolic complications such as hypocalcaemia, glucose intolerance and hyperuricaemia. See table 38 and appendix D.6.

Perindopril 4mg tablets (28s), which was also a drug of choice for the treatment of hypertension, had a higher prevalence for female patients than for male patients. The frequency for female inpatients was 1.64% (n = 66). The frequency for male inpatients was 1.19% (n = 27).

The prevalence of ferrous sulphate co tablets (28s) was for female inpatients at 2.76% (n = 111). Female patients more frequently need iron supplement especially during pregnancies (Van Schoor, 2008a:27).

Folic acid 5mg tablets (28s) is a supplement which is more often taken by female patients than by male patients due to anaemia in pregnancy (Department of Health, 2003:103). The frequency for male patients was 2.88% (n = 65) and 3.92% (n = 158) for female patients.

Prednisone 5mg tablets (28s) was a common treatment for inflammation for male and female in- and outpatients. The frequency for female outpatients was 2.42% (n = 82) and for male outpatients was 2.10% (n = 44). The frequency for female inpatients was 1.86% (n = 75).

Carbamazepine 200mg CR tablets (30s) and carbamazepine 400mg CR tablets (30s) had a mentionable frequency for male outpatients. The frequencies were 1.43% (n = 30) and 1.72% (n = 36) respectively. See table 38 and appendix D.6.

Amitriptyline 25mg tablets (28s) had a frequency of 1.44% (n = 58) for female inpatients, 1.00% (n = 21) for male outpatients and 1.74% (59) for female outpatients.

Metoclopramide 5mg/ml injection (2ml) had a frequency of 1.17% (n = 47) for female inpatients. Refer to table 38.

The multivitamin with vitamin A, D, E, Folic acid, Riboflavin for adults (30s) had a frequency of 1.71% (n = 58) for female outpatients.

Vitamin B co strong tablets (28s) had the highest frequency for female inpatients at 2.68% (n = 108). The frequency for male outpatients was 1.48% (n = 31) and female outpatients 1.45% (n = 49).

Vitamin B6 25mg tablets (28s) had the highest frequency for female inpatients at 1.64% (n = 66) and then for male inpatients at 1.59% (n = 36). Female outpatient also has a frequency of 1.39% (n = 47).

Multivitamin syrup (100ml) had a frequency of 3.45% (n = 78) for male inpatients and a frequency of 1.94% (n = 78) for female inpatients. Multivitamin syrup is also dispensed to male outpatients and has a frequency of 1.77% (n = 37).

The multivitamin tablets (28s) had a significant usage in in- and outpatients for both male and female patients. The frequency is 3.89% (n = 88) for male inpatients and 4.97% (n = 200) for female inpatients. The frequency for male outpatients is 4.87% (n = 102) and 4.55% (n = 154) for female outpatients. Multivitamins is a way to assure that patients gets the required vitamins on a daily base which often not ingested via food due to malnutrition.

Aspirin 300mg soluble tablets (14s) was the highest for female outpatients with a frequency of 1.95% (n = 66). The inpatients' prevalence is slightly lower at 1.37% (n = 55) for females. Aspirin is the most well-researched and cost-effective therapy in preventive cardiovascular medicine, state Anon. (2007b:201).

The Diclofenac 25mg/ml injection was widely used in both genders for in- and outpatients. The highest frequency was for male outpatients at 2.43% (n = 51) and the lowest for female inpatients at 1.02% (n = 41). The prevalence for male inpatients was 1.59% (n = 36) and female outpatients 1.54% (n = 52) which is almost the same.

Diclofenac 25mg tablets (42's) were most of the time dispensed to outpatients. The female patients a frequency of 1.09% (n = 37).

Ibuprofen 200mg tablets (15s) had due to its low cost, a high frequency in patients of both genders. The highest frequency was for male outpatients at 8.11% (n = 170) and secondly for female outpatients at 5.53% (n = 187). Male inpatients has a frequency of 4.96% (n = 112) and the female inpatients has a frequency of 3.25% (n = 131).

Methyl Salicylate 10% in Vaseline ointment (25g) was more frequently dispensed to outpatients than inpatients. The frequency for male outpatients is 1.86% (n = 39) and 1.36% (n = 46) for female outpatients.

The Paracetamol 120mg/5ml syrup (50ml) had a higher frequency for male inpatients at 2.12% (n = 48) than for male outpatients at 1.72% (n = 36). The female inpatients has a frequency of 1.12% (n = 45).

Paracetamol 500mg tablets (10s) were also, just like ibuprofen 200mg tablets, a very popular drug due to the low cost of the product. The highest frequency was for outpatients with a frequency of 11.59% (n = 243) for male patients and 10.05% (n = 340) for female patients. The prevalence for inpatients is not far behind with the frequency of 9.60% (n = 217) for male patients and 6.53% (n = 263) for female patients.

The combination drug rifampicin (150mg), isoniazid (75mg), pyrazinamide (400mg) & ethambutol (275mg) (100s) had a frequency of 1.42% (n = 32) for male inpatients.

Chlorpheniramine maleate 4mg tablets (30s) was more dispensed to outpatients due to the fact that allergies is not severe enough for hospitalisation. The condition is treated mainly at the outpatient department. The frequency was 1.24% (n = 42) for female patients.

The following therapeutic codes had frequencies more than 1.00% but less than 30 items: ceftriaxone 1g injection; vitamin C 250mg tablets (100s); and theophylline syrup (200ml).

5.3.3.2 Frequency of therapeutic codes according to age groups

In appendix D.7 the frequency of therapeutic code according to age for in- and outpatients are shown which include therapeutic codes with frequencies more than 1.00% but exclude codes with less than 20 medicine items.

Amoxycillin 500mg capsules (15s) had a usage of 2.90% (n = 58) in the age group > 19 ≤ 40 years for outpatients and in inpatients the usage in the age group 1.48% (n = 31) in the age group > 40 ≤ 60 years as indicated in table D.7.

The amoxicillin 125mg/5ml suspension (100ml) was dispensed to paediatrics and children inpatients when they are too young to take capsules. The suspension had a frequency of 3.02% (n = 33) in the age group < 0 ≤ 6 years.

The amoxicillin with clavulanic acid 250mg/125mg tablets (15s) were frequently used by inpatients in the age group > 19 ≤ 40 years with a frequency of 2.19% (n = 46) and in the age group > 40 ≤ 60 years at 1.34% (n = 20) because these age groups represent junior adults and senior adults. Outpatients in the age group > 19 ≤ 40 years used it with a frequency of 1.70% (n = 34) and in the age group > 40 ≤ 60 years with a frequency of 1.16% (n = 23).

Ampicillin 250mg injection was mostly used in paediatrics and children inpatients who do not need the strongest dosage. The prevalence for this product was 7.69% (n = 84) in the paediatric age group.

The stronger dosage, ampicillin 500mg injection was widely used by all inpatients in all age groups. The prevalence was the highest in the age group > 19 ≤ 40 years with a frequency of 3.24% (n = 68).

Ciprofloxacin 500mg tablets (10s) were used mainly by outpatients in the age group > 19 ≤ 40 years with a frequency of 1.40% (n = 28). Refer to appendix D.7.

Gentamicin 40mg/ml injection had the highest frequency in the age group < 0 ≤ 6 with a frequency of 6.96% (n = 76) in inpatients.

The stronger dosage, gentamicin 80mg/2ml injection, was used in all inpatients age groups with the highest frequency at 59 (2.81%) in the age group > 19 ≤ 40 years and the lowest frequency of 1.01% (n = 3) in the age group > 6 ≤ 12 years. Refer to appendix D.7 for other frequencies.

Ceftriaxone 250mg IM injection had a significant usage in the paediatric inpatient age group < 0 ≤ 6 years with a frequency of 2.56% (n = 28).

The stronger dosage, ceftriaxone 1g injection was more often used in older outpatient age groups e.g. > 19 ≤ 40 years at 1.38% (n = 29). Refer to appendix D.7.

Co-trimoxazole 480mg tablets (20s) were dispensed to inpatients in the age group > 19 ≤ 40 years with a frequency of 3.05% (n = 64) and to the age group > 40 ≤ 60 years with a frequency 2.47% (n = 37).

Co-Trimoxazole, sulphacetamide (400mg) and trimethroprim (80mg) tablets (56s) had a frequency of 1.48% (n = 31) in the age group > 19 ≤ 40 years and 1.94% (n = 29) in the age group > 40 ≤ 60 years. Outpatients in the age group > 19 ≤ 40 years at 4.05% (n = 81) and for the age group > 40 ≤ 60 years at 4.63% (n = 92).

The frequency for Co-Trimoxazole 200mg/40mg/5ml suspension (50ml) was 8.52% (n = 93) in the paediatric inpatients age group < 0 ≤ 6 years. Refer to appendix D.7.

Doxycycline 100mg tablets (14s) were used in the age group > 19 ≤ 40 years. The usage was 2.35% (n = 47) of all therapeutic medicine items in the age group to outpatients.

Metronidazole 500mg/ml IV injection was used by most of the inpatient age groups. In the age group > 19 ≤ 40 years the frequency was 3.15% (n = 66).

Metronidazole 200mg tablets (21s) were used by all inpatient age groups except the paediatrics. The highest frequency was 56 (2.67%) for the age group > 19 ≤ 40 years and the lowest frequency was 6 (2.03%) in the age group > 6 ≤ 12 years. Outpatients had a frequency of 2.40% (n = 48) in the age group > 19 ≤ 40 and 1.31% (n = 26) in the age group > 40 ≤ 60 years. Refer to appendix D.7.

Efavirenz 600mg tablets (30s) were stronger tablets and were used by adult patients. The frequency was 1.70% (n = 34) for outpatients in the age group > 19 ≤ 40 years and 3.17% (n = 63) in outpatients in the age group > 40 ≤ 60 years.

Lamivudine 150mg tablets (60s) were used in inpatients in the age group > 19 ≤ 40 years the frequency was 1.43% (n = 30) and the elderly (< 60 years) the frequency was 1.40% (n = 21).

Outpatients in the age group > 40 ≤ 60 years with a frequency of 4.15% (n = 83) and in the age group > 60 with a frequency of 3.32% (n = 66).

Nevirapine 200mg tablets (60s) was used in the age group > 19 ≤ 40 years with a frequency of 2.40% (n = 48) in outpatients. The reason why Nevirapine was used in this age groups was due to the fact that patients is in child bearing age and to prevent MTCT (mother-to-child-transmission) in HIV positive pregnant woman (Department of Health, 2003:116). Another reason why Nevirapine is included in the ARV regime of pregnant woman is due to the fact that Efavirenz in tetratogenic (Department of Health, 2006a:174).

Stavudine d4T 30mg capsules (60s) were used by outpatients in the age group > 19 ≤ 40 years with a frequency of 1.65% (n = 33) and in the age group > 40 ≤ 60 years with a frequency of 1.36% (n = 27). Refer to appendix D.7.

Stavudine d4T 40mg capsules (60s) were used in the same age groups (adults) with the frequency respectively 2.60% (n = 52) and 2.21% (n = 44).

Enalapril 5mg tablets (28s) were mainly used by the elderly outpatients in the age groups > 40 ≤ 60 with a frequency of 1.46% (n = 29) and by patients in the age group > 60 with a frequency of 2.83% (n = 23). Refer to appendix D.7.

Enalapril 10mg tablets (28s) were only used by outpatients in the age group > 40 ≤ 60 years with a frequency of 1.46% (n = 29). Results are included in appendix D.7.

The Hydrochlorothiazide 25mg tablets (28s) package were also dispensed to inpatient above the age of 19, with specific frequency of 2.34% (n = 35) in the age group > 40 ≤ 60 years and 2.55% (n = 28) in the age group > 60 years. Hydrochlorothiazide was only used by outpatients in the age groups > 40 ≤ 60 years with a frequency of 3.07% (n = 61) and in the age group > 60 years with a frequency of 6.76% (n = 55). Thiazide diuretics, e.g. hydrochlorothiazide, were the first-line treatment for hypertension (Kredo & Blockman, 2007:445). Mpe (2007:34) indicates that older and black patients respond better to monotherapy with a thiazide diuretic or a calcium channel blocker.

Nifedipine 60mg Sr tablets (28s) were used by outpatients in the age group > 40 ≤ 60 years with a frequency of 1.16% (n = 23) and in the age group > 60 years the frequency was 2.58% (n = 21). This result is in line with Kredo and Blockman, (2007:446) who mention in their study

on 'Hypertension in the elderly' that nifedipine is effective in the treatment of hypertension due to the fact that nifedipine acts by coronary and peripheral vasodilatation.

Perindopril 4mg tablets (28s) (which was also only dispensed from the age of 19 years) had a frequency of 1.74% (n = 26) in the age group > 40 ≤ 60 years and 5.45% (n = 60) in the age group > 60 years. Perindopril 4mg tablets were used in senior adults (age group > 40 ≤ 60 years) with a frequency of 1.21% (n = 24) and in the elderly (age group > 60 years) with a frequency of 4.30% (n = 35). In their study on 'Antihypertensive treatment in the very elderly shows significant mortality benefit' Beckett and Bulpitt (2008:170-171) discovered that the combination treatment with indapamide 1.5mg and perindopril 4mg tablets lowers the blood pressure by 29.5/12.9 mmHg during the study period. In the study population 48% of the patients over 80 years achieved the target blood pressure during a 2 year treatment and had no significant differences in serum potassium, uric acid, glucose or creatinine levels.

Ferrous sulphate co tablets (28s) were commonly used in all inpatients age groups above the age of 12 years. The frequency was 3.91% (n = 82) in the age group > 19 ≤ 40 years, 1.54% (n = 23) in the age group > 40 ≤ 60 years and 1.82% (n = 20) of all diagnoses in the age group > 60 years. Ferrous sulphate co tablets were used by outpatients in the age group > 19 ≤ 40 years with a frequency of 1.15% (n = 23). See appendix D.7.

Folic acid 5mg tablets (28s) were used in every age group for inpatients. The highest frequency was 7.33% (n = 80) for the age group < 0 ≤ 6 years and the lowest frequency was 1.60% (n = 24) in the age group > 40 ≤ 60 years. Patients in the age group > 19 ≤ 40 years had a frequency of 1.10% (n = 22).

Metformin 850mg tablets (56s) were used in type 2 diabetes which occurs mostly in elderly patients, in this case inpatients older than 19 years. The frequency of the age group > 40 ≤ 60 years was 1.60% (n = 24). According to Ascott-evans and Kinving (2004:623) 10% of people over 65 years of age are diabetic, compared with 5% diabetic patients in the age group 45-64 years and 1% in the patients younger than 45 years.

Prednisone 5mg tablets (28s) were widely used by all outpatients above the age of 6 years. The highest frequency was in patients in the age group > 40 ≤ 60 years with a frequency of 3.12% (n = 62).

Carbamazepine 200mg CR tablets (30s) for outpatients in the age group > 19 ≤ 40 years had a frequency of 1.75% (n = 35).

Carbamazepine 400mg CR tablets (30s) were dispensed to outpatients in the age group > 40 ≤ 60 years with a frequency of 2.46% (n = 49).

Haloperidol 5mg tablets (14s) had a frequency of 1.24% (n = 26) in the inpatient age group > 19 ≤ 40 years. Refer to appendix D.7.

Amitriptylin 25mg tablets (28s) had a frequency for inpatients of 1.34% (n = 28) in the age group > 19 ≤ 40 years, 1.47% (n = 22) in the age group > 40 ≤ 60. Amitriptyline was only dispensed to patients in the age groups > 19 ≤ 40 years with a frequency of 1.30% (n = 26), 40 ≤ 60 years with a frequency of 1.66% (n = 33) and > 60 years with a frequency of 2.58% (n = 21).

Metoclopramide 5mg/ml injection had a frequency of 1.47% (n = 22) for inpatients in the age group > 40 ≤ 60 years. Refer to appendix D.7.

The sodium sulphate , sodium bicarbonate, sodium chloride and potassium chloride powder had a frequency of 2.29% (n = 25) in the age group > 0 ≤ 6 years.

The Ringer's lactate solution was only used in the inpatient department and the frequency in the age group > 19 ≤ 40 years was 1.34% (n = 28).

Potassium chloride 300mg/5ml syrup was used by paediatric patients in the age group > 0 ≤ 6 years with a frequency of 2.93% (n = 32). Refer to appendix D.7.

Vitamin A 100 000 IU capsules (250s) were only used in paediatric outpatients in diseases like measles (Department of Health, 2003:145) and had a frequency of 2.01% (n = 22).

The vitamin A, D, E, folic acid and riboflavin tablets (30s) were vitamin supplements in outpatients dispensed to HIV patients and were used by patients in the age group > 19 ≤ 40 years with a frequency of 2.00% (n = 40) and in the age group > 40 ≤ 60 years with a frequency of 1.41% (n = 28). This supplement was stronger and higher in vitamins than the normal multivitamin. This supplement was also available in a 30 tablet package which is easy to use with the ARV medication, which was also dispensed for 30 days at a time.

Vitamin B co strong tablets (28s) were used by inpatients in all age groups. The highest frequency was 60 (2.86%) in the age group > 19 ≤ 40 years. Outpatients in the age group

> 19 ≤ 40 years had a frequency of 1.70% (n = 34), in the age group > 40 ≤ 60 years the frequency was 1.61% (n = 32).

Vitamin B6 25mg tablets (28s) were used in inpatients older than 19 years. The frequency decreased from 2.58% (n = 54) in the age group > 19 ≤ 40 year to 2.34% (n = 35) in the age group > 40 ≤ 60 year. Tablets were used by outpatients in the age group > 19 ≤ 40 years with a frequency of 1.55% (n = 31) and in the age group > 40 ≤ 60 years with a frequency of 1.46% (n = 29). Refer to appendix D.7.

The vitamin C 250mg tablets (100s) were dispensed to outpatients in the age group > 19 ≤ 40 years with the frequency of 1.25% (n = 25).

The multivitamin syrup was usually dispensed to paediatrics or children due to the dosage form but can be used by older patients as well. The frequency in the paediatric inpatients in the age group > 0 ≤ 6 years was 12.36% (n = 135) and in the children age group (> 6 ≤ 12 years) a frequency of 6.76% (n = 20) was noted. The multivitamin syrup was used by paediatric outpatients in the age group > 0 ≤ 6 years with a frequency of 15.33% (n = 44).

Multivitamin tablets (28s) were used in all age groups. The highest frequency was 6.11% (n = 128) in the age group > 19 ≤ 40 years and the lowest frequency is in the paediatric age group with a frequency of 1.10% (n = 12) in inpatients. The multivitamin tablet was used by outpatients older than 6 years. The highest frequency was for patients in the age group > 19 ≤ 40 years with a frequency of 5.69% (n = 114). See appendix D.7.

Aspirin 300mg soluble tablets (14s) were used in patients from the age of 19 years but more commonly in the age group > 40 ≤ 60 years with a frequency of 1.67% (n = 25) and in the age group > 60 years with a frequency of 3.82% (n = 42). The frequency for outpatients in the age group > 40 ≤ 60 was 2.16% (n = 43) and in patients older than 60 years the frequency was 4.79% (n = 39). Although aspirin was classified as a pain reliever in the non-opioid analgesics class, aspirin also had cardiovascular actions. Kirby (2007:32) states that aspirin was a cheap and relatively safe drug and is the most widely used long-term antiplatelet therapy. With long term use, aspirin reduces the relative risk of arterial and venous thrombosis by about 25%.

The diclofenac 25mg/ml injection was only used in the inpatient group older than 12 years. For the age group > 19 ≤ 40 years the frequency was 2.05% (n = 43). The injections were

administered to outpatients in the age group > 19 ≤ 40 years at 2.05% (n = 41) and in the age group > 40 ≤ 60 years the frequency was 1.81% (n = 36).

Diclofenac 25mg tablets (42s) were dispensed to patients in the age group > 40 ≤ 60 years with a frequency of 1.45%. See appendix D.7.

Ibuprofen 200mg tablets (15s) were only dispensed to outpatients older than 6 years. The highest frequency was for outpatients in the age group > 12 ≤ 20 years with a frequency of 17.83% (n = 28).

The methyl salicylate in Vaseline ointment was dispensed to patients older than 19 years. The frequency of patients in the age group > 19 ≤ 40 years was 1.05% (n = 21), in the age group > 40 ≤ 60 years the frequency was 1.51% (n = 21) and the frequency for patients in the age group > 60 years was 3.93% (n = 32).

Paracetamol 120mg/5ml syrup had a frequency of 7.60% (n = 83) in the age group < 0 ≤ 6 years. Paracetamol 120mg/5ml syrup (50ml) was dispensed to paediatric outpatients in the age group < 0 ≤ 6 years with the frequency of 16.72% (n = 48) and to children in the age group > 6 ≤ 12 years with the frequency of 7.96% (n = 18). Refer to appendix D.7. Patients in the age group > 19 ≤ 40 years received 243 medicine items (12.41%) during the study period. Anon. (2007b:36) states that paracetamol relieves pain and fever and has a little anti-inflammatory action and this is what makes this drug the analgesic of choice in children under 12 years. See appendix D.7.

Paracetamol 500mg tablets (10s) were used in every age group. The highest frequency was 14.49% (n = 39) in the age group > 12 ≤ 19 years and the lowest in the paediatric age group (1.19%). This can be due to the dosage form that is not very suitable for this age group. Paracetamol 500mg tablets (10s) were dispensed to outpatients in the age group > 12 ≤ 19 years with a frequency of 22.93% (n = 36). In the age group > 40 ≤ 60 years the frequency was 9.85% (n = 196) and to patients > 60 years the frequency was 11.79% (n = 96).

The tuberculosis treatment rifampicin 60mg, isoniazid 30mg & pyrazinamide 150mg tablets had a frequency of 3.57% (n = 39) in the paediatric age group. According to Donald (2007:992) this is the first-line of tuberculosis treatment at the moment.

Another TB treatment, rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg tablets were only used in adult and elderly treatments. The frequency in the age group > 19 ≤ 40 years is 2.15% (n = 45) and 1.54% (n = 23) in the age group > 40 ≤ 60 years.

Chlorpheniramine maleate 4mg tablets (30s) had a frequency of 1.60% (n = 32) in the age group > 19 ≤ 40 years. See appendix D.7.

The following therapeutic codes had frequencies >1.00% but less than 20 medicine items: amoxycillin 250mg capsules (15s), amoxycillin with clavulanic acid 125mg/31.5mg suspension (100rnl), flucloxacillin 250mg capsules (20s), co-trimoxazole 200mg/40mg/5ml syrup (100ml), erythromycin 250mg tablets (20s), metronidazole 200mg/5ml suspension, efavirenz 50mg capsules, efavirenz 200mg capsules (90s), lamivudine 10mg/ml oral solution (240ml), lopinavir 60ml syrup, stavudine d4T 20mg capsules (60s), stavudine d4T solution (200ml), zidovudine 300mg capsules (60s), amlodipine besylate 5mg tablets (30s), atenolol 50mg tablets (28s), furosemide 40mg tablets (28s), furosemide 10mg/ml injection, hydrochlorothiazide 25mg tablets (14s), indapamide 2.5mg tablets (30s), nifedipine 30mg Sr tablets (28s), spironolactone 25mg tablets (240s), tranexamic acid 100mg/ml injection, ferrous gluconate syrup, benzoyl peroxide 5% cream, benzyl benzoate emulsion, gliclazide 80mg tablets (56s), metformin 850mg tablets (84s), prednisolone 15mg/5ml syrup, phenobarbitone 30mg tablets (56s), sodium valproate 200mg tablets (28s), bromocriptine mesylate 2.5mg tablets (30s), albendazole 200mg tablets (2s), aluminium hydroxide suspension, metoclopramide 5mg/5ml syrup, metoclopramide 10mg tablets (15s), half darrows & glucose solution, thymol glycerin mouth wash, calcitriol 0.25mg capsules (30s), calcium carbonate & glycine 420mg tablets (300), potassium chloride 600mg slow tablets (14s), vitamin c 100mg tablets (28s), Vi-Daylin syrup, diclofenac 25mg tablets (28s), ibuprofen 100mg/5ml suspension, paracetamol 120mg/5ml syrup, tilidine 100mg/ml oral drops, codeine phosphate 30mg tablets (100s), tetanus vaccine, beclomethasone MDI, salbutamol MDI, salbutamol 2mg/5ml syrup, theophylline syrup, theophylline 200mg anhydrous tablets (60s), mist tussi infants mixture, promethazine 25mg/ml injections, promethazine 25mg tablets (500s), and chlorpheniramine maleate 2mg/5ml syrup.

5.3.3.3 Frequency of therapeutic codes according to ICD-10 codes

In this section all therapeutic codes with a frequency n > 50 are included in the discussion and are illustrated in appendix D.1.

For the condition tuberculosis the combination antituberculosis drugs rifampicin 60mg, isoniazid 30mg & pyrazinamide 150mg tablets were dispensed 41 times (19.90%) to inpatients during the study period. Another combinations of antituberculosis drug, rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg, were 71 times (34.47%) dispensed to inpatients during the same period also for the condition tuberculosis. Fixed-dose combinations are strongly encouraged in adults to enhance patient adherence and reduce the risk of inappropriate monotherapy (Department of Health, 2003:218).

Undefined bacterial infection can be treated with several antibiotics in different pharmacological groups. Amoxycillin 500mg capsules were dispensed 79 times (15.74%) to outpatients for the treatment of undefined bacterial infections. Another antibiotic amoxycillin with clavulanic acid 250mg/125mg tablets were used in the treatment of this condition and were dispensed 43 times (6.26%) to inpatients and 57 times (11.35%) to outpatients. The ampicillin 500mg injection and gentamicin 80mg/2ml injection were dispensed 57 (8.30%) and 47 times (6.84%) to inpatients for the treatment of undefined bacterial infection. All of the above mentioned antibiotics are classified in the penicillin anti-infective pharmacological group. Another pharmacological group used for the treatment in chloramphenicol and erythromycins. Co-trimoxazole 480mg tablets had a prevalence of 55 (8.01%) for inpatients and co-trimoxazole 200mg/40mg/5ml suspension a prevalence of 47 (6.84%) for treatment of undefined bacterial infections also in inpatients. Co-trimoxazole, sulfamethoxazole and trimethoprim combination tablets were dispensed to outpatients with a frequency of 48 (9.56%) in outpatients. Doxycycline 100mg tablets were dispensed to outpatients with a frequency of 40 (7.97%) for treatment of the same condition. Metronidazole IV injection had a frequency of 53 (7.71%) for inpatients and metronidazole 200mg tablets were dispensed to both inpatients with a frequency of 59 (8.59%) and to outpatients with a frequency of 50 (9.96%) treatment of undefined bacterial infections.

In the treatment of unspecified HIV, co-trimoxazole, sulfamethoxazole and trimethoprim combination tablets were used to treat the opportunistic infections which may occur due to the low immune system. This drug was dispensed 125 times (18.22%) to outpatients as part of their antiretroviral (ARV) treatment. Botes & Levay (2006:32) stated that co-trimoxazole prophylaxis has become part of the standard of care for HIV patients worldwide and an additional benefit is the decrease of toxoplasmosis and some bacterial infections targeting the urinary tract, respiratory tract or skin. Spencer (2006:32) stated that co-trimoxazole, an inexpensive antimicrobial, can provide survival advantage to HIV infected patients. Co-trimoxazole has a wide range of action against common bacteria, parasites, fungi and yeast and

is highly effective in reducing mortality and morbidity in HIV-infected adults and children not currently on ARV medication (Young *et al.*, 2008:258-259). Looking at the antiretroviral included in the budget group antiviral, efavirenz 600mg capsules were dispensed 97 times (14.14%) to outpatients. Lamivudine 150mg tablets were frequently dispensed to both in- and outpatients with the frequency of 57 (23.65%) and 155 (22.59%), respectively. Nevirapine 200mg tablets were dispensed to outpatients with a prevalence of 53 (7.73%). Stavudine is another ARV medication. Stavudine d4T 30mg tablets were 61 times (8.89%) dispensed to outpatients and stavudine d4T 40mg tablets 98 times (14.29%). Adults with HIV received a vitamin supplement which included vitamin A, D, E, folic acid and riboflavin. The frequency of this product was 76 (12.54%) during the study period (see appendix D.1). Bouic (2003:60) found that in a HIV patient with specific micronutrient abnormalities, low plasma or serum levels of essential vitamins, e.g. vitamin A, B6, B12 and zinc have been associated with poor outcome of the disease. This multivitamin was a stronger multivitamin especially formulated for patients with immune depressing diseases like HIV. See appendix D.1.

Folic acid 5mg tablets were used in great extent to treat unspecified folate deficiency anaemia with a frequency of 220 (99.55%) for inpatients and 42 (97.67%) for outpatients. Refer to appendix D.1.

Unspecified anaemia was treated with ferrous sulphate co tablets with a frequency of 137 (74.86%) in inpatients. Chemaly (2007:32) states that when anaemia occurs the body's red blood cell production is decreased because of deficiencies such as vitamin B12, iron, folic acid and vitamin C. A lower production of red blood cells results in less haemoglobin to transport oxygen from the lungs and deliver it to all parts of the body.

Unspecified coagulation defects was effectively treated with aspirin soluble 300mg tablets in both inpatients with a frequency of 81 (57.45%) and outpatients with a frequency of 93 (75.61%). Aspirin is a very cost-effective way to treat this condition. Refer to appendix D.1.

Diabetes mellitus type 2 was mainly treated with oral anti-diabetic medication. During the study period metformin 850mg tablets were dispensed with a frequency of 45 (47.37%) to inpatients. Campbell (2006:197) states that metformin has a positive effect on insulin resistance, hyperinsulinaemia, visceral obesity, hyperglycaemia, dyslipidaemia and hypertension as well as risk factors involved in endothelial dysfunction, inflammation and atherosclerosis.

Other vitamin supplements used to treat vitamin deficiency included vitamin B co strong tablets where the frequency for inpatients was 122 (15.76%) and 80 (13.20%) for outpatients. Vitamin A, D, E, folic acid, riboflavin tablets for adults were included in the discussion of unspecified HIV as this particular vitamin supplement forms part of the treatment of unspecified HIV. Vitamin B_6 25mg tablets were dispensed 102 times (13.18%) to inpatients and 63 times (10.40%) to outpatients. Bouic (2003:60) states that studies have shown that high doses of vitamin B_6 supplements were associated with improved survival of patients suffering from HIV. Vitamin C was dispensed more frequently to outpatients with a frequency of 42 (6.93%). Vitamin C is an antioxidant that is important in the management of HIV disease since most patients are under oxidative stress which enhance the viral replication cycle due to increased levels of oxidants (Bouic, 2003:60). The multivitamin syrup was dispensed to inpatients with a frequency of 153 (19.77%) and to outpatients with a frequency of 58 (9.57%). Multivitamin tablets had a very high prevalence during the study period and was dispensed 288 times (37.21%) to inpatients and 256 times (42.24%) to outpatients.

Mineral deficiency was not such a common disease like vitamin deficiency according to the frequency of the therapeutic codes and ICD-10 codes and potassium chloride 600mg slow tablets were dispensed 43 times (37.72%) to inpatients to treat this condition.

Aluminium hydroxide suspension was used in the treatment of acid-base balance disorders. This product was 43 times dispensed (41.35%) to inpatients. Refer to appendix D.1.

In other disorders of fluid and electrolyte balance Ringer's lactate solution was used as treatment. This product was administrated 48 times (34.78%) to inpatients.

Haloperidol 5mg tablets were dispensed 40 times (60.61%) to inpatients for the treatment of bipolar disorders during the study period. Amitriptyline 25mg tablets were dispensed to inpatients with a frequency of 68 (73.12%) and to outpatients with a frequency of 80 (77.76%) for the treatment of major depressive disorders.

For the treatment of inflammation, the corticosteroid prednisone 5mg tablets were effectively used in inpatients with a frequency of 71 (53.38%) and in outpatients with a frequency of 98 (58.33%). Refer to appendix D.1.

Epilepsy was treated with carbamazepine CR 200mg and 400mg tablets in outpatients suffering from this condition. The frequency for the 200mg tablets was 63 (34.81%) and for the 400mg tablets the frequency was 65 (35.91%).

Hypertension was treated with a variety of antihypertensive drugs. Enalapril 10mg tablets were more frequently dispensed to outpatients with a frequency of 52 (11.82%). Hydrochlorothiazide 25mg tablets had a high frequency for both in- and outpatients possibly due to the relative low cost of the product. The frequency for inpatients was 71 (15.07%) and for outpatients 116 (26.36%). Nifedipine 60mg SR tablets had a frequency of 44 (10.00%) for outpatients. Perindopril 4mg tablets was another popular product for both in- and outpatients. The frequency of perindopril was higher in inpatients at 93 (19.75%) than in outpatients with a frequency of 59 (13.41%).

In the treatment of acute and chronic persistent asthma, theophylline syrup was dispensed with a frequency of 51 (34.46%) to inpatients and a frequency of 47 (30.92%) to outpatients. Refer to appendix D.1.

Inpatients were treated with metoclopramide 5mg/ml injections when they were suffering from nausea at a frequency of 62 which represent 56.88% of the treatments for inpatients with nausea.

When the main symptom was pain control, patients were treated with a variety of non-opioid analgesics which included NSAIMs. Diclofenac 25mg/ml injections were acute pain relieving injections and were dispensed to inpatients with a frequency of 76 (6.92%) and to outpatients with a higher frequency at 103 (7.40%). Diclofenac 25mg tablets were dispensed to outpatients with a frequency of 58 (4.17%). Ibuprofen 200mg tablets were a more frequently used pain reliever possible due to the lower cost. Ibuprofen was dispensed with a frequency of 241 (21.93%) to inpatients and a much higher frequency for outpatients at 357 (25.66%). NSAIMs were highly effective in the treatment of pain and inflammation mediated by prostaglandin release (Wiseman, 2003:80). Inflammation is a defensive and protective response due to tissue damage and can be decreased by using NSAIMs, states Wiseman (2003:80-81). Methyl salicylate in Vaseline ointment was more frequently dispensed to outpatients as a home remedy for pain control and has a frequency of 85 (6.11%). Van Schoor (2006:14) stated that topical NSAIMs like methyl salicylate was very effective in relieving musculoskeletal pain. Paracetamol 120mg/5ml syrup was used by both in- and outpatients. The frequency of the syrup in

inpatients was 93 (8.46%) but is slightly lower for outpatients at 68 (4.89%). Paracetamol 500mg tablets were the most popular pain reliever used by all genders and all age groups. The frequency of paracetamol 500mg tablets in inpatients were 480 (43.68%) and were 583 times (41.91%) dispensed to outpatients during the study period. This was an acceptable percentage of usage according to Green (2005:36). In his article 'Paediatric fever and pain control with rectal paracetamol' Green says that there is a relative small selection of analgesic/anti-pyretic agents for the safe use in children suffering from pain and fever. According to Green (2005:36) paracetamol is one of the most frequently assessed drugs in post-marketing surveillance due to the fact that paracetamol seldomly causes side-effects. Refer to appendix D.1.

The antihistamine chlorpheniramine maleate 4mg tablets was dispensed with a frequency of 63 (63.00%) to outpatients. Antihistamines are used extensively to provide symptomatic relief in allergic conditions such as hay fever, skin rash, itchy skin and insect bites and stings. It is also used in the treatment of nausea and vomiting, sedation and cold and flu to dry up the nasal congestion (Souter, 2006:10).

The frequencies of the therapeutic codes according to ICD-10 codes are included in appendix D.1 in the appendix.

5.3.3.4 Comprehensive summary of therapeutic codes

The summary of the top 10 therapeutic codes according to frequency was included in appendix D.8. Table 39 contains the top three therapeutic codes according to frequency.

TABLE 39: Top three therapeutic codes according to frequency

Therapeutic code	In- and outpatients		
	Rank	n	%*
Paracetamol Tabs 500mg 10s	1	1063	9.03
Ibuprofen Tabs 200mg 15s	2	600	5.10
Vitamin Multiple Tabs 28s	3	544	4.62
Total of top three therapeutic codes		**2207**	**18.75**

*Percentage was calculated for therapeutic codes according to frequency

The individual therapeutic code which has the highest frequency during the study period of January 1st till June 30th 2007 was paracetamol 500mg tablets (10s). This product was dispensed 480 times to inpatients and 583 units were dispensed to outpatients.

This represents 7.63% of medicine items for inpatients and 10.64% of medicine items dispensed to outpatients. Added together, paracetamol 500mg tablets represent 9.03% of all the therapeutic codes/medicine items dispensed.

Ibuprofen 200mg tablets (15s) were ranked in third place according to frequency for inpatients and in second place for outpatients. Ibuprofen 200mg tablets were dispensed 243 times (3.86%) to inpatients and 357 times (6.51%) to outpatients. This product was ranked second over-all because 5.10% of all individual items dispensed were Ibuprofen 200mg tablets (15s).

These results were in line with the results of the top three budget- and pharmacological groups. The budget group, pain reliever, was ranked second with a frequency of 22.69% of the total frequency of budget groups (see appendix D.2 and 5.3.1.4). The pharmacological group, analgesics, non-opioid including NSAIMs, gold and anti-gout preparations, was the pharmacological group with the highest frequency and represent 21.95% of all pharmacological frequencies (see appendix D.5 and 5.3.2.4).

Multivitamin tablets (28s) were dispensed 288 times in the inpatient department and were ranked second, and 256 times for outpatients which placed it in second rank for the outpatient department. Multivitamin tablets were ranked in third place when added together with a usage of 544 units and represented 4.62% of all the individual items dispensed. This was in line with the top three budget and pharmacological group results. The budget group, gastrolytes, was ranked third with a frequency of 19.18% (see appendix D.2 and 5.3.1.4) and the pharmacological group, vitamins and minerals, is ranked second with a frequency of 13.07% (see appendix D.5 and 5.3.2.4).

The top three individual therapeutic codes (Paracetamol 500mg tablets, Ibuprofen 200mg tablets and Multivitamin tablets) were 18.75% of all the individual medicine items dispensed to either in- or outpatients during the study period.

The top 10 individual therapeutic codes represent 32% of all medicine items dispensed to inpatients and 38% of those dispensed to outpatients. The top 10 therapeutic codes based on frequency was included in appendix D.8.

5.3.4 ICD-10 codes

All medicines for the specific disease as indicated in the patient file were classified according to the International Code of Diseases, 10th version (ICD-10 code). These diseases were first discussed according to gender (section 5.3.4.1) to compare the prevalence between male and female patients. The analysis according to age was discussed in section 5.3.4.2 to evaluate the prevalence of certain diseases in the different age groups. ICD-10 codes with a frequency >3.00% are included in the discussion in this section.

5.3.4.1 Frequency of ICD-10 codes according to gender

All the ICD-10 codes were analysed according to gender and the results are in appendix D.9. *Table 40 summarises the ICD-10 codes with a frequency >3.00% according to gender.*

Infective diarrhoea / food poisoning was a disease with a frequency >3.00% only for male inpatients. The frequency of 96 represents 4.25% of all diseases diagnosed for male inpatients. It was interesting to find that diseases which were almost the same as infective diarrhoea / food poisoning, e.g. gastro-enteritis and gastric diarrhoea, only appeared in male inpatients during the study period. It was strange that gastro and diarrhoea related diseases had the highest prevalence in male inpatients.

TABLE 40: Frequency of ICD-10 codes according to gender > 3.00%

ICD-10 code	Inpatients				Outpatients			
	Male		Female		Male		Female	
	n	%*	n	%*	n	%*	n	%*
Diarrhoea, infective / food poisoning	96	4.25	92	2.28	9	0.43	15	0.44
Tuberculosis	87	3.85	119	2.95	9	0.43	28	0.83
Undefined bacterial infection	216	9.56	471	11.69	198	9.45	304	8.98
Unspecified HIV	52	2.30	189	4.69	221	10.54	456	13.74
Unspecified folate deficiency anaemia	64	2.83	157	3.90	16	0.76	27	0.80
Unspecified anaemia	35	1.55	148	3.67	10	0.48	32	0.95
Vitamin deficiency	255	11.28	519	12.88	242	11.55	364	10.76
Inflammation	45	1.99	88	2.18	58	2.77	110	3.25
Epilepsy	59	2.61	58	1.44	91	4.34		
Hypertension	107	4.73	364	9.04	132	6.30	308	9.10
Pain control	527	23.32	572	14.20	622	29.68	769	22.72

*Percentage was calculated for male and female inpatient and outpatients respectively

Tuberculosis had a 3.85% prevalence (n = 87) in male inpatients. The prevalence in female inpatients and outpatients was <3.00%. The TB smear conversion rate measures the efficiency of the initial treatment to stop the transmission of TB and the average was 55,8 % for 2006/2007 (Cosser, 2007:5) and the relative low prevalence of tuberculosis can be due to this reason (see section 2.2.1.4).

Undefined bacterial infections included all treatments where antibiotics were dispensed but where the diagnosis did not specify the type of bacterial infection. The frequency of this disease was quite high. Male inpatients had a frequency of 216 (9.56%), 471 medicine items (11.69%) for female inpatients, 198 medicine items (9.45%) for male outpatients and 304 medicine items (8.98%) for female outpatients had an undefined bacterial infection.

Unspecified HIV had a higher frequency for outpatients than for inpatients. The reason for this was that HIV is not a disease where hospitalisation was necessary by diagnosis or by treatment. When patients end up in hospital it was usually due to a secondary infection. The prevalence of diagnoses was 10.54% (n = 221) of male outpatients and 13.74% (n = 456) of female outpatients was diagnosed with unspecified HIV while 4.69% (n = 189) of female inpatients had a record of unspecified HIV.

Some female inpatients (3.90%) suffered from unspecified folate deficiency anaemia with a frequency of 157. Folate deficiency usually occurs during pregnancy when females need additional folate. Unspecified anaemia occurred in 3.67% (n = 148) of female inpatients. Bihl (2008:238) states that anaemia of chronic disease is a multifactor anaemia and is the second most common type of anaemia.

A vitamin deficiency was a common disease due to malnutrition. De Haan (2005:5) states that there is more poverty in rural areas because of less education and work opportunities, far from work and transport difficulties, thus diseases like malnutrition are common. The prevalence of this deficiency was 255 (11.28%) in male inpatients, 519 (12.88%) in female inpatients, 242 (11.55%) in male outpatients and 364 (10.76%) in female outpatients.

Inflammation had a prevalence of only >3.00% for female inpatients where the frequency is 110 (3.25%) of all diseases diagnosed for female inpatients.

Epilepsy had a frequency of 91 (4.34%) for male outpatients during the study period but no cases were documented for female outpatients.

Hypertension was a very common cardiovascular disease. The frequency of this disease varies from 9.04% (n = 364) for female inpatients and 9.10% (n = 308) for female outpatients to 4.73% (n = 107) for male inpatients and 6.30% (n = 132) for male outpatients.

Pain control had the highest frequency of all ICD-10 codes. The prevalence was the highest for male outpatients with a frequency of 622 (29.68%) and the lowest for female inpatients at 572 (14.20%). The treatment for pain control was very cheep treatment (usually <R2.00) and was an explanation why the prevalence was so high.

The rest of the frequencies of ICD-10 codes according to gender are presented in appendix D.9.

5.3.4.2 Frequency of ICD-10 codes according to age groups

All the ICD-10 codes according to age group are presented in appendix D.10. A summary of the ICD-10 codes with a frequency >3.00% is presented in table 41.

Infective diarrhoea / food poisoning had the highest frequency in the paediatric age group < 0 ≤ 6 years. The frequency was 120 (10.99%) for this age group.

Tuberculosis was higher in male inpatients than outpatients. The age groups with frequencies >3.00% were < 0 ≤ 6 years with a frequency of 53 (4.85%), the age group > 19 ≤ 40 years with a frequency of 90 (4.29%) and > 40 ≤ 60 years with a frequency of 56 (3.74%).

Undefined bacterial infections were evenly spread over the six age groups for both in and outpatients. The highest frequency was 19.17% (n = 55) for outpatient age group < 0 ≤ 6 years and the lowest for inpatients with an age > 60 years with a frequency of 5.45% (n = 60) according to percentage. Refer to appendix D.10.

Unspecified HIV had the highest prevalence in outpatients in the age group > 6 ≤ 12 years at 57 (25.22%) of the total diagnosis in that age group. The transmission of HIV to children in those age groups was usually through mother-to-child transmission (MTCT). Other age groups with an HIV prevalence >3.00% were inpatients in the age groups > 6 ≤ 12 years with a frequency of 36 (12.16%), > 19 ≤ 40 with a frequency of 102 (4.87%) and in the age group > 40 ≤ 60 years the frequency was 76 (5.08%) and for outpatients in the age groups > 6 ≤ 12 years the frequency was 16 (5.57%), > 19 ≤ 40 years had a frequency of 330 (16.48%) and > 40 ≤ 60 years age group had a frequency of 281 (14.13%).

TABLE 41: ICD-10 codes with frequencies > 3.00 according to age groups

ICD-10 code	Inpatients												Outpatients											
	< 0 ≤ 6		> 6 ≤ 12		> 12 ≤ 19		> 19 ≤ 40		> 40 ≤ 60		> 60		< 0 ≤ 6		> 6 ≤ 12		> 12 ≤ 19		> 19 ≤ 40		> 40 ≤ 60		> 60	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Diarrhoea, infective / food poisoning	120	**10.99**	4	1.35			31	1.48	8	0.53	25	2.27			3	1.33			4	0.20	12	0.60	5	0.61
Tuberculosis	53	**4.85**	2	0.68			90	**4.29**	56	**3.74**	5	0.45	2	0.70					24	1.20	11	0.55		
Undefined bacterial infection	148	**13.55**	23	**7.77**	22	**10.63**	251	**11.98**	183	**12.22**	60	**5.45**	55	**19.17**	22	**9.73**	19	**12.10**	224	**11.19**	137	**6.89**	45	**5.53**
Unspecified HIV	27	2.47	36	**12.16**			102	**4.87**	76	**5.08**			16	**5.57**	57	**25.22**	2	1.27	330	**16.48**	281	**14.13**		
Scabies	2	0.18	3	1.01									1	0.35			5	**3.18**	5	0.25				
Dietary folate deficiency anaemia	80	**7.33**	17	5.74	8	**3.68**	76	**3.63**	22	1.47	18	1.64	8	2.79					22	1.10	11	0.55	2	0.25
Unspecified anaemia	22	2.01	2	0.68	13	**6.28**	93	**4.44**	32	2.14	21	1.91	1	0.35	1	0.44			28	1.40	8	0.40	4	0.49
Unspecified coagulation defects					6	2.90	25	1.19	58	**3.87**	52	**4.73**					2	1.27	16	0.80	61	**3.07**	44	**5.41**
Diabetes mellitus type 2							8	0.38	46	**3.07**	41	**3.73**							13	0.65	25	1.26	24	2.95
Vitamin deficiency	182	**16.67**	27	**9.12**	23	**11.11**	275	**13.12**	165	**11.02**	102	**9.27**	50	**17.42**	32	**14.16**	8	**5.10**	265	**13.24**	204	**10.26**	47	**5.77**
Mineral deficiency	33	**3.02**	18	**6.08**			18	0.86	15	1.00	30	2.73	1	0.35					19	0.95	16	0.80	17	2.09
Disorders of acid-base balance			7	2.36	5	2.42	14	0.67	43	2.87	35	**3.18**			1	0.44	1	0.64	23	1.15			10	1.23
Other disorders of fluid & electrolyte balance	40	**3.66**	4	1.35	2	0.97	44	2.10	27	1.80	21	1.91	9	**3.14**	2	0.88			8	0.40	7	0.35	2	0.25
Inflammation	16	1.47			5	2.42	66	**3.15**	29	1.94	17	1.55	4	1.39	1	0.44			56	2.80	86	**4.32**	21	2.58
Epilepsy	13	1.19	9	**3.04**	3	1.45	29	1.38	38	2.54	25	2.27	3	1.05	11	**4.87**	1	0.64	65	**3.25**	84	**4.22**	17	2.09
Rheumatic fever			1	0.34	14	**6.76**																		
Hypertension	2	0.18	45	**15.20**	4	1.93	52	2.48	162	**10.82**	206	**18.73**	1	0.35					11	0.55	233	**11.71**	195	**23.96**
Tonsillitis (bacterial)			10	**3.38**															3	0.15	2	0.10		
Bronchopneumonia, unspecified	36	**3.30**	2	0.68			6	0.29	1	0.07									1	0.05				
Lower respiratory tract infection	33	**3.02**							2	0.13			3	1.05					1	0.05	1	0.05		
Asthma, acute OR asthma, chronic persistent	50	**4.58**	13	**4.39**			30	1.43	40	2.67	15	1.36	12	**4.18**	15	**6.64**	9	**5.73**	45	2.25	27	1.36	44	**5.41**
Dental abscess			3	1.01			5	0.24			2	0.18	1	0.35	3	1.33	5	**3.18**	11	0.55	10	0.50	2	0.25
Cough	6	0.55	1	0.34	1	0.48	3	0.14	7	0.47	4	0.36	14	**4.88**	5	2.21			20	1.00	7	0.35	3	0.37
Nausea	4	0.37	2	0.68	8	**3.86**	30	1.43	37	2.47	28	2.55	3	1.05			2	1.27	19	0.95	20	1.01	4	0.49
Pain control	128	**11.72**	40	**13.51**	59	**28.50**	412	**19.66**	250	**16.70**	210	**19.09**	67	**23.34**	46	**20.35**	78	**49.68**	516	**25.77**	447	**22.47**	233	**28.62**
Antihistamine for allergies	6	0.55	1	0.34	1	0.48	14	0.67	9	0.60	8	0.73	7	2.44	7	**3.10**	6	**3.82**	36	1.80	34	1.71	10	1.23

Scabies had a frequency of 5 (3.18%) in the outpatient age group > 12 ≤ 19 years. This can be due to bad hygiene in the rural area communities (Department of Health, 2003:97) (refer to section 2.2.1.4). Refer to appendix D.10 and table 41.

Unspecified folate deficiency anaemia had the highest prevalence in inpatients from the age group < 0 ≤ 6 years to > 19 ≤ 40 years decreasing from 7.33% (n = 80) to 3.63% (n = 76).

Unspecified anaemia only occurred in inpatients in the age groups > 19 ≤ 40 years and > 40 ≤ 60 years with frequencies of 13 (6.28%) and 93 (4.44%) as indicated in table 41.

Unspecified coagulation defects is a chronic disease that was usually a secondary disease of diabetes or cholesterol. This disease only occurs in the older age groups, > 40 ≤ 60 years, with a frequency of 58 (3.87%) in inpatients and 61 (3.07%) in outpatients and > 60 years with a frequency of 52 (4.73%) in inpatients and 44 (5.41%) in outpatients.

Diabetes mellitus type 2 (non-insulin dependent diabetes) had a frequency of 46 (3.07%) for inpatients in the age group > 40 ≤ 60 years and 41 (3.73%) for inpatients in the age group > 60 years. Diabetes mellitus was a chronic condition which occurred more frequently in elderly patients. Refer to table 41 and appendix D.10.

Vitamin deficiencies were a common defect as discussed in section 5.3.4.1. All age groups for both in- and outpatients had a frequency >3.00%. The frequencies ranged form 5.10% (n = 8) to 13.12% (n = 275). Refer to table 41.

Mineral deficiency was not as frequently diagnosed as vitamin deficiency. The mineral deficiency occurred in inpatients in the age groups < 0 ≤ 6 years with a frequency of 33 (3.02%) and > 6 ≤ 12 years with a frequency of 18 (6.08%).

A prevalence of 3.18% (n = 35) was found in the inpatients age group > 60 years for disorders of acid-base balance. Refer to table 41 and appendix D.10.

Other disorders of fluid and electrolyte balance were common in children aged < 0 ≤ 6 years, with frequencies of 40 (3.66%) in inpatients and 9 (3.14%) in outpatients, because dehydration was a very common and serious condition in children. According to Naicker (2006:366) the fluid balance depends on the availability of water, environmental factors (heat, humidity), physical activity, fluid losses during illness (e.g. diarrhoea / vomiting / polyuria / sweating due to pyrexia /

respiratory loss due to tachypnoea), glomerular filtration, renal tubular concentration and dilution ability, as well the manner in which fluid is replaced.

Inflammation had a frequency >3.00% in only two age groups: inpatients in the age group > 19 ≤ 40 years had a frequency of 66 (3.15%) and outpatients in the age group > 40 ≤ 60 years had a frequency of 86 (4.32%). Refer to table 41.

Epilepsy had the highest frequency in the age group > 40 ≤ 60 years of 84 (4.22%) for outpatients. It occurred in the age group > 6 ≤ 12 years for both in- and outpatients with a frequency of 9 (3.04%) and 11 (4.87%), respectively. Epilepsy also had a frequency above 3.00% in the age group > 19 ≤ 40 years for outpatients at 65 (3.25%). According to the website of Epilepsy South Africa (2008) one in every 100 South Africans suffers from epilepsy and that 75% of these patients had their first seizure before the age of 20 years.

Rheumatic fever with or mentioning of heart involvement occurred 14 (6.76%) for inpatients in the age group > 12 ≤ 19 years. Refer to table 41.

Hypertension was a common disease in the elderly (Kredo & Blockman, 2007:444). In the age group > 40 ≤ 60 years 10.81% (n = 162) of inpatients and 11.71% (n = 233) of outpatients received treatment for hypertension. In the age group > 60 years the frequency was extremely higher at 18.73% (n = 206) for inpatients and 23.96% (n = 195) for outpatients. There was also hypertension diagnosis in inpatients in the age group > 6 ≤ 12 years were 15.20% (n = 45) of that age group's diagnosis was hypertension.

Bacterial tonsillitis was the diagnosis of 3.38% (n = 10) of the inpatients in the age group > 6 ≤ 12 years. Refer to table 41 and appendix D.10.

Bronchopneumonia, unspecified had a frequency of 36 (3.30%) in the age group < 0 ≤ 6 years for inpatients and lower respiratory tract infections had a prevalence of 33 (3.02%) in the same age group. Krug *et al.* (2004:204) found in their study on 'Why children die: An under-5 health care survey in Mafikeng region' that 31.4% of all causes of death identified in children under the age of 5 years was due to lower respiratory tract infections.

Asthma was a more common condition. In the age group < 0 ≤ 6 years 50 (4.58%) inpatients and 12 (4.18%) outpatients received medication for asthma. In the age group > 6 ≤ 12 years inpatients had a prevalence of 13 (4.39%) and outpatients a prevalence of 15 (6.64%).

Outpatients in the age group > 12 ≤ 19 years had a frequency of 9 (5.73%) and in the age group > 60 years a frequency of 44 (5.41%).

Outpatients in the age group > 12 ≤ 19 years had a prevalence of 5 (3.18%) who had a dental abscess during the study period. Refer to table 41.

In the outpatient age group < 0 ≤ 6 years, 4.88% (n = 14) of the patients suffered from a cough and in the inpatient age group > 12 ≤ 19 years 3.86% (n = 8) of the patients suffered from nausea.

Pain control was diagnosed in all six age groups for both in- and outpatients. The highest frequency was in the outpatient age group > 19 ≤ 40 years with a frequency of 516 (49.68%). The lowest frequency was 40 (13.51%) in the inpatient age group 6 ≤ 12.

Allergies were also diagnosed in the outpatient age groups > 6 ≤ 12 years with a frequency of 7 (3.10%) and > 12 ≤ 19 years with a frequency of 6 (3.82%).

The results of all therapeutic codes according to age group are included in appendix D.10.

5.3.4.3 Comprehensive summary of frequency of ICD-10 codes

The top 10 ICD-10 codes according to frequency are indicated in appendix D.11. Table 42 contains the top 3 ICD-10 codes according to frequency.

TABLE 42: Frequency of top three ICD-10 codes

ICD-10 code	In- and outpatients		
	Rank	n	%*
Pain control	1	2490	21.16
Vitamin deficiency	2	1380	11.73
Undefined bacterial infection	3	1189	10.10
Total of top three diagnoses		**5059**	**42.99**

*Percentage was calculated for ICD-10 codes according to frequency

Pain control (R52.9) was the ICD-10 code with the highest frequency in both in- and outpatients during the study period. During the study 1 099 cases of pain control were identified in inpatients and 1 391 cases in outpatients. This implies that 25.38% of all diagnoses made in outpatients were pain control and 17.48% of the diagnosis for inpatients were pain control.

In total, 21.16% of all diagnosis made for both in- and outpatients were pain control. This was in line with the results of the frequency of the top three budget groups, pharmacological groups and therapeutic code. The budget group for pain relievers was ranked second according to frequency with a total of 22.69% of all the budget groups (see appendix D.2 and 5.3.1.4). Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations were the pharmacological group with the highest frequency. This pharmacological group represented 21.95% of all pharmacological groups (see appendix D.5 and 5.3.2.4). Paracetamol 500mg tablets were the therapeutic code which was ranked first according to frequency (9.03%) and ibuprofen 200mg tablets were ranked second according to the total frequency of the product (5.10%) (see appendix D.9 and 5.3.3.4).

Vitamin supplements (E56.9) were ranked in the second position for inpatients with a total of 774 cases diagnosed and ranked third for outpatients with 606 cases diagnosed during the study period. Vitamin supplements were generally ranked in the second place with a frequency of 1 380 which represent 11.73% of all diagnosis made. This was in line with the results of the top three budget groups, pharmacological groups and therapeutic codes. Gastrolytes (vitamin supplements were included in this budget group) were ranked third according to frequency and represented 19.18% of all the budget groups (see appendix D.2 and 5.3.1.4). Vitamins and minerals had the second highest frequency of all pharmacological groups and represented 13.07% of the total frequency (see appendix D.5 and 5.3.2.4). Multivitamin tablets were generally ranked third and had a frequency of 4.62% (see appendix D.9 and 5.3.3.4).

The ICD-10 code with the third highest frequency was undefined bacterial infections (B20.1). This ICD-10 code was ranked third according to usage by inpatients (10.93%) and fourth by outpatients (9.16). The total frequency for both in- and outpatients was 1 189 cases which were 10.10% of all diagnosis made. This is in line with the results of the budget group with the highest frequency. Anti-infectives were ranked first with a frequency of 26.29% of all budget groups (see appendix D.2 and 5.3.1.4). Penicillin antibiotics were the pharmacological group with the third highest frequency of 10.27% and contributed to the high frequency of undefined bacterial infections (see appendix D.5 and 5.3.2.4).

The top three ICD-10 codes were pain control (R52.9), vitamin supplements (E56.9) and undefined bacterial infections (B20.1). These three ICD-10 codes represented 42.99% of all the diagnoses made during the study period.

Unspecified HIV (B24) was ranked as the ICD-10 code with the second highest frequency for outpatients with a frequency of 686 (12.52%). For inpatients it was the fifth highest ICD-10 code according to frequency (3.83%). Combined, unspecified HIV (B24) was ranked fourth and represented 7.88% of the total diagnoses made during the study period. This was in line with the results of the top three budget groups. Anti-infectives were ranked first with a frequency of 26.29% of all budget groups (see appendix D.2 and 5.3.1.4).

The top 10 ICD-10 codes represented 67% of all diagnoses made for inpatients and 79% of all diagnosis made for outpatients. In total, 72.82% of all diagnosis made are indicated in appendix D.11.

5.4 NUMBER OF MEDICINE ITEMS AND MEDICINE COST PER CONSULTATION

This section discusses the average number of medicine items per consultation according to gender and age groups. The average medicine cost per consultation was also included in the discussion according to gender, age groups, budget groups, pharmacological groups, therapeutic codes and ICD-10 codes.

5.4.1 Average number of medicine items per consultation

The total number of medicine items dispensed during the study period of 1st of January to 31st of July 2007, was 6 288 for inpatients and 5 480 for outpatients. That is a total of 11 760 medicine items. The total number of consultations during the same period was 1 720 for inpatients and 1 500 for outpatients. That was a total of 3 220 consultations during the study period. The average number of medicine items per consultation for inpatients was 2.23 ± 3.00 and for outpatients it was slightly higher at 3.66 ± 1.98 medicine items per consultation. Figure 44 illustrates the number of consultations for in- and outpatients.

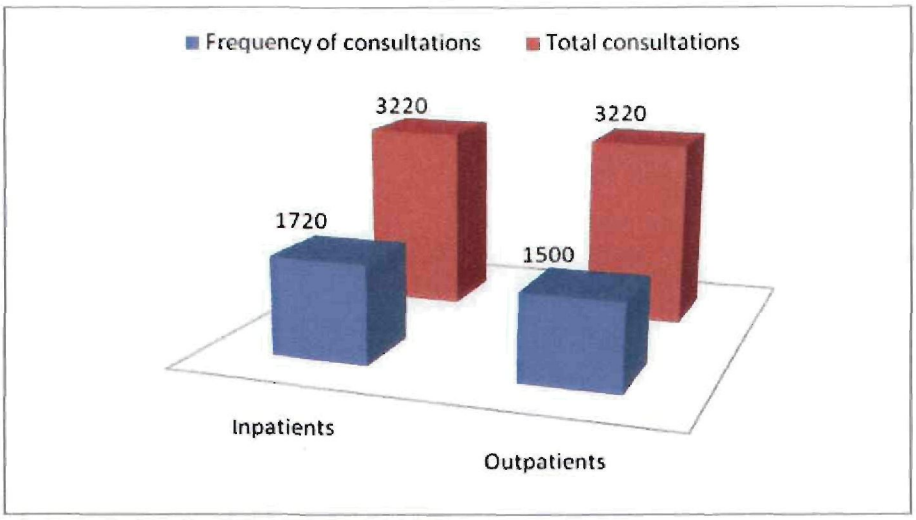


FIGURE 44: Frequency of consultations for in- and outpatients

5.4.2 Average number of medicine items per consultation according to gender

Male patients received a total of 4 356 medicine items during the study period at Thusong Hospital: 2 260 for male inpatients and 2 096 for male outpatients. The female patients received 7 412 medicine items in total (4 028 to inpatients and 3 384 to outpatients). The total number of consultations to male patients was 1 331 (714 by inpatients and 617 by outpatients). Female patients had 1 889 consultations in total, 1 006 consultations by female inpatients and 883 by female outpatients. The average number of medicine items per consultation according to gender was as follows: 3.17 ± 1.76 medicine items per consultation for male inpatients, 4.00 ± 2.45 medicine items per consultation for female inpatients, 3.40 ± 1.85 medicine items per consultation for male outpatients and 3.83 ± 2.05 medicine items per consultations for female outpatients.

TABLE 43: Average number of medicine items per consultation according to gender

	Inpatients			Outpatients		
	Total number of consultations	**Total number of items**	**Average number of items/ consultation**	**Total number of consultations**	**Total number of items**	**Average number of items/ consultation**
	n	n	Mean & std dev	n	n	Mean & std dev
Male	714	2260	3.17 ± 1.76	617	2096	3.40 ± 1.85
Female	1006	4028	4.00 ± 2.45	883	3384	3.83 ± 2.05
Total	**1720**	**6288**		**1500**	**5480**	

Figure 45 indicates the distribution of consultations between in- and outpatients and the genders.

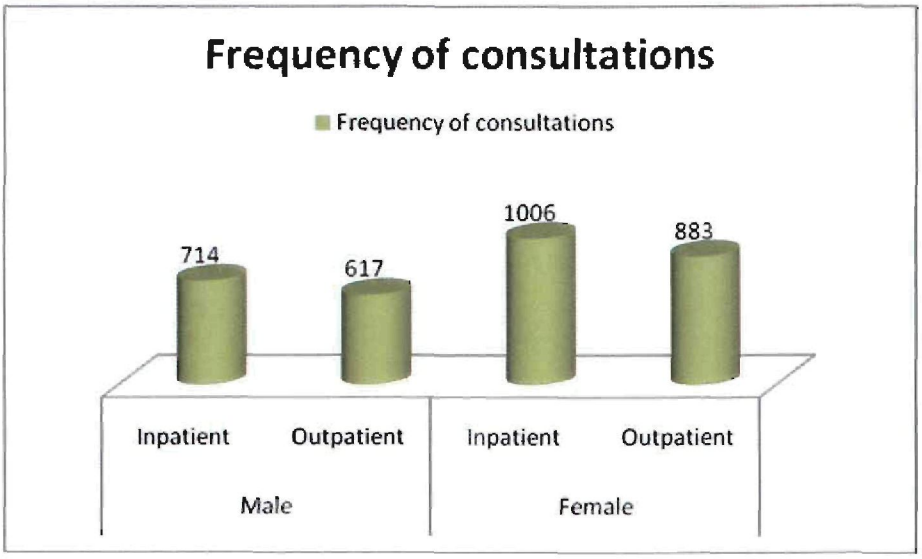


FIGURE 45: Frequency of consultations between in- and outpatients and gender

5.4.3 Average number of medicine items per consultation according to age groups

Age was divided into 6 groups as mentioned in section 5.2.2. The age group < 19 ≥ 40 years had the highest number of medicine items at 4 098 (N = 11 768) and represented 34.75% of the total medicine items. Second was the age group < 40 ≥ 60 years with 3 486 medicine items (N = 11 768) which represented 29.62%. The third largest number of medicine items was in the age group > 60 years with a frequency of 1 914 (N = 11 768) and represented 16.26% of the total number of medicine items dispensed. The age group > 0 ≥ 6 years had 1 379 medicine items (11.72%), age group < 6 ≥ 12 years had 522 medicine items (4.44%) and the age group < 12 ≥ 19 years had the smallest number of medicine items with a frequency of 364 which was 3.09% of the total number of medicine items dispensed during the study period.

The number of consultations decrease in the same order as the number of medicine items – age group < 19 ≥ 40 years had a frequency of 1 118 consultations (n = 3 220) and represent 34.72% of the total number of consultations. In the age group < 40 ≥ 60 years the frequency was 889 (n = 3 220) which represent 27.61% of the total number of consultations. The age group > 60 years had 471 consultations (14.63% of the total number of consultations). In the

age group > 0 ≥ 6 years, the frequency was 449 consultations, which represent 13.94% of the total number of consultations. The children age group < 6 ≥ 12 years had 359 consultations (n = 3 220) during the study period which represented 11.15% of the total number of consultations. In the age group < 12 ≥ 19 years, the frequency for the number of consultations was 135 (4.19%) in this age group.

The average number of medicine items per consultations according to the six different age groups is indicated in table 44.

TABLE 44: Average number of medicine items per consultation according to age groups

Age groups	Inpatients			Outpatients		
	Total number of consultations	Total number of items	Average number of medicine items per consultation	Total number of consultations	Total number of items	Average number of medicine items per consultation
	n	n	Mean & std dev	n	n	Mean & std dev
< 0 ≤ 6	346	1092	3.16 ± 1.99	103	287	2.79 ± 1.53
> 6 ≤ 12	90	296	3.29 ± 2.20	63	226	3.59 ± 1.99
> 12 ≤ 19	69	207	3.00 ± 1.65	66	157	2.38 ± 1.24
> 19 ≤ 40	541	2096	3.87 ± 2.32	577	2002	3.47 ± 1.83
> 40 ≤ 60	382	1497	3.92 ± 2.16	507	1989	3.92 ± 2.03
>60	290	1100	3.79 ± 2.39	181	814	4.50 ± 2.25
Total	**1718**	**6288**		**1497**	**5475**	

As mentioned in section 5.2.2, there were five patient files which did not indicate the age/date of birth. Figure 46 illustrates the distribution of consultations between the different age groups for in- and outpatients.

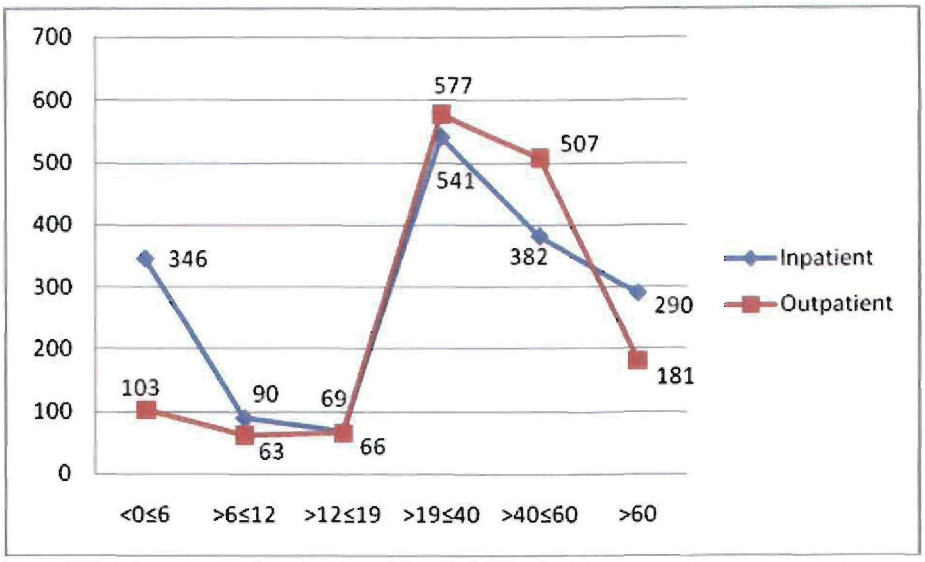


FIGURE 46: Distribution of consultations between different age groups for in- and outpatients

5.4.4 Average medicine cost per consultation

The total number of consultations for inpatients were 1 719 (53.47% of all consultations) and for outpatients 1 497 (46.53% of all consultations). The total medicine cost for inpatients for the study period was R121 711.94 for inpatients and R102 965.15 for outpatients. The average medicine cost per consultation for inpatients was R70.80 ± 177.72 and the CPI was 1.01 which indicates that medicine items dispensed to inpatients were relatively expensive. The average medicine cost per consultation for outpatients was R68.83 ± 120.50 with a CPI of 0.98 indicating that medicine items dispensed to outpatients were relatively inexpensive. Refer to section 4.2.2.9.4.

TABLE 45: Average medicine cost per consultation

	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Inpatients	1719	53.46812	70.80 ± 177.72	121711.94	54.171941	1.013163
Outpatients	1496	46.53188	68.83 ± 120.50	102965.15	45.828059	0.984874
Total	**3215**	**100**		**224677.09**	**100**	

*Percentage was calculated according to frequency for inpatients and outpatients respectively
**Percentage was calculated according to total cost for inpatients and outpatients respectively

5.4.4.1 Average medicine cost per consultation according to gender

The average medicine cost per consultation can further be separated into male and female patients as indicated in table 46. For inpatients, the female patients had the most consultations (n = 1 005) with a total cost of R77 514.26. The average medicine cost per consultation for female inpatients was R77.13 ± 198.16 with a maximum cost of R2 782.10. The male inpatients had 714 consultations during the study period with a total cost of R44 197.68. The average medicine cost per consultation was less than that of the female inpatients at R61.90 ± 143.80. For the outpatients the females had the most consultations just like for inpatients. The female patients had 883 outpatient visits with an average medicine cost per consultation of R69.06 ± 118.89. The male outpatients had 617 visits during the study period which was less than that of the male inpatients during the same period. The average medicine cost per consultation for male outpatients was R68.50 ± 122.85 which was slightly lower than that of the female outpatients.

The highest average medicine cost per consultation was for female inpatients (R77.13 ± 198.16) and the lowest average medicine cost per consultation was for male inpatients (R61.90 ± 143.80).

TABLE 46: Average medicine cost per consultation according to gender

Gender	Inpatients			Outpatients		
	Number of consulta-tions	Cost	Average medicine cost per consultation	Number of consulta-tions	Cost	Average medicine cost per consultation
	n	R	R	n	R	R
Male	714	44 197.68	61.90 ± 143.80	617	42265.23	68.50 ± 122.85
Female	1005	77 514.26	77.13 ± 198.16	883	60699.93	69.06 ± 118.89
Total	**1719**	**121 711.94**		**1500**	**102965.16**	

5.4.4.2 Average medicine cost per consultation according to age groups

The average medicine cost per consultation according to age groups is indicated in table 47. In the inpatient department the age group > 19 ≤ 40 years had the highest number of consultations with a frequency of 541 and a total cost of R50 401.79. The average medicine cost per consultation for this age group was R93.16 ± 198.59. The high frequency of consultations in this age group can be due to the fact that this is the age group where chronic diseases were

diagnosed and had the highest frequency of patients (see section 5.3.1.2). In the outpatients, the older age groups had the highest frequencies. The average medicine cost per consultation was R60.83 ± 109.95 for this age group.

The inpatient age group > 40 ≤ 60 years had the second largest frequency of consultations (n = 382) with a average medicine cost per consultation of R78.38 ± 210.71. The age group with the second highest frequency was > 40 ≤ 60 years with a frequency of 507 which had an average cost of R84.41 ± 120.40 for outpatients.

Age group < 0 ≤ 6 years had the third most consultations (n = 346) but the fourth highest total medicine cost (R13 246.32) for inpatients. This age group had the lowest average medicine cost per consultation at R38.28 ± 111.17. For outpatients, the paediatric age group (< 0 ≤ 6 years) had a slightly higher frequency at 103 but the average medicine cost per consultation was almost the same at R25.80 ± 63.82 for outpatients. A possible reason why this age group is ranked third with total number of consultations is that the World Health Organization (2007b) states that in South Africa the number of deaths among children under five years of age in 2000 due to diarrhoeal diseases was 0,8%. Under causes of death for the same age group in the year 2000 were neonatal causes (35,1%), HIV/AIDS (57,1%), pneumonia (0,9%) and injuries (5,0%). The average lack of weight gain in children under 5 in South Africa for 2006/2007 is estimated at 1.3% (Cosser, 2007:6). Children under the age of five were very susceptible to diseases.

The total cost of medicines for inpatients in the age group > 60 years (n = 290) was R18 459.56 for all consultations. The average medicine cost per consultation was R63.65 ± 169.99. In the outpatient age group > 60 years, the frequency of 181 was the third highest frequency with an average medicine cost per consultation of R69.18 ± 97.76.

In the inpatient age group > 6 ≤ 12 years there were 90 consultations. The average medicine cost per consultation was R61.93 ± 121.82 and the age group had a total cost of R5 573.80. Although the age group > 6 ≤ 12 years had the lowest frequency (n = 63) for outpatients, the average medicine cost per consultation of R131.79 ± 266.81 was the highest.

The age group with the lowest number of consultations (n = 69) was the age group > 12 ≤ 19 years. This age group had an average medicine cost per consultation of R59.25 ± 144.61. The age group > 12 ≤ 19 years had a frequency of 66 and the lowest average medicine cost per

consultation at R25.49 ± 50.34. Table 47 indicates the average medicine cost per consultation according to age groups.

TABLE 47: Average medicine cost per consultation according to age groups

Age groups (years)	Inpatients			Outpatients		
	Number of consulta-tions	Cost	Average medicine cost per consultation	Number of consulta-tions	Cost	Average medicine cost per consultation
	n	R	Mean & std dev	n	R	Mean & std dev
< 0 ≤ 6	346	13 246.32	38.28 ± 111.17	103	2657.34	25.80 ± 63.82
> 6 ≤ 12	90	5 573.80	61.93 ± 121.82	63	8302.91	131.79 ± 266.81
> 12 ≤ 19	69	4 088.57	59.25 ± 144.61	66	1656.85	25.49 ± 50.34
> 19 ≤ 40	541	50 401.79	93.16 ± 198.59	577	34913.62	60.83 ± 109.95
> 40 ≤ 60	382	29 941.90	78.38 ± 210.71	507	42793.67	84.41 ± 120.40
> 60	290	18 459.56	63.65 ± 169.99	181	12522.28	69.18 ± 97.76
Total	**1719**	**121 711.94**		**1497**	**102846.67**	

5.4.4.3 Average medicine cost per consultation according to budget groups

Table 48 illustrates the different budget groups for both in- and outpatients with their average medicine cost per consultation. The highest average medicine cost per consultation for inpatients was for the budget group anti-infectives (R70.12 ± 133.24). There were 849 consultations (21.67%) with medicine from this budget group during the study period with a total cost of R59 529.35 (48.91%). This budget group had a CPI of 2.26 which was higher than the normal value and indicated that the medicine items in this budget group was relatively expensive. For outpatients the budget group anti-infectives had the highest average medicine cost per consultation at R92.53 ± 161.56. A total of 592 consultations had a total cost of R54 776.50. The CPI value was high at 3.03 which indicated that the medicine items in this budget group was relatively expensive.

TABLE 48: Average medicine cost per consultation according to budget groups

Budget group	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Anti-infectives	849	21.67	70.12 ± 133.24	59529.35	48.91	2.26
Cardiovascular agents	525	13.40	22.51 ± 130.17	11815.6	9.71	0.72
Dermatological	80	2.04	10.02 ± 18.66	801.33	0.66	0.32
Endocrine	236	6.03	33.57 ± 152.81	7922.33	6.51	1.08
Functional	244	6.23	18.23 ± 31.30	4447.47	3.65	0.59
Gastrolyte	886	22.62	5.29 ± 10.67	4678.28	3.84	0.17
Pain reliever	826	21.09	34.65 ± 149.20	28616.9	23.51	1.11
Immunological	10	0.26	3.71 ± 6.17	37.14	0.03	0.12
Respiratory agents	261	6.66	14.80 ± 20.46	3863.55	3.17	0.48
Total	3917	100		121711.95	99.99	
Budget group	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	R	%**	
Anti-infectives	592	17.53	92.53 ± 161.56	54776.50	53.20	3.03
Cardiovascular agents	296	8.77	33.95 ± 59.02	10049.98	9.76	1.11
Dermatological	171	5.06	10.80 ± 22.31	1846.19	1.79	0.35
Endocrine	173	5.12	18.03 ± 28.76	3118.38	3.03	0.59
Functional	279	8.26	22.32 ± 16.87	6227.81	6.05	0.73
Gastrolyte	685	20.28	4.69 ± 7.95	3209.70	3.12	0.15
Pain reliever	931	27.57	19.70 ± 45.92	18341.04	17.81	0.65
Immunological	30	0.89	65.93 ± 156.62	1978.04	1.92	2.16
Respiratory agents	220	6.51	15.53 ± 20.26	3417.51	3.32	0.51
Total	3377	100		102965.15	100	

*Percentage was calculated according to frequency of budget groups for inpatients and outpatients respectively
**Percentage was calculated according to total cost of budget groups for inpatients and outpatients respectively

The budget group with the lowest average medicine cost per consultation for inpatients was immunological with an average cost of R3.71 ± 6.17. There were 10 consultations with medicine from this budget group with a total cost of R37.14. The CPI of 0.12 indicated that this medicine item was relatively inexpensive.

The gastrolyte budget group had the lowest average medicine cost for outpatients at R4.69 ± 7.95. During the study period 685 consultations had one or more medicine items from this budget group with a total cost of R3 209.70. The CPI for this budget group was 0.15 and indicated that medicine items in this budget group was relatively inexpensive. See table 48.

5.4.4.4 Average medicine cost per consultation according to pharmacological groups

In appendix D.12 the average medicine cost per consultation is given according to the different pharmacological groups. In this section, medicine cost with an average of more than R100 per consultation and/or CPI value < 3.00 was discussed. Table 49 summarises the average medicine cost per consultation according to pharmacological groups within these parameters. Pharmacological groups with CPI values of more than 3.00 and/or average medicine cost per consultation of more than R100 but frequencies of less than 10 are not included in the discussion.

In the inpatient department, the pharmacological group anti-infective (cephalosporins) (see pharmacological classification in appendix C.2) had an average medicine cost per consultation of R211.01 ± 292.60. There were only 75 consultations (1.59%) with medicine from this pharmacological group but has a total cost of R15 825.63. The CPI value for this pharmacological group was 8.18 which indicated that this group contains relatively expensive medicine items. Refer to table 49 and appendix D.12.

Antiviral had an average medicine cost per consultation of R127.31 ± 128.07 for inpatients. All the ARV medication were in this pharmacological group which were expensive (see section 5.5.6.5 on the discussion of ARV medication). This was also confirmed by the CPI value. A value of 4.93 indicated relatively expensive medications. Antiviral pharmacological group had a CPI of 4.64 for outpatients. After further investigation, the average medicine cost per consultation was <R100 (R87.90 ± 116.95) but the prevalence of 520 had a total cost of R45 708.45. The cost-prevalence ratio indicated that the pharmacological group was relatively expensive (see section 4.2.2.9.4).

Antithrombotic and anticoagulant had an average medicine cost per consultation of R111.75 ± 402.17 for inpatients. This pharmacological group contributed 4.32% of the total cost but only 1.00% of the prevalence. The CPI value of 4.33 indicated that this pharmacological group contained relatively expensive drugs. Refer to table 49 and appendix D.12.

TABLE 49: Average medicine cost per consultation according to pharmacological groups where average medicine cost was < R100 per consultation and/or the CPI value was more than 3

Pharmacological group	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Anti-infective (cephalosporins)	75	1.59	211.01 ± 292.60	15825.63	13.00	8.18
Antiviral	73	1.55	127.31 ± 128.07	9293.36	7.64	4.93
Antithrombotic and anticoagulant	47	1.00	111.75 ± 402.17	5252.40	4.32	4.33
Contraceptive (injectable)	1	0.02	113.92 ± 0	113.92	0.09	4.41
Antihypoglycaemic agent	3	0.06	1097.74 ± 914.63	3293.22	2.71	42.54
Sera & immunologicals						
Eye preparations (local anaesthetic)						
Antiparkinsonistic	7	0.15	22.86 ± 33.44	160.01	0.13	0.89
Pharmacological group	**Outpatients**					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Anti-infective (cephalosporin)	15	0.28	25.07 ± 28.42	376.00	0.37	1.32
Antivirals	520	9.57	87.90 ± 116.95	45708.45	44.39	4.64
Antithrombotic and anticoagulants	29	0.53	31.72 ± 36.81	919.88	0.89	1.67
Contraceptive (injectable)	2	0.04	56.96 ± 0	113.92	0.11	3.00
Antihypoglycaemic agents						
Sera & immunologicals	1	0.02	324.67 ± 0	324.37	0.32	17.11
Eye preparations (local anaesthetic)	1	0.02	60.00 ± 0	60.00	0.06	3.16
Antiparkinsonistic	2	0.04	69.00 ± 0	138.00	0.13	3.64

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively
**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively

The following pharmacological groups had high CPI values (more than 3) and/or an average cost per consultation of more than R100 but the frequencies were less than 10: injectable contraceptive medication, antihypoglycaemic agents, sera and immunologicals, local anaesthetic eye preparations, and antiparkinsonistics.

5.4.4.5 Average medicine cost per consultation according to therapeutic codes

The average medicine cost per consultation according to therapeutic code is illustrated in appendix D.13. All therapeutic codes with an average medicine cost of more than R100 and/or a CPI value > 3.00 are included in the discussion. Table 50 indicates the average medicine cost per consultation according to therapeutic codes within these parameters. Therapeutic codes within these parameters but with frequencies of less than 10 are not included in the discussion.

For inpatients, amoxycillin with clavulanic acid 100mg/200mg injections (1.2g) had an average cost of R105.29 ± 69.77 and a CPI value of 5.27 which indicated that this was a relatively expensive drug.

Ampicillin 500mg injections had an average cost of R135.53 ± 99.94 in inpatients. This product had a prevalence of 132 (2.17%). The CPI of 6.79 indicated that this was a relatively expensive drug. Ampicillin 500mg injection represented 14.70% of the total cost for inpatients.

Ketaconazole 200mg tablets (30s) had a frequency of 15 in outpatients. The CPI of 3.11 was above the average value and indicated a relatively expensive drug.

Ceftriazone 250mg IM injection had a CPI value of 23.45 for inpatients and an average cost per medicine item of R468.30 ± 319.38 (n = 20). Refer to table 50 and appendix D.13.

Efavirenz 50mg capsules (30s) had an average cost of R524.59 ± 185.56 in outpatients. The CPI value (27.67) indicated that his product was relatively expensive although the frequency was 11.

Efavirenz 200mg capsules (90s) had a CPI value of 3.85 which indicated that this was an expensive product with a prevalence of 12 in inpatients. Efavirenz 200mg capsules (90s) had a CPI value of 4.59 in outpatients which indicated that this product was relatively expensive.

Efavirenz 600mg capsules (30s) had an average cost of R193.05 ± 98.80 and the CPI of 9.67 in another indication that this was an expensive drug in inpatients. Efavirenz 600mg capsules (30s) were quite expensive with an average cost of R261.39 ± 13.79 in outpatients and a CPI value of 13.79. The prevalence of this product was 97, and according to the high CPI, further investigation is needed.

TABLE 50: Average medicine cost per consultation according to therapeutic codes with average medicine cost of more than R100 and/or CPI value more than 3.00

Therapeutic code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g	32	0.53	105.29 ± 69.77	3369.22	2.77	5.27
Ampicillin Inj 500mg	132	2.17	135.53 ± 99.94	17889.42	14.70	6.79
Ketoconazole Tabs 200mg 30s	20	0.33	40.21 ± 37.20	804.29	0.66	2.01
Ceftriazone IM inj 250mg	20	0.33	468.30 ± 319.38	9366.00	7.70	23.45
Efavirenz Caps 50mg 30s	1	0.02	2.61 ± 0	2.61	0.00	0.13
Efavirenz Caps 200mg 90s	12	0.20	76.94 ± 50.95	923.34	0.76	3.85
Efavirenz Caps 600mg 30s	12	0.20	193.05 ± 98.80	2316.62	1.90	9.67
Enalapril Tabs 5mg 28s	16	0.26	145.68 ± 170.93	2330.80	1.92	7.30
Nifedipine Tabs SR 60mg 28s	1	0.02	2.61 ± 0	2.61	0.00	0.13
Perindopril Tabs 4mg 28s	12	0.20	76.94 ± 50.95	923.34	0.76	3.85
Prazosin Tabs 1mg 14s	12	0.20	193.05 ± 98.80	2316.62	1.90	9.67
Tranexamic acid Inj 100mg/ml 5ml 5s	16	0.26	110.08 ± 98.74	1761.31	1.45	5.51
Insulin actraphane Hm 100IU/ml 10ml	17	0.28	51.21 ± 31.82	870.51	0.72	2.56
Hydrocortisone sodium succ Inj 100mg/2ml 2ml 5s	23	0.38	88.29 ± 71.04	2030.57	1.67	4.42
Diclofenac Inj 25mg/ml 3ml	72	1.18	360.83 ± 371.25	25979.65	21.35	18.07
Paracetamol codeine phos Tabs 500mg/8mg 20s	6	0.10	76.02 ± 45.67	456.12	0.37	3.81

TABLE 50: Average medicine cost per consultation according to therapeutic codes with average medicine cost of more than R100 and/or CPI value more than 3.00 (continue form page 236)

Therapeutic code	Outpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g						
Ampicillin Inj 500mg	2	0.04	16.32 ± 0	32.64	0.03	0.86
Ketoconazole Tabs 200mg 30s	15	0.28	58.89 ± 29.79	883.38	0.86	3.11
Ceftriaxone IM inj 250mg	2	0.04	84.00 ± 0	168.00	0.16	4.43
Efavirenz Caps 50mg 30s	11	0.20	524.59 ± 185.56	5770.54	5.60	27.67
Efavirenz Caps 200mg 90s	18	0.33	87.08 ± 51.64	1567.49	1.52	4.59
Efavirenz Caps 600mg 30s	97	1.79	261.39 ± 59.93	25354.40	24.62	13.79
Enalapril Tabs 5mg 28s	3	0.06	459.00 ± 0	1377.00	1.34	24.21
Nifedipine Tabs SR 60mg 28s	11	0.20	524.59 ± 185.56	5770.54	5.690	27.67
Perindopril Tabs 4mg 28s	18	0.33	84.08 ± 51.64	1567.49	1.52	4.59
Prazosin Tabs 1mg 14s	97	1.79	261.39 ± 59.93	25354.40	24.62	13.79
Tranexamic acid Inj 100mg/ml 5ml 5s	3	0.06	38.29 ± 0	114.87	0.11	2.02
Insulin actraphane Hm 100IU/ml 10ml	16	0.29	82.56 ± 41.30	1320.95	1.28	4.35
Hydrocortisone sodium succ Inj 100mg/2ml 2ml 5s	6	0.11	32.68 ± 17.53	196.10	0.19	1.72
Diclofenac Inj 25mg/ml 3ml	102	1.88	115.98 ± 15.95	11829.90	11.49	6.12
Paracetamol codeine phos Tabs 500mg/8mg 20s	32	0.59	126.78 ± 60.26	4057.06	3.94	6.69

*Percentage was calculated according to frequency of therapeutic codes for inpatients and outpatients respectively
**Percentage was calculated according to total cost of therapeutic codes for inpatients and outpatients respectively

Enalapril 5mg tablets had an average cost per medicine item of R145.68 ± 170.93 and a CPI value of 7.30 for inpatients. The same medicine item for outpatients had a CPI value of 24.21.

Nifedipine 60mg SR tablets (28s) had a CPI value of 27.67 which was above normal for outpatients.

Perindopril 4mg tablets (28s) had a CPI value of 3.85 for inpatients and 4.59 for outpatients.

Prazosin 1mg tablets (14s) had an average cost per medicine item of R193.05 ± 98.80 for inpatients and an average cost per medicine item of R261.39 ± 59.93 for outpatients.

Tranexamic acid 1200mg/ml injection (5ml) (5s) had an average cost of R110.08 ± 98.74 (n = 16) and a CPI value of 5.51 which indicated that this was a relatively expensive drug in inpatients. Refer to table 50 and appendix D.13.

Actraphane Hm 100IU/ml insulin had a CPI value of 4.35 for outpatients.

Hydrocortisone sodium succinate 100mg/2ml injection (5s) had a CPI value of 4.42 for inpatients and indicated that this was a relatively expensive drug.

Diclofenac 25mg/ml injections (3ml) had an average cost of R360.83 ± 371.25 which was very expensive in inpatients. The CPI of 18.07 contributed to the fact although the prevalence was 72. This needs further investigation. Diclofenac 25mg/ml injection (3ml) had an average cost of R115.98 ± 15.95 in outpatients. That was relatively expensive with correlation to the CPI value of 6.12 although the product was dispensed 102 times.

Paracetamol with codeine phosphate tablets (500mg/8mg) (20s) had an average cost of R126.78 ± 60.26 and a CPI value of 6.69 in outpatients. This proofed that the product was quite expensive although the prevalence was 32. Refer to appendix D.13.

The following medicine items all had a high CPI value (more than 3) which was influenced by a low frequency (less than 10 units) in in- and outpatients: ciprofloxacin injection for IV infusion 2mg/ml (100ml), fluconazole 50mg capsules (14s), fluconazole 200mg capsules (28s), fluconazole injections for IV infusion (100ml), cefazolin 500mg injection, erythromycin 1g IV injection, lopinavir syrup (60ml), stavudine d4T 200ml solution, mannitol injection for IV use (50ml), prazosin 5mg tablets (30s), balanced heparin 1250IU/ml (5ml) (5s), tranexamic acid 500mg tablets (60s), ferrous lactate drops eq to 25mg Fe/ml (10ml), folic acid tabs 5mg (100s), silver sulphadiazine cream (500mg), zinc sulphate 500g, amethocaine 1% cream (25g), medroxyprogesterone 5mg tables (30s), glucagon 1mg/ml injection, prednisone 5mg tablets (100s), carbamazepine 100mg/5ml suspension (250ml), phenytoin 50mg/ml injection (5ml),

sodium valproate sugar free 200mg/300ml liquid, sodium valproate 300mg Cr tablets (84s), bromocriptine mesylate 2.5mg tablets (30s), haloperidol 5mg/ml injection, immunoglobulin human anti-rabies vaccine (150IU), rabies 2.5IU/dose vaccine; and rifampicin (150mg), prazinamide (400mg), isoniazid (75mg) and ethambutol (275mg) tablets (100s). Refer to appendix D.13 for average medicine costs, frequencies and CPI values.

5.4.4.6 Average medicine cost per consultation according to ICD-10 codes

The average medicine cost per consultation according to ICD-10 code is illustrated in appendix D.14. All ICD-10 codes with an average medicine cost of more than R100 and/or a CPI value > 3.00 are included in the discussion. Table 51 indicates the average medicine cost per consultation according to ICD-10 codes within the parameters. ICD-10 codes within these parameters with frequencies of less than 10 are not included in the discussion.

TABLE 51: Average medicine cost per consultation according to ICD-10 codes where average medicine cost was more than R100 and/or CPI was more than 3.00

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Undefined viral infection	11	0.25	101.09 ± 184.98	1111.95	0.92	3.72
Unspecified HIV	71	1.60	132.02 ± 129.24	9373.76	7.78	4.86
Mouth abscess	10	0.23	94.96 ± 125.52	949.56	0.79	3.50
ICD-10 code	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	R	%**	
Undefined viral infection	12	0.22	8.51 ± 10.05	102.08	0.10	0.45
Unspecified HIV	686	12.63	68.50 ± 107.91	46992.64	45.64	3.61
Mouth abscess	7	0.13	4.65 ± 5.14	32.56	0.03	0.25

*Percentage was calculated according to frequency of ICD-10 codes for inpatients and outpatients respectively
**Percentage was calculated according to total cost of ICD-10 codes for inpatients and outpatients respectively

Undefined viral infection had an average medicine cost of R101.9 ± 184.98. This ICD-10 code had a prevalence of 11 which is a possible explanation for the CPI value of 3.72 and was acceptable due to the low frequency. Refer to table 51 and appendix D.14.

Unspecified HIV had a higher prevalence at 71 in inpatients. The average medicine cost per consultation for unspecified HIV was R132.02 ± 129.24. The CPI value of 4.86 also indicated that the medicine cost was relatively high and further investigations were needed. Unspecified HIV had a CPI value of 3.61 in outpatients and a frequency of 686. The CPI indicated that the

medicine used for this medical condition was relatively expensive and needed further investigation. Refer to table 51 and appendix D.14.

Mouth abscess had a CPI of 3.50 but the average medicine cost per consultation for this condition was < R100.00. The prevalence of ten was an explanation for the CPI.

In the following cases were where the CPI value was higher than 3 due to a low frequency of less than 10: septicaemia, cryptococcosis – cerebral meningitis, multiple myeloma, rheumatic fever without mentioning of heart involvement, arteriosclerotic gangrene, abscess of the lung without pneumonia, unspecified appendicitis, alcohol liver disease, unspecified, nephritis, pelvic inflammation disease, bites and stings, family planning, rabies, parkinsonism, and rape. Refer to appendix D.14.

5.5 COST PER MEDICINE ITEMS – BUDGET AND COST-RELATED INFORMATION

In this section, the average cost per medicine item according to gender and age as well as budget groups, pharmacological groups, therapeutic codes and ICD-10 codes are discussed.

5.5.1 Average cost per medicine item

Inpatients had a total cost of R121 711.94 and a total number of medicine items of 6 288. The average cost per medicine item for inpatients was R19.36 ± 86.79. Outpatients had a total cost of R102 965.15 and 5 481 medicine items. The average cost per medicine item for outpatients was R18.79 ± 54.69. Table 52 indicates the average cost per medicine item.

TABLE 52: The average cost per medicine item for in- and outpatients

	Prevalence		Cost		
	n	%*	Mean & std dev	R	%**
Inpatients	6288	53.43	19.36 ± 86.79	121711.94	54.17
Outpatients	5481	46.57	18.79 ± 54.69	102965.15	45.83
Total	**11769**	**100**		**224677.09**	**100**

*Percentage was calculated according to frequency for inpatients and outpatients respectively
**Percentage was calculated according to total cost for inpatients and outpatients respectively

5.5.2 Average cost per medicine item according to gender

According to gender female inpatients received more medicine items during the study period (n = 4 030) with a total cost of R77 514.26. The average cost per medicine item for female inpatients was R19.24 ± 93.32. Male inpatients received 2 262 medicine items during the study period with a total cost of R44 197.68 (N = R224 677.10). The average cost per medicine item was R19.57 ± 73.74 for male inpatients. The average cost per medicine item for inpatients differs with 33 cents between male and female patients (see table 53).

Female outpatients had a total cost of R60 699.93 and 3 385 medicine items were dispensed to them. The average cost per medicine item was R17.93 ± 54.20. Male outpatients received 2 096 medicine items (N = 11 768) which represented a total cost of R42 265.23 during the study period. The average cost per medicine item for male outpatients was R20.16 ± 55.47. The male outpatients' average cost per medicine item was R2.23 higher than the female outpatients' average cost per medicine item. Table 53 indicates the average cost per medicine item according to gender.

TABLE 53: Average cost per medicine item according to gender

Gender	Inpatients				
	Prevalence		Cost		
	n	%*	Mean & std dev	R	%**
Male	2260	35.94	19.57 ± 73.74	44 197.68	36.31
Female	4030	64.09	19.24 ± 93.32	77 514.26	63.69
Total	**6288**	**100.03**		**121 711.94**	**100**
Gender	**Outpatients**				
	Prevalence		**Cost**		
	n	%*	Mean & std dev	R	%**
Male	2096	38.24	20.16 ± 55.47	42265.23	41.05
Female	3385	61.76	17.93 ± 54.20	60699.93	58.95
Total	**5481**	**100**		**102965.16**	**100**

*Percentage was calculated according to frequency of gender for inpatients and outpatients respectively
**Percentage was calculated according to total cost of gender for inpatients and outpatients respectively

5.5.3 Average cost per medicine item according to age groups

Inpatients with the highest number of medicine items received during the study period was patients in the age group > 19 ≤ 40 years (n = 2 096) which had a total cost of R50 401.79. The average cost per medicine item for this age group was the highest at R24.06 ± 92.03. The age group with the lowest average cost per medicine item for inpatients was the paediatric age

group (< 0 ≤ 6 years) with an average cost per medicine item of R12.13 ± 56.36. This age group received 1 092 medicine items (N = 11 768) during the study period and had a total cost of R13 246.32 (N = R224 677.10).

For outpatients the highest average cost per medicine item was R36.74 ± 118.91 and was for patients in the age group > 6 ≤ 12 years. Patients in this age group received 226 medicine items and had a total cost of R8 302.91. The lowest average cost per medicine item was once again for paediatric patients (< 0 ≤ 6 years) with an average cost of R9.26 ± 27.78. They received 287 medicine items with a total cost of R2657.34. The average cost per medicine item according to age group is given in table 54.

TABLE 54: Average cost per medicine item according to age groups

Age group (years)	Inpatients				
	Prevalence		Cost		
	n	%*	Mean & std dev	R	%**
< 0 ≤ 6	1092	17.37	12.13 ± 56.36	13 246.32	10.88
> 6 ≤ 12	296	4.71	18.83 ± 63.37	5 573.80	4.58
> 12 ≤ 19	207	3.29	19.75 ± 79.15	4 088.57	3.36
> 19 ≤ 40	2096	33.33	24.06 ± 92.03	50 401.79	41.41
> 40 ≤ 60	1497	23.81	20.00 ± 100.52	29 941.90	24.60
> 60	1100	17.49	16.78 ± 87.71	18 459.56	15.17
Total	**6288**	**100**		**121 711.94**	**100**
Age group (years)	**Outpatients**				
	Prevalence		**Cost**		
	n	%*	Mean & std dev	R	%**
< 0 ≤ 6	287	5.24	9.26 ± 27.78	2657.34	2.58
> 6 ≤ 12	226	4.12	36.74 ± 118.91	8302.91	8.06
> 12 ≤ 19	158	2.88	10.55 ± 31.32	1656.85	1.61
> 19 ≤ 40	2005	36.59	17.44 ± 52.91	34913.62	33.91
> 40 ≤ 60	1989	36.30	21.52 ± 54.03	42793.67	41.56
> 60	814	14.85	15.38 ± 39.73	12522.28	12.16
Total	**5480**	**99.98**		**102965.2**	**99.88**

*Percentage was calculated according to frequency of age groups for inpatients and outpatients respectively
**Percentage was calculated according to total cost of age groups for inpatients and outpatients respectively

5.5.4 Budget groups

In the discussion on the average cost per medicine item according to budget group, budget group and gender, budget group and age groups and budget group and ICD-10 codes, the highest and the lowest average cost will be included for both in- and outpatients. *All N-values refer to the total prevalence or total cost for either inpatients or outpatients.*

5.5.4.1 Average cost per medicine item according to budget groups

- **Inpatients**

The average cost per medicine item according to budget group indicated that the highest average cost per medicine item for inpatients was R34.27 ± 89.46 for the budget group anti-infective. This budget group received the highest number of medicine items (n = 1 737) which represented 27.62% of the total frequency (N = 6 288 for inpatients) and had the highest total cost of R59 529.35 (N = R121 711.95 for inpatients). See table 55.

For inpatients, the budget group gastrolyte had the lowest average cost per medicine item of R3.47 ± 7.77. In this budget group the frequency was 1 350 (21.47%) which was the second highest frequency of all budget groups (N = 6 288 for inpatients) and the total cost was R4 678.28 (N = R121 711.95 for inpatients). The CPI value of 0.18 indicated that medicine items from this budget group were relatively inexpensive. See table 55.

- **Outpatients**

The outpatient budget group with the highest average cost per medicine item was immunological with an average cost of R63.81 ± 129.76. The CPI value of this budget group (3.40) indicated that medicine items in this budget group was relatively expensive. The frequency was 31 (0.57%) of the total frequency for inpatients (N = 5 480 for outpatients) which can be an explanation why the CPI value was so high. The total cost for immunological was R1 978.04 (N = R102 965.15 for outpatients). Refer to table 55.

The gastrolyte budget group had the lowest average cost per medicine item at R3.56 ± 6.54 for outpatients. The total number of medicine items dispensed to outpatients was 901 (16.44%) out of the total frequency for outpatient (N = 5 480 for outpatients) and the total cost was R3 209.70 (N = R102 965.15 for outpatients). The CPI value of 0.19 indicated that this budget group contained medicine items which were relatively inexpensive. Table 55 contains the average cost per medicine items for all budget groups for in- and outpatients.

TABLE 55: Average cost per medicine item according to budget groups

Budget group	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	n	%**	
Anti-infective	1737	27.62	34.27 ± 89.46	59529.35	48.91	1.77
Cardiovascular agent	956	15.20	12.36 ± 95.25	11815.60	9.71	0.64
Dermatological	84	1.34	9.54 ± 18.27	801.33	0.66	0.49
Endocrine	310	4.93	25.56 ± 133.21	7922.33	6.51	1.32
Functional	341	5.42	13.04 ± 22.80	4447.47	3.65	0.67
Gastrolyte	1350	21.47	3.47 ± 7.77	4678.28	3.84	0.18
Pain reliever	1183	18.81	24.19 ± 123.69	28616.90	23.51	1.25
Immunological	10	0.16	3.71 ± 6.17	37.14	0.03	0.19
Respiratory agent	317	5.04	12.19 ± 17.08	3863.55	3.17	0.63
Total	**6288**	**100**		**121711.95**	**100**	
Budget group	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	n	%**	
Anti-infective	1357	24.76	40.37 ± 92.98	54776.50	53.20	2.15
Cardiovascular agent	584	10.66	17.21 ± 40.54	10049.98	9.76	0.92
Dermatological	200	3.65	9.23 ± 20.62	1846.19	1.79	0.49
Endocrine	260	4.74	11.99 ± 23.00	3118.38	3.03	0.64
Functional	349	6.37	17.84 ± 15.58	6227.81	6.05	0.95
Gastrolyte	901	16.44	3.56 ± 6.54	3209.70	3.12	0.19
Pain reliever	1487	27.14	12.33 ± 34.64	18341.04	17.81	0.66
Immunological	31	0.57	63.81 ± 129.76	1978.04	1.92	3.40
Respiratory agent	311	5.68	10.99 ± 14.21	3417.51	3.32	0.58
Total	**5480**	**100**		**102965.15**	**100**	

*Percentage was calculated according to frequency of budget groups for inpatients and outpatients respectively
**Percentage was calculated according to total cost of budget groups for inpatients and outpatients respectively

5.5.4.2 Average cost per medicine item according to budget groups and gender

The results of the average cost per medicine item according to budget group and gender are included in appendix D.15.

- **Male inpatients**

The budget group with the highest average cost per medicine item was anti-infective for male inpatients and the average cost was R38.13 ± 93.80. The frequency of this budget group was 624 (N = 2 260 for male inpatients) (which is the highest frequency for all budget groups for male inpatients) and had a total cost of R23 791.26. See appendix D.15.

The budget group with the lowest average cost per medicine item for male inpatients was gastrolyte (R3.77 ± 7.60). The total number of medicine items dispensed from this budget group was 462 (N = 2 260 for male inpatients) which had a total cost of R1740.04. Refer to appendix D.15.

- **Female inpatients**

The female inpatients' highest average cost per medicine item (R32.11 ± 86.90) was also from the anti-infective budget group. The female inpatients received 1 113 medicine items (N = 4 028 for female inpatients) from this budget group and had a total cost of R35 738.09 during the study period.

The lowest average cost for female inpatients was R1.59 ± 0.75 for the budget group immunological. The frequency was 2 (N = 4 028 for female inpatients) and the total cost was R3.18. Refer to appendix D.15.

- **Male outpatients**

The male outpatient budget group with the highest average cost per medicine item was immunological with an average cost of R78.78 ± 140.85. The frequency for this budget group was 25 (N = 2 096 for male outpatients) and represented a total cost of R1 969.55. The CPI value of 3.91 indicated that medicine items from this budget group were relatively expensive.

The lowest average cost per medicine item was R3.15 ± 5.70 for the budget group gastrolyte for male outpatients. During the study period 339 (N = 2 096 for male outpatients) medicine items from this budget group were dispensed to male outpatients with a total cost of R1 067.49 (N = R42 265.21 for male outpatients). Refer to appendix D.15.

- **Female outpatients**

Female outpatients received 882 medicine items (N = 3 384 for female outpatients) from the budget group anti-infective which had a total cost of R32 263.59 (N = R60 699.93 for female outpatients). The average cost per medicine item was R36.58 ± 90.94 and it was the highest average cost for female outpatients.

The budget group immunological had an average cost per medicine item of R1.41 ± 0.55 and was the lowest average cost for all female outpatients. The frequency for this budget group was

6 (N = 3 384 for female outpatients) and it represented a total cost of R8.49 (N = R60 699.93 for female outpatients). Refer to appendix D.15.

Thus, for male and female inpatients and female outpatients anti-infective was the budget group with the highest average cost per medicine item. For female in- and outpatients immunological was the budget group with the lowest average cost per medicine item and for male in- and outpatients gastrolyte was the budget group with the lowest average cost per medicine item.

Appendix D.15 indicates the average medicine cost per medicine item for all budget groups according to gender.

5.5.4.3 Average cost per medicine item according to budget groups and age groups

The results of the average cost per medicine item according to budget group and age group was included in appendix D.16. *All N-values refer to the total prevalence or total cost for that specific age group for either inpatients or outpatients.*

- **< 0 ≤ 6 years**

In the paediatric age group (< 0 ≤ 6 years) the inpatient budget group with the highest average cost per medicine item was anti-infective with an average cost of R25.24 ± 88.01. The frequency for this budget group was 426 (N = 1 092) medicine items which represented 81.18% of the total cost for paediatric inpatients (N = 13 246.32). The CPI value of 2.08 indicated that the medicine items in this budget group was relatively expensive. The highest average cost per medicine item for paediatric outpatients was R43.56 ± 39.68 for the budget group functional. The frequency of the product was only 4 (N = 287) and the total cost represented 6.56% of the total cost for paediatric outpatients (N = 2 657.32). This was a possible explanation for the high CPI value of 4.70. Refer to appendix D.16.

The lowest average cost for inpatients was for the budget group cardiovascular agent at R1.43 ± 3.19. The frequency was 102 (N = 1 092) for this budget group and the total cost was R146.09 (1.10% of the total cost for paediatric inpatients (N = 13 246.32)). The CPI value of 0.12 indicated that the medicine in this budget group for this age group was relatively inexpensive. Gastrolyte was the budget group with the lowest average medicine cost of R1.72 ± 2.49 and it had a frequency of 65 (N = 287) and a total cost of R111.65 (4.20%). The

CPI value of 0.19 indicated that this medicine item was relatively inexpensive. Refer to appendix D.16.

- **> 6 ≤ 12 years**

In the age group > 6 ≤ 12 years the budget group with the highest average cost per medicine item for inpatients was anti-infective with an average cost of R32.14 ± 84.26. The patients received 97 (N = 296) medicine items from this budget group and had a total cost of R3117.11 (55.92% of total cost for children inpatients). The CPI value of 1.71 indicated that the medicine items from this budget group were relatively expensive. The same budget group had an average cost of R86.08 ± 182.30 for the outpatients in the same age group. The frequency was 86 (N = 226) and the cost was 89.16% of the total cost (N = R7 402.64). The CPI value of 2.34 indicated that the medicine items from the anti-infective budget group was relatively expensive.

The lowest average cost was for the budget group dermatological for inpatients at R0.82 ± 0.37. The frequency of 12 (4.05% of total frequency for children inpatients) and the total cost of R9.78 (N = R5 573.80) explain the low CPI value of 0.18 which indicated that medicine items from this budget group in this age group was relatively inexpensive. Immunological had the lowest average cost at R1.06 ± 0 (N = R8 302.92 for outpatients) in this age group. See appendix D.16.

- **> 12 ≤ 19 years**

In the age group > 12 ≤ 19 years the inpatient budget group with the highest average cost was anti-infective with an average cost of R55.96 ± 143.90. The CPI value of 2.83 indicated that medicine from this budget group for this age group was relatively expensive. The frequency of 54 (N = 207) and the total cost of R3021.64 (73.90% of total cost for inpatients in this age group) confirmed it. Cardiovascular agent budget group for outpatients had the highest average cost per medicine item at R31.18 ± 10.05. The frequency was only 2 (1.27%) and the total cost was R62.37.

Respiratory agent had an average cost per medicine item of R1.75 ± 0.52 which was the lowest average cost for inpatients in the age group > 12 ≤ 19 years. The frequency was only 3 (N = 207) and the total cost of R5.25 indicated that this budget group was relatively inexpensive in this age group as confirmed by the CPI of 0.09. Immunological was dispensed only three times (1.91%) to outpatients in this age group and the average cost per medicine item was

R1.06 (N = R1 656.86) which was the lowest average cost in this age group for outpatients. Refer to appendix D.16.

- **> 19 ≤ 40 years**

In the age group > 19 ≤ 40 years anti-infective were the budget group with the highest average cost per medicine item for both in- and outpatients. The average cost for inpatients was R39.69 ± 98.81 and for outpatients it was R33.01 ± 84.31. The frequency for inpatients was 656 (N = 2 096) and the total cost was 51.65% (R26 033.71) of the total cost for inpatients in this age group. For outpatients the frequency was 634 (N = 2 002) and the total cost was R20 925.63 (59.94%). The CPI value was 1.65 for inpatients and 1.89 for outpatients which indicated that medicine items from this budget group in this age group was relatively expensive.

The budget group gastrolyte had an average medicine cost of R3.24 ± 6.60 which was the lowest average cost for inpatients in the age group > 19 ≤ 40 years. The frequency was 424 (N = 2 096) and the total cost was R1 369.63 (2.72% of total cost for inpatients in this age group). The CPI value of 0.13 indicated that medicine items from the budget group gastrolyte in this age group was relatively inexpensive. Immunological had an average cost per medicine item of R1.36 ± 0.49 for outpatients in this age group. Refer to appendix D.16 for more information.

- **> 40 ≤ 60 years**

For the senior adult age group (> 40 ≤ 60 years) the budget group with the highest average cost for in- and outpatients was anti-infective. The average cost for anti-infective treatment in inpatients was R35.04 ± 73.24 with a frequency of 350 (N = 1 497) medicine items and a total cost of R12 262.62 (40.95% of total cost for inpatients in this age group). For outpatients the average cost per medicine item was higher at R51.05 ± 90.24 with a frequency of 464 (N = 1 989) and a total cost of R23 685.72 (55.35% of total cost for outpatients in this age group). The CPI value for inpatients (1.75) and for outpatients (2.37) indicated that medicine items from this budget group in this age group were relatively expensive.

Gastrolyte is the budget group for inpatients with the lowest average cost at R3.29 ± 5.92. The frequency of 309 (20.64% of total frequency for inpatients in this age group) and the total cost of R1 017.54 (N = R29 941.90) as well as the CPI value of 0.16 indicated that this budget group's medicine items was relatively inexpensive. The budget group with the lowest average cost per

medicine item for outpatients in the age group > 40 ≤ 60 years was immunological with an average cost of R1.06. Refer to appendix D.16.

- **> 60 years**

The age group > 60 years was the elderly patients and the inpatient budget group with the highest average cost was endocrine. The average cost per medicine item was R49.46 ± 245.47. The frequency was 86 (7.82% of total frequency in this age group) and the total cost for this budget group was R4 253.22 (N = R18 459.57). The CPI value of 2.95 indicated that medicine items from this budget group for this age groups was relatively expensive. The highest average cost for outpatients was R324.37 and it was for the budget group immunological.

The budget group dermatological had the lowest average cost at only R4.67 ± 6.74. In this budget group 9 medicine items (N = 1 100) were dispensed to patients > 60 years and the total cost was R42.00. The CPI value of 0.28 indicated that the medicine items from this budget group was relatively inexpensive. For outpatients in this age group gastrolyte was the budget group with the lowest average medicine cost of R3.76 ± 7.31. The total cost represented 2.73% of the total cost (N = R12 522.30).

Appendix D.16 indicates the average cost per medicine item according to budget group and age groups for in- and outpatients.

5.5.4.4 Average cost per medicine item according to budget groups and ICD-10 codes

Appendix D.17 gives all the results of the average cost per medicine item according to budget group and ICD-10 codes. *All N-values refer to the total prevalence or total cost for that specific budget group and ICD-10 code for either inpatients or outpatients.*

Anti-infectives were included in the treatment of a wide variety of conditions. The highest average cost per medicine item was R594.95 (1.00% of total cost for inpatients in this budget group) for family planning for inpatients.

The lowest average cost for inpatients was for gastro diarrhoea (R0.12 ± 0.12) which had a low CPI value which indicated that the medicine was relatively inexpensive.

Outpatients had a high average cost of R86.74 ± 132.17 for cases of rape. Refer to appendix D.17.

The lowest average cost per medicine item for outpatients was for abortion. The average cost was R1.40 ± 0.30 and the CPI of 0.03 confirmed that this treatment was relatively inexpensive.

In the inpatient budget group **cardiovascular agents,** the highest average cost per medicine item for unspecified coagulation defects was R88.51 ± 355.63. The CPI value of 7.16 indicated that the medicine items used to treat this condition was relatively expensive.

Unspecified HIV had an average cost per medicine item of R247.34 which was the highest average cost for outpatients for the cardiovascular budget group. The CPI value of 14.37. Refer to appendix D.17.

For both in- and outpatients unspecified folate deficiency anaemia was the condition with the lowest average cost. The average cost per medicine item for inpatients was R0.45 ± 0.44 (n = 221) and for outpatients the average cost was R0.95 ± 0.15 (n = 43). The CPI of unspecified folate deficiency anaemia for inpatients (0.04) and for outpatients (0.06) indicated that medicine items included in the treatment was relatively inexpensive.

In the budget group **dermatologicals** for inpatients, candidiasis was the condition with the highest average cost. The average cost per medicine item was R43.24 ± 1.73 with a total cost of R129.71.

The lowest average cost was for sinusitis with an average medicine cost of R0.02. For outpatients the highest average cost per medicine item was for pain control with an average cost of R60.00. Refer to table D.17.

The dermatological condition with the lowest average cost for outpatients was pruritus with a cost of R2.23 ± 1.09. The CPI of 0.24 indicated that these medicine items were relatively inexpensive. Refer to appendix D.17.

For the budget group **endocrine** the inpatient condition with the highest average cost per medicine item was for the treatment of hypoglycaemia / hyperglycaemia in diabetes mellitus. The average cost was R1097.74 ± 914.63 with a CPI value of 41.57.

The lowest average cost per medicine item for inpatients was R0.37 for a vitamin deficiency treated with medicine from the endocrine budget group.

The outpatient condition with the highest average cost was family planning with an average cost of R44.43 ± 21.71. Refer to appendix D.17.

The lowest average cost per medicine item for outpatients was R0.30 ± 0.16 for the treatment of allergies with antihistamines. Refer to appendix D.17.

The **functional** budget group had an average cost per medicine item of R26.96 for the treatment of angina. This was the highest cost for inpatients.

The lowest budget group for inpatients was bipolar affective disorder which had a frequency of 1. Refer to appendix D.17.

Outpatients had a high average cost of R69.00 for the treatment of parkinsonism. The frequency was 2 (0.57% of total frequency of outpatients in this budget group) and the total cost was R139.00 (2.22% of total cost in this budget group for outpatients).

The lowest frequency was R0.46 ± 0.34 for the treatment of sedation for outpatients. The CPI value of 0.03 indicated that these medicine items were relatively inexpensive.

In the inpatient budget group **gastrolyte** the highest average cost per medicine item was R57.60 ± 62.35 for the treatment of a condition with an unknown diagnosis. Refer to appendix D.17.

The lowest average cost for inpatients was R0.61 ± 0.78 for pain control associated with gastrolyte conditions. The CPI of 0.18 confirmed that the medicine was relatively inexpensive.

For outpatients the highest average cost was R17.57 ± 11.98 for disorders of the acid-base balance. The CPI of 4.93 indicated that the treatment was relatively expensive although the frequency was 61 (N = 901) and the total cost R1071.69 (N = R3 209.72).

The lowest average cost was for the treatment of a dental abscess with gastrolytes and was R1.21 ± 0.13. Although the frequency was 27 (N = 901) the treatment was relatively inexpensive according to the CPI of 0.34. See appendix D.17.

The highest cost per medicine item for the inpatient budget group **pain reliever** was for pain control. The average cost was R25.95 ± 128.59 with a frequency of 1 091 (N = 1 183) and a total cost of R28 312.60. The CPI of 1.07 indicated a balance in the cost and prevalence ratio for this treatment.

The lowest cost per medicine item was for the treatment of unknown diagnosis in inpatients with a frequency of 4 and an average cost of R0.56 ± 0. Refer to appendix D.17.

Outpatients had the highest average cost per medicine item of R14.90 for the treatment of unspecified anaemia. The lowest average cost was R1.68 for the treatment of malaria. Refer to appendix D.17.

Immunological were limited to immunisation and vaccination. During the study period, inpatients received immunisation with an average cost of R3.71 ± 6.17. The CPI value of 1.00 indicated that there was a perfect balance between the cost and the prevalence ration for this medication.

Outpatients received vaccination for rabies and immunisation. The rabies vaccination had an average cost per medicine item of R324.37. This was relatively expensive medication as confirmed by the CPI value of 5.08. Refer to appendix D.17.

The outpatient immunisation had an average cost of R1.27 ± 0.43 which was relatively inexpensive. Refer to appendix D.17.

In the budget group **respiratory agents** the in- and outpatients had the same conditions identified with the highest and lowest average cost. The highest average cost per medicine item was tuberculosis with an average cost of R19.31 ± 20.27 for inpatients and R38.25 ± 12.09 for outpatients. The CPI value in both cases was above one which indicated that medicine used in the treatment of tuberculosis was relatively expensive.

The condition with the lowest cost was allergies which were treated with antihistamines. The lowest average cost for inpatients was R1.46 ± 0.81 and for outpatients it was R2.04 ± 0.79. The CPI value for in- and outpatients was below 1 which indicated that this medicine items was relatively inexpensive.

The average cost per medicine item for budget groups according to ICD-10 codes for in- and outpatients is given in appendix D.17.

5.5.4.5 Comprehensive summary of total cost for budget groups

The total cost of the different budget groups is indicated in appendix D.18. Table 56 gives the top 3 budget groups according to total cost.

TABLE 56: Top three budget groups according to total cost

Budget group	In- & outpatients		
	Rank	Cost (Rand)	%*
Anti-infective	1	114305.85	50.88
Pain reliever	2	46957.94	20.90
Cardiovascular agent	3	21865.58	9.73
Total of top three budget groups		**183129.37**	**81.51**

*Percentage was calculated according to budget groups according to total cost

Anti-infective drugs were ranked first in both the inpatient and outpatient departments as the budget group with the highest total cost. The total cost for inpatients was R59 529.35 during the study period and was 48.91% of the total cost for inpatients. The total cost for anti-infective drugs was higher for inpatients than for outpatients because the frequency was higher for inpatients than for outpatients (see appendix D.2). The total cost for outpatients was R54 776.50 (53.20% of total cost). Anti-infective drugs thus represented R114 305.85 of the total expenditure for all medicine items and were 50.88% of the total cost for medicine items.

Once again, pain reliever medication was in second place according to the total cost for budget groups. The total cost for inpatients was R28 616.90 (23.51%) and R18 341.04 (17.81%) for outpatients. Pain reliever medicine had a total cost of R46 957.94 during the study period and represented 20.90% of all cost.

Cardiovascular agents was the budget group with the third highest total cost. Although the frequency of this budget group was placed in fourth place, the total cost for inpatients was R11 815.60 (9.71% of total cost for inpatients) and for outpatients R10 049.98 (9.76% of total cost for outpatients). Cardiovascular agents represented 9.73% of the total cost which was R21 865.58.

The top three budget groups according to total cost were the same for in- and outpatients. These three budget groups had a total cost of R183 129.37 during the study period and were 81.51% of the total cost. Refer to table D.18.

5.5.5 Pharmacological groups

In this section all the pharmacological groups used during the study period are discussed according to gender, age groups and ICD-10 codes. All pharmacological groups with a total cost > 5.00% and a CPI value of > 3.00 are included in the discussion. *The N-value refers to the total frequency or total cost of either inpatients or outpatients.*

5.5.5.1 Average cost per medicine item according to pharmacological groups

All the results of the average cost per medicine item according to pharmacological groups are included in appendix D.19. The pharmacological groups included in this discussion are represented in table 57. Pharmacological groups within these parameters (see section 5.5.5) but with frequencies less than 10 were not included in the discussion.

For inpatients the antibacterial group which contained penicillin antibiotics accounted for 26.80% of the total cost for all pharmacological groups (N = R121 711.98 for inpatients). The frequency of 861 (N = 6 288) had a total cost of R32 735.43 and the CPI value of 1.96 indicated that the average cost per medicine item (R38.02 ± 68.54) was relatively expensive. Refer to table 56 and appendix D.19.

Cephalosporin anti-infectives had an average cost per medicine item of R158.26 ± 252.37. The CPI value of 8.18 confirmed that this pharmacological group contain medicine items that were relatively expensive. The 100 medicine items dispensed from this budget group represented 13.00% of the total cost of all pharmacological groups for inpatients (N = R121 711.98 for inpatients). Refer to appendix D.19.

Antiviral medication accounted for 7.64% of the total cost for inpatients and 44.39% of the total cost for outpatients. The average cost for inpatients was R45.11 ± 75.77. For outpatients the average cost per medicine item was higher at R87.90 ± 116.95 and as confirmed by the CPI value of 4.68, it was a relatively expensive pharmacological group for outpatients.

Antihypertensive medication corresponds to 8.29% of the total cost for pharmacological groups for outpatients. The average cost per medicine item was R19.44 ± 43.59 and the CPI value was 1.03. This indicated that the treatment was relatively expensive for outpatients.

TABLE 57: Pharmacological groups with a total cost of more than 5.00% and/or a CPI value of more than 3.00

Pharmacological group	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Antibacterial (penicillins)	861	13.69	38.02 ± 68.54	32735.43	26.90	1.96
Anti-infective (cephalosporins)	100	1.59	158.26 ± 252.37	15825.63	13.00	8.18
Antiviral	206	3.28	45.11 ± 75.77	9293.36	7.64	2.33
Antihypertensive	466	7.41	12.73 ± 41.37	5932.94	4.87	0.66
Antithrombotic and anticoagulant	57	0.91	92.15 ± 364.65	5252.40	4.32	4.76
Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations	1110	17.65	25.13 ± 127.62	27895.35	22.92	1.30
Pharmacological group	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	R	%**	
Antibacterial (penicillins)	348	6.35	13.64 ± 28.61	4746.85	4.61	0.73
Anti-infective (cephalosporins)	15	0.27	25.07 ± 28.42	376.00	0.37	1.33
Antiviral	520	9.49	87.90 ± 116.95	45708.45	44.39	4.68
Antihypertensive	439	8.01	19.44 ± 43.59	8534.61	8.29	1.03
Antithrombotic and anticoagulants	29	0.53	31.72 ± 36.81	919.88	0.89	1.69
Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations	1473	26.88	12.35 ± 34.80	18197.17	17.67	0.66

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively
**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively

The pharmacological group antithrombotic and anticoagulant had a CPI value of 4.76 which indicated that medicine from this pharmacological group was relatively expensive. The average cost per medicine item for inpatients was R92.15 ± 364.65 which was, according to the CPI value, relatively expensive (n = 57). Refer to table 56.

Non-opioid analgesics including NSAIMs, gold and antigout preparations accounted for 17.67% of the total cost for all pharmacological groups. The frequency was 1 473 medicine items from

this pharmacological group and the total cost was R18 197.17. The average cost per medicine item was calculated at R12.35 ± 34.80 which was relatively inexpensive and this was confirmed by the CPI value of 0.66.

The following pharmacological groups had a high CPI value (more than 3.00) and a total cost of less than 10: local anaesthetic used in eye preparations, injectable contraceptives, antihypoglycaemic agents, antiparkinsonistics, and sera and immunologicals. Refer to appendix D.19.

5.5.5.2 Average cost per medicine item according to pharmacological groups and gender

The average cost per medicine item according to pharmacological group and gender is given in appendix D.20. All pharmacological groups with a total cost of more than 5.00% and a CPI value of more than 3 are included in the discussion and are given in table 58. Pharmacological groups with frequencies less than 10 and a CPI value more than 3 was not included in the discussion. *The N-value refer to the total frequency or total cost for male or female in- and outpatients respectively.*

- **Male patients**

In male inpatients penicillin antibiotics represented 30.34% of the total cost of all pharmacological groups (N = R44 197.70 for male inpatients). The average cost per medicine item was R37.88 ± 69.21 with a frequency of (N = 2 259 for male inpatients) and a total cost of R13 408.05.

Cephalosporin anti-infective accounted for 16.90% of the total cost of all pharmacological groups (N = R44 197.70) for inpatients during the study period. The frequency of this pharmacological group was 45 (N = 2 259 for male inpatients). The average cost per medicine item (R165.98 ± 241.65) as well as the CPI value (8.48) indicated that the medicine items in this pharmacological group were relatively expensive.

TABLE 58: *Pharmacological group according to gender with a total cost more than 5.00% and/or a CPI value more than 3.00*

Gender	Pharmacolgical group	Inpatients						Outpatients					
		Prevalence		Cost			CPI	Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%		n	%	Mean & std dev	R	%	
Male													
	Antibacterial (penicillins)	354	15.67	37.88 ± 69.21	13408.05	**30.34**	1.94	150	7.16	12.90 ± 25.49	1935.26	4.58	0.64
	Anti-infective (cephalosporins)	45	1.99	165.98 ± 241.65	7469.22	**16.90**	**8.48**	6	0.29	22.34 ± 23.56	134.05	0.32	1.11
	Antiviral	42	1.86	61.45 ± 73.25	2580.95	**5.84**	**3.14**	168	8.02	116.56 ± 135.04	19581.63	**46.33**	**5.78**
	Anti-epileptic	57	2.52	17.74 ± 25.18	1011.18	2.29	0.91	91	4.34	25.51 ± 18.41	2321.80	**5.49**	1.27
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	518	22.93	22.02 ± 108.57	11404.89	**25.80**	1.13	642	30.63	12.53 ± 33.43	8046.71	**19.04**	0.62
	Vaccines	8	0.35	4.24 ± 6.88	33.95	0.08	0.22	24	1.15	68.55 ± 134.06	1645.18	3.89	**3.40**
Female													
	Antibacterial (penicillins)	507	12.43	38.12 ± 68.13	19327.38	**24.93**	2.01	198	5.85	14.20 ± 30.81	2811.59	4.63	0.79
	Anti-infective (cephalosporins)	55	1.35	151.93 ± 262.86	8356.40	**10.78**	**7.99**	9	0.27	26.88 ± 32.52	241.94	0.40	1.50
	Antiviral	164	4.02	40.93 ± 76.05	6712.41	**8.66**	2.15	352	10.40	74.22 ± 104.72	26126.81	**43.04**	**4.14**
	Antihypertensive	359	8.80	13.79 ± 45.40	4951.63	**6.39**	0.73	307	9.07	21.52 ± 50.51	6606.46	**10.88**	1.20
	Antithrombotic and anticoagulant	37	0.91	116.35 ± 452.27	4305.11	**5.55**	**6.12**	23	0.68	35.21 ± 40.54	809.93	1.33	1.96
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	592	14.52	27.86 ± 142.24	16490.45	**21.27**	1.47	831	24.56	12.21 ± 35.83	10150.46	**16.72**	0.68

Antiviral represented 5.84% (N = R44 197.70 for male inpatients) of inpatients' and 46.33% (N = R42 265.24 for male outpatients) of outpatients' total cost. The average cost per medicine item for inpatients was R61.45 ± 73.25 and the CPI of 3.14 confirmed that the pharmacological group was relatively expensive. Outpatients had an average cost per medicine item of R116.56 ± 135.04. Although the frequency was 168 (N = 2 096 for male outpatients) the CPI of 5.78 indicated that medicine items in this pharmacological group for outpatients were relatively expensive.

Anti-epileptic contributed 5.49% of the total cost for all outpatients' pharmacological groups (N = R42 265.24 for male outpatients). The average cost per medicine item for this pharmacological group was R25.51 ± 18.41. This CPI of 1.27 indicated that medicine items in these groups were relatively expensive. Refer to table 58 and appendix D.20.

Non-opioid analgesics including NSAIMs, gold and anti-gout preparations represented 25.80% of the total cost for inpatients (N = R44 197.70 for male inpatients) and 19.04% of the total cost for outpatients (N = R42 265.24 for male outpatients). The average cost per medicine item was R22.02 ± 108.57 for inpatients with a CPI value of 1.13 which indicate that analgesic treatment for inpatients was relatively expensive. The average cost for outpatients was R12.53 ± 33.43 and the CPI of 0.62 confirmed that the treatment for outpatients was relatively inexpensive. Refer to table 58.

Vaccination had a CPI value of 3.40 which indicated that this pharmacological group was relatively expensive. The average cost per medicine item was R68.55 ± 134.06 which was high.

The pharmacological group sera & immunologicals had a low frequency (less than 10) and a high CPI value (more than 3.00). Refer to appendix D.20.

- **Female patients**

Female patients received penicillin antibacterials during their stay as inpatients which represented 24.93% of the total cost of all female inpatient pharmacological groups (N = R77 514.29 for female inpatients). The frequency for this pharmacological group was 507 (N = 4 078 for female inpatients) with an average cost per medicine item of R38.12 ± 68.13. The CPI value of 2.01 indicated that this pharmacological group contained medication which was relatively expensive.

Cephalosporin anti-infectives contributed 10.78% of the total cost for female inpatient pharmacological groups (N = R77 514.29 for female inpatients). The average cost per medicine item was R151.93 ± 262.86 and the CPI value of 7.99 confirmed that the medicine items in this pharmacological group were relatively expensive. Refer to table 58.

The pharmacological group antiviral represented 8.66% of the total cost for female inpatients (N = R77 514.29 for female inpatients). The average cost per medicine item was R40.93 ± 76.05 and the CPI value of 2.15 indicated that medicine items from this budget group were relatively expensive. Antivirals represented 43.04% (N = R60 699.96 for female outpatients) of the total cost for all pharmacological groups for female outpatients. The average cost per medicine item was R74.22 ± 104.72 and the CPI value of 4.14 confirmed that this pharmacological group was relatively expensive although the frequency was 352 (N = 3 384 for female outpatients).

Antihypertensive drugs represented 6.39% of the total cost for female inpatients (N = R77 514.29) and 10.88% of the total cost for female outpatients (N = R60 699.96). The average cost for inpatients was R13.79 ± 45.40 with a CPI value of 0.73 which indicated that this pharmacological group was relatively inexpensive for female inpatients. The average cost per medicine item for outpatients was R21.52 ± 50.51 and the CPI of 1.20 indicated that medicine for female outpatients was relatively expensive.

Antithrombotic and anticoagulant accounted for 5.55% (N = R77 514.29 for female inpatients) of the total cost for female inpatients during the study period. The CPI value of 6.12 indicated that medicine items from this pharmacological group were relatively expensive referring to the average cost per medicine item of R116.35 ± 452.27. Refer to table 58.

Medicine items in the pharmacological group analgesics, non-opioids including NSAIMs, gold and anti-gout preparations contributed 21.27% of the total cost for all female inpatient pharmacological groups (N = R77 514.29). The frequency was 592 (N = 4 078 for female inpatients) and the total cost was R16 490.45 with an average cost per medicine item of R27.86 ± 142.24. The same pharmacological group represented 16.72% of the total cost for all pharmacological groups for female outpatients (N = R60 99.96). The frequency was 831 (N = 3 384 for female outpatients) and the total cost was R10 150.46 which calculated the average cost per medicine item at R12.21 ± 35.83. The CPI of 0.68 indicated that medicine items from this budget group were relatively inexpensive for the treatment of female outpatients.

The following pharmacological groups had a low frequency (less than 10) and a high CPI value (more than 3.00): injectable contraceptives, antihypoglycaemic agents, antiparkinsonistics, and other gastrolytes. Refer to appendix D.20.

Appendix D.20 gives all the pharmacological groups according to gender for in- and outpatients with their average cost per medicine item.

5.5.5.3 Average cost per medicine item according to pharmacological groups and age groups

Pharmacological groups according to age group and the average cost per medicine item are included in appendix D.21. Tables 59-64 summarises the pharmacological groups according to the different age groups which had a total cost of more than 5.00% and a CPI value of more than 3 but excluded pharmacological groups with high CPI values (more than 3.00) and frequencies below 10. *All N-values refer to the total prevalence and/or total cost for that specific age group for either inpatients or outpatients.*

- **< 0 ≤ 6 years**

In the paediatric age group (< 0 ≤ 6 years) penicillin antibacterial medication represented 14.14% of the total cost of all pharmacological groups dispensed in this age group to inpatients (N = R13 246.31) and 7.78% of those dispensed to outpatients (N = R2 657.34).

Cephalosporins contributed to 55.82% of total cost for inpatients (N = R13 246.31) and had a CPI value of 16.47 which indicated that medicine items in that pharmacological group were relatively expensive confirmed by the average cost per medicine item of R199.79 ± 223.61.

Chloramphenicol and erythromycins contributed 6.48% to the total cost (N = R2 657.34) for outpatient paediatrics with an average cost per medicine item of R5.07 ± 4.87. Refer to table 59.

Antiviral medication represents 9.86% of the total cost for inpatients (N = R13 246.31) and 47.29% of the total cost for outpatients (N = R2 657.34). The CPI values of 5.13 and 11.31 respectively indicated that medicine items from this pharmacological group for paediatrics were relatively expensive.

TABLE 59: Pharmacological groups in the paediatric age group with total cost of more than 5.00% and/or CPI values of more than 3.00

Age group	Pharmacological group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
< 0 ≤ 6 years	Antibacterial (penicillins)	250	22.89	7.49 ± 11.90	1873.29	14.14	0.62
	Anti-infective (cephalosporins)	37	3.39	199.79 ± 223.61	7392.13	55.81	16.47
	Antibacterial (chloramphenicol, erythromycins)	113	10.35	1.46 ± 2.53	164.89	1.24	0.12
	Antiviral	21	1.92	62.18 ± 8.09	1305.74	9.86	5.13
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	125	11.45	1.43 ± 1.01	178.33	1.35	0.12
	Pharmacological group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Antibacterial (penicillins)	36	12.54	5.74 ± 6.31	206.66	7.78	0.62
	Anti-infective (cephalosporins)	3	1.05	59.08 ± 43.16	177.24	6.67	6.38
	Antibacterial (chloramphenicol, erythromycins)	34	11.85	5.07 ± 4.87	172.25	6.48	0.55
	Antiviral	12	4.18	104.72 ± 80.78	1256.63	47.29	11.31
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	66	23.00	2.54 ± 1.35	167.77	6.31	0.27

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively in the paediatric age group
**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively in the paediatric age group

Non-opioid analgesics represented 6.31% of the total cost (N = R2 657.34) in the outpatient paediatric age group with an average cost of R2.54 ± 1.35 per medicine item. Refer to table 59.

The following pharmacological groups had a low frequency (less than 10) and a high CPI value (more than 3.00) in this age group: cephalosporins, topical antifungals, hormones, androgens, oestrogens & progesterone, and anti-epileptics. Refer to appendix D.21.

- **> 6 ≤ 12 years**

In the age group for children, > 6 ≤ 12 years, the penicillin antibacterial pharmacological group represented 16.33% of the total cost for inpatients (N = R5 573.81) in that age group. The average cost per medicine item was R29.37 ± 63.29 and as the CPI value (1.56) indicated, the medicine items in the pharmacological group was relatively expensive. Refer to table 60.

TABLE 60: Pharmacological groups in the children age group with a total cost of more than 5.00% and/or a CPI value of more than 3.00

Age group	Pharmacological group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 6 ≤ 12 years	Antibacterial (penicillins)	31	10.47	29.37 ± 63.29	910.43	16.33	1.56
	Antiviral	34	11.49	56.57 ± 125.17	1923.50	34.51	3.00
	Antihypertensive	45	15.20	42.84 ± 96.12	1928.01	34.59	2.28
	Pharmacological group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Antibacterial (penicillins)	20	8.85	4.37 ± 4.19	87.34	1.05	0.12
	Antiviral	43	19.03	167.11 ± 231.87	7185.92	86.55	4.55
	Antihypertensive						

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively in the children group

**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively in the children age group

The antiviral pharmacological group represented a large percentage of the total cost for inpatients in this age group. Of the total cost for inpatients (N = R5 573.81) 34.51% was for antivirals and the CPI value of 3 indicated that the medicine items were relatively expensive as the average cost per medicine item of R56.57 ± 125.17 proofed. For outpatients 86.55% of the total cost (N = R8 302.93) was for antivirals. The CPI was 4.55 for outpatients.

Antihypertensive medication contributed 34.59% of the total cost of all pharmacological groups for inpatients (N = R5 573.81) in this age group.

- **> 12 ≤ 19 years**

Teenagers in the age group > 12 ≤ 19 years used penicillin antibacterial pharmacological group drugs for both in- and outpatients. The inpatients contributed 41.35% of the total cost (N = R4 088.60) for this pharmacological group while outpatients contributed 21.57% of the total cost (N = R1 656.85). The average cost per medicine item differed from R54.53 ± 115.96 for inpatients to R19.85 ±59.65 for outpatients.

TABLE 61: Pharmacological groups in the teenager age group with a total cost of more than 5.00% and/or a CPI value of more than 3.00

Age group	Pharmacological group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 12 ≤ 19 years	Antibacterial (penicillins)	31	14.98	54.53 ± 115.96	1690.50	41.35	2.76
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	59	28.50	7.11 ± 25.32	419.37	10.26	0.36
	Pharmacological group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Antibacterial (penicillins)	18	11.46	19.85 ± 59.65	357.36	21.57	1.88
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	78	49.68	11.48 ± 32.89	895.70	54.06	1.09

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively in the teenage age group
**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively in the teenage age group

The pharmacological group for analgesics, non-opioid including NSAIMs, gold and anti-gout preparations was calculated at 10.26% of the total cost for inpatients (N = R4 088.60) and 54.06% of the total cost for outpatients (N = R1 656.85). The CPI value for inpatients was 0.36 which indicated that the average cost per medicine item was relatively inexpensive at R7.11 ± 25.32. The CPI for outpatients was 1.09 which indicated that the treatment used for outpatients was relatively expensive. See table 61.

The following pharmacological groups in this age groups had frequencies of less than 10 and CPI values of more than 3.00: cephalosporins, antithrombotics and anticoagulants, and anti-asthmatics and mucolytics. Refer to appendix D.21.

- **> 19 ≤ 40 years**

In the age group > 19 ≤ 40 years the penicillin antibacterial pharmacological group was more frequently used by inpatients with a frequency of 14.07% (N = 2 096) than by outpatients with a frequency of 158 (N = 2 002). This pharmacological group represented 30.54% of the total cost

for inpatients (N = R50 401.81) and 7.19% for outpatients (N = R34 910.68). The average cost per medicine item also differed between inpatients (R52.17 ± 71.00) and outpatients (R15.88 ± 29.39).

TABLE 62: Pharmacological groups in the junior adult age group with a total cost of more than 5.00% and/or a CPI value of more than 3.00

Age group	Pharmacological group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 19 ≤ 40 years	Antibacterial (penicillins)	295	14.07	52.17 ± 71.00	15391.59	30.54	2.17
	Anti-infective (cephalosporins)	39	1.86	160.61 ± 308.89	6263.89	12.43	6.68
	Antibacterial (chloramphenicol, erythromycins)	231	11.02	2.02 ± 2.90	466.89	0.93	0.08
	Antiviral	86	4.10	45.00 ± 62.63	3869.58	7.68	1.87
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	390	18.61	40.82 ± 163.03	15919.25	31.58	1.70
	Pharmacological group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Antibacterial (penicillins)	158	7.89	15.88 ± 29.39	2509.47	7.19	0.91
	Anti-infective (cephalosporins)	7	0.35	20.77 ± 21.87	145.37	0.42	1.19
	Antibacterial (chloramphenicol, erythromycins)	216	10.79	11.82 ± 105.61	2552.36	7.31	0.68
	Antiviral	252	12.59	62.36 ± 79.86	15714.44	45.01	3.58
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	522	26.07	12.52 ± 33.90	6537.24	18.73	0.72

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively in the junior adult age group

**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively in the junior adult age group

Cephalosporin represented 12.43% of the total cost of this inpatient pharmacological group (N = R50 401.81) in this age group. The average cost per medicine item was R160.61 ± 308.89

and the CPI value of 6.68 indicated that this pharmacological group was relatively expensive. Refer table 62.

Chloramphenicol and erythromycins anti-infective amounted to 7.31% of the total cost for outpatients (N = R34 910.68) in this age group. The average cost per medicine item was relatively inexpensive at R11.82 ± 105.61.

The pharmacological group antiviral, which includes ARV medication, was calculated to represent 7.68% of the total cost for inpatients (N = R50 401.81). The frequency was higher for outpatients where antivirals were 45.01% of the total cost (N = 34 910.68) and according to the CPI (3.58) and average cost (R62.36 ± 79.86) the medicine items in this pharmacological group were relatively expensive.

Analgesics, non-opioid including NSAIMs, gold and antigout preparations were used by both in- and outpatients. The frequency was 390 (N = 2 096) for inpatients where the cost contributed 31.58% to the total cost (N = R50 401.81) and the CPI value of 1.70 indicated that the analgesic treatment for inpatients was relatively expensive. The frequency for outpatients was 522 (N = 2 002) and represented 18.73% of the total cost (N = R34 910.68). The analgesic treatment for outpatients was relatively inexpensive as the CPI of 0.72 indicated.

Antithrombotic and anti-coagulant had a frequency of 3 and injectable contraceptive medicines were only used once. The frequency was below 10 and the CPI value above 3.00. Refer to appendix D.21.

- **> 40 ≤ 60 years**

The pharmacological group penicillin antibacterial represented 29.35% of the total cost (N = R29 941.91) for inpatients in this age group. The average cost per medicine item was R55.98 ± 88.88 and it was relatively expensive according to the CPI value of 2.80.

Antiviral had CPI value of 7.33 for inpatients which indicated that the average cost per medicine item of R34.28 ± 48.99 was relatively expensive. Outpatients had a CPI value of 4.74 for the pharmacological group antivirals which represented 50.33% of the total cost (N = R42 793.70). Refer to table 63.

TABLE 63: Pharmacological groups in the senior adult age group with a total cost of more than 5.00% and/or a CPI value of more than 3.00

Age group	Pharmacological group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 40 ≤ 60 years	Antibacterial (penicillins)	157	10.49	55.98 ± 88.88	8788.38	29.35	2.80
	Antiviral	64	4.28	34.28 ± 48.99	2194.20	7.33	1.71
	Antihypertensive	158	10.55	10.38 ± 38.38	1639.36	5.48	0.52
	Antithrombotic and anticoagulant	30	2.00	130.17 ± 500.36	3905.17	13.04	6.51
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	260	17.37	23.53 ± 137.89	6117.32	20.43	1.18
	Pharmacological group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Antibacterial (penicillins)	81	4.07	13.83 ± 30.58	1120.29	2.62	0.64
	Antiviral	211	10.61	102.08 ± 112.84	21539.62	50.33	4.74
	Antihypertensive	232	11.66	19.95 ± 54.13	4628.02	10.81	0.93
	Antithrombotic and anticoagulant	18	0.90	29.52 ± 33.72	531.34	1.24	1.37
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	490	24.64	13.03 ± 33.85	6385.32	14.92	0.61

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively in the senior adult age group

**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively in the senior adult age group

Antihypertensive pharmacological group represented 5.48% of the total cost (N = R29 941.91) for inpatients in this age group. Outpatients represented 10.81% of the total cost (N = R42 793.70) but the CPI value of 0.93 indicates than the medicine items in this budget group was relatively inexpensive.

The pharmacological group antithrombotic and anticoagulant represented 13.04% of the total cost for inpatients (N = R 29 941.70) and had a CPI value of 6.51 which indicated that this pharmacological group was relatively expensive.

Analgesics, non-opioid including NSAIMs, gold and antigout preparations represented 20.43% (N = R6 117.32) of the total cost for inpatients and 14.92% (N = R6 385.32) of the total cost for outpatients. Refer to table 63.

The following pharmacological groups had a high CPI value (more than 3.00) but a low frequency (less than 10): cephalosporin anti-infectives and antiparkinsonistics. Refer to appendix D.21.

- **> 60 years**

TABLE 64: Pharmacological groups in the elderly age group with a total cost of more than 5.00% and/or a CPI value of more than 3.00

Age group	Pharmacological group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 60 years	Antibacterial (penicillins)	97	8.82	42.07 ± 65.48	4081.24	22.11	2.51
	Antihypertensive	205	18.64	8.38 ± 16.20	1718.80	9.31	0.50
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	236	21.45	21.99 ± 104.16	5189.01	28.11	1.31
	Pharmacological group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Antibacterials (penicillins	35	4.30	13.31 ± 13.10	456.74	3.65	0.85
	Antihypertensive	195	23.96	17.93 ± 27.43	3496.84	27.94	1.17
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	268	32.92	14.85 ± 43.94	3980.70	31.81	0.97

*Percentage was calculated according to frequency of pharmacological groups for inpatients and outpatients respectively in the elderly age group
**Percentage was calculated according to total cost of pharmacological groups for inpatients and outpatients respectively in the elderly age group

The penicillin antibacterial pharmacological group contributed 22.11% of the total cost (N = R18 459.57) in the inpatient age group > 60 years. The average cost per medicine item was R42.07 ± 65.48 for this group. Refer to table 64.

Antihypertensive pharmacological group represented 9.31% of the total cost for inpatients (N = R18 459.57) in this age group and 27.94% of the total cost for outpatients (N = R12 513.30). The average cost per medicine item for inpatients was R8.38 ±16.20 with a CPI value of 0.50 which indicated that the treatment was relatively inexpensive. The average cost for outpatients was R17.93 ± 27.43 and the CPI value of 1.17 indicated that the outpatient treatment was relatively expensive.

Analgesics, non-opioids including NSAIMs, gold and anti-gout preparations accounted for 28.11% of the total cost for inpatients (N = R18 459.57) and 31.81% for outpatients (N = R12 513.30). The CPI value was higher for inpatients (1.31) where the average cost was R21.99 ± 1104.16 per medicine item than for outpatients where the CPI value was 0.97 with a average cost of R14.85 ± 43.94. The treatment for inpatients was relatively expensive and for outpatients relatively inexpensive. Refer to table 64.

The following pharmacological groups had high CPI values (more than 3.00) but low frequencies (less than 10): antihypoglycaemic agents, other gastrolytes, sera and immunologicals, and vaccines.

Appendix D.21 illustrates the average cost per medicine item according to pharmacological group and age group for in- and outpatients.

5.5.5.4 Average cost per medicine item according to pharmacological groups and ICD-10 codes

In the discussion on the average cost per medicine item for pharmacological groups according to ICD-10 codes, all CPI values > 3.00 and frequencies > 50 were included. The pharmacological groups were classified according to use for a certain ICD-10 code. Appendix D.22 gives the average cost per medicine item according to pharmacological group and ICD-10 codes. Table 65 summarises the pharmacological groups within these parameters.

For the disease infective diarrhoea / food poisoning the frequency for treatment with antibacterials (penicillin antibiotics) for inpatients was 98 (52.13% of the total frequency for this disease).

TABLE 65: Average cost per medicine item according to pharmacological groups and ICD-10 codes

ICD-10 code	Pharmacological group	Inpatient						Outpatient					
		Prevalence			Cost		CPI	Prevalence			Cost		CPI
		n	%	Mean & std dev	R	%		n	%	Mean & std dev	R	%	
Infective diarrhoea / food poisoning	Antibacterial (penicillins)	98	52.13	22.39 ± 54.70	2193.74	62.03	1.19	3	12.50	8.44 ± 8.62	25.31	29.63	2.37
Tuberculosis	Antituberculosis	146	70.87	19.31 ± 20.27	2819.49	48.23	0.68	34	91.89	38.25 ± 12.09	1300.51	99.00	1.08
Undefined bacterial infection	Antibacterial (penicillins)	371	54.00	38.80 ± 69.12	14393.20	60.16	1.11	272	54.18	12.61 ± 18.15	3429.75	53.39	0.99
	Antibacterial (chloramphenicol, erythromicins)	272	39.59	3.80 ± 29.41	1033.09	4.32	0.11	206	41.04	12.11 ± 108.10	2493.82	38.82	0.95
Unspecified HIV	Antibacterial (chloramphenicol, erythromicins)	39	16.18	4.21 ± 2.32	164.04	1.75	0.11	166	24.20	6.30 ± 8.36	1045.70	2.23	0.09
	Antiviral	202	83.82	45.59 ± 76.39	9209.71	98.25	1.17	515	75.07	88.72 ± 117.21	45693.01	97.23	1.30
Unspecified folate deficiency anaemia	Drugs affecting the blood	221	100.00	0.45 ± 0.44	100.52	100.00	1.00	42	97.67	0.95 ± 0.15	39.88	97.55	1.00
Unspecified anaemia	Drugs affecting the blood	177	96.72	2.15 ± 5.15	381.04	89.75	0.93	41	97.62	3.56 ± 8.72	145.87	90.73	0.93
Unspecified coagulation defects	Antithrombotic and anticoagulant	57	40.43	92.15 ± 364.65	5252.40	97.60	2.41	28	22.76	32.82 ± 36.99	918.89	85.18	3.74
	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	81	57.45	0.88 ± 0.75	70.97	1.32	0.02	93	75.61	1.56 ± 0.35	144.75	13.42	0.18
Diabetes mellitus type 2	Antidiabetic agent (Oral)	94	98.95	4.51 ± 4.18	424.19	97.64	0.99	62	100.00	8.16 ± 3.40	505.85	100.00	1.00
Vitamin deficiency	Vitamin & mineral	771	99.61	0.81 ± 1.35	627.04	99.23	1.00	605	99.83	2.05 ± 4.39	1237.52	99.75	1.00
Mineral deficiency	Vitamin & mineral	107	93.86	1.44 ± 1.97	154.43	85.86	0.91	53	100.00	2.68 ± 2.04	142.25	100.00	1.00
Disorders of acid-base balance	Antacids / anti-ulcer	96	92.31	10.76 ± 11.20	1033.09	98.59	1.07	60	98.36	17.85 ± 11.88	1070.93	99.93	1.02
Bipolar disorders	Psycotic disorder	64	96.97	10.58 ± 29.46	677.36	99.58	1.03	28	96.55	3.02 ± 1.51	84.51	96.07	0.99
Major depressive disorders	Mood disorder	93	100.00	11.38 ± 13.48	1058.48	100.00	1.00	103	100.00	16.75 ± 8.70	1724.80	100.00	1.00
Inflammation	Corticosteroids for systemic use (oral/injections)	110	82.71	21.34 ± 46.44	2314.38	93.23	1.13	117	69.64	5.50 ± 10.39	643.35	77.28	1.11
Epilepsy	Corticosteroids for systemic use (oral/injections)	114	97.44	21.00 ± 26.83	2393.71	99.72	1.02						
	Anti-epileptic							181	100.00	22.71 ± 17.36	4110.29	100.00	1.00

TABLE 65: Average cost per medicine item according to pharmacological groups and ICD-10 codes (continue from page 269)

Hypertension	Antihypertensive	466	98.94	12.73 ± 41.37	5932.94	98.53	1.00	439	99.77	19.44 ± 43.59	8534.61	99.95	1.00
Unspecified pneumonia	Antibacterial (penicillins)	52	61.18	51.32 ± 71.06	2668.60	78.46	1.28						
Asthma, acute or asthma chronic persistent	Anti-asthmatic & mucolytic	116	78.38	8.25 ± 12.22	957.45	80.72	1.03	128	84.21	14.05 ± 12.40	1798.70	92.16	1.09
Nausea	Anti-emetic	106	97.25	4.17 ± 6.29	442.46	94.01	0.97	48	100.00	1.43 ± 0.95	68.60	100.00	1.00
Pain control	Analgesics, non-opioids including NSAIMs, gold and antigout preparations	1018	92.63	27.10 ± 133.02	27591.05	97.21	1.05	1377	98.99	13.09 ± 35.87	18022.71	98.86	1.00
	Analgesics (opioids) / narcotic analgesics	69	6.28	9.59 ± 10.57	661.94	2.33	0.37	4	0.29	2.02 ± 2.38	8.06	0.04	0.15
Allergies	Antihistamines for systemic use	32	82.05	1.46 ± 0.81	46.77	35.95	0.44	91	91.00	2.04 ± 0.79	185.37	95.51	1.05

Antituberculosis medication was part of the treatment of tuberculosis with a frequency of 146 (70.87% of all frequencies for tuberculosis) for inpatients. The CPI value of 0.68 indicated that the medicine items in the pharmacological group antituberculosis were relatively inexpensive.

Undefined bacterial infection was treated with penicillin antibacterial medicine items with a frequency of 371 (54.00% of the total frequency for this disease) in inpatients and with a frequency of 272 (54.18%) in outpatients. Antibacterials containing chloramphenicol and erythromycins were also used in the treatment of undefined bacterial infections with a total cost of R1 033.09 (N = R23 926.85) in inpatients and a total cost of R2 493.82 (N = R6 423.63) in outpatients. Refer to table 65.

Unspecified HIV was mainly treated with medicine items from the pharmacological group antivirals. Inpatients received 202 medicine items (83.82% of the total frequency for this condition) during the study period and outpatients received 515 (75.05% of the total frequency for this condition) medicine items. Outpatients received 166 medicine items (24.20% of the total frequency for this condition) from the pharmacological group chloramphenicol and erythromycin antibacterials.

Unspecified folate deficiency anaemia was only treated with medicine items from the pharmacological group drugs affecting the blood which had a frequency of 221 (100.00%) during the study period in inpatients. Refer to table 65 and appendix D.22.

Unspecified anaemia received treatment form the pharmacological group drugs affecting the blood. The frequency was 177 (96.72%) for treatment in inpatients.

The pharmacological group antithrombotic and anticoagulants was used in the treatment of unspecified coagulation defects in both in- and outpatients. The frequency for inpatients was 57 (40.43% of the total frequency for this condition) during the study period. For outpatients this pharmacological group had a CPI value of 3.74 which indicated that the average cost per medicine item of R32.82 ± 36.99 was relatively expensive. For the same condition, medicine items from the pharmacological group non-opioid analgesics, including NSAIMs, gold and antigout preparations were used with a frequency of 81 (57.45% of the total frequency for this condition) in inpatients and 93 (75.61% of the total frequency for this condition) in outpatients. Refer to appendix D.22.

In the treatment of diabetes mellitus type 2 (non-insulin dependent) medicine items from the pharmacological group oral antidiabetic agents were dispensed with a frequency of 94 (98.95% of the total frequency for this condition) to inpatients and 62 (100.00% of the total frequency for this condition) to outpatients. Refer to table 65 and appendix D.22.

Vitamin deficiency was treated with the pharmacological group vitamins and minerals with a frequency of 771 (99.61% of the total frequency for this condition) in inpatients and 605 (99.83% of the total frequency for this condition) in outpatients. Refer to table 65 and appendix D.22.

Mineral deficiency was treated with the same pharmacological group as for vitamin deficiency (vitamin and mineral) with a frequency of 107 (93.86% of the total frequency for this condition) in inpatients and 53 (100.00% of the total frequency for this condition) in outpatients.

Disorders of acid-base balance were mainly treated with medicine items from the pharmacological group antacids / anti-ulcers in inpatients with a frequency of 96 (92.31% of the total frequency for this condition) and in outpatients with a frequency of 60 (98.36% of the total frequency for this condition) during the study period. Refer to table 65 and appendix D.22.

Bipolar disorder received 64 medicine items (96.97% of the total frequency for this condition) from the pharmacological group psychotic disorders as treatment during the study period.

The pharmacological group, mood disorders, was the only pharmacological group used in the treatment of major depressive disorder. Inpatients received 93 medicine items (100.00%) and outpatients 103 (100.00%) during the study period as treatment for major depressive disorder. This was the only pharmacological group used in the treatment of major depressive disorder and the cost totalled to an amount of R1 058.48 for inpatients and R1 724.80 for outpatients. Refer to appendix D.22.

Inflammation was primarily treated with corticosteroids for systemic use where inpatients received 110 medicine items (82.71% of the total frequency for this condition) from this pharmacological group and outpatients received 117 medicine items (69.64% of the total frequency for this condition).

Epilepsy in outpatients was treated with medicine items from the pharmacological group anti-epileptics. During the study period, all outpatients were treated with this pharmacological group

(100%). Corticosteroids for systemic use was dispensed with a frequency of 114 (97.44% of total frequency for this condition in inpatients) to inpatients.

Hypertension was a condition treated in both in- and outpatients with medicine items from the pharmacological group antihypertensive. Inpatients received 466 medicine items (98.94% of the total frequency for this condition) from this pharmacological group and outpatients received 439 medicine items (99.77% of the total frequency for this condition) during the study period.

Unspecified pneumonia received treatment from the pharmacological group penicillin antibacterials. The frequency in inpatients was 52 (61.18% of the total frequency for this condition).

Asthma, acute or asthma chronic persistent was treated with medicine items from the pharmacological group anti-asthmatics and mucolytics. Inpatients received 116 medicine items (78.38% of the total frequency for this condition) and outpatients received 128 (84.21% of the total cost for this condition) medicine items during the study period. Refer to appendix D.22.

Nausea was treated with medication from the pharmacological group anti-emetics with a frequency of 106 (97.25%) in inpatients.

Pain control was primarily treated with medicine items from the pharmacological group non-opioid analgesics including NSAIMs, gold and antigout preparations. Inpatients received 1 018 medicine items (92.63% of the total frequency for this condition) during the study period and outpatients received 1 377 (98.99% of the total frequency for this condition) medicine items for the treatment of pain. Opioid analgesics / narcotic analgesics were dispensed with a frequency of 69 (6.28% of the total frequency for this condition) to inpatients.

Outpatients received 91 medicine items (91.00% of the total frequency for this condition) for the pharmacological group antihistamines for systemic use for the treatment of allergies.

The following pharmacological groups had high CPI values (more than 3.00) but low frequencies (less than 10): cephalosporin anti-infective for the disease infective diarrhoea / food poisoning, cephalosporin anti-infectives for the treatment of tuberculosis, cephalosporin anti-infectives for the treatment of undefined viral infections, drugs affecting the blood in the treatment of unspecified HIV, chloramphenicol and erythromycin antibacterials in the treatment of scabies, topical antifungals for the disease candidiasis, antihelmintics for the treatment of

unspecified anaemia, local anaesthetics in the treatment of unspecified anaemia, cephalosporin anti-infectives used in the treatment of other disorders of fluid and electrolyte balance, antacids / anti-ulcers for the treatment of other disorders of fluid and electrolyte balance, feeding and nutritional supplements (parenteral) for the treatment of other disorders of fluid and electrolyte balance, anti-epileptics for the treatment of angina, penicillin antibacterials for the treatment of sinusitis, cephalosporin anti-infectives for the treatment of unspecified bronchopneumonia, cephalosporin anti-infectives in the treatment of unspecified pneumonia, cephalosporin anti-infectives for the treatment of chronic obstructive pulmonary disease with acute lower respiratory infection, cephalosporins in the treatment of a mouth abscess, constipation was treated with penicillin antibacterials, abdominal cramps were treated with penicillin anti-infectives, penicillin antibacterials for the treatment of nausea, local anaesthetic eye preparations for the treatment of pain, corticosteroids for systemic treatment of allergies, other gastrolytes for the treatment of conditions with a unknown diagnosis, family planning received treatment with cephalosporin anti-infectives. Refer to appendix D.22.

5.5.5.5 Comprehensive summary of total cost for pharmacological groups

The total cost of the top 10 different pharmacological groups is given in appendix D.23. Table 66 indicates the top three pharmacological groups according to total cost.

TABLE 66: Top three pharmacological groups according to total cost

Pharmacological group	In- and outpatients		
	Rank	Cost (Rand)	%*
Antiviral	1	55 001.81	24.48
Analgesics, non opioids including NSAIMs, gold & antigout preparations	2	46 092.52	20.52
Anti-bacterial (penicillins)	3	37 482.28	16.68
Total of top 3 pharmacological groups		**138 576.61**	**61.68**

*Percentage was calculated for pharmacological groups according to total cost

Antiviral drugs were ranked fourth for inpatients but first for outpatients. Antivirals had a total cost of R9 293.36 for inpatients and R45 708.45 for outpatients. Combined, antiviral medication had a total cost of R55 001.81 (N = 224 677.10) during the study period. This represented 24.48% of the total cost.

This was in line with the top three budget groups identified according to their total cost. Anti-infective were the budget group with the highest total cost and represented 50.88% of the total cost of all budget groups (see appendix D.18 and 5.5.4.5).

Analgesics, non-opioids including NSAIMS, gold and antigout preparations were ranked second for both in- and outpatients. In the inpatients department, the total cost was R27 895.35 (22.92%) and for outpatients R18 197.17 (17.67% of the total cost, N = R224 677.10). Combined, the total cost was R46 092.52 which was 20.52% of the total cost for pharmacological groups. This was in line with the budget group pain relievers which was ranked second with a total cost of 20.90% of all budget groups (see appendix D.18 and 5.5.4.5).

Although penicillin antibiotics were ranked first for inpatients as the highest total cost for pharmacological groups (R32 735.43), it was in fourth place in the outpatient department (R4 746.85). When added together, penicillin antibiotics had a total cost of R37 482.28 which was 16.68% of the total cost (N = R224 677.10). Penicillin antibiotics was part of the anti-infective budget group. This result was in line with the top three budget group results according to total cost. Anti-infectives represented 50.88% of the total cost of all budget groups (see appendix D.18 and 5.5.4.5).

The top three pharmacological groups based on total cost during the study period were antivirals, non-opioid analgesics and penicillin antibiotics. Together, the total cost of these three pharmacological groups was R138 576.61 which was 61.68% of the total cost.

Other pharmacological groups which appeared in both the inpatient and outpatient top 10 according to total cost was: anti-infectives (cephalosporins) with a total cost of R15 825.63 (13.00%) only in the inpatient department, antihypertensive drugs had a total cost of R14 467.55 (5.91%) and anti-epileptic medication which represented 2.90% (R6 530.98) of the total cost (N = R224 677.10).

The top 10 pharmacological groups in the inpatient department represented 88.81% (R108 087.87) of the total cost for inpatients (n = R121 711.94). The top 10 pharmacological groups represented 89.10% (R91 738.48) of the outpatient department's total cost (n = R102 965.16).

5.5.6 Therapeutic codes

Therapeutic codes refer to the individual medicine items / drugs as prescribed by health care workers and dispensed to patients by pharmacists.

5.5.6.1 Average cost per medicine item according to therapeutic codes

In appendix D.24 the average cost per medicine item according to therapeutic code is given. In this section items with a total cost percentage ≥ 3.00% and/or items with a CPI ≥ 2.00 are included. *The N-value refers to the total prevalence or total cost for that specific therapeutic code for either inpatients of outpatients.*

5.5.6.1.1 Inpatients

a) Anti-infective drugs

Ampicillin 500mg injection represented 14.70% of the total cost (n = R17 889.42) and had an average cost of R121.70 ± 100.80. The CPI was 6.29 despite the high prevalence (n = 147). Refer to table 67.

TABLE 67: Anti-infective drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in inpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Ampicillin Inj 500mg	147	2.34	121.70 ± 100.80	17889.42	14.70	6.29
Cloxacillin IV Inj 500mg	20	0.32	73.70 ± 45.23	1473.96	1.21	3.81
Ketoconazole Tabs 200mg 30s	20	0.32	40.21 ± 37.20	804.29	0.66	2.08
Cefazolin Inj 500mg	10	0.16	429.69 ± 370.36	4296.89	3.53	22.20
Ceftriaxone IM Inj 250mg	30	0.48	312.20 ± 301.93	9366.00	7.70	16.13
Efavirenz Caps 200mg 90s	12	0.19	76.94 ± 50.95	923.34	0.76	3.98
Efavirenz Caps 600mg 30s	12	0.19	193.05 ± 98.80	2316.62	1.90	9.97

*Percentage was calculated for therapeutic codes according to frequency for inpatients
**Percentage was calculated for therapeutic codes according to total cost for inpatients

Cloxacillin 500mg IV injection was prescribed 20 times (N = 6 288 for inpatients) with an average cost of R73.70 ± 45.23 per medicine item.

Ketoconazole tablets 200mg (30s) had a CPI of 2.08 and an average cost of R40.21 ± 37.20. The prevalence of the product was 20 (N = 6 288 for inpatients).

Cefacilin 500mg injection had a CPI value of 22.20 and an average cost per medicine item of R429.69 ± 370.36.

Ceftriaxone 250mg IM injection had a total cost of R9 366.00 which was 7.70% of the total cost. The prevalence of ceftriaxone during the study period was 30 which was relatively high. The CPI of 16.13 represented an abnormality between the prevalence and the cost of the product. The average cost per items was R312.20 ± 0301.93.

Efavirenz 200mg capsules (90s) which were used in antiretroviral drug therapy had a CPI of 3.98. This product was used with a frequency of 12 which had a total cost of R923.34 (N = R121 712.14). Refer to table 67.

Efavirenz 600mg capsules (30s) had an average cost of R193.05 ± 98.80. This product had a prevalence of 12 and a CPI of 9.97 which indicated that this medicine item was relatively expensive.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): ciprofloxacin injection for iv infusion 2mg/ml (100ml), fluconazole capsules 50mg (14s), fluconazole injection for iv infusion 2mg/ml (100ml), erythromycin 1g iv injection, cefotaxime 500mg injection, and lopinavir 60ml syrup. Refer to appendix D.24.

b) Cardiovascular drugs

Enalapril 5mg tablets (28s) had a CPI of 7.08 and a prevalence of 17. The high average cost per medicine item (R137.11 ± 154.60) explains the high CPI. Refer to table 68.

Nifedipine 60mg slow release tablets (28s) had a prevalence of 19 and a high CPI value of 2.13. The average cost per item was below R42.00. Refer to table 68.

Tranexamic acid 100mg/ml injection (5ml) had a CPI of 4.79. The average cost per item was R92.70 ± 72.55 and it had a prevalence of 19 (N = 6 288 for inpatients).

TABLE 68: Cardiovascular drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in inpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Enalapril Tabs 5mg 28s	17	0.27	137.11 ± 154.60	2330.80	1.92	7.08
Nifedipine Tabs Sr 60mg 28s	19	0.30	41.22 ± 33.97	783.23	0.64	2.13
Tranexamic acid Inj 100mg/ml 5ml 5s	19	0.30	92.70 ± 72.55	1761.31	1.45	4.79

*Percentage was calculated for therapeutic codes according to frequency for inpatients
**Percentage was calculated for therapeutic codes according to total cost for inpatients

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): mannitol injections for IV use 20% (50ml) and balanced heparin 1250 IU/ml 5ml (5s). Refer to appendix D.24.

c) Dermatological drugs

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): miconazole nitrate oral gel 2% 30g, podophyllum resin 25g, and silver sulphadiazine 500g cream. Refer to appendix D.24.

d) Endocrine drugs

TABLE 69: Endocrine drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in inpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Insulin actraphane Hm 100IU/ml 10ml	17	0.27	51.21 ± 31.82	870.51	0.72	2.65
Hydrocortisone sodium succ Inj 100mg/2ml 2ml 5s	27	0.43	75.21 ± 68.95	2030.57	1.67	3.89

*Percentage was calculated for therapeutic codes according to frequency for inpatients
**Percentage was calculated for therapeutic codes according to total cost for inpatients

Actraphane Hm 100 IU/ml insulin (10ml) had a CPI of 2.65 and a prevalence of 17. Refer to table 69.

Hydrocortisone sodium succinate 100mg/2ml injection (2ml) had a CPI of 3.89 and a prevalence of 27. The average cost per item was high on R75.21 ± 68.95.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): medroxyprogesterone 5mg tablets (30s), Actraphane Hm 100 IU/ml 3ml penset; glucagon 1mg injection (1ml), and prednisone 5mg tablets (100s). Refer to appendix D.24.

e) Functional drugs

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): phenobarbitone vitamin nicot syrup (100ml), phenytoin 50mg/ml injection (5ml), sodium valproate liquid sugar free syrup (300ml), carbidopa 25mg & levodopa 250mg (100s); chlorpromazine 50mg tablets (500s), and haloperidol 5mg/ml injection (1ml). Refer to appendix D.24.

f) Gastrolyte drugs

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): sodium chloride 0.9% injection (200ml) and sodium alginate in a hydro-active base (50g). Refer to appendix D.24.

g) Pain reliever drugs

TABLE 70: Pain reliever drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in inpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Diclofenac Inj 25mg/ml 3ml	77	1.22	337.40 ± 361.68	25979.65	21.35	17.43

*Percentage was calculated for therapeutic codes according to frequency for inpatients
**Percentage was calculated for therapeutic codes according to total cost for inpatients

Diclofenac 25mg/ml injection (3ml) had an average cost of R337.40 ± 361.68 and a total cost of R25 979.65 (21.35% of the total cost for inpatients). The prevalence of the product was 77. The CPI was 17.43 which was in correlation with the high average cost per item and the high prevalence. Further investigation was needed. According to Harmzen (2008) the average cost for Micro-Diclofenac® 75mg/ml (the trade name used by Thusong Hospital according to their

price list report on July 24th 2007) was R1.99 ± 6.40 during 2006 in the private health sector according to the data from a medicine claims database. This raises concern on why the price per pack for Thusong Hospital was R115.47 and needs further investigation.

Paracetamol codeine phosphate 500mg/8ml tablets (20s) had a CPI value of more than 2.00 but a frequency of less than 10. Refer to appendix D.24.

h) Respiratory drugs

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): budesonide MDI 200mg and rifampicin 150mg, pyrazinamide 400mg, isoniazid 75mg & ethambutol 275mg tablets (100mg). Refer to appendix D.24.

i) Conclusion

From the inpatients' information balanced heparin 1250 IU/ml 5ml (5s) had the highest average cost per item (R2764.80) and the highest CPI (162.81). The second highest CPI was for erythromycin 1g IV injection (28.54) and third was erythromycin 1g IV injection with a CPI of 25.30. Amoxycillin with clavulanic acid 1000mg/200mg injection (1.2g), ampicillin 500mg injection, ceftriaxone 250mg IM injection, ceftriaxone 1g injection and diclofenac 25mg/ml injection (3ml) are products where the prevalence of the product was high and not in correlation with the total cost of the item and resulted in high CPI values.

5.5.6.1.2 Outpatients

a) Anti-infective drugs

Ketoconazole 200mg tablets (30s) had a CPI of 3.14 and a prevalence of 15. The average cost per medicine item was R58.89 ± 29.79. Refer to table 71.

Efavirenz 50mg capsules (30s) had an average cost of R524.59 ± 185.56 and a CPI of 27.94. The product had a prevalence of 11 and contributed 5.61% of the total cost (N = R102 893.03 for outpatients).

TABLE 71: Anti-infective drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in outpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Outpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Ketoconazole Tabs 200mg 30s	15	0.27	58.89 ± 29.79	883.38	0.86	3.14
Efavirenz Caps 50mg 30s	11	0.20	524.59 ± 185.56	5770.54	5.61	27.94
Efavirenz Caps 200mg 90s	18	0.33	87.08 ± 51.64	1567.49	1.52	4.64
Efavirenz Caps 600mg 30s	97	1.77	261.39 ± 59.93	25354.40	24.64	13.92
Lamivudine Tabs 150mg 60s	155	2.83	41.90 ± 8.17	6494.33	6.31	2.23
Nevirapine Tabs 200mg 60s	53	0.97	38.03 ± 14.89	2015.53	1.96	2.03

*Percentage was calculated for therapeutic codes according to frequency for outpatients
**Percentage was calculated for therapeutic codes according to total cost for outpatients

Efavirenz 200mg capsules (90s) had a CPI of 4.64 but the usage reached a maximum of 18 during the study period. Refer to table 71.

Efavirenz 600mg capsules (30s) had a total cost of R25 354.40 (24.64% of total cost) and a CPI of 13.92. This product had a prevalence of 97 and the CPI value indicated that this medicine item was relatively expensive.

Lamivudine 150mg tablets (60s) had a CPI of 2.23 and a 6.31% of the total cost. The prevalence of this product was 155. The cost-prevalence ratio was high and indicated that this medicine item was relatively expensive.

Nevirapine 200mg tablets (60s) had a CPI of 2.03 although the prevalence was 53. This CPI ratio indicated that this medicine item was relatively expensive. Refer to table 71.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): ciprofloxacin 2mg/ml injection for iv infusion (100ml), fluconazole 200mg capsules (28s), nalidixic acid 500mg tablets (100s), cefazoline 500mg injection, ceftriaxone 250mg IM injection, metronidazole 200mg tablets (60s), lamivudine 10mg/ml oral solution (240ml); and stavudine 200ml solution. Refer to appendix D.24.

b) Cardiovascular drugs

TABLE 72: Cardiovascular drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in outpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Outpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Nifedipine Tabs Sr 60mg 28s	44	0.80	59.05 ± 5.70	2598.33	2.53	3.15
Spironolactone Tabs 25mg 240s	11	0.20	42.96 ± 27.68	472.51	0.46	2.29

*Percentage was calculated for therapeutic codes according to frequency for outpatients
**Percentage was calculated for therapeutic codes according to total cost for outpatients

Nifedipine 60mg slow release tablets (28s) had a CPI of 3.15 and a frequency of 44 (N = 5 480 for outpatients). The average cost per medicine item was R59.05 ± 5.70. Refer to table 72.

Spironolactone 25mg tablets (240s) have a CPI of 2.29. The prevalence was 11 and the average cost per item was below R43.00. The simultaneously use of spironolactone and potassium supplements must be avoid. Refer to table 72.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): enalapril 5mg tablets (28s), prazosin 5mg tablets (30s), tranexarnic acid 100mg/ml injection (5ml), tranexamic acid 500mg tablets (60s) and ferrous lactate drops eq 2mg Fe/ml (10ml). Refer to appendix D.24.

c) Dermatological drugs

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): miconazole nitrate cream 2% 40mg, miconazole nitrate oral gel 2% 30g, nystatin vaginale cream 100 000IU 60g, podophyllum resin 25g, zinc sulphate 500g grade, and amethocaine cream 1% 25g. Refer to appendix D.24.

d) Endocrine drugs

Actraphane Hm 100IU/ml insulin (10ml) had a prevalence of 16. The CPI was 4.40. The average cost was high at R82.56 ± 41.30. See table 73.

TABLE 73: Endocrine drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in outpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Outpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Insulin actraphane Hm 100IU/ml 10ml	16	0.29	82.56 ± 41.30	1320.95	1.28	4.40

*Percentage was calculated for therapeutic codes according to frequency for outpatients
**Percentage was calculated for therapeutic codes according to total cost for outpatients

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): medroxyprogesterone 5mg tablets (30s), progesterone conj vaginal cream (42.5g), and protaphane Hm 100IU/ml insulin (3ml penset). Refer to appendix D.24.

e) Functional drugs

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): carbamazepine 100mg/5ml suspension (250ml), sodium valproate liquid sugar free syrup (300ml), sodium valproate 300mg Cr tablets (84s), valproic acid 150mg capsules (56s), valproic acid 500mg capsules (100s), and bromocriptine mesylate 2.5mg tablets (30s). Refer to appendix D.24.

f) Pain reliever drugs

TABLE 74: Functional drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in outpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Outpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Diclofenac Inj 25mg/ml 3ml	103	1.88	114.85 ± 0	11829.90	11.50	6.12
Paracetamol codeine phos Tabs 500mg/8mg 20s	32	0.58	126.78 ± 60.26	4057.06	3.94	6.75

*Percentage was calculated for therapeutic codes according to frequency for outpatients
**Percentage was calculated for therapeutic codes according to total cost for outpatients

Diclofenac 25mg/ml injection (3ml) had an total cost of R11 829.90 (11.50% of total cost). The prevalence of this product was 103. Despite the high prevalence the CPI was also high (6.12).

This needs further investigation in order to find a more cost-effective alternative. See section 5.5.6.1.1 (g).

Paracetamol and codeine phosphate 500mg/8mg tablets (20s) had a CPI of 6.75 and a prevalence of 32. This product contributes 3.94% of the total cost for outpatients. The average cost per item was R126.78 ± 60.26. Refer to table 74.

g) Immunological drugs

Anti-rabies human immunoglobulin vaccine (150Iu) and rabies vaccine 1.5Iu/dose (single dose) had a CPI value of more than 2.00 but the frequency of these drugs was less than 10. Refer to appendix D.24.

h) Respiratory drugs

Beclomethasone MDI 100mg (200 dose) had a CPI of 2.16 and was prescribed 13 times which represented 0.51% of total prevalence (N = 5 480 for outpatients).

Rifampicine 50mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg (100s) was prescribed 24 times. The CPI of 2.26 was an indication of the uneven ratio between the cost and prevalence. Refer to table 75.

TABLE 75: Respiratory drugs with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in outpatients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Therapeutic code	Outpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Beclomethasone MDI 100mg 200 dose	13	0.24	40.51 ± 0.00	526.60	0.51	2.16
Rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg 100s	24	0.44	42.78 ± 9.32	1020.24	0.99	2.26

*Percentage was calculated for therapeutic codes according to frequency for outpatients
**Percentage was calculated for therapeutic codes according to total cost for outpatients

Budesonide MDI 200mg (300 dose) had a CPI value of more than 2.00 but the frequency was less than 10. Refer to appendix D.24.

i) Conclusion

According to the outpatients department's information, efavirenz 50mg capsules (30s) had the highest CPI of 27.94 and a average cost of R524.59 ± 185.56. The second highest CPI was enalapril 5mg tablets (28s) with a CPI of 24.45. Anti-rabies human immunoglobulin vaccine (150IU) and the rabies vaccine 1.5Iu/dose (single dose) both had a CPI of 17.28 which was the third highest CPI for outpatients. Efavirenz 600mg capsules (30s) had a total cost of R25 354.40 which was 24.64% of total cost for the outpatient department. Diclofenac 3ml injections contributed 11.50% of the total cost with a total of R11 829.90. Lamivudine 150mg tablets (60s), nevirapine 200mg tablets (60s) and diclofenac 25mg/ml injection (3ml) were drugs that needed further investigation.

5.5.6.1.3 Summary

The following drugs were identified who had a CPI above 2 for both in- and outpatient departments: ciprofloxacin 2mg/ml injection of iv infusion (100ml), ketoconazole 200mg tablets (30s), cefazolin 500mg injection; ceftriaxone 250mg IM injection, efavirenz 200mg capsules (90s), efavirenz 600mg capsules (30s), enalapril 5mg tablets (28s), nifedipine slow release 60mg tablets (28s), tranexamic acid 100mg/ml injection (5ml), miconazole nitrate oral gel (30g), podophyllum resin (25g), medroxyprogesterone 5mg tablets (30s), actraphane Hm 100iu/ml insulin (10ml), sodium valproate liquid sugar free syrup (300ml), diclofenac 25mg/ml injection (3ml), paracetamol codeine phosphate tablets (20s), and budesonide MDI 200mg (300 doses).

5.5.6.2 Average cost per medicine item according to therapeutic codes and gender

The average cost per medicine item according to therapeutic code and gender is given in appendix D.25. Tables 76 and 77 summarise the therapeutic codes within these parameters.

- **Male patients**

The N-values refer to the total prevalence or total cost for male inpatients or outpatients.

The average cost per medicine item for amoxycillin with clavulanic acid 1000mg/200mg injection in male inpatients (R102.72 ± 76.41) represented 3.02% of the total cost (N = R44 198.87). The CPI value of 5.25 confirmed that this product was relatively expensive.

TABLE 76: Therapeutic codes with a total cost of more than 3.00% and a CPI value of more than 2.00 in male patients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Gender	Therapeutic code	Inpatients						Outpatients					
		Prevalence		Cost			CPI	Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%		n	%	Mean & std dev	R	%	
Male	Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g	13	0.58	102.72 ± 76.41	1335.36	**3.02**	**5.25**						
	Ampicillin Inj 500mg	57	2.52	108.61 ± 91.15	6191.05	**14.01**	**5.55**	2	0.10	16.32 ± 0	32.64	0.08	0.81
	Cloxacillin IV Inj 500mg	15	0.66	78.38 ± 49.15	1175.76	2.66	**4.01**						
	Ceftriaxone IM Inj 250mg	14	0.62	341.40 ± 311.90	4779.60	**10.81**	**17.46**						
	Ceftriaxone Inj 1g	25	1.11	39.43 ± 43.47	985.77	2.23	**2.02**	3	0.14	9.24 ± 0	27.73	0.07	0.46
	Efavirenz Caps 200mg 90's	9	0.40	64.94 ± 31.11	584.48	1.32	**3.32**	12	0.57	85.12 ± 51.83	1021.41	2.42	**4.22**
	Efavirenz Caps 600mg 30's	5	0.22	247.34 ± 0	1236.72	2.80	**12.65**	42	2.00	259.12 ± 53.31	10883.14	**25.75**	**12.84**
	Lamivudine Tabs 150mg 60's	5	0.22	42.97 ± 0	214.83	0.49	**2.20**	43	2.05	42.55 ± 9.58	1829.58	**4.33**	**2.11**
	Nifedipine Tabs SR 60mg 28's	5	0.22	38.93 ± 28.82	194.65	0.44	1.99	15	0.72	57.39 ± 9.76	860.88	2.04	**2.84**
	Insulin actraphane Hm 100iu/ml 10ml	3	0.13	73.39 ± 0	220.16	0.50	**3.75**	14	0.67	83.87 ± 44.19	1174.18	2.78	**4.16**
	Carbamazepine CR Tabs 400mg 30's	3	0.13	14.09 ± 18.82	42.25	0.10	0.72	36	1.72	35.64 ± 17.20	1282.93	**3.04**	1.77
	Diclofenac Inj 25mg/ml 3ml	36	1.59	288.69 ± 308.00	10392.66	**23.51**	**14.76**	51	2.43	113.44 ± 14.55	5785.25	**13.69**	**5.62**
	Paracetamol codeine phos Tabs 500mg/8mg 20's	4	0.18	56.29 ± 43.81	225.18	0.51	**2.88**	11	0.53	115.47 ± 0	1270.21	**3.01**	**5.72**

Ampicillin 500mg injections represented 14.01% of the total cost for male inpatients (N = R44 198.87) and had an average cost of R108.61 ± 91.15 per item which was confirmed by the CPI value of 5.55 as relatively expensive.

Cloxacillin 500mg IV injection had a CPI value of 4.01 in male inpatients which indicated, according to the average cost of R78.38 ± 49.15 per medicine item, that the product was relatively expensive. Refer to table 76.

Ceftriaxone 250mg IM injection represented 10.81% of the total cost for male inpatients and the CPI value of 17.46 indicated that the treatment was relatively expensive with an average cost of R341.40 ± 311.90. Refer to table 76.

Ceftriaxone 1g injections had a CPI value of 2.02 which indicated that the average cost of R39.43 ± 43.47 was relatively expensive for male inpatients.

Efavirenz 200mg capsules had a CPI value of 4.22 for outpatients. This indicate that efavirenz treatment was relatively expensive.

Efavirenz 600mg capsules represented 25.75% of the total cost for male outpatients with an average cost of R259.12 ± 53.31 per medicine item. The CPI value was 12.84 for outpatients which confirmed that efavirenz was relatively expensive.

Lamivudine 150mg tablets represented 4.33% of the total cost for male outpatients and the CPI value of 2.11 for outpatients indicated that treatment was relatively expensive.

Nifedipine 60mg SR tablets had a CPI value of 2.84 for male outpatients which indicated that the average cost of R57.39 ± 9.76 was relatively expensive. Refer to table 76.

Actraphane Hm insulin 100IU/ml had a CPI value of 4.16 for outpatients. The therapy was relatively expensive due to the limited use of insulin only in patients with type 1 diabetes.

Carbamazepine 400mg Cr tablets represented 3.04% of the total cost (N = R42 265.73) for male outpatients.

Diclofenac 25mg/ml injection represented 23.51% of the total cost for inpatients (N = R44 198.87) and 13.69% of the total cost for outpatients (N = R42 265.73). The average cost per medicine item for inpatients was R288.69 ± 308.00 and the CPI of 14.76 indicated that

this treatment was relatively expensive when used in inpatients. For outpatients the CPI was lower at 5.62 but was still high with an average cost of R113.44 ± 14.55.

Paracetamol with codeine phosphate 500mg/8mg tablets represented 3.01% of the total cost (N = R42 265.73) and the CPI value of 5.72 indicated that this treatment was relatively expensive.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): ciprofloxacin injection for IV infusion (2mg/ml), fluconazole 50mg capsules, fluconazole 2mg/ml injection for IV infusion, ketoconazole 200mg tablets, cefazolin 500mg injection, cefotaxime 500mg injection, efavirenz 50mg capsules, efavirenz 200mg capsules; efavirenz 600mg capsules, lamivudine oral solution, lamivudine 150mg tablets, stavudine d4t 200ml solution, mannitol injection for IV use, enoxaparin prefilled SC syringes, tranexamic acid injection, miconazole nitrate oral gel, nystatin vaginal cream (100 000iu), podophyllum resin 25g, silver sulphadiazine creams, amethocaine cream, actraphane Hm insulin 100IU/ml, carbamazepine 100mg/5ml suspension, phenobarbitone vit nicot syrup, phenytoin 50mg/ml injection, sodium valproate liquid, valproic acid caps 500mg (100s), chlorpromazine 50mg tablets, haloperidol 5mg/ml injection, paracetamol with codeine phosphate 500mg/8mg tablets, immunoglobulin vaccine, rabies vaccine, and budesonide 200mg MDI. Refer to appendix D.25.

- **Female patients**

The N-values refer to the total prevalence or total cost for female inpatients or outpatients.

In female inpatients amoxycillin with clavulanic acid injection had a CPI value of 5.56 which indicate that the average cost per medicine item of R107.05 ± 66.95 was relatively expensive.

Ampicillin 500mg injections represented 15.09% of the total cost (N = R77 514.40) for female inpatients during the study period. The CPI value of 6.75 indicated that the average cost of R129.98 ± 106.11 per medicine item was relatively expensive.

Ketoconazole 200mg tablets had a CPI value of 3.33 for outpatients which indicated that the average cost of R59.66 ± 29.93 was relatively expensive. Refer to table 77.

Ceftriaxone 250mg IM injection represented 5.92% of the total cost for female inpatients and the CPI value of 14.89 indicated that the average cost of R286.65 ± 300.73 was relatively expensive.

TABLE 77: Therapeutic codes with a total cost of more than 3.00% and a CPI value of more than 2.00 in female patients excluding the therapeutic codes with CPI values of more than 2.00 and frequencies of less than 10

Gender	Therapeutic code	Inpatients						Outpatients					
		Prevalence		Cost			CPI	Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%		n	%	Mean & std dev	R	%	
Female	Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g	19	0.47	107.05 ± 66.95	2033.86	2.62	**5.56**						
	Ampicillin Inj 500mg	90	2.24	129.98 ± 106.11	11698.37	**15.09**	**6.75**						
	Ketoconazole Tabs 200mg 30's	19	0.47	37.46 ± 36.06	711.79	0.92	1.95	10	0.30	59.66 ± 29.93	596.63	0.98	**3.33**
	Ceftriaxone IM Inj 250mg	16	0.40	286.65 ± 300.73	4586.40	**5.92**	**14.89**	2	0.06	84.00 ± 0	168.00	0.28	**4.68**
	Efavirenz Caps 600mg 30's	7	0.17	154.27 ± 116.99	1079.90	1.39	**8.01**	55	1.63	263.11 ± 64.96	14471.26	**23.84**	**14.67**
	Lamivudine Tabs 150mg 60's	52	1.29	26.86 ± 18.72	1396.51	1.80	1.39	112	3.31	41.65 ± 7.59	4664.75	**7.68**	**2.32**
	Nevirapine Tabs 200mg 60's	34	0.84	27.81 ± 17.02	945.53	1.22	1.44	53	1.57	38.03 ± 14.89	2015.53	**3.32**	**2.12**
	Enalapril Tabs 5mg 28's	16	0.40	143.64 ± 157.22	2298.21	2.96	**7.46**	3	0.09	459.00 ± 0	1377.00	2.27	**25.59**
	Furosemide Tabs 40mg 28's	26	0.65	27.61 ± 32.11	717.77	0.93	1.43	26	0.77	38.75 ± 24.52	1007.49	1.66	**2.16**
	Nifedipine Tabs SR 60mg 28's	14	0.35	42.04 ± 36.60	588.58	0.76	**2.18**	29	0.86	59.91 ± 0	1737.45	2.86	**3.34**
	Tranexamic acid Inj 100mg/ml 5ml 5's	12	0.30	105.30 ± 86.59	1263.55	1.63	**5.47**	3	0.09	38.29 ± 0	114.87	0.19	**2.13**
	Insulin actraphane Hm 100Iu/ml 10ml	14	0.35	46.45 ± 33.29	650.35	0.84	**2.41**	2	0.06	73.39 ± 0	146.77	0.24	**4.09**
	Hydrocortisone sodium succ Inj 100mg/2ml 2ml 5's	18	0.45	97.06 ± 74.19	1747.11	2.25	**5.04**	3	0.09	23.77 ± 10.29	71.31	0.12	1.33
	Colchicine Tabs 1mg 60's							52	1.54	116.24 ± 5.55	6044.65	**9.96**	**6.48**
	Diclofenac Inj 25mg/ml 3ml	41	1.02	380.17 ± 401.90	15586.99	**20.11**	**19.75**						
	Paracetamol codeine phos Tabs 500mg/8mg 20's	2	0.05	115.47 ± 0	230.95	0.30	**6.00**	21	0.62	132.71 ± 74.31	2786.85	**4.59**	**7.40**
	Beclomethasone MDI 100mg 200 dose							10	0.30	40.51 ± 0.00	405.08	0.67	**2.26**

Efavirenz 600mg capsules (30s) represented 23.84% of the total cost for outpatients (N = R60 699.73) with an average cost of R263.11 ± 64.96 and a CPI value of 14.67 which indicated that this product was relatively expensive.

Lamivudine 150mg tablets (60s) represented 7.68% of the total cost for outpatients (N = R60 699.73) and the CPI value of 2.32 indicate that this was relatively expensive.

Nevirapine 200mg tablets (60s) represented 3.32% of the total cost for outpatients. The CPI value of 2.12 indicated that this treatment was relatively expensive. Refer to table 77.

Enalapril 5mg tablets (28s) had a CPI value of 7.46 for inpatients which indicate that the average cost per medicine item of R143.64 ± 157.22 was relatively expensive.

Furosemide 40mg tablets (28s) had a CPI value of 2.16 for outpatients which indicated that this product was relatively expensive. Refer to table 77.

Nifedipine 60mg SR tablets were relatively expensive due to the CPI value of 2.18 for inpatients and 3.34 for outpatients.

Tranexamic acid 100mg/ml injection had a CPI value of 5.47 which was high due to the high average cost of R105.30 ± 86.59 per medicine item. Refer to table 77.

Actraphane 100IU/ml insulin (10ml) had a CPI of 2.41 for inpatients. The average cost per medicine item for inpatients was R46.45 ± 33.29 which indicated that the item was relatively expensive.

Hydrocortisone sodium succinate injection had a CPI of 5.04 and as the average cost of R97.06 ± 74.16 confirm, was relatively expensive. Refer to table 77.

Colchicine 1mg tablets (60s) had a CPI value of 7.40 and an average cost per medicine item of 4.59.

Diclofenac 25mg/ml injection represented 20.11% of the total cost for inpatients (N = R77 514.40) and had an average cost of R380.17 ± 401.90 which was relatively expensive according to the CPI value of 19.75. Refer to table 77.

Paracetamol codeine phosphate tablets (20s) had a CPI value of 7.40 and an average cost of R132.71 ± 74.31 per medicine item which was relatively expensive. Refer to table 77.

Beclomethasone 100mg MDI had a CPI value of 2.26 and an average cost of R40.51 per medicine item which was relatively expensive treatment.

The combination drug rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg had a CPI value of 2.42 which indicated that this treatment was relatively expensive.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): benzathine penicillin G injections, ciprofloxacin injection for IV infusion, cloxacillin 500mg IV injection, flucloxacillin 125mg suspension, fluconazole 200mg capsules, fluconazole injection for IV infusion, cefazolin 500mg injection, ceftriaxone 250mg IM injection, erythromycin IV injection, metronidazole 200mg tablets, efavirenz 50mg capsules, efavirenz 200mg capsules, efavirenz 600mg capsules, lamivudine oral solution, lopinavir syrup, prazosin 5mg tablets, spironolactone 25mg tablets, balanced heparin 1250IU/ml, tranexamic acid 500mg tablets (60s), folic acid 5mg tablets (1000s), miconazole nitrate oral gel, zinc sulphate grade (500g), medroxyprogesterone 5mg tablets, oestrogens conj vaginal cream, actraphane 100IU/ml insulin penset (3ml), protaphane 100IU/ml insulin, glucagon 1mg/ml injection; betamethasone 0.5mg tablets (100s), prednisone 5mg tablets 100s), phenytoin 50mg/ml injection, sodium valproate liquid, sodium valproate 300mg Cr tablets, valproic acid 150mg capsules, bromocriptine mesylate 2.5mg tablets, carbidopa 25mg and levodopa 250mg, haloperidol 5mg/ml injection, sodium alginate in a hydro-active vase (50g), paracetamol codeine phosphate tablets (20s), budesonide 200mg MDI, fenoterol 0.5mg/2ml UDV, rifampicin 150mg, pyrazinamide 400mg; and isoniazid 75mg and ethambutol 275mg. Refer to appendix D.25.

5.5.6.3 Average cost per medicine item according to therapeutic codes and age groups

The average cost per medicine item according to therapeutic code and age group is given in appendix D.26. Tables 78-82 summarise the therapeutic codes according to the different age groups which had a total cost of more than 5.00% and a CPI value of more than 3.00 and exclude therapeutic codes with high CPI values (more than 3.00) and frequencies of less than 10. *The N-values refer to total frequency or total cost for either inpatients or outpatients in different age groups.*

- **< 0 ≤ 6 years**

TABLE 78: Therapeutic codes with a total cost of more than 5.00% and/or a CPI value of more than 3.00 in paediatrics excluding the therapeutic codes with CPI values of more than 3.00 and frequencies of less than 10

Age group (years)	Therapeutic group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 0 ≤ 6 years	Ampicillin Inj 250mg	84	7.69	10.95 ± 12.71	919.73	6.94	0.90
	Ampicillin Inj 500mg	14	1.28	24.24 ± 25.57	339.41	2.56	2.00
	Ceftriaxone IM Inj 250mg	28	2.56	259.50 ± 226.81	7266.00	54.85	21.39
	Co-trimoxazole Susp 200/40mg/5ml 50ml	93	8.52	1.51 ± 2.61	140.25	1.06	0.12
	Paracetamol Syr 120mg/5ml 50ml	83	7.60	1.29 ± 0.82	107.00	0.81	0.11
	Therapeutic group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Ampicillin Inj 250mg						
	Ampicillin Inj 500mg						
	Ceftriaxone IM Inj 250mg	2	0.70	84.00 ± 0	168.00	6.34	9.07
	Co-trimoxazole Susp 200/40mg/5ml 50ml	19	6.64	5.07 ± 6.37	96.31	3.64	0.55
	Paracetamol Syr 120mg/5ml 50ml	48	16.78	2.16 ± 0.29	103.62	3.91	0.23

*Percentage was calculated for therapeutic codes according to frequency for inpatients and outpatients in the paediatric age group
**Percentage was calculated for therapeutic codes according to total cost for inpatients and outpatients in the paediatric age group

Ampicillin 250mg injection represented 6.94% of the total cost for inpatients (N = R13 246.36) in this age group.

The ampicillin 500mg injection had a CPI value of 2.00 which indicate that 24.24 ± 25.57 was relatively expensive for inpatients. Refer to table 78.

Ceftriaxone 250mg IM injection was a popular anti-infective drug. This medicine item represented 54.85% of the total cost for inpatients (N = R13 246.36) and had a CPI value of 21.39 which indicated that R259.50 ± 226.81 was a relatively expensive average cost per medicine item. Refer to table 78.

Co-trimoxazole 200mg/40mg/5ml suspension represented 3.64% of the total cost for outpatients (N = R2 648.94) in this age group. The average cost was relatively inexpensive at R5.07 ± 6.37.

Paracetamol syrup represented 3.91% of the total cost for outpatients (N = R2 648.94) in this age group (> 0 ≤ 6 years). The average cost per medicine item was R2.16 ± 0.29 which was relatively inexpensive (CPI = 0.23).

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): amoxycillin with clavulanic acid 125mg/31.25mg suspension, benzathine penicillin G injection, clindamycin 150mg capsules, nalidixic acid 250mg/ml suspension, ceftriaxone 250mg IM injection, efavirenz 200mg capsules, lamivudine 10mg/ml oral solution, lopinavir syrup, stavudine d4t solution, ferrous lactate drops, miconazole nitrate oral gel, podophyllum resin, oestrogens conj vaginal cream, dexamethasone IM injection, hydrocortisone sodium succinate injection, prednisone syrup, carbamazepine suspension, clonazepam injection, phenobarbitone vitamin nicot syrup, sodium valproate liquid, hyoscine-n-butylbromide syrup, electrolyte No 2 solution, and salbutamol UDV inhaler. Refer to appendix D.25.

- **> 6 ≤ 12 years**

Efavirenz 50mg capsules represented 69.50% of the total cost for outpatients (N = R8 302.90) in this age group. The CPI value of 14.28 indicated that efavirenz was relatively expensive with an average cost of R524.59 ± 185.56. Refer to table 79.

Efavirenz 200mg capsules represented 9.55% of the total cost (N = R8 302.90) with an average cost of R72.09 ±19.67.

Enalapril 5mg tablets represented 32.12% of the total cost in inpatients with a CPI value of 6.79 which indicates that the average cost per medicine item of R127.86 ±141.13 is relatively expensive.

TABLE 79: Therapeutic codes with a total cost of more than 5.00% and/or a CPI value of more than 3.00 in children excluding the therapeutic codes with CPI values of more than 3.00 and frequencies of less than 10

Age group (years)	Therapeutic group	Inpatients					
		Prevalence		Cost			CPI
		n	%*	Mean & std dev	R	%**	
> 6 ≤ 12 years	Efavirenz Caps 50mg 30s						
	Efavirenz Caps 200mg 90s	4	1.35	62.45 ± 33.57	249.82	4.48	3.32
	Enalapril Tabs 5mg 28s	14	4.73	127.86 ± 141.13	1790.10	32.12	6.79
	Therapeutic group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%*	Mean & std dev	R	%**	
	Efavirenz Caps 50mg 30s	11	4.87	524.59 ± 185.56	5770.54	69.50	14.28
	Efavirenz Caps 200mg 90s	11	4.87	72.09 ± 19.67	792.99	9.55	1.96
	Enalapril Tabs 5mg 28s						

*Percentage was calculated for therapeutic codes according to frequency for inpatients and outpatients in the children age group
**Percentage was calculated for therapeutic codes according to total cost for inpatients and outpatients in the children age group

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): ampicillin 500mg injection, cloxacillin IV injection, fluconazole injection, cefotaxime 500mg injection, efavirenz 200mg capsules, lamivudine oral suspension, lopinavir syrup, sodium valproate liquid, and sodium valproate CR tablets. Refer to appendix D.26.

- **> 12 ≤ 19 years**

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): amoxycillin with clavulanic acid injection, ampicillin 500mg injection, ciprofloxacin injection for IV infusion, fluconazole injection for IV infusion, gentamicin 80mg/2ml, ketoconazole 200mg tablets, nitrofurantoin 100mg capsules, ceftriaxone IM injection, ceftriaxone injection, erythromycin 250mg tablets, tranexamic acid injection, tranexamic acid 500mg tablets, aluminium hydroxide suspension, diclofenac 25mg/ml injection, paracetamol with codeine phosphate tablets, and beclomethasone MDI. Refer to appendix D.26.

- **> 19 ≤ 40 years**

In the age group of junior adults (> 19 ≤ 40 years), amoxycillin with clavulanic acid injection represented 4.20% of the total cost for inpatients (N = R50 401.84) and the CPI value of 4.40 indicated that this medicine item was relatively expensive and was confirmed by the average cost per medicine item of R105.80 ± 67.41. Refer to table 80.

Ampicillin 500mg injection represented 17.58% of the total cost for inpatients (N = R50 401.84). The CPI value of 5.42 confirmed that the average cost per medicine item of R130.30 ± 89.11 was relatively expensive.

Ketoconazole 200mg tablets had a CPI value of 3.64 for outpatients in this age group. The average cost per medicine item was R63.47 ± 29.41 and was according to the CPI value relatively expensive. Refer to table 80.

Efavirenz 600mg capsules represented 3.61% of the total cost for inpatients (N = R50 401.84) and had a CPI value of 7.57 which indicated that the average cost of R182.19 ±105.57 was relatively expensive. For outpatients, efavirenz 600mg capsules represented 24.95% of the total cost and as the CPI value of 14.69 confirmed, the average cost of R256.17 ± 51.45 per medicine item was relatively expensive.

Lamivudine 150mg tablets represented 9.90% of the total cost for outpatients (N = R34 913.61) in this age group. The CPI value of 2.39 indicated that the average cost of R41.66 ± 5.14 was relatively expensive.

Nevirapine 200mg tablets represented 5.28% of the total cost in outpatients and the CPI value of 2.20 indicates that the treatment was relatively expensive. Refer to table 80.

Stavudine d4T 40mg capsules represented 3.13% of the total cost for inpatients (N = R50 401.84). Refer to table 80.

Hydrocortisone sodium succinate injection had a CPI value of 3.84 which indicated that the average cost per medicine item of R92.38 ± 62.69 was relatively expensive.

TABLE 80: Therapeutic codes with a total cost of more than 5.00% and/or a CPI value of more than 3.00 in junior adults excluding the therapeutic codes with CPI values of more than 3.00 and frequencies of less than 10

Age group (years)	Therapeutic group	Inpatients					
		Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%	
> 19 ≤ 40 years	Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g	20	0.95	105.80 ± 67.41	2116.03	4.20	4.40
	Ampicillin Inj 500mg	68	3.25	130.30 ± 89.11	8860.67	17.58	5.42
	Ketoconazole Tabs 200mg 30s	14	0.67	40.30 ± 41.60	564.25	1.12	1.68
	Efavirenz Caps 600mg 30s	10	0.48	182.19 ± 105.57	1821.94	3.61	7.57
	Lamivudine Tabs 150mg 60s	30	1.43	32.62 ± 16.55	978.70	1.94	1.36
	Nevirapine Tabs 200mg 60s	17	0.81	32.32 ± 14.56	549.47	1.09	1.34
	Stavudine d4T Caps 40mg 60s	11	0.53	19.52 ± 5.54	214.74	0.43	0.81
	Hydrocortisone Sodium succ Inj 100mg/2ml 2ml 5	11	0.53	92.38 ± 62.69	1016.17	2.02	3.84
	Diclofenac Inj 25mg/ml	43	2.05	354.43 ± 363.78	15240.57	30.24	14.73
	Paracetamol Codeine Phos Tabs 500mg/8mg	2	0.10	115.47 ± 0	230.95	0.46	4.80
	Therapeutic group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%	Mean & std dev	R	%	
	Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g						
	Ampicillin Inj 500mg						
	Ketoconazole Tabs 200mg 30s	13	0.65	63.47 ± 29.41	825.10	2.36	3.64
	Efavirenz Caps 600mg 30s	34	1.70	256.17 ± 51.45	8709.70	24.95	14.69
	Lamivudine Tabs 150mg 60s	83	4.15	41.66 ± 5.14	3457.72	9.90	2.39
	Nevirapine Tabs 200mg 60s	48	2.40	38.44 ± 15.11	1845.06	5.28	2.20
	Stavudine d4T Caps 40mg 60s	52	2.60	20.99 ± 1.47	1091.29	3.13	1.20
	Hydrocortisone Sodium succ Inj 100mg/2ml 2ml 5	1	0.05	17.83 ± 0	17.83	0.05	1.02
	Diclofenac Inj 25mg/ml	41	2.05	113.91 ± 17.54	4670.51	13.38	6.53
	Paracetamol Codeine Phos Tabs 500mg/8mg	11	0.55	106.38 ± 30.15	1170.21	3.35	6.10

*Percentage was calculated for therapeutic codes according to frequency for inpatients and outpatients in the junior adult age group

**Percentage was calculated for therapeutic codes according to total cost for inpatients and outpatients in the junior adult age group

Diclofenac 25mg/ml injection represented 30.24% of the total cost for inpatients (N = R50 401.84) and the CPI value of 14.73 indicated that R354.43 ± 363.78 was relatively expensive for an average cost. For outpatients the injection represented 13.38% of the total cost (N = R34 913.61) and the CPI value of 6.53 indicated that this item was relatively expensive with an average cost of R113.91 ± 17.54 per medicine item.

Paracetamol with codeine phosphate represented 3.35% of the total cost with a CPI value of 6.10. The average cost of R106.68 ± 30.15 per medicine item was relatively expensive.

Rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg & ethambutol 275mg had an average cost of R42.05 ± 10.26 per medicine item but the CPI of 2.41 indicated that this medicine item was relatively expensive.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): ciprofloxacin injection, fluconazole 50mg capsules, fluconazole injection for IV infusion, cefazolin 500mg injection, ceftriaxone 250mg IM injection, doxycycline 100mg capsule, metronidazole tabs 200mg (60s), furosemide 40mg tablets, mannitol injection for IV use, spironolactone 25mg tablets, tranexamic acid injection, tranexamic acid 500mg tablets, folic acid 5mg tablets, miconazole nitrate oral gel, podophyllum resin, zinc sulphate 500mg grade, medroxyprogesterone 5mg tablets, actraphane Hm 100IU/ml insulin, prednisone 5mg tablets, phenytoin 50mg/ml injection, valproic acid 500mg capsules, chlorpromazine 50mg tablets, paracetamol with codeine phosphate, beclometazone MDI, budesonide MDI, and rifampicin 150mg, pyrazinamide 400mg, isoniazid 75mg & ethambutol 275mg. Refer to appendix D.26.

- **> 40 ≤ 60 years**

Ampicillin 500mg injection represented 19.86% of the total cost for inpatients (N = R29 941.98) in this age group. The CPI value of 7.63 indicated that the average cost of R152.15 ± 117.91 was relatively expensive.

Efavirenz 600mg capsules (30s) had a CPI value of 5.01 for outpatients during the study period. See table 81 and appendix D.26.

Lamivudine 150mg tablets represented 6.73% of the total cost for outpatients (N = R42 784.67) and the CPI value of 2.03 indicated that this medicine item was relatively expensive.

TABLE 81: Therapeutic codes with a total cost of more than 5.00% and/or a CPI value of more than 3.00 in senior adults excluding the therapeutic codes with CPI values of more than 3.00 and frequencies of less than 10

Age group (years)	Therapeutic group	Inpatients					
		Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%	
> 40 ≤ 60 years	Ampicillin Inj 500mg	39	2.61	152.51 ± 117.91	5947.91	19.86	7.63
	Efavirenz Caps 600mg 30s	2	0.13	247.34 ± 0	494.69	1.65	12.37
	Lamivudine Tabs 150mg 60s	21	1.40	28.92 ± 18.74	607.23	2.03	1.45
	Nifedipine Tabs SR 60mg 28s	11	0.73	35.80 ± 28.19	393.80	1.32	1.79
	Insulin actraphane Hm 100IU/ml 10ml	11	0.73	51.45 ± 31.70	565.95	1.89	2.57
	Carbamazepine CR Tabs 400mg 30s	8	0.53	27.30 ± 15.78	218.42	0.73	1.37
	Diclofenac Inj 25mg/ml 3ml	14	0.94	404.16 ± 461.34	5658.23	18.90	20.21
	Paracetamol codeine phos Tabs 500mg/8mg 20s	2	0.13	69.28 ± 65.32	138.57	0.46	3.46
	Therapeutic group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%	Mean & std dev	R	%	
	Ampicillin Inj 500mg						
	Efavirenz Caps 600mg 30s	63	3.17	264.20 ± 64. 26	323.47	0.76	5.01
	Lamivudine Tabs 150mg 60s	66	3.32	43.61 ± 8.41	2878.37	6.73	2.03
	Nifedipine Tabs SR 60mg 28s	23	1.16	59.91 ± 0	1377.98	3.22	2.79
	Insulin actraphane Hm 100IU/ml 10ml	14	0.70	89.11 ± 39.97	1247.56	2.92	4.14
	Carbamazepine CR Tabs 400mg 30s	49	2.46	30.38 ± 11.57	1488.82	3.48	1.41
	Diclofenac Inj 25mg/ml 3ml	36	1.81	115.47 ± 0	4157.06	9.72	5.37
	Paracetamol codeine phos Tabs 500mg/8mg 20s	12	0.60	115.47 ± 0	1385.69	3.24	5.37

*Percentage was calculated for therapeutic codes according to frequency for inpatients and outpatients in the senior adult age group

**Percentage was calculated for therapeutic codes according to total cost for inpatients and outpatients in the senior adult age group

Nifedipine 60mg SR tablets represented 3.22% of the total cost for outpatients (N = R42 784.67) and the CPI value of 2.79 indicated that this treatment was relatively expensive. Refer to table 81.

Actraphane Hm 100IU/ml insulin had a CPI value of 2.57 for inpatients and 4.14 for outpatients. This indicated that insulin therapy was relatively expensive. Refer to table 81.

Carbamazepine CR tablets represented 3.48% of the total cost for outpatients (N = R42 784.67).

Diclofenac 25mg/ml injection represented 18.90% of the total cost for inpatients and had a CPI value of 20.21 which indicated that this treatment for inpatients was relatively expensive. For outpatients this medicine item represented 9.72% of the total cost and the CPI value of 5.37 indicated that this treatment was relatively expensive.

Paracetamol with codeine phosphate represented 3.24% of the total cost for outpatients with a CPI value of 5.37 for outpatients and 3.46 for inpatients which indicated that this treatment was relatively expensive.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): amoxycillin with clavulanic acid injection, ciprofloxacin injection for IV infusion, cloxacillin 500mg IV injection, fluconazole injection for IV infusion, nitrofurantoin caps 100mg, cefazolin 500mg injection, erythromycin iv injection, metronidazole IV injection, efavirenz 200mg capsules, efavirenz 600mg capsules, enalapril 5mg tablets, balanced heparin, tranexamic acid injection, tranexamic acid tabs 500mg, nystatin vaginal cream, podophyllum resin, silver sulphadiazine cream, amethocaine cream, medroxyprogesterone 5mg tablet, hydrocortisone sodium succinate injections, phenytoin injection, bromocriptine mesylate 2.5mg tablets, haloperidol injection, budesonide MDI, fenoterol UDV, and rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg and ethambutol 275mg. Refer to appendix D.26.

- **> 60 years**

Ampicillin 500mg injections represented 9.81% of the total cost for inpatients (N = R18 459.58) and the CPI value of 6.00 indicated that the treatment was relatively expensive.

Furosemide 40mg tablets represented 4.27% of the total cost for outpatients (N = R12 491.77) and the CPI value of 2.14 indicated that the average cost per medicine item of R33.31 ± 21.73 was relatively expensive.

TABLE 82: Therapeutic codes with a total cost of more than 5.00% and/or a CPI value of more than 3.00 in elderly excluding the therapeutic codes with CPI values of more than 3.00 and frequencies of less than 10

Age group (years)	Therapeutic group	Inpatients					
		Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%	
> 60 years	Ampicillin Inj 500mg	18	1.64	100.63 ± 94.82	1811.30	9.81	6.00
	Furosemide Tabs 40mg 28s	14	1.27	30.68 ± 29.35	429.49	2.33	1.83
	Nifedipine Tabs Sr 60mg 28s	8	0.73	48.68 ± 41.51	389.43	2.11	2.90
	Perindopril Tabs 4mg 28s	60	5.45	5.78 ± 5.54	346.79	1.88	0.34
	Amitriptyline Tabs 25mg 28s	16	1.45	12.61 ± 11.79	201.83	1.09	0.75
	Diclofenac Inj 25mg/ml 3ml	17	1.55	278.50 ± 288.85	4734.43	25.65	16.60
	Therapeutic group	**Outpatients**					
		Prevalence		**Cost**			**CPI**
		n	%	Mean & std dev	R	%	
	Ampicillin Inj 500mg	2	0.25	16.32 ± 0	32.64	0.26	1.05
	Furosemide Tabs 40mg 28s	16	2.00	33.31 ± 21.73	532.99	4.27	2.14
	Nifedipine Tabs Sr 60mg 28s	21	2.62	58.11 ± 8.25	1220.35	9.77	3.73
	Perindopril Tabs 4mg 28s	35	4.37	14.18 ± 4.92	496.39	3.97	0.91
	Amitriptyline Tabs 25mg 28s	21	2.62	20.59 ± 0.87	432.46	3.46	1.32
	Diclofenac Inj 25mg/ml 3ml	19	2.37	115.47 ± 0	2194.01	17.56	7.40

*Percentage was calculated for therapeutic codes according to frequency for inpatients and outpatients in the elderly age group
**Percentage was calculated for therapeutic codes according to total cost for inpatients and outpatients in the elderly age group

Nifedipine 60mg SR tablets represented 9.77% of the total cost for outpatients. The CPI value of 3.73 for outpatients indicated that this medicine item was relatively expensive. Refer to table 82.

Perindopril 4mg tablets represented 3.97% of the total cost for outpatients (N = R12 491.77).

Amitriptyline 25mg tablets represented 3.46% of the total cost for outpatients. Refer to table 82.

Diclofenac 25mg/ml injection represented 26.56% of the total cost for inpatients (N = R18 459.58) with a CPI value of 16.60 which indicated that the treatment was relatively expensive. For outpatients this injection represented 17.56% of the total cost (N = R12 491.77) and the CPI value of 7.40 confirmed that this treatment was expensive.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): amoxycillin with clavulanic acid injection, benzylpenicillin G injection, ciprofloxacin injection, cloxacillin IV injection, nalidixic acid 500mg tablets, prazosin 5mg tablets, spironolactone 25mg tablets, enoxaparin prefilled syringes, tranexamic acid injections, actraphane Hm 100IU/ml insulin, glucagon 1mg injection, carbamazepine Cr tablets, phenytoin injections, carbidopa 25mg and levodopa 250mg, omeprazole 20mg capsules, sodium algenate in a hydro-active base, dextrose in water injection, paracetamol with codeine phosphate, immunoglobulin anti-rabies vaccine, and beclomethasone MDI 100mg.

The average cost per medicine item according to therapeutic codes and age groups is given in appendix D.26.

5.5.6.4 Average cost per medicine item according to therapeutic codes and ICD-10 codes

In this section, all therapeutic codes with a frequency of > 50 and a CPI value of > 3.00 are included in the discussion. This average cost per medicine item according to therapeutic codes and ICD-10 code is given in appendix D.27. Table 83 summarises the therapeutic codes and ICD-10 codes used in this discussion. *The N-values refer to the total frequency and total cost for either inpatients or outpatients for each ICD-10 code.*

Ampicillin 500mg injection was used in the treatment of infective diarrhoea / food poisoning and had a CPI value of 5.51. This high CPI value indicated that the average cost per medicine item of R103.62 ± 113.84 was relatively high. The standard treatment guidelines (Department of Health, 2003) suggest that acute diarrhoea must be treated with 'homemade sugar and salt solution'. This treatment is much cheaper and is promoted widely in public health care settings.

TABLE 83: Therapeutic codes with a frequency of more than 50 and a CPI value of more than 3.00 according to ICD-10 code excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Therapeutic code	Inpatients						Outpatients					
		Prevalence		Cost			CPI	Prevalence		Cost			CPI
		n	%	Mean & std dev	R	%		n	%	Mean & std dev	R	%	
Infective diarrhoea / food poisoning	Ampicillin Inj 500mg	10	5.32	103.62 ± 113.84	1036.19	29.30	5.51						
Undefined bacterial infection	Amoxycillin Caps 500mg 15s	35	5.09	2.66 ± 1.43	93.20	0.39	0.08	79	15.74	3.46 ± 0.03	273.43	4.26	0.27
	Amoxycillin with clavulanic acid Inj 1000mg/200mg 1.2g	14	2.04	102.72 ± 55.24	1438.08	6.01	2.95						
	Amoxycillin with clavulanic acid Tabs 250mg/125mg 375mg 15s	43	6.26	18.39 ± 4.61	790.94	3.31	0.53	57	11.35	17.31 ± 3.98	986.75	15.36	1.35
	Ampicillin Inj 500mg	57	8.30	135.10 ± 113.94	7700.46	32.18	3.88	2	0.40	16.32 ± 0	32.64	0.51	1.28
	Cloxacillin IV Inj 500mg	14	2.04	81.24 ± 43.87	1137.42	4.75	2.33						
	Ketoconazole Tabs 200mg 30s	11	1.60	28.11 ± 26.07	309.23	1.29	0.81	15	2.99	58.89 ± 29.79	883.38	13.75	4.60
	Co-trimoxazole Tabs 480mg 20s	55	8.01	2.01 ± 1.94	110.67	0.46	0.06	18	3.59	2.04 ± 0.57	36.67	0.57	0.16
	Doxycycline Caps 100mg 14s	14	2.04	1.33 ± 0.51	18.64	0.08	0.04	40	7.97	40.58 ± 245.43	1623.05	25.27	3.17
	Metronidazole IV Inj 500mg/ml 100ml	53	7.71	0.29 ± 0.22	15.27	0.06	0.01	1	0.20	0.15 ± 0	0.15	0.00	0.01
	Metronidazole Tabs 200mg 21s	59	8.59	1.36 ± 0.83	79.97	0.33	0.04	50	9.96	1.66 ± 0.57	82.88	1.29	0.13

Unspecified HIV	Co-Trimoxazole, sul 400mg, trim 80mg Tabs 56s	25	10.37	4.89 ± 1.81	122.36	1.31	0.13	125	18.22	4.58 ± 0.61	573.09	1.22	0.07
	Efavirenz Caps 50mg 30s	1	0.41	2.61 ± 0	2.61	0.03	0.07	11	1.60	185.56 ± 185.56	5770.54	12.28	7.66
	Efavirenz Caps 600mg 30s	12	4.98	193.05 ± 98.80	2316.62	24.71	4.96	97	14.14	261.39 ± 59.93	25354.40	53.95	3.82
	Lamivudine Tabs 150mg 60s	57	23.65	28.27 ± 18.45	1611.33	17.19	0.73	155	22.59	41.90 ± 8.17	6494.33	13.82	0.61
	Nevirapine Tabs 200mg 60s	31	12.86	27.90 ± 16.83	864.98	9.23	0.72	53	7.73	38.03 ± 14.89	2015.53	4.29	0.56
	Stavudine D4t Caps 30mg 60s	27	11.20	13.34 ± 7.90	360.07	3.84	0.34	61	8.89	18.70 ± 2.70	1140.75	2.43	0.27
	Stavudine D4t Caps 40mg 60s	17	7.05	20.11 ± 4.46	341.89	3.65	0.52	98	14.29	21.74 ± 3.87	2130.28	4.53	0.32
unspecified anaemia	Ferrous sulphate Co Tabs eq 65mg Fe 28s	137	74.86	0.81 ± 0.77	111.40	26.24	0.35	30	71.43	1.56 ± 0.55	46.69	29.04	0.41
	Ferrous gluconate Syr eq 30mg Fe/5ml 100ml	20	10.93	6.80 ± 5.93	136.01	32.03	2.93						
Unspecified coagulation defects	Tranexamic acid Inj 100mg/ml 5ml 5s	19	13.48	92.70 ± 72.55	1761.31	32.73	2.43	3	2.44	38.29 ± 0	114.87	10.65	4.37
	Aspirin Soluble Tabs 300mg 14s	81	57.45	0.88 ± 0.75	70.97	1.32	0.02	93	75.61	1.56 ± 0.35	144.75	13.42	0.18
Diabetes mellitus type 2	Metformin Tabs 850mg 84s	14	14.74	10.27 ± 2.73	143.77	33.09	2.25	26	41.94	10.72 ± 1.45	278.63	55.08	1.31
Vitamin deficiency	Vitamin A, D, E, folic acid, riboflavin Tabs for adults 30s	11	1.42	7.91 ± 0	87.03	13.77	9.69	76	12.54	9.57 ± 9.26	727.11	58.61	4.67
	Vitamin B Co Strong Tabs 28s	122	15.76	0.42 ± 0.44	51.58	8.16	0.52	80	13.20	0.84 ± 0.33	67.15	5.41	0.41
	Vitamin B6 Tabs 25mg 28s	102	13.18	1.20 ± 1.10	122.16	19.33	1.47	63	10.40	1.99 ± 0	125.43	10.11	0.97
	Vitamin multiple Syr 100ml	153	19.77	0.81 ± 0.75	123.38	19.52	0.99	58	9.57	1.31 ± 0.51	75.89	6.12	0.64
	Vitamin multiple	288	37.21	0.36 ± 0.34	104.33	16.51	0.44	256	42.24	0.51 ± 0.43	137.24	11.06	0.26

Major depressive disorders	Amitriptyline Tabs 25mg 28s	68	73.12	14.99 ± 14.15	1019.21	96.29	1.32	80	77.67	20.54 ± 5.07	1643.56	95.29	1.23
Inflammation	Hydrocortisone sodium succ Inj 100mg/2ml 2ml 5s	23	17.29	82.08 ± 72.30	1887.95	76.05	4.40	4	2.38	22.28 ± 8.91	89.14	10.71	4.50
Epilepsy	Carbamazepine CR Tabs 200mg 30s	35	29.91	11.96 ± 13.12	418.73	17.44	0.58	63	34.81	14.98 ± 8.73	943.81	22.96	0.66
	Carbamazepine CR Tabs 400mg 30s	9	7.69	24.59 ± 16.86	221.28	9.22	1.20	65	35.91	33.78 ± 15.17	2195.98	53.43	1.49
Hypertension	Enalapril Tabs 5mg 28s	17	3.61	137.11 ± 154.60	2330.80	38.71	10.72	3	0.68	459.00 ± 0	1377.00	16.13	23.65
	Enalapril Tabs 10mg 28s	20	4.25	1.85 ± 1.28	37.10	0.62	0.15	52	11.82	2.61 ± 0.79	135.55	1.59	0.13
	Hydrochlorothiazide Tabs 25mg 28s	71	15.07	0.52 ± 0.41	36.82	0.61	0.04	116	26.36	0.98 ± 0.56	113.42	1.33	0.05
	Nifedipine Tabs SR 60mg 28s	19	4.03	41.22 ± 33.97	783.23	13.01	3.22	44	10.00	59.05 ± 5.70	2598.33	30.43	3.04
	Perindopril Tabs 4mg 28s	93	19.75	6.08 ± 5.68	565.29	9.39	0.48	59	13.41	12.91 ± 4.20	761.90	8.92	0.67
	Spironolactone Tabs 25mg 240s	15	3.18	5.00 ± 6.71	75.03	1.25	0.39	11	2.50	42.96 ± 27.68	472.51	5.53	2.21
Pneumonia, unspecified	Ampicillin Inj 500mg	11	12.94	144.64 ± 75.76	1591.01	46.78	3.61						
Asthma, acute OR asthma, chronic persistent	Beclomethasone MDI 100mg 200 dose	2	1.35	20.36 ± 28.50	40.71	3.43	2.54	13	8.55	40.51 ± 0.00	526.60	26.98	3.15
	Salbutamol UDV Inh Sol 2.5mg/2.5ml 30s	10	6.76	17.43 ± 18.82	174.28	14.69	2.17	7	4.61	17.44 ± 20.58	122.10	6.26	1.36
	Theophylline Syr 200ml	51	34.46	4.02 ± 1.94	204.95	17.28	0.50	47	30.92	5.52 ± 0.79	259.39	13.29	0.43

Abortion, complicated, therapeutic legal	Misoprostol Tabs 0.2mg 60s	3	8.82	10.78 ± 6.26	32.35	3.49	0.40	15	30.00	12.95 ± 1.03	194.29	76.71	2.56
Nausea	Metoclopramide Inj 5mg/ml 2ml	62	56.88	6.32 ± 7.42	392.03	83.30	1.46	8	16.67	2.13 ± 0	17.04	24.84	1.49
Pain control	Diclofenac Inj 25mg/ml 3ml	76	6.92	340.32 ± 363.16	25864.18	91.13	13.18	103	7.40	114.85 ± 11.01	11829.90	64.89	8.76
	Diclofenac Tabs 25mg 42s	16	1.46	5.09 ± 2.43	81.38	0.29	0.20	58	4.17	7.53 ± 4.17	436.70	2.40	0.57
	Methyl salicylate in Vaseline Oint 10% 25g	16	1.46	0.64 ± 0	10.30	0.04	0.02	85	6.11	0.64 ± 0	54.74	0.30	0.05
	Paracetamol codeine phos Tabs 500mg/8mg 20s	6	0.55	76.02 ± 45.67	456.12	1.61	2.94	32	2.30	126.78 ± 60.26	4057.06	22.26	9.67
	Paracetamol Syr 120mg/5ml 50ml	93	8.46	1.34 ± 0.85	124.71	0.44	0.05	68	4.89	2.30 ± 0.88	156.42	0.86	0.18
Sedation	Diazepam Inj 5mg/ml 2ml	12	35.29	1.42 ± 0.87	17.09	88.69	2.51						

Undefined bacterial infections were treated with a wide variety of therapeutic medicine items. One of these items was Amoxycillin 500mg capsules which had a frequency of 79 (15.74%) in outpatients. Amoxycillin with clavulanic acid injections had a CPI value of 2.95 which indicated that the average cost per medicine item of R102.72 ± 55.24 was relatively high. Amoxycillin with clavulanic acid 250mg/125mg tablets had a frequency of 57 (N = 687) in outpatients during the study period. Ampicillin 500mg injection had a frequency of 57 (8.30% of the total frequency for this disease) in inpatients. The CPI value for this treatment was 3.88 which indicated that the average cost per medicine item of R135.10 ± 113.94 was relatively high. Cloxacillin 500mg IV injection had a CPI value of 2.33 which indicated that the average cost per medicine item of R81.24 ± 43.87 was relatively high. Ketoconazole 200mg tablets had a CPI value of 4.60 which indicated that the average cost of R58.89 ± 29.79 per medicine item was relatively high. Co-trimoxazole 480mg tablets had a frequency of 55 for inpatients (N = 687) during the study period. Doxycycline 100mg tablets had a CPI value of 3.17 for outpatients in the treatment of undefined bacterial infections. This indicate that the average cost per medicine item of R40.58 ± 245.43 was relatively high. Metronidazole 500mg/ml IV injection had a frequency of 53 (7.71% of the total frequency for this condition) in the treatment of undefined bacterial infections in inpatients. Metronidazole 200mg tablets had a frequency of 50 (9.96%) in outpatients and 59 for inpatients. Refer to table 82.

Unspecified HIV was treated with co-trimoxazole, sulfamethoxazole 40mg and trimethoprim 80mg tablets and had a frequency of 125 (18.22% of the total frequency for this condition) in outpatients. Efavirenz 50mg capsules had a CPI value of 7.66 which indicated that the average cost per medicine item of R185.56 ± 185.56 was relatively high for outpatients. Efavirenz 600mg capsules had a frequency of 97 (14.14% of the total frequency for this condition) in outpatients and the CPI value of 3.82 indicated that the average cost of R261.39 ± 59.93 was relatively high. Lamivudine 150mg tablets were dispensed with a frequency of 57 (23.65% of the total frequency for this condition) to inpatients and with a frequency of 155 (22.59%) to outpatients. Nevirapine 200mg tablets had a frequency of 53 (7.73% of the total frequency for this condition) for outpatients and the CPI value of 0.56 indicated that this treatment was relatively inexpensive. Stavudine d4T 30mg capsules had a frequency of 61 (8.89% of the total frequency for this condition) in outpatients and an average cost per medicine item of R18.70 ± 2.70. Stavudine d4T 40mg capsules had a frequency of 98 (14.29% of the total frequency for this condition) for outpatients.

Unspecified anaemia was treated with ferrous sulphate co-tablets. The frequency was 137 (74.86% of the total frequency for this condition) in inpatients. Ferrous gluconate syrup had a CPI value of 2.93 which indicated that the average cost per medicine item of R6.80 ± 5.93 was relatively high. Refer to table 82.

Unspecified coagulation defects was treated with tranexamic acid 100mg/ml injection had a CPI value of 2.43 which indicated that the average cost per medicine item of R92.70 ± 72.55 was relatively expensive in inpatients. Aspirin 300mg soluble tablets had a frequency of 93 (75.61%) in outpatients (N = 141) for the treatment of unspecified coagulation defects.

Diabetes mellitus type 2 (non-insulin dependent) was treated with metformin 850mg tablets had a CPI value of 2.25 which indicate that the average cost per medicine item of R10.27 ± 2.73 was relatively high. Refer to table 82.

Vitamin deficiency was treated with vitamin A, D, E, folic acid, riboflavin tablets for adults and had a frequency of 76 (12.54% of the total frequency for this condition) in outpatients. The CPI value was 4.67 which indicated that the average cost of R9.57 ± 9.26 per medicine item was relatively high. Vitamin B Co strong tablets had a frequency of 122 (15.76% of the total frequency for this condition) in inpatients and 80 (13.20% of the total frequency for this condition) for outpatients. Vitamin B6 25mg tablets had a frequency of 102 (13.18%) for inpatients and 63 (10.40%) for outpatients. Multivitamin syrup had a frequency of 13 (19.77% of the total frequency for this condition) in inpatients and a frequency of 58 (9.57% of the total frequency for this condition) in outpatients. The CPI value in both cases is < 1.00 which indicated that this medicine item was relatively inexpensive. Multivitamin tablets had a frequency of 288 (N = 774) in inpatients during the study period with an average cost of R0.36 ± 0.34. For outpatients the frequency was 256 (N = 606) and the average cost was R0.51 ± 0.43.

Major depressive disorder was treated with amitriptyline which had a frequency of 80 (N = 103) in outpatients. The average cost per medicine item was R20.54 ± 5.07.

Inflammation was treated with hydrocortisone sodium succinate 100mg/2ml injection had a CPI value of 4.40 for inpatients which indicate that the average cost per medicine item of R82.08 ± 72.80 was relatively high. The frequency for prednisone 5mg tablets (28s) was 71 (N = 133) for inpatients and 98 (N = 168) for outpatients. Refer to table 82.

Carbamazepine 200mg CR tablets had a frequency of 63 (N = 181) in outpatients during the study period in the treatment of epilepsy and an average cost of R14.98 ± 8.73 per medicine item. Carbamazepine 400mg CR tablets had a frequency of 65 (35.91% of the total frequency for this condition for outpatients) during the study period. The average cost per medicine item was R33.78 ± 15.17 for outpatients during the study period for the treatment of epilepsy.

Hypertension was treated with several antihypertensive medications. Enalapril 5mg tablets had a CPI value of 10.72 in inpatients. The frequency was high at 17 (N = 471) and the average cost per medicine item was R137.11 ± 154.60. This influenced the CPI value to be high. Enalapril 10mg tablets had a frequency of 52 (N = 440) during the study period in outpatients and the CPI value of 0.13 indicated that this medicine item was relatively inexpensive. Hydrochlorothiazide 25mg tablets had a frequency of 71 (15.07% of the total frequency for this condition in inpatients) and a frequency of 116 (26.36% of the total frequency for this condition in outpatients). Nifedipine 60mg SR tablets had a CPI value of 3.22. The average cost per medicine item of R41.22 ± 33.97 was, according to the CPI value, relatively high for inpatients. For outpatients, the CPI value was 3.04 which confirmed that R59.05 ± 5.70 was relatively expensive. Perindopril 4mg tablets had a frequency of 93 (N = 471) in inpatients and a frequency of 59 (N = 440) in outpatients. Spironolactone 25mg tablets had a CPI value of 2.21 which indicate that the average cost per medicine item of R42.96 ± 27.68 which was according to the CPI value relatively high.

Unspecified pneumonia was treated with ampicillin 500mg injection where the CPI value of 3.61 indicated that the average cost per medicine item was high at R144.64 ± 75.76 and relatively expensive. Refer to table 82.

Acute asthma or chronic persistent asthma was treated with beclomethasone 100mg MDI had a CPI value of 3.15 for outpatients which indicated that the average cost per medicine item of R40.51 was relatively high. Salbutamol UDV inhalation solution had a CPI value of 2.17. This indicated that the average cost of R17.43 ± 18.82 per medicine item was relatively high. Theophylline syrup had a frequency of 51 (N = 148) for inpatients during the study period.

Complicated, therapeutic, legal abortions were treated with misoprostol 0.2mg tablets had a CPI value of 2.56 which indicated that this therapy was relatively expensive for outpatients. weeks sise. Refer to table 82.

Nausea was treated with metoclopramide 5mg/ml injections with a frequency of 62 (N = 62). According to Truter (2008) metoclopramide is indicated for nausea and vomiting associated with the post-operative period, infections, drugs, toxins (including cancer chemotherapy), uraemia and radiation sickness. Metoclopramide is ineffective in motion sickness, vertigo and nausea and vomiting due to labyrinthine disturbances.

Pain was treated with a wide variety of medicine items. Diclofenac 25mg/ml injection had a frequency of 76 (N = 1 099) during the study period and the CPI value of 13.18 indicated that the average cost per medicine item of R340.32 ± 363.16 was relatively high in inpatients. For outpatients the frequency was 103 (N = 1 391) and the CPI value of 8.76 indicated that this medicine item was relatively expensive in outpatients. Diclofenac 25mg tablets had a frequency of 58 (4.17% of the total frequency for this condition for outpatients) and the CPI value of 0.57 indicated that the treatment was relatively inexpensive. Ibuprofen 200mg tablets had a frequency of 241 (21.93% of the total frequency for this condition for inpatients) in inpatients and a frequency of 357 (25.66% of the total frequency for this condition for outpatients) in outpatients. Methyl salicylate in Vaseline ointment had a frequency of 85 (6.11%) in outpatients. Paracetamol with codeine phosphate tablets had a CPI value of 9.67 in outpatients. The high CPI values indicated that the medicine item was relatively expensive. Paracetamol syrup was dispensed with a frequency of 68 (4.89% of the total frequency for this condition) to outpatients. Refer to table 82.

Sedation was accomplished with diazepam 5mg/ml with a CPI value of 2.51, which indicated that the average cost per medicine item of R1.42 ± 0.87 was relatively high.

The following therapeutic codes had high CPI values (more than 3.00) but low frequencies (less than 10): Infective diarrhoea / food poisoning: amoxycillin with clavulanic acid injection, amoxycillin with clavulanic acid tablets, cefotaxime injection, ceftriaxone IM 250mg injection, erythromycin 250mg tablets, and half darrows & glucose 5% solution. Tuberculosis: amoxycillin with clavulanic acid injection, ampicillin 500mg injections, fluconazole 50mg capsules, fluconazole injection for IV infusion, ceftriaxone 250mg IM injection, rifampicin 150mg, isoniazid 75mg, pyrazinamide 400mg and ethambutol 275mg, rifampicin 150mg, pyrazinamide 400mg. isoniazid 75mg and ethambutol 275mg, and streptomycin injection. Septicaemia: ceftriaxone 250mg IM injection. STD suspicion: benzathine penicillin G injections and ciprofloxacin injection for IV infusion. Undefined bacterial infections: ciprofloxacin injection for IV infusion, fluconazole 50mg, fluconazole 200mg capsules, nalidixic acid 500mg tablets, nitrofurantoin 100mg

capsules, cefazolin 500mg injection, ceftriaxone 250mg IM injection, erythromycin IV injection, chloramphenicol 0.5% eye drops, and hydrocortisone sodium succinate injection. Undefined viral infections: cefazolin 500mg injection. Kaposi's sarcoma: ketoconazole 200mg tablets. Unspecified HIV: lopinavir syrup, stavudine d4T solution, and folic acid 5mg tablets. Fungal skin infections: miconazole nitrate cream, miconazole nitrate oral gel, and nystatin vaginal cream. Scabies: amoxycillin with clavulanic acid 250mg/125mg tablets, and benzatihine penicillin vials. Candidiasis: Griseofulvin 125mg tablets, and miconazole nitrate oral gel. Unspecified malignant neoplasm of the testis: ciprofloxacin injection for IV infusion. Unspecified folate deficiency anaemia: folic acid 5mg tablets, Ferrous sulphate co-tablets. Unspecified anaemia: ferrous lactate drops, phytomenadione IM injection, albenadazole suspension, and lignocaine gel. Unspecified coagulation defects: Balanced heparin 1250IU/ml, tranexamic acid injection, tranexamic acid 500mg tablets, warfarin sodium 5mg tablets (28s), warfarin sodium 5mg tablets (42s), warfarin sodium 5mg tablets (49s). Diabetes mellitis type 1 (insulin dependent): actraphane Hm 100IU/ml insulin. Diabetes mellitus type 2 (non-insulin dependent): actraphen Hm 100IU/ml insulin. Vitamin deficiency: potassium chloride syrup, thiamine IV injection, thiamine 100mg tablets, vitamin A, D, E and ascorbic acid tablets, vitamin B Co injection, multivitamin oral drops, and Bettaway children's own tablets. Mineral deficiency: magnesium chloride 500-700mg tablets, potassium chloride injections, and Vi-daylin syrup. Cholesterol: cholestyramine powder. Disorders of acid-base balance: omeprazole 20mg tablets. other disorders of fluid and electrolyte balance: amoxycillin 125mg/5ml suspension, ceftriaxone IM injection, aluminium hydroxide suspension, cimetidine 400mg tablets, ranitidine 25mg/ml injection, *electrolyte no 2 solution*, *sodium chloride 0.9% injection* (1000ml), *sodium chloride* 0.9% injection (200ml), and Dextrose solution for IV infusion. Bipolar disorder: chlorpromazine 50mg tablets, and haloperidol 5mg/ml injection. inflammation: indomethacin 100mg suppositories, sulfasalazine 500mg tablets, hydrocortisone sodium succinate 100mg/2ml injection, methylprednisolone 40mg/ml injection, prednisolone 15mg/5ml syrup, prednisone 5mg tablets (100s), and diclofenac 25mg/ml injections. Symptomatic epilepsy with complex partial seizures: ceftriaxone 250mg IM injection. Epilepsy: carbamazepine 100mg/5ml suspension, phenytoin 50mg/ml injection, sodium valproate liquid, and sodium valproate 200mg tablets. Acute inflammation of orbit (cellulitis of the eye): cloxacillin 500mg IV injection. Conjunctivitis: acyclovir 200mg tablets, chloramphenicol 0.5% eye drops, and antazoline tetrahydrozoline eye drops. Rheumatic fever without mention of heart involvement: fluconazole injection for IV infusion. Hypertension: nevirapine 200mg tablets, enalapril 5mg tablets, mannitol injection for IV use, prazosin 1mg tablets, and prazosin 5mg tablets. Angina: lorazepam 4mg/ml injection.

Congestive CCF: ampicillin 500mg injection, amoxycillin 500mg capsules, amoxycillin with clavulanic acid 250mg/125mg tablets, and oxymetazoline 0.025% nose drops. Bacterial tonsillitis: cefotaxime 500mg injection. Gastro-enteritis: amoxycillin with clavulanic acid 125mg/3125mg suspension. Acute upper respiratory tract infections (unspecified): amoxycillin with clavulanic acid 250mg/125mg tablets. Unspecified Bronchopneumonia: ceftriaxone 250mg IM injection. Unspecified Pneumonia: amoxycillin with clavulanic acid 1000mg/200mg injection, Ceftriaxone 250mg IM injection. Chronic obstructive pulmonary disease with acute lower respiratory infection: ampicillin 500mg injection, and Ceftriaxone 250mg IM injection. Asthma, acute OR Asthma chronic persistent: hydrocortisone sodium succinate 100mg/2ml injection, prednisone 5mg tablets, budesonide 200mg MDI, fenoterol 0.5mg/2rnl UDV, salbutamol 100mg MDI complete. Abscess of the lung without pneumonia: amoxycillin with clavulanic acid 1000mg/200mg injection, fluconazole injection for IV infusion. Dental abscess: amoxycillin 125mg/5ml suspension, and metronidazole 200mg/5ml suspension. Mouth abscess: ampicillin 500mg injections, flucloxacillin 250mg capsules, cefazolin 500mg injection. Peptic ulcers: amoxycillin 500mg injection, fluconazole injection for IV infusion. Gastritis – acute haemorrhagic: ampicillin 500mg injection, fluconazole injection for IV infusion. Unspecified Appendicitis: ampicillin 500mg injection. Constipation: ampicillin 500mg injection, ketoconazole 200mg tablets. Alcoholic lever disease, unspecified: ampicillin 500mg injections. Abdominal cramps: ampicillin 500mg injection, gentamicin 80mg/2ml injection, metoclopramide 5mg/ml injection, hyoscine-n- butylbromide syrup. Boils / impetigo: cefotaxime 1g/15ml injections. Unspecified cellulitis: ampicillin 500mg injection. Rash: betamethazone in urea cream. Acute septic arthritis: ampicillin 500mg injection, cloxacillin 500mg IV injection. Chronic obstructive pyelonephritis: ampicillin 500mg injection. Urinary tract infection (uncorrplicated): amoxycillin with clavulanic acid 250mg/125mg tablets, ampicillin 500mg injection, nalidixic acid 500mg tablets, and erythromycin 250mg tablets. Pelvic inflammation disease: ampicillin 500mg injection. Bartholin's abscess: ampicillin 500mg injection. Abortion, complicated, therapeutic legal: ampicillin 500mg injections, cefazolin 500mg injection, and magnesium sulphate crystals. Abscess of the breast: ampicillin 500mg injection. Gastro diarrhoea: ciprofloxacin 500mg tablets. Nausea: amoxycillin with clavulanic acid 250mg/125mg tablets, and co-trimoxazole, sulphamethoxazole 400mg and trimethoprim 80mg tablets. Pain control: amethocaine, paracetamol with codeine phosphate tablets, and paracetamol 500mg tablets. Amputation of upper limb, level unspecified: ampicillin 500mg injection. Foreign body in ear (wax): neomycin polymixin hydrocortisone ear drops. Rape: ciprofloxacin injection for IV infusion, and erythromycin 250mg tablets. Allergies: ampicillin 500mg injection, antazoline tetrahydrosoline

eye drops, and hydrocortisone sodium succinate 100mg/2ml injection. Unknown diagnoses: podophyllum resin, silver sulphadiazine cream, and zinc sulphate grade. Hormone replacement therapy: oestrogens conj vaginal cream. Family planning: cefazolin 500mg injection.

This conclude the discussion of the average cost per medicine item according to ICD-10 code. All the results was indicated in appendix D.27. The summary was indicated in table 82.

5.5.6.5 Comprehensive summary of total cost for therapeutic codes

Appendix D.28 gives the top 10 therapeutic codes according to total cost. In table 84 the top 3 therapeutic codes according to total cost are given.

TABLE 84: Top three therapeutic codes according to total cost

Therapeutic code	In- and outpatients		
	Rank	Cost (Rand)	%*
Diclofenac Inj 25mg/ml 3ml	1	37809.55	16.83
Efavirenz Caps 600mg 30's	2	27671.02	12.32
Ampicillin Inj 500mg	3	17889.42	7.96
Total of top three therapeutic codes		**83369.99**	**37.11**

*Percentage was calculated according for therapeutic codes according to total cost

The therapeutic code (individual medicine item) which was responsible for the highest total cost per item was Diclofenac 25mg/ml injection (3ml). The total cost for this item for inpatients was R25 979.65 which was 21.35% of the total cost for all therapeutic codes in the inpatient department (N = R121 711.94) and was ranked first. Diclofenac 25mg/ml injection had a total cost of R11 829.90 (11.49%) for outpatients which placed it in second ranked in this department. The total cost for Diclofenac 25mg/ml injection was R37 809.55 when the two departments were combined. This was 16.83% of all the individual medicine items' total cost (N = R224 677.10). This was in line with the top three results of budget and pharmacological groups. Pain relievers were ranked in second position with a total cost of 20.90% (see appendix D.18 and 5.5.4.5). Analgesics, non-opioids including NSAIMS, gold and antigout preparations were also ranked second with a total cost which represented 20.52% of all pharmacological groups' total cost (see appendix D.23 and 5.5.5.5).

Efavirenz 600mg capsules (30s) had the highest total cost for outpatients and was ranked first in this department. The total cost for this individual item was R25 354.40 and it represented 24.62% of the total cost for the outpatient department (N = R102 965.16). Efavirenz 600mg tablets (30s) were ranked in ninth position for inpatients with a total cost of R2316.62 (1.90%). Combined, Efavirenz 600mg capsules (30s) had the second highest total cost of all the therapeutic codes (R27 671.02) which was 12.32% of all the therapeutic codes. This was correct when referring to the top three budget and pharmacological groups. Anti-infectives had the highest total cost of all budget groups used in this study and represented 50.88% (see appendix D.18 and 5.5.4.5) of the total cost. Antivirals had the highest total cost of all pharmacological groups and represented 24.48% of the total cost (see appendix D.23 and 5.5.5.5).

Ampicillin 500mg injection was ranked second in the inpatient department. During the study period, the total cost for this product added up to R17 889.42 which was 14.70% of the total cost for the inpatient department (N = R121 711.94). Ampicillin 500mg injection did not appear in the top 10 therapeutic codes for outpatients. Despite this, Ampicillin 500mg injection was ranked as the third highest therapeutic code with a total cost of R17 889.42 which was 7.96% of the total cost for all items (N = R224 677.10). These results were in line with the top three budget groups, pharmacological groups and therapeutic codes. The top budget group according to total cost was anti-infectives which represented 50.88% of the total cost of all budget groups (see appendix D.18 and 5.5.4.5). Penicillin antibiotics were the third highest pharmacological group according to total cost (16.68%) (see appendix D.23 and 5.5.5.5).

The top three therapeutic codes was Diclofenac 25mg/ml injection, Efavirenz 600mg capsules (30s) and Ampicillin 500mg injection. These three individual items had a total cost of R83 369.99. This total was 37.11% of the overall total cost for therapeutic codes. The top 10 therapeutic codes according to total cost represented 61% of the inpatient department and 62% of the outpatient department's total cost. The top 10 therapeutic codes according to total cost are illustrated in appendix D.28.

It is significant, according to appendix D.28, that five of the ten individual medicine items in the outpatient department were antiretroviral medicines. Efavirenz 600mg capsules (30s) were ranked first with a total cost of R25 354.40.

This was 24.62% of the total cost for all medicine items dispensed to outpatients. Lamivudine 150mg tablets (60s) were ranked in third place. The total cost was R6494.33 which was 6.31% of the total cost. Efavirenz 50mg capsules (30s), which was ranked fourth, had a total cost of R5 770.54 and represent 5.60% of the total cost. Stavudine d4T 40mg capsules (60s) had the eighth highest total cost (R2130.28) in the outpatient department which was 2.07% of the total cost. Nevirapine 200mg tablets (60s) were ranked ninth. This product had a total cost of R2 015.53 which was 1.96% of the total cost. In total, these five products had a total cost of R41 765.08 in the outpatient department.

TABLE 85: ARV medication in the top 10 outpatient therapeutic codes

Therapeutic code	Outpatients		
	Rank	R	%*
Efavirenz Caps 600mg 30's	1	25354.40	24.62
Lamivudine Tabs 150mg 60s	3	6494.33	6.31
Efavirenz Caps 50mg 30's	4	5770.54	5.60
Stavudine d4T Caps 40mg 60s	8	2130.28	2.07
Nevirapine Tabs 200mg 60s	9	2015.53	1.96
Total of ARV medicine in top 10		**41765.08**	**18.59**

*Percentage was calculated for therapeutic codes according to total cost

5.5.7 ICD-10 codes

All the diseases which appeared during the study period in the data were classified according to the International Code of Diseases (10^{th} ed.) In the discussion on ICD-10 codes, all the codes with a cost > 3.00% and a CPI value > 2.00 are included in this discussion.

5.5.7.1 Average cost per medicine item according to ICD-10 codes

Appendix D.29 includes all the results of the average cost per medicine item according to ICD-10 codes. Table 86 includes all ICD-10 codes within these parameters excluding those ICD-10 codes with high CPI values (more than 2) and frequencies of less than 10. *The N-values refer to the total prevalence or total cost for ICD-10 codes for inpatients or outpatients.*

TABLE 86: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	Total cost	%**	
Diarrhoea, infective / food poisoning	188	2.99	18.81 ± 54.48	3536.74	2.91	0.97
Tuberculosis	206	3.28	28.38 ± 53.76	5845.88	4.80	1.47
Undefined bacterial infection	687	10.93	34.83 ± 106.96	23926.85	19.66	1.80
Undefined viral infection	16	0.25	69.50 ± 151.52	1111.95	0.91	3.59
Unspecified HIV	241	3.83	38.90 ± 57	9373.76	7.70	2.01
Unspecified coagulation defect	141	2.24	38.17 ± 234.93	5381.84	4.42	1.97
Epilepsy	117	1.86	20.52 ± 26.65	2400.47	1.97	1.06
Rheumatic fever without mention of heart involvement	15	0.24	84.05 ± 155.84	1260.78	1.04	4.34
Hypertension	471	7.49	12.78 ± 41.20	6021.38	4.95	0.66
Congestive cardiac failure	13	0.21	57.65 ± 90.36	749.51	0.62	2.98
Pneumonia, unspecified	85	1.35	40.01 ± 70.61	3401.00	2.79	2.07
Abscess of the lung without pneumonia	22	0.35	41.14 ± 73.00	905.15	0.74	2.13
Mouth abscess	22	0.35	43.16 ± 90.94	949.56	0.78	2.23
Peptic ulcus	15	0.24	40.06 ± 68.95	600.94	0.49	2.07
Pain control	1099	17.48	25.83 ± 128.13	28382.76	23.32	1.33
Family planning	10	0.16	80.32 ± 183.77	803.23	0.66	4.18
ICD-10 code	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	Total cost	%**	
Diarrhoea, infective / food poisoning	24	0.44	3.56 ± 4.90	85.40	0.08	0.19
Tuberculosis	37	0.68	35.50 ± 14.90	1313.59	1.28	1.89
Undefined bacterial infection	502	9.16	12.80 ± 70.65	6423.63	6.24	0.68
Undefined viral infection	12	0.22	8.51 ± 10.05	102.08	0.10	0.45
Unspecified HIV	686	12.52	68.50 ± 107.91	46992.64	45.64	3.65
Unspecified coagulation defects	123	2.24	8.77 ± 21.81	1078.78	1.05	0.47
Epilepsy	181	3.30	22.71 ± 17.36	4110.29	3.99	1.21
Rheumatic fever without mention of heart involvement						
Hypertension	440	8.03	19.41 ± 43.55	8538.91	8.29	1.03
Congestive CCF						
Pneumonia, unspecified						
Abscess of the lung without pneumonia						
Mouth abscess	7	0.13	4.65 ± 5.14	32.56	0.03	0.25
Peptic ulcus						
Pain control	1391	25.38	13.11 ± 35.72	18229.81	17.70	0.70
Family planning	3	0.05	44.43 ± 21.71	133.29	0.13	2.36

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively
**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively

Infective diarrhoea / food poisoning had a CPI value of 0.97 which. The average cost per medicine item was R18.81 ± 54.48 for inpatients and it contributed 2.91% to the total cost of all ICD-10 codes for inpatients (N = R117 787.08).

Tuberculosis represented 4.80% of the total cost for inpatients and only 1.08% of the total cost for outpatients (N = R102 965.21). The frequency for inpatients was 206 and the average cost was R28.38 ± 53.76. Refer to table 86.

Undefined bacterial infection represented 19.66% of the total cost for inpatients (N = R117 787.08) and 5.27% of the total cost for outpatients (N = R102 965.21). The average cost per medicine item for inpatients was R34.83 ± 106.96 and the CPI of 1.80 confirmed that the inpatients treatment was relatively expensive. The average cost for outpatients was R12.80 ±70.65 and the CPI was 0.57. The treatment of undefined bacterial infections in outpatients was relatively inexpensive.

Undefined viral infections had a CPI value of 3.59 which indicated that medicine items used to treat this condition was relatively expensive. The average cost per medicine item was R69.50 ± 151.52 which was high.

Unspecified HIV disease represented 7.70% of the total cost for inpatients and 45.64% of the total cost for outpatients. The average cost for inpatients was R38.90 ± 57.00 and the CPI was 2.01. This indicated that medicine item used for the treatment of this condition was relatively expensive. For outpatients the average cost was higher at R68.50 ± 107.91 and the CPI of 3.65 also indicated that this condition's treatment was relatively expensive.

Unspecified coagulation defects represented 4.42% of the total cost for inpatients. Refer to table 86.

Epilepsy contributed 3.37% of the total cost for outpatients (N = R102 965.21 for outpatients) during the study period. The frequency was 181 treatments (N = 5 480 for outpatients) and the average cost per medicine item was R22.71 ± 17.36. The CPI value of 1.02 indicated that the treatment was relatively expensive.

Rheumatic fever without mentioning of heart involvement was only treated in inpatients. The average cost per medicine item used to treat this condition was R84.05 ± 155.84 and as the CPI value of 4.49 confirmed, was relatively expensive.

Hypertension represented 5.11% of the total cost in inpatients (N = R117 787.08) and 7.00% of the total cost in outpatients (N = R102 965.21 for outpatients). The CPI value for both in- and outpatients was < 1 which indicated that the medicine items used in the treatment of hypertension were relatively inexpensive. Refer to table 86.

Congestive cardiac failure had a CPI value of 3.08 and the average cost of R57.65 ± 90.36 confirm that the treatment of congestive CCF was relatively expensive.

Unspecified pneumonia had a CPI value of 2.14 which indicated that the treatment for unspecified pneumonia was relatively expensive. The average cost per medicine item was relatively high at R40.01 ± 70.61.

An abscess of the lung without pneumonia had an CPI value of 2.20 and as the average cost per medicine item (R41.14 ± 73.00) confirmed, this treatment was relative expensive.

Mouth abscess had a CPI value of 2.30. This indicated that the medicine items use to treat a mouth abscess were relative expensive. Refer to table 86.

A peptic ulcer had a CPI value of 2.14. The average cost per medicine item was R40.06 ±68.95 and it confirmed that the treatment of peptic ulcers was relatively expensive.

Pain was definitely one of the most common diagnoses during the study period. In inpatients pain control represented 24.10% of the total cost (N = R117 787.08) and in outpatients 14.95% of the total cost (N = R102 965.21). The average cost per medicine item for inpatients was R25.83 ± 128.13 with a CPI value of 1.38 which indicated that medicine items used in the treatment of pain control in inpatients were relatively expensive where the average cost for outpatients of R13.11 ± 35.72 indicated that the treatment for outpatients was relatively inexpensive (CPI = 0.59).

Family planning had a CPI value of 4.29 for inpatients. The average cost per medicine item for inpatients was R80.32 ±183.77 which was relatively high as indicated by the CPI value of 4.29.

The following therapeutic codes had high CPI values (more than 2.00) but low frequencies (less than 10): septicaemia, rabies, cryptococcosis – cerebral meningitis, unspecified malignant neoplasm of the testis, multiple myeloma, hypoglycaemia / hyperglycaemia in diabetes mellitus, parkinsonism, arteriosclerotic gangrene, unspecified appendicitis, alcoholic liver disease,

unspecified, nephritis, abscess of the breast, wound caring, bites and stings, rape, family planning, and post partum bleeding. Refer to appendix D.29.

5.5.7.2 Average cost per medicine item according to ICD-10 codes and gender

The average cost per medicine item according to ICD-10 code and gender is indicated in appendix D.30. Table 87 and 88 indicate the ICD-10 codes with a total cost of more than 3.00% and a CPI value of more than 2.00.

- **Male**

The N-values refer to the total prevalence or total cost for male inpatients or outpatients.

In male patients infective diarrhoea / food poisoning contributed 5.88% of the total cost for all inpatients (N = R44 131.61). The average cost per medicine item to treat infective diarrhoea / food poisoning was R27.07 ± 71.30 and as confirmed by the CPI of 1.38, was relatively high.

Tuberculosis contributed 6.39% to the total cost of inpatients (N = R44 131.61) and 6.36% to the total cost for outpatients (N = R44 835.28). In this case the frequency was 87 for inpatients (N = 2 258) with an average cost per medicine item for R32.47 ± 65.95. The CPI value was 1.66 which indicated that medicine items was relatively expensive. Outpatients had an average cost per medicine item of R31.37 ± 19.34.

Undefined bacterial infections represented 18.22% of the total cost for inpatients and 4.49% for outpatients. A possible explanation for the big difference in percentage between in- and outpatients was that inpatients received more treatment during their stay in hospital due to unspecified diagnosis where outpatients receive treatment for well diagnosed diseases or they would be hospitalised if the diagnose was not clear. Refer to table 87.

TABLE 87: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients						Outpatients					
	Prevalence		Cost			CPI	Prevalence		Cost			CPI
	n	%	Mean & Std dev	R	%		n	%	Mean & Std dev	R	%	
Diarrhoea, infective / Food poisoning	96	4.25	27.07 ± 71.30	2599.00	**5.89**	1.39	9	0.43	5.90 ± 6.91	53.08	0.12	0.28
Tuberculosis	87	3.85	32.47 ± 65.95	2824.92	**6.40**	1.66	9	0.43	31.37 ± 19.34	2852.36	**6.36**	**14.82**
Undefined bacterial infection	216	9.57	37.28 ± 112.37	8051.66	**18.24**	1.91	198	9.45	10.17 ± 13.27	2013.90	**4.49**	0.48
Unspecified HIV	52	2.30	50.59 ± 69.42	2630.79	**5.96**	**2.59**	221	10.54	90.23 ± 126.76	19940.89	**44.48**	**4.22**
Diabetes mellitis type 1	6	0.27	38.04 ± 38.74	228.25	0.52	1.95	27	1.29	45.39 ± 51.33	1225.49	2.73	**2.12**
Epilepsy	59	2.61	16.80 ± 24.94	990.96	2.25	0.86	91	4.34	25.51 ± 18.41	2321.80	**5.18**	1.19
Rheumatic fever without mention of heart involvement	15	0.66	84.05 ± 155.84	1260.78	2.86	**4.30**						
Hypertension	107	4.74	9.17 ± 23.02	981.31	2.22	0.47	132	6.30	14.61 ± 18.97	1928.15	**4.30**	0.68
Pneumonia, unspecified	23	1.02	62.07 ± 98.51	1427.66	**3.24**	**3.18**						
Abscess of the lung without pneumonia	15	0.66	50.98 ± 86.20	764.75	1.73	**2.61**						
Mouth abscess	18	0.80	49.51 ± 99.62	891.19	2.02	**2.53**	1	0.05	15.60 ± 0	15.60	0.03	0.73
Pain control	527	23.34	21.95 ± 107.53	11566.18	**26.21**	1.12	622	29.68	13.04 ± 33.95	8109.66	**18.09**	0.61

Unspecified HIV represented 5.95% of the total cost for inpatients (N = R44 131.61) and 44.48% of the total cost for outpatients (N = R44 835.28). The reason why the percentage for outpatients were higher was because HIV was a chronic disease which did not need hospitalisation. The 5.95% of the total cost for inpatients included patients hospitalised for other conditions but whose ARV treatment was continued during the hospital stay. Both in- and outpatients' CPI values were > 1 which indicated that the medicine items used to treat unspecified HIV was relatively expensive.

Diabetes mellitus type 1 (insulin dependant) had a CPI value of 2.12 for outpatients which indicate that, as confirmed by the average cost per medicine item of R45.39 ± 51.33, the treatment was relatively expensive.

Epilepsy contributed 5.18% to the total cost for male outpatients during the study period. The average cost was R25.51 ± 18.41. Refer to table 87.

Rheumatic fever without mentioning of heart involvement had a CPI value of 4.30 which indicated that medicine items used in the treatment of rheumatic fever was relatively expensive as confirmed by the average cost per medicine item of R84.05 ± 155.84. There were no diagnoses of rheumatic fever in outpatients because this was a hospitalised condition.

Hypertension was a well diagnosed and treated condition throughout the study. Male outpatients represented 4.30% of the total cost (N = R44 131.61) and had a CPI value of 0.68. This indicated that antihypertensive medication was relatively inexpensive.

Unspecified pneumonia was also a hospitalised condition with 23 patients diagnosed during the study period. It represented 3.23% of the total cost for male inpatients and had a CPI value of 3.17 which indicated that medicine items used for the treatment of unspecified pneumonia was relatively expensive. Refer to table 87.

An abscess of the lung without pneumonia had a CPI of 2.61 which indicated that this treatment was relatively expensive as confirmed by the average cost per medicine item of R50.98 ± 86.20.

A mouth abscess was diagnosed and treated 18 times in inpatients with a CPI value of 2.53 which indicated that the treatment was relatively expensive.

Pain was a common and very frequent disease and pain relievers were included in the treatment of many other diseases and conditions. Pain control represented 26.17% of the total

cost for male inpatients (N = R44 131.61) and had an average cost of R21.95 ± 107.53. The treatment for inpatients was more expensive than for outpatients which had an average cost per medicine item of R13.04 ± 33.95. Pain control in outpatients represented 18.09% of the total cost (N = R44 835.28).

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): tuberculosis, septicaemia, rabies, undefined viral infections, unspecified malignant neoplasm of testis, multiple myeloma, wound caring, and bites and stings. Refer to appendix D.30.

- **Female**

The N-values refer to the total prevalence or total cost for female inpatients or outpatients.

Both female in- and outpatients received treatment for tuberculosis. The treatment represented 3.90% of the inpatients' total cost (N = R77 580.40) and 1.70% of the outpatients' total cost (N = R60 699.95). The CPI value for outpatients was 2.05 and for inpatients was 1.32 which indicated that the treatment for outpatients was more expensive than for inpatients.

Undefined bacterial infections contributed 20.48% to the total cost of female inpatients and 7.26% of female outpatients. The average cost per medicine item for inpatients was R33.71 ± 104.48 and for outpatients it was R14.51 ± 90.17. Refer to table 88.

Unspecified HIV represented 8.70% of the total cost for female inpatients and 44.57% of the total cost for outpatients. The CPI value for outpatients treated for unspecified HIV was 3.24 which indicated that medicine items included in the treatment was relatively expensive. Refer to table 88.

Unspecified coagulation defects represented 5.62% of the total cost for female inpatients. The average cost per medicine item was R46.87 ± 288.56 and the CPI of 2.44 confirms that this treatment was relatively expensive. Refer to table 88.

Hypertension in females represented 6.50% of the total cost for inpatients (N = R77 580.40) and 10.89% of the total cost for outpatients (N = R 60 699.95). The average cost per antihypertensive medicine item for inpatients was relatively high at R13.85 ± 45.14 which was confirmed by the CPI value of 0.72. The average cost for outpatients was R21.46 ± 50.44 and as the CPI indicated (CPI = 1.20), the treatment was relatively expensive.

TABLE 88: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients						Outpatients					
	Prevalence		Cost			CPI	Prevalence		Cost			CPI
	n	%	Mean & Std dev	R	%		n	%	Mean & Std dev	R	%	
Tuberculosis	119	2.95	25.39 ± 42.77	3020.96	3.90	1.32	28	0.83	36.83 ± 13.33	1031.24	1.70	2.05
Undefined bacterial infection	471	11.69	33.71 ± 104.48	15875.19	20.48	1.75	304	8.98	14.51 ± 90.17	4409.73	7.26	0.81
Unspecified HIV	189	4.69	35.68 ± 71.99	6742.97	8.70	1.85	465	13.74	58.18 ± 96.12	27051.75	44.57	3.24
Unspecified coagulation defects	93	2.31	46.87 ± 288.56	4358.90	5.62	2.44	91	2.69	10.20 ± 24.84	928.47	1.53	0.57
Hypertension	364	9.04	13.85 ± 45.14	5040.07	6.50	0.72	308	9.10	21.46 ± 50.44	6610.76	10.89	1.20
Congestive CCF	11	0.27	65.01 ± 96.75	715.08	0.92	3.38						
Bronchopneumonia, unspecified	31	0.77	42.25 ± 151.21	1309.65	1.69	2.20	1	0.03	3.46 ± 0	3.46	0.01	0.19
Pain control	572	14.20	29.40 ± 144.54	16816.59	21.69	1.53	769	22.72	13.16 ± 37.11	10120.15	16.67	0.73

Congestive cardiac failure had a CPI value of 3.38 which indicated that medicine items used in the treatment of congestive CCF were relatively expensive. This was confirmed by the average cost per medicine item of R65.01 ± 96.75. Refer to table 88.

Unspecified bronchopneumonia had an average cost per medicine item of R42.25 ± 151.65 which was confirmed by the CPI value of 2.20 as relatively expensive.

Pain was a very common diagnosis made in female patients. In the inpatients pain control represented 21.60% of the total cost (N = R77 580.40) and 16.67% of the total cost (N = R60 699.95) for outpatients.

Family planning for female patients was done for both in- and outpatients. The CPI value for inpatients was 4.17. The average cost confirmed that the treatment in these cases was relatively expensive.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): cryptococcosis - cerebral meningitis, hypoglycaemia / hyperglycaemia in diabetes mellitus, parkinsonism, symptomatic epilepsy with complex partial seizures, atherosclerotic gangrene, peptic ulcers, unspecified appendicitis, nephritis, breast abscess, rape, family planning, alcohol liver disease, unspecified, unknown diagnosis, and post partum bleeding. Refer to appendix D.30.

5.5.7.3 Average cost per medicine item according to ICD-10 codes and age group

The average cost per medicine item according to age group is given in appendix D.31. Tables 89-94 indicate the ICD-10 codes within these parameters per age group. *The N-values refer to the total prevalence or total cost for patients in that specific age group.*

- **< 0 ≤ 6 years**

For the paediatric patients in the age group < 0 ≤ 6 years the condition infective diarrhoea / food poisoning represented 12.10% of the total cost for inpatients (N = R13 246.32) in that age group. The standard treatment guidelines (Department of Health, 2006b:23) warn that diarrhoea is a serious common childhood illness which is often caused by viral or bacterial infection, dietary or other causes. This easily lead to dehydration and metabolic disturbances

are common if treatment is not instituted early and may result in severe disease, irreversible organ damage and death in children (Department of Health, 2006b:23).

TABLE 89: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in paediatrics excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Diarrhoea, infective / food poisoning	120	10.99	13.36 ± 47.04	1603.15	12.10	1.10
Tuberculosis	53	4.85	18.59 ± 68.85	985.14	7.44	1.53
Undefined bacterial infection	148	13.55	24.77 ± 98.76	3666.67	27.68	2.04
Unspecified HIV	27	2.47	49.53 ± 80.94	1337.38	10.10	4.08
Symptomatic epilepsy with complex partial seizures	10	0.92	35.83 ± 53.87	358.25	2.70	2.95
Bronchopneumonia, unspecified	36	3.30	32.64 ± 139.20	1175.04	8.87	2.69
Pneumonia, unspecified	16	1.47	44.11 ± 92.73	705.82	5.33	3.64
Chronic obstructive pulmonary disease with acute lower respiratory infection	33	3.02	16.30 ± 35.83	537.93	4.06	1.34
Asthma, acute OR asthma, chronic persistent	50	4.58	7.91 ± 13.52	395.26	2.98	0.65
Pain control	128	11.72	1.40 ± 1.01	179.62	1.36	0.12
ICD-10 code	**Outpatients**					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Diarrhoea, infective / food poisoning						
Tuberculosis	2	0.70	6.67 ± 0	13.34	0.50	0.72
Undefined bacterial infection	55	19.30	9.10 ± 15.87	500.54	18.84	0.98
Unspecified HIV	16	5.61	79.45 ± 82.63	1271.27	47.84	8.52
Symptomatic epilepsy with complex partial seizures						
Bronchopneumonia, unspecified						
Pneumonia, unspecified						
Chronic obstructive pulmonary disease with acute lower respiratory infection	3	1.05	2.93 ± 1.67	8.78	0.33	0.31
Asthma, acute OR asthma, chronic persistent	12	4.21	8.44 ± 11.33	101.25	3.81	0.90
Pain control	67	23.51	2.52 ± 1.35	168.77	6.35	0.27

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively in the paediatric age group

**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively in the paediatric age group

Malnutrition is also an important side-effect of diarrhoeal disease and must be managed correctly by employing ongoing feeding while treatment is given.

Tuberculosis was also a common disease in this age group with a percentage of 7.44% of the total cost for inpatients in this age group. Refer to table 89.

Undefined bacterial infections represented 27.68% of the total cost for inpatients (N = R13 246.32) and 18.84% of the total cost for outpatients (N = R2 657.43). The CPI value of 2.04 indicated that medicine items used in the treatment of undefined bacterial infections in inpatients, was relatively expensive.

Unspecified HIV represented 10.10% with a CPI value of 4.08% which indicated that the medicine regime was relatively expensive for inpatients. For outpatients unspecified HIV represented 47.84% of the total cost and the CPI value was higher at 8.52. Refer to table 89.

Symptomatic epilepsy with complex partial seizures indicated a CPI value of 2.95 which could be due to the low frequency of diagnosis and treatments for inpatients.

Unspecified bronchopneumonia was only treated in inpatients and represented 8.87% of the total cost (N = R13 246.32) and had a CPI value of 2.69 which indicated that this treatment was relatively expensive.

Unspecified pneumonia accounted for 5.33% of the total cost for paediatric inpatients and as the CPI value of 3.64 indicated the average cost per medicine item (R44.11 ± 92.73) was relatively high.

Chronic obstructive pulmonary disease with acute lower respiratory infection represented 4.06% of the total cost in inpatients. Refer to table 89.

Asthma (acute or chronic persistent) represented 3.81% of the total cost in paediatric outpatients (N = R2 657.43).

Pain control in paediatric outpatients represented 6.35% of the total cost and the CPI value of 0.27 indicated that these treatments were very inexpensive.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): septicaemia, fungal skin infections, unspecified anaemia, epilepsy, uncomplicated urinary tract infections; and hormone replacement therapy. Refer to appendix D.31.

- **> 6 ≤ 12 years**

TABLE 90: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in children excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Undefined bacterial infection	23	7.77	23.65 ± 68.37	544.00	9.76	1.26
Unspecified HIV	36	12.16	53.48 ± 122.23	1925.27	34.54	2.84
Epilepsy	9	3.04	21.37 ± 36.41	192.37	3.45	1.14
Hypertension	45	15.20	42.84 ± 96.12	1928.01	34.59	2.28
Tonsillitis (bacterial)	10	3.38	18.07 ± 18.46	180.70	3.24	0.96
ICD-10 code	**Outpatients**					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Undefined bacterial infection	22	9.73	4.44 ± 4.22	97.63	1.18	0.12
Unspecified HIV	57	25.22	127.64 ± 212.65	7275.50	87.63	3.47
Epilepsy	11	4.87	31.32 ± 24.34	344.51	4.15	0.85
Hypertension						
Tonsillitis (bacterial)						

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively in the children age group

**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively in the children age group

In the age group for children (> 6 ≤ 12 year) undefined bacterial infection represented 9.76% of the total cost for inpatients (N = R5 573.82) in this age group with a frequency of 23. Refer to table 90.

Unspecified HIV represented 34.54% of the total cost for inpatients (N = R5 573.82) and 87.63% for outpatients (N = 8 302.94). Both CPI values were > 1 which indicated that medicine used in the treatment of unspecified HIV was relatively expensive.

Epilepsy represented 4.15% of the total cost in outpatients (N = R8 302.94) and had a frequency of 11. Refer to table 90.

Hypertension was only treated in inpatients in this age group due to the seriousness of hypertension in children. Hypertension represented 34.59% of the total cost in this age group (N = R5 573.82) and the CPI was 2.28 which indicated that antihypertensive medication was

relatively expensive and this was confirmed by the average cost per medicine item of R42.84 ± 96.12.

Bacterial tonsillitis represented 3.24% of the total cost for inpatients in this age group and the CPI of 0.96 indicated that medicine items used to treat this infection was relatively inexpensive.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): Cryptococcus – cerebral meningitis and epilepsy. Refer to appendix D.31.

- **> 12 ≤ 19 years**

TABLE 91: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in teenagers excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Undefined bacterial infection	22	10.63	57.75 ± 180.98	1270.50	31.07	2.92
Rheumatic fever without mention of heart involvement	14	6.76	90.02 ± 159.94	1260.32	30.83	4.56
Pain control	59	28.50	7.45 ± 25.36	439.55	10.75	0.38
ICD-10 code	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	R	%**	
Undefined bacterial infection	19	12.10	5.13 ± 6.81	97.47	5.88	0.49
Rheumatic fever without mention of heart involvement						
Pain control	78	49.68	11.48 ± 32.89	895.70	54.06	1.09

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively in the teenager age group
**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively in the teenager age group

In the age group > 12 ≤ 19 years undefined bacterial infections represented 31.07% of the total cost for inpatients (N = R4 088.58) and 5.88% of the total cost for outpatients (N = R1 656.87). The average cost per medicine item used for treatment of undefined bacterial infections was R57.75 ± 180.98 and it had a CPI value of 2.92 which indicated that the treatment was relatively expensive. The average cost for outpatients was R5.13 ± 6.81 and the CPI value of 0.49 confirmed that the treatment was relatively inexpensive.

Rheumatic fever was only treated in inpatients where it represented 30.83% of the total cost in inpatients and the CPI value of 4.56 indicated that the treatment was relatively expensive. See table 91.

Pain control was indicated to represent 10.75% of the total cost in inpatients (N = R4 088.58) in this age group and 54.06% of the total cost for outpatients.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): unspecified coagulation defects, mineral deficiency, unspecified pneumonia, acute and chronic persistent asthma, pelvic inflammation disease; and rape. Refer to appendix D.31.

- **> 19 ≤ 40 years**

The junior adult age group (> 19 ≤ 40) had frequent cases of tuberculosis in both in- and outpatients. Tuberculosis represented 5.72% of the total cost in inpatients (N = R50 301.79) and 2.51% in outpatients (N = R34 913.63). In both cases the CPI value indicated that the treatment was relatively expensive.

Undefined bacterial infections represented 20.99% of the total cost in inpatients (N = R50 301.79) and 11.73% of the total cost in outpatients (N = R34 913.63). Refer to table 92.

Undefined viral infection had a CPI value of 3.30 and as confirmed by the average cost of R79.13 ± 160.29 that the treatment was relatively expensive. The frequency was 14 (N = 2 095). Refer to table 92.

Unspecified HIV represented 7.82% of the total cost in inpatients (N = R50 301.79) and 46.91% of the total cost in outpatients (N = R34 913.63). The CPI of 2.85 for outpatients indicated that the treatment was relatively expensive.

Epilepsy in outpatients represented 3.98% of the total cost during the study period. The average cost per medicine item was R21.39 ± 18.68 which was confirmed by the CPI value of 1.23 as relatively expensive. Refer to table 92.

Hypertension had a CPI value of 2.08 in outpatients in this age group and had an frequency of 11 (N = 2 002). The average cost per medicine item was R36.36 ± 23.87.

TABLE 92: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in junior adults excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%*	Mean & std dev	R	%**	
Tuberculosis	90	4.30	31.99 ± 47.71	2879.11	5.72	1.33
Undefined bacterial infection	251	11.98	42.07 ± 129.85	10559.37	20.99	1.75
Undefined viral infection	14	0.67	79.13 ± 160.29	1107.86	2.20	3.30
Unspecified HIV	102	4.87	38.57 ± 59.37	3934.61	7.82	1.61
Epilepsy	29	1.38	26.70 ± 31.32	774.41	1.54	1.11
Hypertension	52	2.48	12.19 ± 33.80	633.96	1.26	0.51
Pneumonia, unspecified	50	2.39	32.82 ± 55.92	1640.96	3.26	1.37
Abscess of the lung without pneumonia	16	0.76	50.67 ± 83.66	810.70	1.61	2.11
Pain control	412	19.67	39.08 ± 158.72	16099.68	32.01	1.63
ICD-10 code	**Outpatients**					
	Prevalence		**Cost**			**CPI**
	n	%*	Mean & std dev	R	%**	
Tuberculosis	24	1.20	36.52 ± 13.59	876.54	2.51	2.09
Undefined bacterial infection	224	11.19	18.28 ± 104.78	4093.78	11.73	1.05
Undefined viral infection	7	0.35	7.34 ± 9.58	51.39	0.15	0.42
Unspecified HIV	330	16.48	49.63 ± 74.67	16378.96	46.91	2.85
Epilepsy	65	3.25	21.39 ± 18.68	1390.18	3.98	1.23
Hypertension	11	0.55	36.36 ± 23.87	399.91	1.15	2.08
Pneumonia, unspecified						
Abscess of the lung without pneumonia						
Pain control	516	25.77	12.79 ± 34.06	6601.74	18.91	0.73

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively in the junior adult age group

**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively in the junior adult age group

Unspecified pneumonia represented 3.26% of the total cost in inpatients (N = R50 301.79) in this age group.

Abscess of the lung without pneumonia had a CPI value of 2.11. See table 92.

Pain control represented 32.01% of the total cost for inpatients (N = R50 301.79) and 18.91% of the total cost for outpatients (N = R34 913.63). Refer to table 92.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): genital wards, congestive CCF, abscess in the lung without pneumonia, nephritis, rape, family planning; and post partum bleeding. Refer to appendix D.31.

- **> 40 ≤ 60 years**

TABLE 93: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in senior adults excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%	Mean & std dev	R	%	
Tuberculosis	56	3.74	33.94 ± 49.15	1900.61	6.35	1.70
Undefined bacterial infection	183	12.22	33.79 ± 82.06	6183.18	20.65	1.69
Unspecified HIV	76	5.08	28.64 ± 46.38	2176.50	7.27	1.43
Unspecified coagulation defects	58	3.87	68.73 ± 362.65	3986.38	13.31	3.44
Diabetes mellitus type 1	21	1.40	28.55 ± 33.53	599.64	2.00	1.43
Epilepsy	38	2.54	20.84 ± 25.39	791.89	2.64	1.04
Hypertension	162	10.82	10.66 ± 38.06	1727.47	5.77	0.53
Pain control	250	16.70	25.09 ± 140.49	6273.28	20.95	1.25
ICD-10 code	**Outpatients**					
	Prevalence		Cost			CPI
	n	%	Mean & std dev	R	%	
Tuberculosis	11	0.55	38.52 ± 13.99	423.72	0.99	1.78
Undefined bacterial infection	137	6.89	7.97 ± 11.22	1091.75	2.54	0.37
Unspecified HIV	281	14.13	78.49 ± 106.11	22055.08	51.32	3.63
Unspecified coagulation defects	61	3.07	9.80 ± 22.09	597.89	1.39	0.45
Diabetes mellitus type 1	28	1.41	49.20 ± 50.12	1377.65	3.21	2.28
Epilepsy	84	4.22	23.19 ± 14.09	1948.27	4.53	1.07
Hypertension	233	11.71	19.88 ± 54.03	4632.32	10.78	0.92
Pain control	447	22.47	14.25 ± 35.32	6370.29	14.82	0.66

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively in the senior adult age group
**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively in the senior adult age group

In the senior adult age group (> 40 ≤ 60) tuberculosis represented 6.35% of the total cost for inpatients (N = R29 941.93).

Undefined bacterial infections represented 20.65% of the total cost for inpatients (N = R29 941.93) and had a frequency of 183 (N = 1 497). Refer to table 93.

Unspecified HIV represented 7.27% of the total cost for inpatients and 51.32% for outpatients (N = R42 793.72). Both CPI values were > 1 which indicated that the treatment in this age group for unspecified HIV was relatively expensive.

Unspecified coagulation defects had a CPI value of 3.44 for inpatients and represented 13.31% of the total cost.

Diabetes mellitis type 1 (insulin dependent) represented 3.21% of the total cost for outpatients (N = R42 793.72) and the CPI value of 2.28 confirmed that the average cost per medicine item at R49.20 ± 50.12 was relatively expensive. See table 93.

Epilepsy had a frequency of 84 (N = 1 989) for outpatients and represented 4.53% of the total cost for outpatients (N = R42 793.72).

Hypertension represented 5.77% of the total cost for inpatients and 10.78% of the total cost for outpatients. The CPI value for both in- and outpatients was < 1 which indicated that anti-hypertensive medicine was relatively inexpensive.

Pain control in inpatients represented 20.95% of the total cost (N = R29 941.93) and 14.82% of outpatients' total cost (N = R42 793.72). Refer to table 93.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): STD suspicions, unspecified malignant neoplasm of the testis, multiple myeloma, parkinsonism, atherosclerotic gangrene, unspecified pneumonia, mouth abscess, unspecified appendicitis, alcohol liver disease, unspecified, alcohol liver disease, unspecified, and wound caring. Refer to appendix D.31.

- **> 60 years**

In the elderly (> 60 years) infective diarrhoea / food poisoning represented 4.25% of the total cost in inpatients (N = R18 949.56). See table 94.

Undefined bacterial infection represented 8.99% of the total cost in inpatients (N = R18 949.56) and 4.33% of the total cost in outpatients (N = R12 522.31). The treatment was relatively expensive for inpatients (CPI = 1.65) and relatively inexpensive for outpatients (CPI = 0.78).

TABLE 94: ICD-10 codes with a total cost of more than 3.00% and/or a CPI value of more than 2.00 in elderly excluding the ICD-10 codes with high CPI values due to frequencies of less than 10

ICD-10 code	Inpatients					
	Prevalence		Cost			CPI
	n	%	Mean & std dev	R	%	
Diarrhoea, infective / food poisoning	25	2.27	32.23 ± 73.86	805.76	4.25	1.87
Undefined bacterial infection	60	5.45	28.39 ± 48.17	1703.14	8.99	1.65
Diabetes mellitus type 1	17	1.55	35.22 ± 34.14	598.71	3.16	2.04
Major depressive disorder	21	1.91	10.00 ± 11.30	210.02	1.11	0.58
Hypertension	206	18.73	8.35 ± 16.17	1719.13	9.07	0.48
Asthma, acute OR asthma, chronic persistent	15	1.36	7.48 ± 5.39	112.13	0.59	0.43
Pain control	210	19.09	25.33 ± 110.01	5318.56	28.07	1.47
ICD-10 code	**Outpatients**					
	Prevalence		Cost			CPI
	n	%	Mean & std dev	R	%	
Diarrhoea, infective / food poisoning	5	0.61	1.54 ± 1.13	7.70	0.06	0.10
Undefined bacterial infection	45	5.53	12.05 ± 12.38	542.47	4.33	0.78
Diabetes mellitus type 1						
Major depressive disorder	23	2.83	19.02 ± 5.27	437.50	3.49	1.24
Hypertension	195	23.96	17.93 ± 27.43	3496.84	27.92	1.17
Asthma, acute OR asthma, chronic persistent	44	5.41	14.59 ± 10.67	641.84	5.13	0.95
Pain control	233	28.62	17.01 ± 46.79	3962.37	31.64	1.11

*Percentage was calculated for ICD-10 codes according to frequency for inpatients and outpatients respectively in the elderly age group
**Percentage was calculated for ICD-10 codes according to total cost for inpatients and outpatients respectively in the elderly age group

Diabetes mellitis type 1 (insulin dependent) represented 3.16% of the total cost for inpatients (N = R18 949.56) and the CPI of 2.04 indicated that the treatment was relatively expensive.

Major depressive disorders represented 3.49% of the total cost for outpatients with a frequency of 23 (N = 814).

Hypertension represented 9.07% of the total cost for inpatients (N = R18 949.56) and 27.92% of outpatients (N = R12 5221.31). The CPI value for inpatients was 0.48 which indicated that treatment was relatively inexpensive.

Asthma represented 5.13% of the total cost in outpatients (N = R12 522.31) with a frequency of 44 (N = 814). Refer to table 94.

Pain control represented 28.07% of the total cost in inpatients (N = 18 949.56) and 31.64% of the total cost in outpatients (N = R12 522.31). Refer to table 94.

The following ICD-10 codes had high CPI values (more than 3.00) but low frequencies (less than 10): rabies, unspecified hypothyroidism, hypoglycaemia / hyperglycaemia in diabetes mellitus, parkinsonism, unspecified pneumonia, peptic ulcers; and chronic obstructive pyelonephritis. Refer to appendix D.31.

5.5.7.4 Comprehensive summary of total cost for ICD-10 codes

This concludes the discussion on the average cost per medicine item according to ICD-10 codes. The top 10 ICD-10 codes according to total cost are indicated in appendix D.32. Table 95 includes the top 3 ICD-10 codes according to total cost.

TABLE 95: Total cost of top three ICD-10 codes

ICD-10 code	In- and outpatients		
	Rank	Cost (Rand)	%*
Unspecified HIV	1	56366.40	25.09
Pain control	2	46612.57	20.75
Undefined bacterial infection	3	30350.48	13.51
Total of top three ICD-10 codes		**133329.45**	**59.35**

*Percentage was calculated according to total cost

Unspecified HIV (B24) had the highest total cost for outpatients of R46 992.64 which represented 45.64% of the total cost for outpatients (N = R102 965.16). For inpatients, the total cost was R9373.76 and was ranked third in this department. Unspecified HIV (B24) had the highest total cost when combining in- and outpatients. The total cost was R56 366.40 and represented 25.09% of all diagnoses made. This was in line with the results of the top three budget group, pharmacological group and therapeutic code.

The budget group with the highest frequency was anti-infectives with a frequency of 50.88% of all budget groups (see appendix D.18 and 5.5.4.5).

Antivirals were the pharmacological group with the highest frequency of 24.48% of all pharmacological groups (see appendix D.23 and 5.5.5.5). Efavirenz 600mg capsules had the second highest frequency of all the therapeutic codes and was 12.32% of all therapeutic codes (see appendix D.28 and 5.5.6.5).

Pain control (R52.9) had the highest total cost for inpatients during the study period. The total cost for pain control was R28 382.76 and it was 23.2% of the total cost for inpatients (N = R121 711.95). Pain control (R52.9) was ranked second for outpatients and had a total cost of R18 229.81 which was 17.70% of the total cost for outpatients. Combined, pain control (R52.9) was ranked second with a total cost of R46 612.57. This represented 20.75% of all diagnoses made during the study period. This was in line with the results of the top three budget groups, pharmacological groups and therapeutic codes. Pain relievers were the budget group with the second highest total cost. The total cost of this budget group was 20.90% of the total cost of all budget groups (see appendix D.18 and 5.5.4.5). Analgesics, non-opioids including NSAIMS, gold and antigout preparations represented 20.52% of the total cost of all pharmacological groups and was ranked second (see appendix D.23 and 5.5.5.5). Diclofenac 25mg/ml injection was the therapeutic code with the highest total cost and represented 16.83% of all therapeutic codes (see appendix D.28 and 5.5.6.5).

Undefined bacterial infection (B20.1) had the second highest total cost in the inpatient department. The total cost of R23 926.85 represented 19.66% of the total cost for inpatients. Undefined bacterial infection (B20.1) was ranked fourth for outpatients with a total cost of R6 423.63. This was 6.24% of the total cost for outpatients. Undefined bacterial infections (B20.1) were ranked third when adding in- and outpatients total cost. The total cost was R30 350.48 and represented 13.51% of the total cost of all ICD-10 codes. This was in line with the results of the top three budget group, pharmacological group and therapeutic codes. The budget group anti-infectives represented 50.88% of the total cost of all the budget groups and was ranked first (see appendix D.18 and 5.5.4.5). Penicillin antibiotics were ranked the third highest pharmacological group according to total cost. Penicillin antibiotics represented 16.68% of the total cost of all pharmacological groups (see appendix D.23 and 5.5.5.5). Ampicillin 500mg injection (which was a penicillin antibiotic) has the third highest total cost of all therapeutic codes.

The total cost represents 7.96% of the total cost of all therapeutic codes (see appendix D.28 and 5.5.6.5).

The top three ICD-10 codes according to total cost were unspecified HIV (B24), pain control (R52.9) and undefined bacterial infection (B20.1).

Together these three ICD-10 codes had a total cost of R133 329.45 during the study period and represented 59.34% of the total cost of all ICD-10 codes.

The top 10 ICD-10 codes according to total cost represented 75% of all ICD-10 codes diagnosed for inpatients and 90% of all ICD-10 codes diagnosed for outpatients. Combined, 82.05% of the total cost of ICD-10 codes was illustrated in appendix D.32.

5.6 THERAPEUTIC BUDGET MODEL

The general objective of this study, as mentioned in chapter 1, was to develop (and implement) a therapeutic medicine budget model at Thusong Hospital in the North-West Province which can be used as a planning and control instrument based on the actual usage of medicines at Thusong Hospital (John, 2004:185). In their article, Blok *et al.* (2002:32) found that budgets allocated to provinces in South Africa were done without guidance and statistical data which prevented the calculations of actual requirements and medicine usage. This therapeutic budget model serves as a management tool which the pharmacy manager can use in order to determine the actual medicine usage at the specific public health care institution and which can be used as a platform in the projections of the budget of the next financial year.

The budget distribution can assist the pharmacy manager in planning the budget for pharmaceutical medicine items. This can be done at three levels: primary level, secondary level and tertiary level.

Primary level refers to the budget groups. For the purpose of this study all medicine items which appear in the medicine stock list were classified into budget groups. Only pharmaceutical medicine items were used, thus only the first nine budget groups out of eleven budget groups were used in this study.

At secondary level were the pharmacological groups. The budget groups (primary level) were divided into subgroups to form pharmacological groups. There were 63 pharmacological groups used in this study.

At the tertiary level were therapeutic codes. This refers to the individual medicine items. There were 386 medicine items used during this study. There were cases where the same active ingredient had different strengths or pack sises and was then counted as different medicine items for the purpose of this study. The therapeutic budget model with the percentage distribution of all the budget groups, pharmacological groups and therapeutic codes is given in appendix E.

The unique therapeutic budget model was based on the actual medicine usage during a six months period from January 2007 till June 2007 including seven months' patient visits (January 2007 till July 2007). The initial sample size was calculated at 25% but after the data collection period, the actual sample size was only 18.67%. The total medicine cost as calculated according to the study for only 18.67% of medicine usage during a six months period was R224 677.10. If we recalculate it to the total medicine cost for 100% of medicine usage in a full year, this will calculate to an amount of R2 406 824.96. The actual budget for pharmaceutical medicine items for Thusong Hospital was R2 457 562.50 for the year 2007 (Rix, 2008). The correlation between the actual budget according to the study and the projected budget of the hospital indicates a R50 737.54 surplus in the budget of the hospital.

The scope of a therapeutic budget model to be implemented at Thusong Hospital in the North-West province seems to be promising. The therapeutic budget can also help in achieving the following:

- Proper preparation and planning of budgetary policies in a phased manner based on scientific evidence;
- Evaluation of budgetary compliance, cost-efficiency of therapeutic and standard treatment guidelines, essential drugs list and formulary compliance;
- Better procurement strategies based on demand, expenditure and inventory control, and
- Better delivery and maintenance of quality health care by evaluating operational and clinical policies.

The therapeutic budget model is a more appropriate manner to use in the projections of budgets and medicine usage.

5.7 CHAPTER CONCLUSION

In chapter 5 the results of the data collected at Thusong Hospital were discussed according to budget groups, pharmacological groups, therapeutic codes and ICD-10 codes. Parameters like gender and age were also included in the discussion. There were eight comprehensive summaries as mentioned in section 5.1 which summarise the most important results.

The conclusion and recommendations of this study are discussed in chapter 6.

CHAPTER 6

Conclusions and Recommendations

In this chapter, the conclusion of the results discussed in chapter 5 (results and discussion) are presented according to the research objectives mentioned in chapter 1 (introduction). The researcher also makes certain recommendations in order to improve the documentation of current medicine usage patterns in the public health sector of South Africa. This chapter also states the limitations encountered during this study.

6.1 PUBLIC HEALTH SECTOR OF SOUTH AFRICA

The **first specific objective** of the **literature phase** was to *conceptualise from literature, the current situation in the public health sector of South Africa from a national perspective narrowing it down to provincial, local and community level including demographic details and health care facilities.*

6.1.1 Conclusions

After reviewing the literature of the current situation in the public health sector of South Africa from a national perspective narrowing it down to provincial, local and community level including demographic details and health care facilities, the following conclusions were reached:

- The current public health services in South Africa are decentralised to form national, provincial, district and community levels of health care (see section 2.1) with the aim to make health care more accessible for the community.

- The White Paper on Local Government (South Africa, 1998) set out the roles and responsibilities of the National Government with respect to a local government (see section 2.1.1).

- The mid-year estimation of the total population in the country is at 48,7 million people of which about 51% is female and approximately 11% is HIV positive (see section 2.1.1.1).
- The roles and responsibilities of Provincial Governments are described in the White Paper on local government (see section 2.1.2).
- North-West Province is one of the nine provinces in South Africa and accommodates approximately 7.0% of the total population (see section 2.1.2.1) and has certain health facilities under its jurisdiction (see section 2.1.2.2).
- The White Paper on local government states that the District Health System is important in the process to make health more accessible, available and affordable to patients (see section 2.1.3).
- The Ngaka Modiri Molema district (formerly known as Central district) consists of several local municipalities (sub-districts) and provincial primary health care facilities (see section 2.1.3.1 and 2.1.3.2).
- At community level the Ditsobotla sub-district is one of four local municipalities in which Thusong Hospital is situated and has a few primary health care facilities (see section 2.1.4.1 and 2.1.4.2).

Thus the **first specific objective** of the **literature phase** which was to conceptualise from literature, the health systems, medicine usage and public health care budgeting systems from a global perspective, narrowing down to national, provincial and local perspective **was achieved.**

6.1.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- More effective use of the decentralised health care sector so that more patients have more and easier access to affordable health care services in their own community.
- The number of health care facilities in the province, district and sub-district should be enough to satisfy the health related needs of the patients.

6.2 FACTORS AFFECTING HEALTH

The **second specific objective** of the **literature phase** was *to identify from literature, certain factors affecting health care in South Africa.*

6.2.1 Conclusions

After reviewing the literature to identify from literature, certain factors affecting health care in South Africa, the following conclusions were reached:

- There are several factors which affect health care delivery in the public health care sector of South Africa. Some are due to appropriate health service provision, e.g. health legislation and inequity in health (see section 2.2.1), and others are due to environmental and psychosocial factors, e.g. cultural factors and educational factors (see section 2.2.2).

- The factor which affects health in South Africa the most is inequity in health care services between rural and urban areas (see section 2.2.1.4).

- Poor hygiene and sanitation and not always being able to access safe water can easily lead to parasitic infections (see section 2.2.1.4).

- External factors were identified which threaten to influence the number of pharmacists in the country. Shortage of skills as well as poor service delivery in the public health sector were identified as factors which increase the demand for pharmacists in this sector (see section 2.2.1.5).

- The Ngaka Modiri Molema district (formerly known as Central district) was categorised in the second worst-off quintile according to socio-economical status (see section 2.2.2.1).

- The importance of early reporting and rapid response were identified (see section 2.2.2.5).

Thus the **second specific objective** of the **literature phase** which was to identify, from literature, certain factors affecting health care in South Africa **was achieved.**

6.2.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- More research on the factors affecting health care delivery in South Africa should be done so that these factors could either be eliminated or incorporated in the planning on how to minimise the effect of these factors.

- The inequity in health care between rural and urban areas should be more urgently addressed in order to improve the circumstances of people living in rural areas.

6.3 DRUG SUPPLY MANAGEMENT CYCLE

The **third specific objective** of the **literature phase** was *to investigate from literature and key role players, the drug supply management cycle with specific reference to drug selection, procurement, distribution and use of medicine items in the public health care sector of South Africa and North-West Province.*

6.3.1 Conclusions

After reviewing the literature to investigate the key role players, the drug supply management cycle with specific reference to drug selection, procurement, distribution and use of medicine items in the public health care sector of South Africa and North-West Province, the following conclusions were reached:

- The drug supply management is not only the responsibility of the National Department of Health but the Provincial Government, medical stores, Department of Pharmaceutical Services, district government, hospital management and pharmacy staff all play an important role in assuring that procurement, distribution and storage of medicine items happen on time and according to standard operating procedures (see section 2.3).

- The National Drug Policy set guidelines for optimal medicine usage and the factors which contribute to rational usage of medicine in the public health sector (see section 2.3).

- The Standard Treatment Guidelines and Essential Drugs List are complete guides to optimise medicine usage in the public health sector and include treatment regimes, dosage forms and strengths of medicine items (see section 2.3.1). There are separate manuals for primary health care, adult hospital level and paediatric hospital level.

- Procurement in the North-West Province is done by using the procurement cycle (see section 2.3.2.3) as explained in section 2.3.2.2.

- Distribution in the North-West Province was investigated (see section 2.3.3.2) according to the distribution cycle (see section 2.3.3.3).

- Medicine usage in South Africa and in the North-West Province was investigated and could be improved using guidelines set by the National Drug Policy (see section 2.3.4.2).

- Pharmacists have an important centralised role in educating and instructing patients in the correct use of drugs and thus are an important key in ensuring optimal medicine usage (see section 2.3.4.2.6).

Thus the **third specific objective** of the **literature phase** which was to investigate from literature and key role players, the drug supply management cycle with specific reference to drug selection, procurement, distribution and use of medicine items in the public health care sector of South Africa and North-West Province **was achieved.**

6.3.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- It is recommended that more official documentation of the public health sector should be available to researchers so that there is a clearer picture of what is expected from each department, district or manager in order to improve the drug supply management cycle.

- The National Drug Policy and the Standard Treatment Guidelines and Essential Drugs List should be available in every health care institution and be used by health care professionals throughout the public health care sector in order to improve and promote the cost-effective and rational use of drugs.

- The role of the pharmacist as key player in ensuring the optimal usage of medication should be emphasised and pharmacists should accept this challenge.

- The benefit of research in the public health sector should be emphasised in all departments of the public health care sector and co-operation with researchers should be encouraged.

6.4 PRESENT MEDICINE DISTRIBUTION SYSTEM

The **fourth specific objective** of the **literature phase** was to *write a short description of the present medicine distribution system at Thusong Hospital, North-West Province.*

6.4.1 Conclusions

After reviewing the literature about the present medicine distribution system at Thusong Hospital in North-West Province, the following conclusions were reached:

- In the North-West Province the procurement warehouse and distribution of stock from the suppliers are outsourced to a private company which distributes all the medical supplies to the health care institutions in the districts of the province (see section 4.3.2 in chapter 2).

- Good distribution practice includes stock rotation on the 'first in, first out' (FIFO) principle, enhances security by limiting the access to the storage area, arranges medicines alphabetically or in therapeutic categories and creates a separate quarantine space for damaged, expired, dangerous and restricted use products (see section 4.3.3 in chapter 2).

- Supply requisition is based on a 'pull or push system'. The 'push system' is where central level decides how much to deliver to the health care institution based on past deliveries and a 'pull system' is where every health care institution determines quantities they need (see section 4.3.3 in chapter 2).

- The more frequent the deliveries is done, the smaller the capacity of storage space that is needed at the health institution, the less frequent deliveries occur, the bigger the capacity for storage needs to be (see section 4.3.3 in chapter 2).

- Currently, no consumption information is collected from the health care facilities and stock movement is monitored in order to know the consumption.

- The resupply intervals, resupply frequency, method of distribution, method of transport, delivery schedule and delivery routes must be selected in the best cost-effective way.

Thus the **fourth specific objective** of the **literature phase** which was to write a short description of the present medicine distribution system at Thusong Hospital, North-West Province **was achieved**.

6.4.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- Supply requisition should be based on a 'pull system' based on scientific evidence so than no unneeded or unnecessary medicine items are delivered to the health care institution which influences the budget negatively.

- The frequency of deliveries should be based according to the storage space at the specific health care institution. If the institution has a big storage space, more stock can be delivered at once and less frequent deliveries are needed and visa versa.

- Stock movement is not an optimal indication of consumption because theft, breakage, expiry dates and misuse of medicines can not be identified by stock movement. It is suggested that consumption information should be collected from every health institute in the province in order to improve medicine usage and procurement.

- Further research is suggested to identify the most cost-effective way of resupply intervals, resupply frequency, method of distribution, method of transport, delivery schedule and delivery routes.

6.5 FINANCIAL EXPENDITURE DATA

The **fifth specific objective** of the **literature phase** was to *conceptualise from literature as well as Government White Papers, the financial expenditure data from national treasury, narrowing down to provincial and local levels.*

6.5.1 Conclusions

After reviewing the literature about the conceptualisation from literature as well as from Government White Papers, the financial expenditure data from national treasury, narrowing down to provincial and local levels, the following conclusions were reached:

- The National Drug Policy states four economic objectives which should be the basis for funding and budgeting in South Africa as well as provincial, district and community levels (see section 2.4).

- The budget for health care services in North-West Province for the year 2007/2008 was R176 966 million which was a drop of R13 918 million from 2006/2007 (see section 2.4). District health services allocated R1.8 billion for the financial year 2007/2008.

- There are several sources for funding of the public health care sector of which the government is the largest (see section 2.4.1).

- North-West Department of Health had a budget of R3 916 million for the year 2007/2008 (see section 2.4.2.2).

- Thusong Hospital had a budget of R2 457 562.50 for the year 2007/2008 for pharmaceutical medicine items.

Thus the **fifth specific objective** of the **literature phase** was to conceptualise from literature as well as Government White Papers, the financial expenditure data from national treasury, narrowing down to provincial and local levels, **was achieved.**

6.5.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- The layout of the budget from national level down to provincial, district and community levels should be more detailed in terms of where funds were received and allocated in order to monitor the appropriate use of these funds.

- There are several sources of financing mechanisms in the public health sector (see section 2.4.1 in chapter 2). Budgeting forms part this mechanism, and in the context of the pharmacy, the pharmacy manager's role is to ensure efficient inventory control in the health care institution. Thus pharmacy managers should practice proper financial management principles.

- Information on budgeting and the financial structure of the provincial Department of Health should be more accessible to researchers.

6.6 MANAGED HEALTH CARE

The **sixth specific objective** of the **literature phase** was *to conceptualise from literature, a brief overview of managed health care, how managed health care systems work, the different types of managed care organisations and management components.*

6.6.1 Conclusions

After reviewing the literature for conceptualisation from literature a brief overview of managed health care, how managed health care systems work, the different types of managed care organisations and management components, the following conclusions were reached:

- Managed health care is a system of seamless delivery which aims to reduce unnecessary service delivery while promoting high quality, cost-effective health care (see section 1 of chapter 3).
- A short description on how managed health care systems work was given (see section 3.1.1).
- There are four major types of managed care organisations as indicated in figure 28 (see section 3.1.2).
- There are four major types of management components of managed health care as indicated in figure 29 (see section 3.1.3).

Thus the **sixth specific objective** of the **literature phase** to conceptualise from literature, a brief overview of managed health care, how managed health care systems work, the different types of managed care organisations and management components, **was achieved.**

6.6.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- More research on managed health care and its components within the South African context is encouraged.

6.7 DRUG UTILISATION REVIEW

The **seventh specific objective** of the **literature phase** was *to conceptualise from literature the concepts of drug utilisation review (DUR), the International Code for Disease (ICD-10) classification system and the Anatomic Therapeutic Chemical (ATC) classification system.*

6.7.1 Conclusions

After reviewing the literature for conceptualisation of drug utilisation review (DUR) which focuses on the features of the International Code of Disease (ICD-10) classification system and the Anatomical Therapeutic Chemical (ATC) classification system, the following conclusions were reached:

- DUR aims to optimise treatment, to make essential drugs available and to control the cost of therapy in the hospital (see section 3.2).
- The Anatomical Therapeutic Chemical (ATC) classification system is designed according to the system in which the drug acts as well as the chemical, pharmacological and therapeutic characteristics. The aim of the ATC classification system is to serve as a tool to improve quality of life by using drug utilisation research (see section 3.2.7.1.1 in chapter 3).
- The International Code of Diseases (ICD) is a global and internationally accepted classification which is used to report and categorise diseases, health-related conditions and external causes of diseases and injury in order to get internationally recognised health information on deaths, illness and injury. This system is used globally to classify diseases on medical cards, death certificates and hospital record cards (see section 3.2.7.1.2).

Thus the **seventh specific objective** of the **literature phase** which was to conceptualise from literature drug utilisation review (DUR) articles on the features of the International Code for Disease (ICD-10) classification systems and the Anatomic Therapeutic Chemical (ATC) classification systems, **was achieved.**

6.7.2 Recommendations

The following recommendations based on the review of the existing literature could be made:

- Implementation of the ICD-10 code classification system in the public health care sector for disease is recommended in order to contribute to the internationally recognised health information systems.

- It is suggested that medicine items should be classified in the Standard Treatment Guidelines and Essential Drugs List according to the ATC classification system to make it globally acceptable.

- Implementation of the therapeutic budget model classification system (see appendix C.3) in the public health sector is encouraged which will classify all medicine items used at a specific health care institution. It includes all the medicine items currently in use at Thusong Hospital and it can easily accommodate more medicine items. The therapeutic budget model classification system is based on the ATC classification system (see section 3.2.7.1 in chapter 3) but caters for the unique needs of the South African public health sector.

6.8 PHARMACOECONOMICS AND PHARMACOEPIDEMIOLOGY

The **eighth specific objective** of the **literature phase** was *to conceptualise from literature, a brief overview of pharmacoeconomics and pharmacoepidemiology.*

6.8.1 Conclusions

After reviewing the literature for conceptualisation from literature, a brief overview of pharmacoeconomics and pharmacoepidemiology, the following conclusions were reached:

- Pharmacoeconomics has five different methods which can be used to perform pharmacoeconomic evaluations (see section 3.3.3).

- Cost is the value of the resources consumed by a program or treatment alternative and could be classified accordingly (see section 3.3.3.6).

- Pharmacoepidemiology is the study of use and effects/side-effects of drugs in large numbers of people (see section 3.4.3) and aspects like methods of pharmacoepidemiological studies and reasons to perform pharmacoepidemiological studies were included in the overview.

Thus the **eighth specific objective** of the **literature phase** to conceptualise from literature, a brief overview of pharmacoeconomics and pharmacoepidemiology, **was achieved**.

6.8.2 Recommendations

The following recommendations based on the review of the conclusions could be made:

- More pharmacoeconomic and pharmacoepidemiological studies are supported.

6.9 GENERAL AND DEMOGRAPHIC DATA

The **first specific objective** of the **empirical phase** was *to analyse the general and demographic data which include gender and age distribution, average age of patients, frequency of demography, visits, immunisation (outpatients) and duration of stay (inpatients).*

6.9.1 Conclusions

After reviewing and analysing the general and demographic data which include gender and age distribution, average age of patients, frequency of demography, visits, immunisation (outpatients) and duration of stay (inpatients), the following conclusions were reached:

- The total number of patients included in the study population was 1 166 (see section 5.2.1).
- The majority of patients were female representing 53.5% of the total sample population. Outpatients represented 62.4% of the total sample population (see section 5.2.1).
- The age group > 19 ≤ 40 had 446 patients in this age group which represent 37.9% of the total sample population (see section 5.2.2).
- The average age for inpatients was calculated at 30 years and 7 months while outpatients had an average age of 33 years and 10 months (see section 5.2.3).
- Of the 433 inpatients visits, 146 (33.7%) were female patients visiting the female surgical ward. Acute outpatients visits represented 76.6% (n = 562) of the total frequency of demography for outpatients (see section 5.2.4).

- Of all the inpatients 87.3% had only one inpatient visit and 73.4% had no outpatient visits. Outpatients had no inpatient visits and 55.3% had only one outpatient visit (see section 5.2.5).

- Immunisation only occurred in outpatients and 97.1% of patients did not receive any form of immunisation at Thusong Hospital (see section 5.2.6).

- Duration of stay was only recorded for inpatients. Nine patients were discharged on the same day as admission; the majority (20.62%) of inpatients were hospitalised for 2 days and the longest duration of stay was 91 days.

Thus the **first specific objective** of the **empirical phase** which was to analyse the general and demographic data which include gender and age distribution, average age of patients, frequency of demography, visits, immunisation (outpatients) and duration of stay (inpatients) **was achieved**.

6.9.2 Recommendations

The following recommendations based on the empirical investigation could be made:

- Investigate why female patients visit the hospital more often than male patients.

- Investigate why patients in the junior adult age group visit the hospital more frequently.

- Investigate why inpatients had the highest prevalence for the female surgical ward.

- Investigate if immunisation is done properly at the clinics surrounding the hospital.

- Investigate why the longest duration of stay for an inpatient was 91 days.

6.10 MEDICINE USAGE INFORMATION

The **second specific objective** of the **empirical phase** was *to analyse the medicine usage information referring to the frequency of budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary).*

6.10.1 Conclusions

After reviewing and analysing the medicine usage information referring to the frequency of budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary), the following conclusions were reached:

6.10.1.1 Conclusion on all parameters according to the budget groups

With reference to sections 5.3.1.1 to 5.3.1.4 and appendices D.1 and D.2, when the top three budget groups were classified based on total prevalence, the following salient points were identified:

- Anti-infective budget group represented 26.29% of the total frequency for budget groups (n = 3 094). Female inpatients had the highest frequency as well as patients in the age group > 19 ≤ 40 years for this budget group.
- Pain reliever budget group represented 22.69% of total frequency for budget groups with a frequency of 2 670. Female outpatients and patients in the age group > 19 ≤ 40 years had the highest frequency for this budget group.
- Gastrolyte budget group represented 19.13% of total frequency for budget groups with a frequency of 2 251. Female inpatients had the highest frequency for this budget group as well as patients in the age group >19≤40 years for this budget group.

6.10.1.2 Conclusion of all parameters according to the pharmacological groups

With reference to sections 5.3.2.1 to 5.3.2.4 and appendices D.1 and D.3 to D.5, when the top three pharmacological groups were classified based on total prevalence, the following salient points were identified:

- The pharmacological group Analgesic, non-opioids including NSAIMs, gold and antigold preparations had the highest frequency of 2 583 (21.95%) of all pharmacological groups. Female outpatients had the highest frequency for this pharmacological group (24.56%) as well as patients in the outpatients age group > 19 ≤ 40 years.

- The vitamin and mineral pharmacological group represented 13.07% (n = 1 538) of all pharmacological groups. Female inpatients received the most medicine items from this pharmacological group. Inpatients in the age group >19≤40 years received the most items from this pharmacological group.

- Penicillin antibiotics had the third highest frequency of 10.27% (n = 1 209) of all pharmacological groups. Female inpatients represented 507 medicine items from this pharmacological group as well as inpatients from the age group >19≤40 years.

6.10.1.3 Conclusion on all parameters according to the therapeutic code

With reference to sections 5.3.3.1 to 5.3.3.4 and appendices D.1 and D.6 to D.8, when the top three therapeutic codes were classified based on total prevalence, the following salient points were identified:

- Paracetamol 500mg tablets had the highest frequency of all therapeutic codes with a frequency of 1 063 (9.03%). Female outpatients had the highest frequency for this product at 340 (10.05%) and it was used in every age group for in- and outpatients.

- Ibuprofen 200mg tablets had a frequency of 600 (5.10%). Female outpatients had the highest frequency for this product at 187 (5.53%) and for outpatients in the age group > 12 ≤ 19 years.

- Multivitamin tablets represented a frequency of 4.62% (n = 544). Female inpatients had the highest frequency for multivitamin tablets (4.97%) and it was used in all age groups with the highest frequency for inpatients in the age group >19≤40 years.

6.10.1.4 Conclusion on all parameters according to the ICD-10 code

With reference to sections 5.3.4.1 to 5.3.4.3 and appendices D.1 and D.9 to D.11, when the top three ICD-10 codes were classified based on total prevalence, the following salient points were identified:

- Pain was the condition with the highest frequency during the study period with a frequency of 2 490 (21.16%). Pain was treated most frequently in female outpatients (22.72%) as well as in outpatients in the age group >19≤40 years with a frequency of 516 (25.77%).

- Vitamin deficiency had the second highest frequency of all ICD-10 codes with a frequency of 1 380 which represented 11.73% of all conditions. Female inpatients most frequently received the treatment for this condition (12.88%) as well as inpatients in the age group > 19 ≤ 40 years (13.12%).

- Undefined bacterial infections represented 10.10% of all conditions during the study period with a frequency of 1 189. This condition was diagnosed the most in female inpatients (11.69%) and in inpatients in the junior adult age group.

Thus the **second specific objective** of the **empirical phase** which was to analyse the medicine usage information referring to the frequency of budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary) **was achieved**.

6.10.2 Recommendations

The following recommendations based on the empirical investigation could be made:

- An investigation as to why female patients had the highest frequency in all the top three groups and codes.

- An investigation as to why patients in the age group >19≤40 years had the highest frequency for the anti-infective, pain reliever and gastrolyte budget groups, non-opioid analgesics, vitamins and minerals and penicillin antibiotics pharmacological groups, multivitamins, pain control, vitamin deficiency and unspecified bacterial infections.

6.11 AVERAGE NUMBER OF MEDICINE ITEMS PER CONSULTATION

The **third specific objective** of the **empirical phase** was *to analyse the average number of medicine items per consultation according to gender and age group.*

6.11.1 Conclusions

After reviewing and analysing the average number of medicine items per consultation according to gender and age group, the following conclusions were reached:

- The total number of items dispensed during the study period was 11 768 of which 6 288 were for inpatients and 5 480 were for outpatients. There were 3 220 consultations during this period (see section 5.4.1).

- The average number of medicine items per consultation for inpatients was 2.23 ± 3.00 and for outpatients 3.66 ± 1.98 (see section 5.4.1).

- Female inpatients had the most consultations at 1 006 (30.3%) and received 4 028 medicine items (34.2%) during these consultations (see section 5.4.2).

- Patients in the age group >19≤40 years had the most consultations – 541 consultations for inpatients (16.8%) and 577 consultations for outpatients (17.9%) (see section 5.4.3).

Thus the **third specific objective** of the **empirical phase** which was to analyse the average number of medicine items per consultation according to gender and age group **was achieved**.

6.11.2 Recommendations

The following recommendations based on the empirical investigation could be made:

- Investigate why female inpatients had the most consultations and received the most medicine items during the study period.

- Investigate why patients in the junior adult age group (> 19 ≤ 40 years) had the most consultations and received the most medicine items during the study period.

6.12 AVERAGE COST PER CONSULTATION

The **fourth specific objective** of the **empirical phase** was *to analyse the average cost per consultation according to gender, age groups, budget groups, pharmacological groups, therapeutic codes and ICD-10 codes.*

6.12.1 Conclusions

After reviewing and analysing the average cost per consultation according to gender, age groups, budget groups, pharmacological groups, therapeutic codes and ICD-10 codes, the following conclusions were reached:

- The average cost per consultation for inpatients was R70.80 ± 177.72 and for outpatients it was R68.83 ± 120.50 (see section 5.4.4).
- Female inpatients had the highest average cost per consultation at R77.13 ± 198.16 (see section 5.4.4.1).
- Inpatients in the age group > 19 ≤ 40 years had the highest average cost per consultation at R93.16 ± 198.59. Outpatients in the age group >6≤12 years had the highest average cost per consultation at R131.79 ± 266.81 (see section 5.4.4.2).
- The budget group, Anti-infectives had the highest average cost per consultation for both inpatients (R70.12 ± 133.24) and outpatients (R92.53 ± 161.56) (see section 5.4.4.3).
- The pharmacological group, Antihypoglycaemic agents had an average cost per consultation of R1 097.74 ± 914.63 for inpatients. The pharmacological group, Sera and Immunologicals had the highest average cost per consultation at R324.67 (see section 5.4.4.4).
- Diclofenac 25mg/ml injection had the highest average cost per consultation at R360.83 ± 371.25 for inpatients while efavirenz 200mg capsules had an average cost per consultation of R524.59 ± 185.56 (see section 5.4.4.5).
- Hypoglycaemia/hyperglycaemia in diabetes mellitus had the highest average cost per consultation for inpatients at R659.74 ± 882.03 while unspecified HIV had the highest average cost per consultation at R68.50 ± 107.91 for outpatients.

Thus the **fourth specific objective** of the **empirical phase** which was to analyse the average cost per consultation according to gender, age groups, budget groups, pharmacological groups, therapeutic codes and ICD-10 codes **was achieved**.

6.12.2 Recommendations

The following recommendations based on the empirical investigation could be made:

- Investigate why female patients had the highest average cost per consultation.
- Investigate why inpatients in the age group > 19 ≤ 40 years had the highest average cost per consultation and outpatients in the age group > 6 ≤ 12 years.
- Investigate why the budget group, Anti-infectives had the highest average cost per consultation for both inpatients and outpatients.
- Investigate why the pharmacological group, Antihypoglycaemic agents had an average cost per consultation of R1 097.74 for inpatients and why the pharmacological group, Sera and Immunologicals had the highest average cost per consultation of R324.67 for outpatients (refer to appendix D.12).
- Investigate why diclofenac 25mg/ml injection had the highest average cost per consultation for inpatients while efavirenz 200mg capsules had an average cost per consultation for outpatients (refer to appendix D.13).
- Investigate why Hypoglycaemia/hyperglycaemia in diabetes mellitus had the highest average cost per consultation for inpatients and why unspecified HIV had the highest average cost per consultation for outpatients.

6.13 AVERAGE COST PER MEDICINE ITEM

The **fifth specific objective** of the **empirical phase** was *to analyse the average cost per medicine item for budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary).*

6.13.1 Conclusions

After reviewing and analysing the average cost per medicine item for budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary), the following conclusions were reached:

6.13.1.1 Conclusion on all parameters according to the budget groups

With reference to sections 5.5.4 to 5.5.4.5 and appendices D.15, D.16 and D.17, when the top three budget groups were classified based on total cost, the following salient points were identified:

- Anti-infective drugs had the highest total cost (R114 305.85) and represented 50.88% (N = R224 677.10) of the total cost. The average medicine cost per budget group was the highest for outpatients (R40.37 ± 92.98) while female patients had a higher prevalence (64.48%) and the age group of >19≤40 years had the highest prevalence (41.69%).

- Pain reliever drugs had a cost percentage of 20.90% (n = R46 957.94) with an average cost per medicine item of R24.19 ± 123.69 in inpatients. The highest prevalence was for female patients (54.91%) and patients in the age group >19≤40 years (35.58%).

- Cardiovascular agents represented 9.73% (n = R21 865.58) of the total cost (N = R224 677.10) during the study period where the highest average cost per medicine item was for outpatients (R17.21 ± 40.54). Female patients (73.38%) as well as patients in the age group >40≤60 years (35.65%) had the highest prevalence for cardiovascular agents.

6.13.1.2 Conclusion on all parameters according to the pharmacological groups

With reference to sections 5.5.5 to 5.5.5.5 and appendices D.19 to D.22, when the top three pharmacological groups were classified based on total cost, the following salient points were identified:

- Antiviral pharmacological group had the highest total cost (R55 001.81) of all pharmacological groups and represented 24.48% of the total cost (N = R224 677.10). Female patients had the highest prevalence of 4.38% while patients in the age group > 19 ≤ 40 years had the highest prevalence of 2.87%.

- Analgesics, non-opioids including NSAIMs, gold and antigout preparations represented 20.52% of the total cost (R46 092.52). The highest prevalence was for outpatients with

a frequency of 1 473 while outpatients had the highest average cost per medicine item at R25.13 ± 127.62. Female patients had the highest prevalence of 12.09% as did patients in the age group >19≤40 years (7.75%)

- Antibacterial (penicillins) had a total cost of R37 482.28 (16.68% of the total cost). The average cost per medicine item was the highest for inpatients at R38.02 ± 68.54 and the highest prevalence was for female patients at 5.99% and for patients in the age group > 19 ≤ 40 years 3.85%.

6.13.1.3 Conclusion on all parameters according to the therapeutic code

With reference to sections 5.5.6 to 5.5.6.5 and appendices D.24 to D.27, when the top three therapeutic codes were classified based on total cost, the following salient points were identified:

- Diclofenac 25mg/ml injection represented 16.83% of the total cost for therapeutic codes with a total cost of R37 809.55 and an average cost per medicine item of R337.40 ± 361.68 for inpatients. The highest prevalence was for female patients at 0.79% and for patients in the age group >19≤40 years (0.71%).

- Efavirenz 600mg capsules (30s) had a total cost of R27 671.02 and represented 12.32% of the total cost (N = R 224 677.10) with an average cost per medicine item of R261.39 ± 59.93 for outpatients. Female patients had the highest prevalence of 4.07% as did patients in the age group >40≤60 years (0.55%).

- Ampicillin 500mg injection had a total cost of R17 889.42 (7.96%) and a total prevalence for 149 (1.27%). Inpatients had the highest average cost per medicine item at R121.70 ± 100.80. Female patients had the highest prevalence of 90 (0.76%) and patients in the age group >19≤40 years had the highest prevalence of 0.58%.

6.13.1.4 Conclusion on all parameters according to the ICD-10 code

With reference to sections 5.5.7 to 5.5.7.4 and appendices D.29 to D.31, when the top three ICD-10 codes were classified based on total cost, the following salient points were identified:

- Unspecified HIV represented a total cost of R56 366.40 (25.09%) and had a prevalence of 7.88%. The highest prevalence was for outpatients with an average cost per

medicine item of R68.50 ± 107.91. Female patients had a higher prevalence of 5.55% as did patients in the age group >19≤40 years with a prevalence of 3.67%.

- Pain control had a total cost of R46 612.57 which represented 20.75% of the total cost and 21.16% of the total prevalence. Inpatients had the higher average cost per medicine item of R25.83 ± 128.13. Female patients had a higher prevalence of 11.40% according to gender and patients in the age group > 19 ≤ 40 years had the highest prevalence of 7.89% according to age groups

- Undefined bacterial infections had a total cost of R30 350.48 which represented 13.51% of the total cost and 10.10% of the total prevalence. Inpatients had a higher average cost per medicine item of R34.83 ± 106.96. The highest prevalence was for female patients (6.59%) and patients in the age group >19≤40 years (4.04%).

Thus the **fifth specific objective** of the **empirical investigation** which was analysis of the average cost per medicine item for budget groups, pharmacological groups, therapeutic codes and ICD-10 codes according to gender, age group and ICD-10 code (where necessary) **was achieved**.

6.13.2 Recommendations

The following recommendations based on the empirical investigation could be made:

- An investigation as to why anti-infective drugs had the highest total cost of all budget groups.

- An investigation as to why patients in the age group >19≤40 years had the highest prevalence for anti-infective budget group, pain reliever budget group, antiviral pharmacological group, non-opioid analgesic pharmacological group, penicillin antibacterial pharmacological group, diclofenac injection, ampicillin 500mg injection, unspecified HIV, pain control and undefined bacterial infections.

- An investigation as to whether there is a correlation between the usage of anti-infectives and pain relievers in female patients at Thusong Hospital.

- An investigation as to why non-opioid analgesics had such a high prevalence.

- A pharmacoeconomic investigation of the cost-effectiveness of diclofenac 25mg/ml injection in relation to therapeutic outcomes based on the therapeutic code classification system, and whether there is a more cost-effective alternative available.
- A pharmacoeconomic investigation of the cost-effectiveness of efavirenz 600mg capsules in relation to therapeutic outcomes based on the therapeutic code classification system, and whether there is a more cost-effective alternative available.
- A pharmacoeconomic investigation of the cost-effectiveness of ampicillin 500mg injection in relation to therapeutic outcomes based on the therapeutic code classification system, and whether there is a more cost-effective alternative available.
- An investigation into the actual prevalence of patients with unspecified HIV disease at Thusong Hospital.
- An investigation as to why the prevalence of pain control is so high and whether the correct treatment regime is followed for the different diagnoses.
- An investigation as to why the prevalence of unspecified bacterial infections is so high in female patients.

6.14 THERAPEUTIC BUDGET MODEL

The **sixth specific objective** of the **empirical phase** was *to determine the framework for the formulation of a unique therapeutic budget model for Thusong Hospital.*

6.14.1 Conclusions

After reviewing and determining the framework for the formulation of a unique therapeutic budget model for Thusong Hospital, the following conclusions were reached:

- The correlation between the actual budget and the projected budget showed a R50 737.54 surplus in the budget of the hospital (see section 5.6).
- The distribution of costs between budget groups, pharmacological groups and therapeutic codes can be used as a budget and planning tool (see appendix E).

- The therapeutic budget model assists the pharmacist in identifying areas of specific needs in medicine demand-procurement-expenditure strategies.
- The scope of a therapeutic budget model to be implemented in Thusong Hospital seems to be promising in order to assist the pharmacy manager in planning the budget.
- The therapeutic budget model serves as a planning and control instrument.

Thus the **sixth specific objective** of the **empirical phase** which was to determine the framework for the formulation of a unique therapeutic budget model for Thusong Hospital **was achieved**.

6.14.2 Recommendations

The following recommendations based on the empirical investigation could be made:

- The implementation of a therapeutic budget model at Thusong Hospital and the evaluation of the accuracy of this model.
- Planning and budgeting can occur in a phased manner based on the scientific evidence from this study.
- Compliance with the Standard Treatment Guidelines (STG) and the Essential Drug List (EDL) can be evaluated and monitored, and if necessary, improved.
- Continuous updating of the therapeutic budget model to ensure accurate budgeting.
- Interventions should be used to improve the current system at Thusong Hospital.
- Actual medicine consumption is no longer monitored through the movement of stock at the provincial medical store but in the health care institution by using the therapeutic budget model.
- Provincial government can use the therapeutic budget model in their planning of budget allocations to the health care institutions in the province and to foresee a more effective budget system.

- Medicine usage control can assist the provincial medical stores in their procurement process and better planning of stock and medical supplies can be achieved.

- The therapeutic budget model will encourage pharmacists to improve their record keeping and data management in order to have more scientific evidence of the medicine usage at that institution.

6.15 LIMITATIONS TO THIS STUDY

The following limitations should also be taken into consideration when formulating the above conclusions and implementing the recommendations:

- The raw data collected by the researcher are assumed to be correct and accurate.

- The shortage of funds or lack of studies in connection with the public health sector in South Africa could be a limiting factor in the proper implementation of the principles in the literature review and the empirical investigation section.

- The public health sector is always subject to changes so that at the time of publishing this study, the scenario in the North-West Province and in the Ditsobotla sub-district could have changed with regards to the factors discussed in the literature review and the empirical investigation section.

6.16 CHAPTER CONCLUSION

In this chapter the objectives stated in chapter 1 of this study were discussed and answered according to the results in chapter 5. Mention was also made of the achievements of research objectives. Conclusions were reached for every objective of the literature and empirical phase of this study from the literature review and results of the empirical investigation. A few recommendations were made to be followed by the role players in the public health care sector at hospital level in order to control and improve medicine usage at Thusong Hospital. Some limitations of this study were mentioned and included in this chapter.

All eight specific objectives from the literature phase (see sections 6.1 to 6.8.2) and all six specific objectives form the empirical phase (see sections 6.9 to 6.14.2) have been achieved and reached during this study and it was ended off by conclusions and recommendations in

chapter 6. Thus, the general objective of this study which was to develop a therapeutic medicine budget model at Thusong Hospital, North-West Province to control medicine usage, has been answered accordingly.

It is hence concluded that the objectives of this study have been achieved.

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