

Physical activity and selected coronary heart disease risk factors among South African employees at a financial institution: an analysis over time

R Labuschagne

10132783

December 2016

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NORTH-WEST UNIVERSITY
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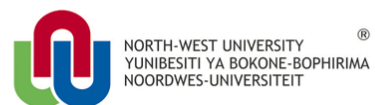
Thesis submitted for the degree *Doctor of Philosophy* in Human Movement Science at the Potchefstroom Campus of North-West University

Promoter: Dr M Swanepoel

Co-Promoter: Prof G L Strydom

December 2016

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The Author.

December 2016

Declaration

Dr. M. Swanepoel (Promoter and co-author), professors G.L. Strydom (co-promoter and co-author), M.A. Monyeki, H.S. Steyn, Drs. J.C. Rothmann, S. Rothmann and L. de Beer (co-authors) hereby give permission to the candidate, Mr R. Labuschagne to include the articles as part of this doctoral thesis. The contribution of each promoter and co-author was kept within reasonable limits and included:

Mr R. Labuschagne:	Developing the proposal, gathering of research data, analysing and interpretation of the results, writing of manuscript;
Promoter / Co-author:	Dr. M. Swanepoel - Supervision and study guidance;
Co-promoter / Co-author:	Prof. Dr. G. L. Strydom - Supervision and study guidance;
Co-authors:	Prof. H.S. Steyn - Statistical analysis and support;
	Prof. M.A. Monyeki - Guidance in preparing manuscripts;
	Dr. J.C. Rothmann, Dr S. Rothmann and Dr. L.T. de Beer - Guidance and statistical analysis of psycho-social parameters.

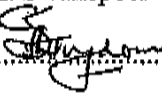
This thesis therefore serves fulfilment of the requirements of the PhD degree in Human Movement Science within Physical Activity, Sport and Recreation (PhASRec) Focus Area in the Faculty of Health Sciences at the North-West University, Potchefstroom Campus.

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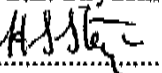
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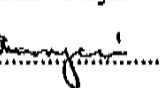

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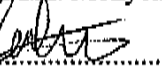
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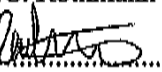
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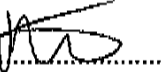
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Abstract

Physical inactivity has been identified as one of the primary, but modifiable risk factors for coronary heart disease (CHD), which together with chronic respiratory disease, cancer and diabetes mellitus forms the four main categories for the so-called non-communicable diseases (NCDs). This health threat, also referred to as “diseases of lifestyle” has reached epidemic proportions globally, causing about 70% of all premature deaths. This drainage of human resources also posed a threat to the corporate environment as about 50% of those who died from NCD were in the prime of their productive years. This led the World Economic Forum to warn, that this situation might significantly impact on productivity over the next 2 decades. Research has already identified a constellation of risk factors which may lead to CHD with the primary factors viz. obesity, hypertension, elevated cholesterol, physical inactivity and smoking, all being modifiable. The prevalence of CHD risk factors in the corporate environment has already reached perturbing numbers and intervention strategies are needed to curb this potential economic burden. Therefore the purpose of this study was to: (i) determine the prevalence of selected CHD risk factors over time (2007 - 2013) amongst employees in a financial institution in South Africa; (ii) study the relationship between physical activity status and selected CHD risk factors (body mass index (BMI), blood pressure, smoking, total cholesterol and blood glucose levels) amongst employees in a financial institution in South Africa and (iii), analyze the contribution of psycho-social ill-health (stress, depression and burnout) to the CHD risk factor index (CHDRI). A total number of 20910 assessments (males = 8062 and females = 12848) between the age 20 - 60 years, employed by a financial institution in South Africa, were included in this study over a period of 7 years. This non-randomized, availability population represented 7 head offices and 628 branches spread over the country. Although this study covers a 7 year period it was not design as a longitudinal study, but to reflect the company’s risk profile over time. Registered biokineticists were responsible to gather the data at the different locations, after attending a conduction course by the company’s chief biokineticist. The following parameters were assessed namely; gender, age, stature, body mass index (BMI), systolic and diastolic blood pressure (SBP & DBP), non-fasting total cholesterol (TC) and glucose (Glu) (capillary blood from finger prick), physical activity and smoking status (derived from the Bjurström and Alexiou’s, CHD risk index questionnaire), coronary heart disease risk index (CHDRI) and psycho-social health status (stress, depression and burnout). The results of this study

indicated that employees (males and females) in the younger pre-clinical age group (≤ 45 yrs.) reflect six CHD risk factors in common (BMI, physical inactivity, smoking, psycho-social ill health, physical ill health and burnout), falling in the moderate risk category. In the older group (males and females) (post-clinical horizon, > 45 yrs.) eight CHD risk factors (BMI, SBP, DBP, physical inactivity, smoking, psycho-social ill health, physical ill health and burnout) were classified as moderate risk category. It is further indicated that for females 83% and 88% in the pre- and post-clinical horizon group respectively, can be labeled as “population at risk” (PAR) for the psycho-social ill health (stress and depression) risk factor, indicating that they are experiencing moderate or high stress levels. This is followed by burnout (79% and 74%) respectively. In the case of males in the younger group, 67% could be classified as PAR for the psycho-social ill health, followed by 65% for burnout. In the older males 78% could be classified as PAR for BMI and SBP, followed by 71% for DBP. In assessing the mean values of the various risk factors it seems that in the younger females (≤ 45 yrs.) SBP (116.19 ± 14.35 mmHg), DBP (75.55 ± 10.6 mmHg), TC (4.46 mmol/L ± 0.93) and Glu (5.16 ± 1.40 mmol/L) were in the low risk category. Except for SBP the males (≤ 45 yrs.) shared the same low risk profile. For the older group of employees (male and female) TC and Glu values were in the low risk category. It is also clear that in the case of females (> 45 yrs.) a moderate practical significance ($d = 0.31$) difference occurred between the low and high physically active groups, regarding the BMI. When the impact of physical activity (PA) is analyzed on the CHDRI a moderate to high practical significance difference were found between all activity groups.

For females in both age groups physical activity index (PAI) showed a small practical significant positive correlation with BMI ($r = 0.05$ and $r = 0.11$) and a medium practical significant positive correlation with the CHD risk index ($r = 0.48$ and $r = 0.46$). Additionally, the older female group showed a small positive practical significant correlation between PAI and DBP ($r = 0.11$) and SBP ($r = 0.10$). In the males (≤ 45 yrs.) a small practical significant positive correlation between PAI and SBP ($r = 0.03$), DBP ($r = 0.06$), TC ($r = 0.05$) and Glu ($r = 0.03$) were found with a large positive practical significant positive correlation with CHD risk ($r = 0.52$). In the older males a large practical significant correlation between PAI and CHDRI ($r = 0.52$) was noted as well as a small practical significant positive relationship with BMI ($r = 0.08$). A negative but non-significant correlation occurred between PAI and TC in the females ($r = -0.02$ and $r = -0.01$) but not in the males. In the females ≤ 45 years, negative but non-significant correlations occurred between smoking and SBP ($r = -0.01$),

DBP ($r = -0.01$) and Glu ($r = -0.03$), as well as with BMI ($r = -0.08$), SBP ($r = -0.04$), DBP ($r = -0.08$), TC ($r = -0.01$), Glu ($r = -0.03$), PAI ($r = -0.02$) in the older females. In the case of males (≤ 45 yrs.) smoking showed small but non-significant negative correlations with SBP ($r = -0.01$), DBP ($r = -0.03$) and TC ($r = -0.01$) while in the older group negative but non-significant correlations existed between TC ($r = -0.03$) and Glu ($r = -0.05$).

The results also showed that the psychological health parameters (psycho-social ill health, physical ill health and burnout) contributed significantly to the CHDRI. The ANOVA analyses indicated statistical significant differences in all three psycho-social dependent variables between the low vs. high CHDRI groups, with psycho-social ill health $F(2) = 16.06$, $p = 0.001$, physical-ill health, $F(2) = 18.165$, $p = 0.001$ and burnout $F(2) = 3.75$, $p = 0.025$. Female employees showed a higher percentage score (48%) for being at high risk of physical ill health, compared to males (38%). Female employees also presented with higher percentage scores of being at high risk for burnout than their male counterparts across the age groups.

Key words: Employees, coronary heart disease, risk factors, physical activity, psycho-social health.

Opsomming

Fisieke onaktiwiteit is reeds as een van die primêre risiko faktore vir koronêre hartsiektes identifiseer, dog wat wel veranderbaar is. Tesame met kroniese respiratoriese siektes, kanker en diabetes mellitus vorm dit die vier (4) hoof siektetoestande van die sogenaamde “nie-aansteeklike” siektes. Hierdie gesondheidsbedreigings ook genoem “leefstylsiektes”, het reeds globale epidemiese afmetings bereik, wat vir ongeveer 70% van alle voortydige siektes verantwoordelik is. Hierdie dreinerings van menslike hulpbronne verskerp die bedreiging in die korporatiewe omgewing, aangesien 50% van diegene wat aan die nie-aansteeklike siektes sterf, in die bloeytydperk van hulle produktiewe jare is. Die situasie het daartoe gelei dat die Wêreld Ekonomiese Forum reeds gewaarsku het dat dit ‘n betekenisvolle negatiewe impak op produktiwiteit oor die volgende 2 dekades kan veroorsaak. Navorsing het reeds ‘n aantal risikofaktore wat met koronêre hartsiektes (KHS) geassosieer kan word identifiseer waaronder obesiteit, hipertensie, verhoogde totale cholesterol, rook en fisieke onaktiwiteit as die primêre, dog veranderbare faktore gelys word. Die voorkoms van KHS risikofaktore in die korporatiewe omgewing het alreeds onrusbarende afmetings aangeneem wat intervensie strategieë om hierdie ekonomiese bedreigings hok te slaan, noodsaaklik maak. Die doel van hierdie studie was derhalwe om: (i) die voorkoms van bepaalde KHS risikofaktore oor die tydperk 2007 - 2013, by werknemers in ‘n finansiële instelling in Suid Afrika te bepaal; (ii) die verwantskap tussen fisieke aktiwiteitstatus (FA) en bepaalde KHS risikofaktore (liggaamsmassa-indeks (LMI), bloeddruk, rook, totale cholesterol en glukose waardes) (nie-vastend) by werknemers in ‘n finansiële instelling te ondersoek, en (iii) die bydrae van psigososiale risikofaktore (stres, depressie en uitbranding) tot die KHS risiko-indeks (KHSRI) by die werknemers te ontleed. Vir die doel van hierdie studie is die data van 20910 gesondheidstatus-evaluasies (mans = 8062 en dames = 12848 tussen die ouderdomme van 20 - 60 jaar), oor die tydperk van 7 jaar ontleed. Hierdie nie-ewekansige beskikbaarheidpopulasie het 7 hoofkantore en 628 takke van die maatskappy oor Suid Afrika verteenwoordig. Alhoewel hierdie studie oor tyd gedoen is, is dit nie as ‘longitudinale studie beplan nie, maar eerder om die risikoprofiel van die maatskappy oor tyd te ontleed. Die data is ingesamel deur geregistreerde biokinetici wat vooraf ‘n induksieprogram wat deur die maatskappy se hoof biokinetikus aangebied is, deurloop het. Die volgende metings is gedoen naamlik: geslag, ouderdom, lengte, massa, liggaamsmassa-indeks (LMI) sistoliese en diastoliese bloeddruk (SBD en DBD), totale cholesterol (TC) en glukose (Glu) waardes

(kapillêre bloed van vingerprik), fisieke aktiwiteit en rook status (verkry uit die vraelys van Bjurström en Alexiou se koronêre hartsiekte risikofaktore indeks) asook die psigo-sosiale gesondheid status (stres, depressie en uitbranding). Die resultate van hierdie studie toon aan dat vir werknemers (mans en dames) in die pre-kliniese horison leeftyd (≤ 45 jr.), 6 KHS risikofaktore (LMI, FA, rook, psigo-sosiaal- en fisieke stres simptome asook uitbranding) in die matige risiko kategorie val. In die geval van die ouer groep mans en dames (> 45 ; post-kliniese fase), kan 8 KHS risikofaktore (LMI, SBD, DBD, FA, rook psigo-sosiaal- en fisieke stres simptome asook uitbranding) in die matige risiko kategorie gelys word. Dit is verder ook duidelik dat by die dames, met betrekking tot die psigo-sosiale risiko's, 83% en 88% in respektiewelik die pre- en post-kliniese horison as “risiko populasie” beskou kan word, wat beteken dat hulle matige en hoë stres en depressie ervaar. Dit word gevolg deur uitbranding (79% en 74%). In die geval van mans in die jonger leeftyd kan 67% as “risiko populasie” geklassifiseer word met betrekking tot die psigo-sosiale risiko faktore, gevolg deur 65% vir uitbranding. By die ouer mans kan 78% as “risiko populasie” vir LMI en SBD geklassifiseer word, gevolg deur 71% vir DBD.

Wat die gemiddelde waardes van die onderskeie risikofaktore betref, blyk dit dat vir dames (≤ 45 jr.), SBD (116.19 ± 14.35 mmHg), DBD (75.55 ± 10.6 mmHg), TC (4.46 mmol/L ± 0.93) en Glu (5.16 ± 1.40 mmol/L) in die lae risiko kategorie val. Behalwe vir SBD, toon die jong mans (≤ 45 jr.) dieselfde risikoprofiel as die dames (≤ 45 jr.). By die ouer groep persone (mans en dames) is dit net TC en Glu wat in die lae risiko kategorie val. Uit die resultate blyk dit verder dat daar matige prakties betekenisvolle verskille ($d = 0.31$) tussen die laag, matige en hoog aktiewe groepe by die ouer dames met betrekking tot LMI voorkom.

Wanneer die invloed van FA op die KHSRI beskou word, kom daar matig tot hoë praktiese betekenisvolle verskille tussen al die aktiwiteitsgroeperings, by mans sowel as dames voor. By die dames (albei groepe) toon FAI 'n lae prakties betekenisvolle positiewe korrelasie met LMI ($r = 0.05$ en $r = 0.11$) asook 'n matige prakties betekenisvolle positiewe korrelasie met KHSRI ($r = 0.48$, en $r = 0.46$). Verder toon die ouer dames ook 'n lae prakties betekenisvolle positiewe korrelasie tussen FA en SBD ($r = 0.1$) en DBD ($r = 0.11$). By die mans (≤ 45 jr.) kom lae prakties betekenisvolle positiewe korrelasies ook voor tussen FAI en SBD ($r = 0.03$), DBD ($r = 0.06$), TC ($r = 0.05$), Glu ($r = 0.03$) asook 'n hoë prakties betekenisvolle positiewe korrelasie met KHSRI ($r = 0.52$). By die ouer mans het 'n lae prakties betekenisvolle positiewe korrelasies voor tussen FAI en LMI ($r = 0.08$) en 'n hoë KHSRI ($r = 0.52$)

voorgekom. 'n Negatiewe dog nie-betekenisvolle korrelasie het by die dames ($r = -0.02$ en $r = -0.01$) tussen FAI en TC voorgekom. Dit het nie by die mans gebeur nie.

In die geval van rook het ewe-eens negatiewe dog nie-betekenisvolle korrelasies met SBD ($r = -0.01$), DBD ($r = -0.01$) en Glu ($r = -0.03$) in die jonger dames voorgekom, terwyl in die ouer dames dit met LMI ($r = -0.08$), SBP ($r = -0.04$), DBP ($r = -0.08$), TC ($r = -0.01$), Glu ($r = -0.03$) en FAI ($r = -0.02$) voorgekom het. In die geval van die mans (≤ 45 jr.) het rook ook nie-betekenisvolle negatiewe korrelasies met SBD ($r = -0.01$), DBD ($r = -0.03$), TC ($r = -0.01$) getoon, terwyl in die geval by die ouer mans negatiewe dog nie-betekenisvolle korrelasies met TC ($r = -0.03$) en Glu ($r = -0.05$) voorgekom het.

Die resultate in hierdie studie toon verder aan dat die psigo-sosiale parameters (psigo-, fisieke stresssimptome en uitbranding) betekenisvol tot die KHSRI bydra. Die ANOVA ontledings toon statistiese betekenisvolle verskille in al die psigo-sosiale afhanklike veranderlikes aan, naamlik, die lae vs. hoë KHSRI groepe met psigo-stressimptome $F(2) = 16.06$, $p = 0.001$, fisieke stressimptome, $F(2) = 18.165$, $p = 0.001$, en uitbranding $F(2) = 3.75$, $p = 0.025$. Dames het die hoogste voorkoms getoon vir fisieke stressimptome (48%), in vergelyking met mans (38%) en dieselfde neiging is waargeneem ten opsigte van uitbranding.

Sleutel terme: Werknemers, koronêre hartsiektes, risiko faktore, fisieke aktiwiteit, psigo-sosiale gesondheid.

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List of abbreviations

ACOEM:	American College of Occupational and Environmental Medicine
AHA:	American heart association
AMI:	Acute myocardial infarction
BMI:	Body Mass Index
BP:	Blood pressure
CHD:	Coronary heart disease
CHDRI:	Coronary heart disease risk index
CNS:	Central nervous system
COPD:	Chronic obstructive pulmonary disease
CRP:	Creative protein
CVD:	Cardiovascular disease
DALYs:	Disability adjusted life years
DASH:	Dietary approaches to stop hypertension
DBP:	Diastolic blood pressure
EWP:	Employee wellness program
GDM:	Gestational diabetes mellitus
GERD :	Gastroesophageal reflux disease
HbA1c:	Glycosylated haemoglobin
HD:	Heart disease
HDL:	High-density lipoprotein
HRA:	Health risk appraisal / Health risk assessment
IBI:	Integrated Benefits Institute
IDF:	International Diabetes Federation
IHD:	Ischemic heart disease
LDL:	Low-density lipoprotein

LV:	Left Ventricle
MetS:	Metabolic syndrome
MI:	Myocardial infarction
MRFIT:	Multiple Risk Factor Intervention Trial
NCD:	Non-communicable disease
NCHS:	National Center for Health Statistics
NHANES:	National Health and Nutrition Examination Survey
NHIS:	National Health Insurance Scheme
NIAAA:	National Institute on Alcohol Abuse and Alcoholism
PA:	Physical activity
PAI:	Physical activity index
ROI:	Return on investment
SA:	South Africa
SADHS:	South African Demographic Health Survey
SAEHWS:	South African Employee Health and Wellness Survey
SBP:	Systolic blood pressure
TC:	Total cholesterol
TCFA:	Thin-cap fibro-atheroma
US:	United States
WHO:	World Health Organisation
WEF:	World Economic Forum

CHAPTER 1

INTRODUCTION

1.1 INTRODUCTION

Non-communicable diseases (NCDs) have evolved over the past decade as a new frontier (health concern) in the fight to improve global health (UNGA, 2011:1). These diseases, commonly known as chronic diseases, also called diseases of lifestyle (Booth *et al.*, 2000:75; UNGA, 2011:1) refers to clinical conditions resulting from unhealthy lifestyle habits, often starting during adolescence (Naik & Kaneda, 2015:2). In this regard the World Health Organization (WHO) estimated that 70% of premature deaths in adults worldwide were the result of behaviours that started during adolescence (UNGA, 2011:1). This threat of NCDs also challenges employers in developed as well as developing countries. It is estimated that 63% of deaths worldwide were attributable to NCDs, while 80% were in the low and middle income countries (WHO, 2012). Half of those who died of NCDs were in the prime of their productive years (WEF, 2013:7) which may significantly impact productivity over the next 2 decades (Bloom *et al.*, 2011). The WHO has identified four main categories of NCDs, viz. cardiovascular diseases, chronic respiratory diseases, cancers and diabetes (Naik & Kaneda, 2015:2; UNGA, 2011:2), sharing four key risk factors which are all modifiable, e.g. tobacco use, physical inactivity, alcohol abuse and unhealthy diet (Naik & Kaneda, 2015:2).

1.2 PROBLEM STATEMENT

Physical inactivity is already identified as one of the primary, but modifiable risk factors for coronary heart disease (CHD) (Puoane *et al.*, 2013:9; WEF, 2013:7) and are closely associated with other NCDs and chronic diseases such as diabetes mellitus, colon and breast cancer, obesity, hypertension, bone and joint disease, and depression (Booth *et al.*, 2000:776; Pedersen & Saltin, 2006:3; Warburton *et al.*, 2006:801). According to Warburton *et al.* (2006:801) the prevalence of physical inactivity was higher than all the other modifiable risk factors among the Canadian adult population (51%). This is not only confined to Canada, but is true for most other countries in the world (Kirsten & Karch, 2012), including Africa (Naik & Kaneda, 2015:2) and South Africa (Puaone *et al.*, 2013:116; van Zyl *et al.*, 2010:73), and in South Africa the prevalence is still on the increase (Bradshaw *et al.*, 2011:2). Physical inactivity is also associated with increased mortality and morbidity rates for CHD (Blair & LaMonte, 2007:144; Dishman *et al.*, 2013:79) as well as with other risk factors associated with CHD e.g. hypertension (Contractor *et al.*, 2013:148) dyslipidemia (Grandjean, *et al.*, 2013:166) diabetes mellitus (Alcazar *et al.*, 2000:196) smoking (Rainey *et al.*, 1996:28;

Winnail *et al.*, 1995:438) and obesity (Ross & Janssen, 2007:184) as well as with psychosocial risk factors like stress, burnout and depression (Chandola *et al.*, 2007:640; Milani & Lavie, 2009:1390). On the contrary, comprehensive research have been published indicating the therapeutic and prophylactic value of regular physical activity (PA) for human health and wellbeing (Bouchard *et al.*, 2007; Dishman *et al.*, 2013; Durstine *et al.*, 2008; Ehrman *et al.*, 2013). In this regard Booth *et al.* (2000: 779) stated that “we know of no single intervention with greater promise than physical exercise to reduce the risk of virtually all chronic diseases simultaneously”. Notwithstanding this salutogenic impact of PA on the general health and wellbeing of a person, it seems that the prevalence of physical inactivity is rising in most countries across the globe (WHO, 2014). Which is more worrisome, is that this tendency of hypokineses already starts during childhood (Lambert & Kolbe-Alexander, 2006:24; Onywera, 2010:1; Proimos & Klein, 2012:380) from where it progresses slowly until a chronic disease manifest during the clinical horizon (≥ 40 years of age) (Booth *et al.*, 2000:777).

Various researchers have already indicated some mechanisms which may be responsible for the salutogenic changes brought about by physical exercise (Booth *et al.*, 2000:782; Warburton 2006:806), ranging (but not limited to) from changes in body composition (Murdy & Ehrman, 2013:128), improved lipoprotein profiles (Grandjean *et al.*, 2013:168) glucose homeostasis (Albright, 2013:108; Pedersen & Saltin, 2006:5), reduced blood pressure (Pedersen & Saltin, 2006:10), chronic inflammation (Peterson & Pederson, 2005:1158) and genetic predisposition (Li *et al.*, 2010:1), to enhance psycho-social wellbeing (Landers & Petruzzello, 1994:78).

With all this health-related knowledge freely accessible, it stays an open question why people proceed with a hypokinetic lifestyle, putting all responsibility on the health professionals to treat chronic conditions after clinical manifestation (Strydom, 2013:985). In this respect Booth *et al.* (2000:777) indicated that preventing a chronic disease is in the first place more humane, produces less suffering and is also more cost effective. This highlights the need for intervention in all walks of life and should preferably start at a young age (Koop, 1996:11; Naik & Kaneda, 2015:2).

As the economic workforce is usually a reflection of the community, the concern regarding the prevalence of chronic diseases of lifestyle and associated risk factors in the workplace

comes as no surprise (Cowan *et al.*, 2004; WEF, 2013 & WHO, 2014). These chronic conditions may affect employees adversely, leading to a decrease in quality of life, premature death and disability, increased health care costs (Patel *et al.*, 2013:172; WEF, 2013:7), and decreased productivity (Bloom *et al.*, 2011:27; WEF, 2013:7). According to Bloom *et al.* (2011: 32) the next two decades could be evidenced by a significant negative impact of NCDs on productivity. This contributes to the situation that companies are currently more aware of issues relating to employee health and wellbeing, and implementing various strategies to counter this situation (Burton *et al.*, 2005:344; Patel *et al.*, 2013:172). According to Soler *et al.* (2010:238) the number of companies in the USA with at least 50 employees that offer a worksite health promotion program has increased from 81% in the 1990's to nearly 90% in the year 2000. This is also happening in South Africa where employees' health is becoming a great concern to corporate management. Patel *et al.* (2013:172) indicated that although an accurate figure on South African companies offering an employee wellness program is not available, some evidence exists stating that 58.7% of the companies included in their study reported some form of onsite intervention. The fundamental reason for these developments was that employees are spending the largest portion of their awakening time at work and that employee health becomes a costly item to companies (Soler *et al.*, 2010:238). Hence it was indicated that the five top health conditions (heart disease, cancers, cerebrovascular disease, chronic respiratory disease and unintentional injuries) are potentially responsive to health intervention (Soler *et al.*, 2010:238). Several of these diseases as well as almost 55% of all deaths can significantly be affected by four modifiable risk factors e.g. tobacco smoking, physical inactivity, poor diet and alcohol abuse (Soler *et al.*, 2010:238).

Successful results due to intervention regimes, not only showed significant reductions in several risk factors (Laubscher *et al.*, 2003:47; Opperman & Strydom, 2014:42), but also financial benefit to companies, as it indicated that the return on investment can be as high as around \$6 for every \$1 spent over a period of 1 year (Milani & Lavie, 2009:1391). Successful intervention regimes also indicated an increase in productivity and decrease in absenteeism as well as a decrease in presenteeism (WHAA, 2016:3).

Research indicated that the prevalence of risk factors for CHD among South African employees are indeed perturbing and Patel *et al.* (2013:174) indicated that the prevalence of various risk factors in 71 companies in South Africa, representing various production lines (e.g. finance, manufacturing, communication/ marketing/ information technology,

professional services, transport, construction, wholesale etc.) were as follows (Patel *et al.*, 2013:174): physical inactivity emerged as the top risk factor (69.8%), followed by overweight and obesity (68.0%), tobacco use (22.5%), stress (19.9%), hypertension (19.1%) and increased total cholesterol (6.3%). In another study in the financial environment, Swanepoel *et al.* (2015:1479) reported the prevalence of risk factors as follows viz. overweight and obesity (65.8%), physical inactivity (55.3%), stress (23.3%), smoking (18.6%), hypertension (17.9%), high levels of casual (non-fasting) blood glucose (14.5%) and increased total cholesterol (7.8%).

The volatile character of the global corporate environment and economy, together with the increasing demands to reach deadlines and improvement on performance, may place employees under constant pressure (Batt & Colvin, 2011:1; Moretti & Postruznik, 2012:2), which often lead to increased physical and psycho-social illnesses (Illiceto *et al.*, 2013:143; Moretti & Postruznik, 2012:2). Evidence exist that some psycho-social ailments e.g. depression is responsible for the highest increase in medical expenses for a company, namely \$2184 per year (Johnson, 2012:2). This is 48% more than for an employee without depression (Johnson, 2012:2). Other health risk factors responsible for increased health care cost per employee are hypertension (\$1653), obesity (\$1090), physical inactivity (\$606), tobacco use (\$587) and high stress (\$343) (Johnson, 2012:2). Two combined risk factors for psycho-social problems, e.g. depression and high stress, predicted an increase of 60.6% in medical expenses (Johnson, 2012:2). Furthermore, indications also exist that the prevalence of psycho-social illnesses are globally on the rise (WorldatWork, 2015:1), showing perturbing rates over the period 2012 - 2014. The increased rate in stress, anxiety and depression in different countries were respectively as follows: Asia (73.0%, 20.1%, 71.2%), Central and South America, (55.3%, 40.9%, 22.9%) (WorldatWork, 2015:1).

Coronary heart disease risk factors show an intertwinement in nature, which may cause a clustering of risk factors in an individual (Swanepoel *et al.*, 2015:1479). Medibank Private Econtech (2007) indicated that employees with multiple CHD health risk factors showed a 9 times higher annual illness absence rate compared to their healthy colleagues. Kolbe-Alexander *et al.* (2008:6) indicated that 20% of the South African employees reported > 4 risk factors to be present, while Swanepoel *et al.* (2015:1479) reported 50.7% of the employees showed ≤ 2 risk factors, 42.0% indicating 3 - 4 and 7.3% reporting ≥ 5 risk factors to be present. In the light of this alarming statistics it is of critical importance for companies

to assess the prevalence of various risk factors amongst employees and create strategic intervention regimes, addressing these risk factors. According to Musich *et al.* (2003:397) employee health risk status is not static and in the absence of successful intervention programs are likely to migrate between 2% to 4% annually to a higher risk category.

With this perturbing statistics it is clear that employee wellbeing should cause great concern to management and more research is warranted in this regard. As PA appears to be a major risk factor in the corporate environment (Patel *et al.*, 2013; Swanepoel *et al.*, 2015), and with PA promising to positively impact on virtually all risk factors simultaneously (Booth *et al.*, 2000:779), it makes sense that intervention regimes should be based on the improvement of the PA profile of employees (Carnethon *et al.*, 2009; Opperman & Strydom, 2014:50).

All of the studies conducted in South Africa regarding PA and employee health, were based on a cross-sectional design and nothing could be found that focus on the health risk analysis over a period of time. The corporate environment is not static, but is continuously subjected to challenges which may affect the prevalence of risk factors in employees. In analysing the challenges that the corporate environment is facing during the last decades, it is clear that it covers a wide spectrum inter alia, international threats, strikes corruption etc. (Moretti & Postruznik, 2012:1). Already in 1989 Uys and Coetzee (*In Dreyer et al.*, 1996:461) warned that labour and political challenges in the workplace could affect the South African employees' health adversely.

Research suggested that the type of corporate environment may play a role in the prevalence of employee health risk factors (Mannocci *et al.*, 2015:148, Rao & Rao, 2014:500). Lokare *et al.* (2012:1628) and Shivaramakrishna *et al.* (2010:153) indicated that employees in the financial environment represent a subset of the population prone to the development of CHD. Reasons for this situation inter alia are: sedentary lifestyle, relative better socioeconomic conditions and stressful jobs (Lokare *et al.*, 2012:1628; Shivaramakrishna *et al.*, 2015:153). It is against this background that the following research questions were formulated:

- What is the prevalence of CHD risk factors amongst employees in a financial institution in South Africa: an analysis over time;

- What is the relationship between physical activity status and selected CHD risk factors amongst employees in a financial institution in South Africa;
- What is the effect of psycho-social health on CHD risk index amongst employees in a financial institution in South Africa.

Information on the above mentioned may provide corporate health professionals and management with data leading to informed decisions regarding health promotion programs in their companies. This will not only enhance the health and quality of life of the employees but also contributes to improved productivity and company image.

1.3 RESEARCH OBJECTIVES

The objectives of this research are to determine the following:

- 1.3.1. The prevalence of selected CHD risk factors amongst employees in a financial institution in South Africa over time (2007 - 2013).
- 1.3.2. The relationship between physical activity status and selected CHD risk factors (BMI, hypertension, smoking, elevated total cholesterol and blood glucose levels) amongst employees in a financial institution in South Africa.
- 1.3.3. The effect of psycho-social health (stress, burnout, depression) on CHD risk index amongst employees in a financial institution in South Africa.

1.4 RESEARCH HYPOTHESES

The following hypotheses can be formulated for this study, e.g.:

- 1.4.1. A variation in the prevalence of CHD risk factors over time will occur amongst employees in a financial institution in South Africa.
- 1.4.2. A significant positive relationship between physical activity status and selected

CHD risk factors (BMI, hypertension, smoking, elevated total cholesterol, CHDRI and casual blood glucose) will be found amongst employees in a financial institution in South Africa.

1.4.3. A significant effect of psycho-social health parameters (stress, depression and burnout) will be found with coronary heart disease risk index (CHDRI) amongst employees in a financial institution in South Africa.

1.5 STRUCTURE OF THE THESIS

Ethical approval for this thesis was gained from the North-West University (Potchefstroom Campus) Human Research Ethics Committee (HREC: NWU-00109-12-A1). The thesis will be presented in article format as approved by the Senate of the North-West University, and will be structured as follows:

Chapter 1: Introduction.

Chapter 2: Physical activity, selected coronary heart disease- and psycho-social health risk factors: A literature survey.

Chapter 3 – Article 1: The prevalence of selected CHD risk factors amongst employees in a financial institution of South Africa: an analysis over time. The manuscript will be prepared for publication in Ergonomics, SA. The references will be prepared in accordance with the journal guidelines.

Chapter 4 – Article 2: The relationship between physical activity status and selected CHD risk factors amongst employees in a financial institution of South Africa. The manuscript will be prepared for publication in the South African Journal for Sport, Physical Education and Recreation. The references will be prepared in accordance with the journal guidelines.

Chapter 5 – Article 3: The effect of psycho-social health on CHD risk index amongst employees in a financial institution of South Africa. The manuscript will be prepared for publication in the Africa Journal for physical activity and health science (AJPHEs). The references will be prepared in accordance to the journal guidelines.

Chapter 6: In Chapter 6 a summary of the research will be presented together with the main conclusions based on the hypotheses as described in Chapter 1. Limitations of the study together with recommendations for further study will also be presented. The references of Chapter 1, 2 and 6 will be prepared according to the Harvard style as required by the North-West University. The references of Chapter 3, 4, and 5 will be prepared according to the guidelines of the various journals to which the manuscripts will be presented for publication.

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CHAPTER 2

**PHYSICAL ACTIVITY, SELECTED CORONARY
HEART DISEASE- AND PSYCHO-SOCIAL HEALTH
RISK FACTORS AMONGST EMPLOYEES IN A
FINANCIAL INSTITUTION IN SOUTH AFRICA: A
LITERATURE SURVEY**

2.1 INTRODUCTION

Human health across the world is being shaped by some powerful forces such as demographics, ageing, rapid urbanization and the globalization of unhealthy lifestyle habits (WHO, 2013:5). Resource-constrained as well as wealthy countries are increasingly facing similar challenges with a prominent shift in the direction of non-communicable diseases (NCDs). NCDs such as cardiovascular disease (CVD), diabetes and chronic lung diseases, have replaced infectious diseases as the world's leading cause of mortality (Smith *et al.*, 2012:2343; WHO, 2013:5). Various conditions such as atherosclerosis, coronary heart disease (CHD), myocardial infarction (MI), arrhythmias, valvular heart disease, coagulopathies and stroke, are collectively known as cardiovascular diseases and contribute greatly to mortality, morbidity and the economic burden of CVD (Buttar *et al.*, 2005:229).

The physical, economic and social environment in which modern society spend their daily lives, have shown dramatic changes since the middle of the last century. Changes in transportation, communication, as well as workplace and domestic entertainment technologies, have resulted in significantly reduced demands for physical activity (PA), and have been associated with compromising cardiorespiratory and metabolic health (Owen *et al.*, 2010:105-106). In this regard Ratey and Hagerman (2010) reported: *"In today's technology driven, plasma-screened world, it is easy to forget that we were born to be active, and we have engineered movement out of our lives"*. They anticipated that the sedentary character of modern life is a disruption of human nature, and that it poses a threat to human survival. Gordon and Gibbons, (1991:131) as well as Shapiro *et al.* (1990:42-43) already advocated some decades ago that more lives can be saved by participating in regular PA than by treating any other health-risk factor for the development of CHD with medication. The Centers for Disease Control and Prevention (CDC, 2015a) claimed that health benefits of PA outweigh the risks by far.

Mathers and Loncar (2006) indicated that mortality due to NCDs was projected to rise from 59% in 2002 to 69% in 2030 with stroke and CHD becoming two of the three leading causes of mortality in low- and middle-income countries globally. According to the global burden of disease update in 2004 (WHO, 2008a), CHD was the second highest cause of mortality in most African and low-income countries, accounting for 10% of all deaths. It was also estimated that this burden will double from 1990 to 2020. According to estimates by the

World Health Organisation (WHO, 2015), 17.5 million people died from CVD in 2012, representing 31% of all deaths globally. An estimated 7.4 million of these deaths were due to CHD and 6.7 million due to stroke. The World Economic Forum (WEF, 2011:8) reported CVD to be responsible for an estimated 17 million deaths and 151 million DALYs (disability adjusted life years, referring to healthy years of life lost and indicating the total burden of a disease as opposed to simply the resulting deaths) in 2008. They also anticipated CVD to be the single largest cause of death globally, representing nearly 30% of all deaths and approximately 50% of NCD deaths. More than 82% of the mortality burden were caused by CHD, stroke and hypertensive heart disease (congestive heart failure) (WEF, 2011:8).

The South African Medical Research Council (2014:8) announced that South Africa is suffering from a quadruple burden of disease and referred to chronic diseases related to destructive lifestyle practices (amongst HIV/Aids, underdevelopment, injuries and tuberculosis) as the burdens of disease. The Heart and Stroke Foundation of South Africa (Steyn, 2007:2) reported that 195 people died per day in South Africa due of CHD between 1997 and 2004, and concluded that for every female that died of a heart attack, two males have died. The Heart and Stroke Foundation South Africa (2013) reported an estimated 130 MIs and 240 strokes in South Africa daily. This implicates that 10 people will suffer a stroke and 5 individuals will have an MI every hour in South Africa (The South African Heart and Stroke Foundation, 2014:9).

In the United States an epidemic of “*chronic lifestyle diseases*” (also called NCDs) has developed over the last decades and unhealthy lifestyle habits such as physical inactivity, poor nutrition, tobacco use and frequent alcohol consumption have increased the prevalence of NCDs (Mattke *et al.*, 2013:13). Mattke *et al.* (2013:13) further stated that these chronic conditions became a burden as they lead to decreased quality of life, premature death, disability, and increased health care cost. These chronic diseases had affected America’s working population and added to the economic burden because of illness-related loss of productivity resulting from absenteeism (sick and absent from work) and presenteeism (reduced performance while at work) (Mattke *et al.*, 2013:13). Loeppke *et al.* (2009:411) suggested that companies were facing a host of challenges impacting on their profitability and viability, as chronic health (NCDs) conditions were on the rise across all age groups, costing employers heavily as they provided medical benefits for employees, absorbed the costs of sick-absence and presence (presenteeism), as well as disability claims.

Kirsten and Karch (2012:xiii) reported that employers and employees worldwide are facing immense challenges and refer to the on-going economic crisis, an increasingly fast-paced business environment, growing demands to improve productivity and a global rise in chronic disease. In this regard Business Day Live (2016) reported on restructuring in the South African financial sector because of automization and digital migration that resulted in branches being closed and staff being retrenched. Examples of the impact of automization was demonstrated with a 14% increase in electronic transactions, 15% increase in online banking transactions, and 69% increase in using a banking application. Business Day Live (2016) further reported that digital banking has changed the tasks of employees and that new skills will be required in future.

Management in the South African financial sector also indicated that the changing economic environment (viz. increase interest rates and foreign currency) puts pressure on companies to maximise efficiencies (Business Day Live, 2016). They also pointed out that the staff cost of Nedbank was 54% of its total cost, that of Barclays Africa 56%, and that ABSA's headcount reduced by 6 000 employees from 2012 to 2015. The South African Banking Survey (2013:9) and Bashir and Ramay (2010:122-123) indicated that the financial corporate sector is highly competitive (restructuring, cutting costs, affirmative action downscaling of employees resulting in uncertainty and fear amongst employees) and organizations, management and employees are under constant pressure to perform better, resulting in extreme demands, physically and mentally, that can strain employee wellbeing. The Healthy Company Index survey conducted in South Africa (Ferreira, 2011) indicated that 71.6% of respondents had a vitality age higher than their actual age (actual age 36.4 years and vitality age 39.8 years), suggesting that most employees were losing 3.4 years of their life due of destructive lifestyle habits (e.g. physical inactivity) which increased their health-risk. In a study by Kolbe-Alexander *et al.* (2008:9) including 18 South African companies, they reported that employees had higher rates of obesity, smoking and physical inactivity when compared to the general SA population. They also found that increased health-related expenditure was associated with increased number of risk factors, absenteeism and physical inactivity.

Lifestyle as a contributing factor to CHD risk, was highlighted by Pieters *et al.* (2011:448,452) who reported that CHD has historically been rare amongst black South Africans. Sekhri *et al.* (2014:1) and Steward *et al.* (2011:498) however indicated an increase in the prevalence of CHD as a result of urbanisation and its accompanying lifestyle changes

including changes in diet, physical inactivity, drug and alcohol intake, as well as an increase in the prevalence of diabetes mellitus.

Biswas *et al.* (2002:204-206) reported that in general individuals are unaware of and negligent towards their risk of developing CHD, and that knowledge of CHD symptoms was found to be limited. Similarly, the Centers for Disease Control and Prevention (2008:175-179) reported that only 42% of females 35 years of age were concerned about CHD and 8% to 20% were aware that CHD is a major cause of death. The Centers for Disease Control and Prevention (2008:175-179) further reported that among individuals in 14 states participating in the 2005 Behavioural Risk Factor Surveillance Systems survey, only 31% were aware of 5 heart attack warning symptoms (pain in jaw or neck, feeling weak, lightheaded, fainting, chest pain or discomfort, pain or discomfort in arms or shoulders, shortness of breath). Dracup *et al.* (2008) similarly reported that in a survey of more than 3 500 patients with a history of CHD, 44% had limited knowledge of risk factors for the development of CHD. In the high-risk group for future acute myocardial infarction (AMI), 43% reported their risk as less than or the same as healthy individuals their age. Dracup *et al.* (2008) and Bradshaw *et al.* (2007:700) similarly indicated that individuals with a history of CHD had an inferior knowledge of CHD and reported their risk as less than, or the same as healthy individuals of their age.

Bradshaw *et al.* (2007:700-706) explained that the underlying pathology for CHD was atherosclerosis that develops silently over years and was usually advanced by the time it became symptomatic. They also reported that ischemic heart disease (IHD) and stroke were the main components of CHD sharing common risk factors, and indicated that the progression of atherosclerosis was accelerated by the presence of modifiable risk factors such as tobacco use, obesity, hypertension, diabetes and dyslipidaemia, all common risk factors amongst employees in the corporate sector. Dracup *et al.* (2008) reported that individuals with documented CHD had 5 to 7 times higher risk of having an MI than the general population. According to the WEF (2011:8) about 80% of the CHD burden can be explained by behavioural risk factors such as physical inactivity, tobacco use and unhealthy eating habits. Kolbe-Alexander *et al.* (2008:2) assured that the burden of disease can be reduced in society and in the workplace by addressing risk factors for the development of CHD. The health risk profile of the general public often mirrored the situation amongst employees (Swanepoel *et al.*, 2015:1471; WHO, 2014a). Therefore, it can be expected that the health

trends already discussed earlier, will be similar to those of employees in the corporate sector. However, a changing corporate environment to outperform competition and ensure sustainable profits can create an atmosphere that can increase employee health-risk status (Swanepoel *et al.*, 2015:1471; WHO, 2014a).

The further discussion will therefore focus on the situation in the corporate environment, the potential of developing NCDs, the migration of CHD health-risk status and the interaction of CHD risk factors with psycho-social health.

2.2. NON-COMMUNICABLE DISEASES – A CHALLENGE TO THE CORPORATE ENVIRONMENT

Non-communicable diseases (NCDs), are not passed from individual to individual but are of long duration and slow progression (WHO, 2014a), with cardiovascular diseases (CHD and stroke), cancer, chronic respiratory diseases, and diabetes, being the four main types of NCDs. CHD is one of the most prominent NCDs and the leading cause of mortality worldwide, it has truly become a pandemic that respects no borders (De Backer, 2009). Medibank (2011:8) reported that CHD will be one of the most common types of illnesses (others include; hypertension, arthritis, back-, neck- and spinal problems) by 2050 and that employers should consider this when developing strategies to manage employee health. Of all CHD patients who died within 28 days of the onset of symptoms, almost two thirds died before reaching the hospital. This highlights the need for early recognition and prevention of CHD risk factors (De Backer, 2009). It has been well established that the number of deaths attributable to NCDs are increasing globally (Bradshaw *et al.*, 2003:683) and it reflects in South Africa as well where 37% of all deaths are due to NCDs. The rankings for the 15 leading causes of death from 2002 to 2030 projected that CHD will still be the leading cause of mortality in 2030, followed by cerebrovascular disease (Mathers & Loncar, 2006).

In modern society most adults spend most of their time sitting, whether at work, at home or during leisure time, having a sedentary approach to lifestyle (Donnelly *et al.*, 2009:463). Strydom (2000:22) reported that a sedentary lifestyle leads to the development of hypokinetic diseases (disease due to a physically inactive lifestyle) such as atherosclerosis, posture abnormalities and risks for the development of CHD. A sedentary lifestyle was referred to as minimal PA with no health benefits because of a lack of regular PA (Steyn, 2007:8). Ratey

and Hagerman (2010) as well as Hutchinson (2004:17) reported in this regard that modern technology makes it easier for people to be inactive and referred to the internet, on-line buying and escalators as examples. The evidence concerning the impact of lifestyle factors on health was overwhelming, as smoking, excess alcohol intake, poor nutrition, a sedentary lifestyle and psychological distress have all been associated with numerous diseases (Mills, 2005). Even lifestyle habits associated with oral health (Delta Dental, 2014; Levy, 2014) were linked to CHD. They indicated that residual bacteria that remain in the accessory canals, dentinal tubules, or remnants of pulp tissue were injected into the circulation, leading to elevation in C-reactive protein, a marker for inflammation in the blood vessels associated with atherosclerosis, increased the potential of blood clotting and increased risk for CHD.

As for the long-term consequences of lifestyle habits on the genesis of disease, there was increasing evidence of the short-term effects such factors had on individual performance and productivity. Mills (2005) reported that smoking, high body mass index (BMI) and psychological distress have a major negative impact on employee productivity. Additionally, he reported that those individuals who were physically active in their leisure time were less likely to show short-term illness-related absence.

Labuschagne *et al.* (2011:82) and Swanepoel *et al.* (2015:1842) reported that the working environment in the South African corporate industry is mainly sedentary. McDowell-Larson (2001:1-2) described the lifestyle of management as sitting at desks, in meetings, in cars and in airplanes most of the day with mobile phones and e-mails to ensure workflow and communication, as well as having the closest parking spots at their convenience, in order to save time and improve productivity. Kaplan (1997:14) reported that a sedentary working environment can enhance the development of hypokinetic diseases. Kolbe-Alexander *et al.* (2008:6) highlighted that an inactive lifestyle was associated with the increase of health risk factors such as poor nutrition or insufficient fruit and vegetable intake (80%), smoking (61%), overweight/obesity (31%), increased serum cholesterol concentration (19%) and elevated blood pressure (12%), among employees. The South African Demographic Health Survey (Kolbe-Alexander *et al.*, 2008:2) conducted among the general South African population showed that amongst other health risks, 55% and 29% of South African females and males respectively were overweight, and 42% of males and 11% of females were smokers.

Kolbe-Alexander *et al.* (2008:1) claimed that destructive lifestyle habits of employees in South Africa were placing them at increased risk of developing CHD. Labuschagne *et al.* (2007:72) reported the majority (57%) of employees in a South African corporate setting to be at moderate-high risk and only 38% at low-risk for the development of CHD.

Loeppke *et al.* (2009:427) concluded that the productivity of the employees at work (presenteeism) was significantly affected by behavioural health issues (depression, anxiety, gastro-oesophageal reflux disease (GERD), fatigue, sleep disorders etc.), underlining the need for a more integrated focus for intervention. Improved health status decreased the length of sick time by producing more healthy days, weeks, months and years (Mathias *et al.*, 2013:264). Kolbe-Alexander *et al.* (2008:8) reported employees with a higher number of risk factors to be significantly more absent from work, and more days with performance adversely affected by poor physical or mental health. They also argued that it therefore was likely that reducing the number of risk factors, will reduce direct and indirect costs associated with absenteeism (Kolbe-Alexander *et al.*, 2008:8). This underscored the importance to assess employee health-risk in identifying appropriate interventions to manage employee health-risk migration.

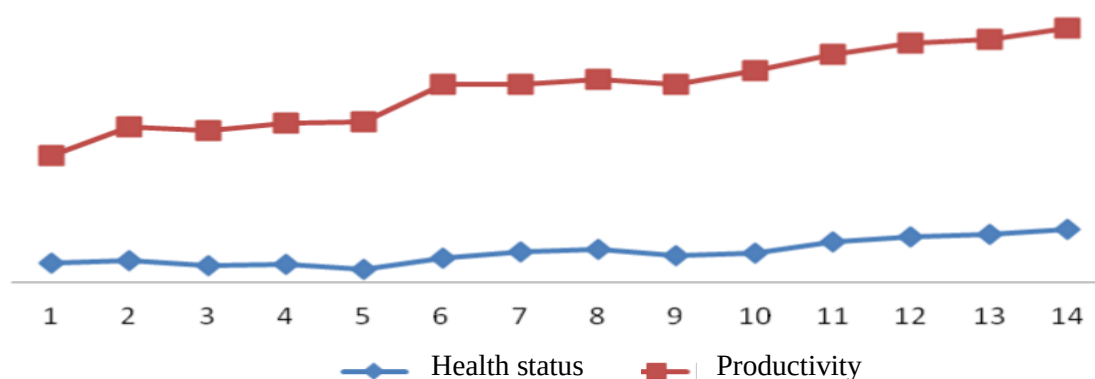


Figure 2.1 Health status and productivity 1999 - 2014 (Mathias *et al.*, 2013:261).

Figure 2.1 shows that in a 14-year study, improvement in health status was associated with increased productivity. Health status therefore affected labour force participation, as healthier individuals worked more and was physically and cognitively stronger (Mathias *et al.*, 2013:268). According to Mills (2005) it has been estimated that about a quarter of all healthcare costs can be attributed to conditions directly resulting from easily modifiable lifestyle factors. Kuriyama *et al.* (2004:1197) claimed that physical inactivity, smoking and obesity were associated with an 8.0%, 8.35% and 7.1% increase in health care cost respectively.

In addition, employees having a combination of all three modifiable risk factors, had the highest percentage increase (42.6%) in health care expenditure compared to their lower risk counterparts (Kuriyama *et al.*, 2004:1198). This underscored the pro-active view of Musich *et al.* (2003:394) and Clymer (2005:5) stating that maintaining low-risk can be at least as cost-effective as addressing high-risk. Soler *et al.* (2010:256) reported that economic benefits from intervention derived direct from medical costs and indirect from productivity losses. They anticipated that these costs can range from \$93 to \$695 per employee per year. Soler *et al.*, (2010:237) also reported return on investment (ROI) ratios that have ranged from 1.4:1 to 4.6:1 (average 3.2:1) implicating an annual gain of \$1.40 to \$4.60 for every dollar invested in the program. Soler *et al.* (2010:257) reported that the cost for high-risk participants reduced between \$14 and \$73 per 1% reduction in CHD risk over a three-year period, and that for moderate-risk participants ranged from \$11 to \$73.

As employers assessed their employee health trends, they found that the most compelling cost issue was the link between poor health and reduced productivity (Loeppke *et al.*, 2009:26). They reported that employees with one comorbid condition comprised nearly 40% of comorbid cases and generated about 15,600 lost days from absence and presenteeism, whilst employees with six or more comorbidities made up about 8% of the group but contributed more than 36,000 lost days. Loeppke *et al.* (2009:423) further showed in combining costs across 25 health conditions, that on average, for every \$1 of pharmacy costs there were \$2.3 of health-related productivity costs relating to absenteeism and presenteeism. Their results were supported by Childress & Lindsay (2006:451) who suggested that on average, for every \$1 to \$2 employers spend on worker medical or pharmacy costs, they gain at least \$2 to \$5.81 of health-related productivity costs. Loeppke *et al.* (2009:423) reported the top 10 health conditions in terms of total workplace costs are attributed to depression, obesity, arthritis, back or neck pain, anxiety, gastro-oesophageal reflux disease (GERD), allergy, cancer, chronic pain, and hypertension. They indicated that the combined medical, pharmacy, absenteeism and presenteeism costs of these health conditions were far more costly than employers have anticipated (Loeppke *et al.*, 2009:423).

Clymer (2005:6) claimed that low-risk employees who maintain good health can be viewed as employers existing “*market share*” as they were more productive and at low cost to the company.

Musich *et al.* (2003:393) reported employee health-risk to not be static and likely to migrate between 2% and 4% annually from low to higher-risk status in the absence of successful intervention programs. If employee low-risk status was not maintained through intervention, research indicated that many of these low-risk employees inevitably joined the ranks of the higher-risk employees (higher cost) and underscored the advantage of having a health promotion program focused on keeping healthy employees at low risk (Edington, 2001:343-344). Maintaining low risk therefore can be at least as cost-effective as addressing high-risk and the challenge of health promotion programs was to minimize the number who remained at, or shifted to high-risk while maximizing those who reduced to, or remained at low-risk status (Clymer, 2005:6; Edington, 2001:342; Musich *et al.*, 2003:393-394).

More than half the deaths caused by chronic diseases (including CHD) occurred prematurely prior to the age of 65 years (Heart Disease Fact Sheet, 2011; Steyn, 2007:2). These premature deaths caused by CHD in individuals of working age (35-64 yrs.) were expected to increase by 41% between 2000 and 2030 and can have a potential negative impact on the economy (Heart Disease Fact Sheet, 2011; Leeder *et al.*, 2004:23; Steyn, 2007:2). Mirroring the national trend of increasing costs, the AHA's projections showed CHD cost tripling from \$272.5 billion in 2010 to an estimated \$818.1 billion in 2030 (Heidenreich *et al.*, 2011:935). Whilst genetic factors played a part, 80% to 90% of people dying from CHD had one or more major CHD risk factors that were influenced by lifestyle (Mendis *et al.*, 2011:142).

From the above explanation it is clear that employee wellness can be vital in terms of the success of the employer. The employer has a responsibility to financially invest in the employee in terms of training and employment perks in return for the employee's service. Therefore, it is important for the employer to create a working environment in the best interest of the employee's health and wellbeing in order to empower the employee for optimal performance. The employee in return has to accept self-responsibility for his health by following constructive lifestyle habits associated with longevity and low risk for the development of CHD.

The following discussion will address CHD risk factors and their effect on employee health.

2.3 CORONARY HEART DISEASE RISK FACTORS AND EMPLOYEE HEALTH

2.3.1 Coronary heart disease risk factors

Coronary heart disease (CHD) also referred to in the literature as ischemic or coronary artery disease, has no single cause and results from the interaction between various factors such as genetic factors, lifestyle habits and medical conditions (Gordon & Gibbons, 1991:206). Gordon and Gibbons (1991:206), Strydom (2000:14) as well as Wallace, (2003:149) reported hypertension, cigarette smoking, physical inactivity, high serum cholesterol and obesity as primary CHD risk factors while stress, diabetes, age, gender, ethnicity, hereditary etc. can be grouped as secondary CHD risk factors. Risk factors for the development of CHD can further be grouped into avoidable risk factors, mainly lifestyle related such as cigarette smoking, hypertension, obesity, high-serum cholesterol, physical inactivity and unavoidable risk factors, mainly genetic in nature such as age, gender, ethnicity and family history of CHD (Gordon & Gibbons, 1991:206; Strydom, 2000:14).

Davis (2010:71) indicated that physical inactivity, obesity and smoking can also be referred to as behavioural risk factors for the development of CHD. Davis (2010:71) reported that primary CHD risk factors undermined the endogenous defences of the vascular endothelium (inner or luminal layer of the coronary artery) contributing to endothelium dysfunction, breaking down its ability to protect against the atherosclerotic process and subsequent thrombotic events (Davis, 2010:71). Coronary heart disease results from a complex process known as atherosclerosis – a process by which fatty deposits (plaques) of cholesterol penetrates and built up in the inner linings of the coronary arteries, causing stenosis and eventually blockage of arteries, and has been identified in humans from as old as one year of age (Gordon & Gibbons, 1991:129-136; Medscape, 2015; Squires, 2013:216). Research (Davis, 2010:70; Dzau *et al.*, 2002:1249; Medscape, 2015) revealed that atherosclerosis is a prolonged active and complex process involving multiple categories of development such as endothelial dysfunction, inflammation, adaptive intimal thickening, vascular proliferation and fibro-atheroma (atheroma with thick fibrous cap) resulting in thrombosis. They also anticipated the progression of atherosclerosis to be dependent on the interaction of various conditions and risk factors such as hemodynamic forces (blood pressure and blood turbulence), levels of plasma lipoprotein concentration (HDL and LDL cholesterol), cigarette smoking (chemical damage) as well as diabetes, physical inactivity, obesity, homocysteine concentration, C-

reactive protein, stress and ageing. The local stressors (viz. turbulent blood flow or vasoconstriction) and chemical factors (enzymes such as metalloproteinases that weaken the fibrous cap) can result in plaque rupture exposing the plaque to the blood flow (Squires, 2013:217).

Danaei *et al.* (2009:10) reported that the analysis of data from the National Center for Health Statistics (NCHS) in terms of disease-specific deaths in 2005 showed that tobacco smoking and high blood pressure were estimated to be responsible for > 1 in 5 deaths among US adults. Overweight and physical inactivity were each estimated to be responsible for nearly 1 in 10 deaths. Danaei *et al.* (2009:10) similarly indicated that hypertension was the single largest risk factor for cardiovascular mortality in the US, followed by overweight-obesity, physical inactivity, high LDL cholesterol, smoking, high dietary salt, high dietary trans-fatty acids, and low dietary omega-3-fatty acids.

A 17-year follow-up study by Mensah *et al.* (2005:68) reported that the risk for fatal CHD was 51% and 71% lower for males and females respectively in the absence of 3 primary risk factors - hypertension, current smoking, high total cholesterol. They further anticipated that if all 3 primary risk factors did not occur, 64% of all CHD deaths among females and 45% of CHD deaths in males could have been avoided. According to Mensah *et al.* (2005:73) 90% of adults in the US who died of CHD had at least one of the primary risk factors. Terry *et al.* (2005:1948) reported that individuals with low levels of primary CHD risk factors in middle age were associated with overall survival and morbidity-free survival to 85 years of age or older, and that those with low-risk profiles ran a significantly lower risk for CVD mortality compared to those with high-risk profiles.

A study of Yusuf *et al.* (2004:9) including 52 countries showed that the optimization of 9 measurable and potentially modifiable risk factors resulted in a 90% reduction in the risk of having a MI. They further reported that the effect of these risk factors are consistent in males and females across different geographic regions and ethnic groups, which makes the study applicable worldwide. The risk factors identified were cigarette smoking, abnormal blood lipid levels, hypertension, diabetes mellitus, abdominal obesity, physical inactivity, low daily fruit and vegetable consumption, alcohol overconsumption and psycho-social ill health.

Lloyd-Jones *et al.* (2010:591) and Sidney *et al.* (2013:22) reported that “*ideal cardiovascular health*” can be defined by the absence of clinically manifesting CHD and the simultaneous presence of optimal levels of 7 health criteria viz. lean body mass (males $\geq 80\%$; females $\geq 75\%$), not smoking, participation in PA, healthy dietary intake consistent of dietary approaches to stop hypertension (DASH), untreated total cholesterol $< 5.17 \text{ mmol}\cdot\text{l}^{-1}$, untreated blood pressure $< 120/< 80 \text{ mmHg}$ and fasting blood glucose $< 5.55 \text{ mmol}\cdot\text{l}^{-1}$.

Gordon and Gibbons (1991:209), Greenland *et al.* (2003:896,897) as well as Maredza *et al.* (2011:48) supported findings that the presence of more than one CHD risk factor significantly increased the risk of CHD. Gordon and Gibbons, (1991:209) reported a person with two CHD risk factors to run a 9 times higher risk, and a person with three risk factors a 16 times higher risk for the development of CHD than a person with only one CHD risk factor. Greenland *et al.* (2003:897), Maredza *et al.* (2011:48-50) and Steyn (2007:6) advocated in this regard that in individuals with multiple risk factors, the chance of suffering a MI grows exponentially with each additional risk factor. According to this principle an individual with three risk factors had a 27-times higher chance of suffering a MI than a person with no CHD risk factors (Maredza *et al.*, 2011:48-50).

2.3.2 Unavoidable risk factors for CHD

The following unavoidable risk factors are all secondary risk factors for the development of CHD.

2.3.2.1 Age

The risk for CHD increases with age and about 85% of people who died from CHD were older than 65 years (University of Maryland Medical Center, 2013). The underlying pathology for CHD e.g. atherosclerosis (Bradshaw *et al.*, 2007:700-706), develops over time (Gordon & Gibbons, 1991:129-136; Medscape, 2015; Squires, 2013:216) and as age increased, the possibility of plaque build-up in the arteries increased, resulting in an increased CHD risk (National Heart, Lung and Blood Institute, 2015).

2.3.2.2 Gender

Males have a greater risk for CHD and MI earlier in life than females. Prior to menopause, females are protected against CHD by the hormone oestrogen, but with oestrogen levels decreasing after menopause, their risk for CHD became similar to that of males (National Heart, Lung and Blood Institute, 2015). The ovarian hormone production (oestrogen) has an

anti-inflammatory effect that protects against the development of atherosclerosis prior to the menopause that reduce CHD risk (Dach, 2016; Schierbeck *et al.*, 2012:1,2,4,11). The hormonal decline following menopause, leads to reduced oestrogen levels that increase the onset of chronic inflammation, chronic degenerative disease, as well as coronary atherosclerosis in woman (Dach, 2016). This can explain why, according to the University of Maryland Medical Center (2013), females after menopause, are more likely to have angina (CHD symptom) compared to males.

2.3.2.3 Genetic factors and family history

Certain genetic factors related to the development of diabetes and hypertension increased the likelihood of CHD. Family (parental) history of CHD was associated with increased burden of atherosclerosis in coronary arteries and the abdominal aorta. A family history of early-onset sudden cardiac death in a first-degree relative was associated with a > 2 times higher risk for sudden cardiac death in offspring (Friedlander *et al.*, 2002:2012; Lee *et al.*, 2006:145; Nasir *et al.*, 2007:622). Individuals whose parents or siblings developed CHD at a younger age were more likely to develop it themselves (University of Maryland Medical Center, 2013).

2.3.2.4 Race and ethnicity

According to the University of Maryland Medical Center (2013) African-Americans are at the highest risk of CHD, in part due to their high rates of severe hypertension, as well as the increased prevalence of diabetes and obesity in this population.

2.3.3 Avoidable risk factors for CHD

For the purposes of this study the focus will be on avoidable and modifiable CHD risk factors as reported in the CHD risk index (CHDRI) questionnaire developed by Björström and Alexiou (1978:521) and used in this study. Primary risk factors will be identified and reference will be made to the prevalence of these risk factors among the general public as it can mirror the risk of employees in the workplace. The focus of this research will be on the prevalence of, and possible interaction between these risk factors amongst employees in the financial corporate sector.

Physical activity (PA) can reduce CHD risk in various ways such as anti-atherosclerotic (preventing the blood vessels from narrowing), anti-thrombotic (prevents blood from clotting), anti-ischaemic (increase blood supply) as well as improvement in psychological wellbeing (Exercise is medicine Australia factsheet, May 2014). The ACSM (2005:8) and

O'Keefe *et al.* (2012:588) further reported an increase in serum high-density lipoprotein cholesterol (HDL) levels, maximal oxygen uptake, reduction in serum triglyceride, low-density lipoprotein cholesterol (LDL) levels, risk of obesity, arterial blood pressure, psychological stress, potential of atherosclerosis, improvement in insulin sensitivity, glucose levels and endothelial function, all as benefits of PA in the combat against CHD.

Blood coagulation and fibrinolysis are two physiological functions that influence the formation and breakdown of thrombosis (CHD) within blood vessels (Buttar & Ravi, 2005:231-232). These researchers indicated that these haematological functions are influenced by various blood factors which either inhibit or increase clot formation. Inhibition of fibrinogen concentrations and platelet aggregation reduces clot formation and the risk of CHD, whilst increased concentrations of fibrinogen and platelet aggregation increased the probability of intravascular coagulation and increased CHD risk. The lower the concentration of fibrinogen content, the lesser the risk of thrombus formation which consequently reduces the possible risk of ischemic cardiac events. Physical activity significantly reduces plasma fibrinogen concentrations and platelet aggregation under maximal (100% VO₂max for 30 min) and sub-maximal (75% of VO₂max for 30 min) exercise conditions (Buttar & Ravi, 2005:231-232). A routine of daily PA stimulates a number of beneficial physiological changes in the body and can be highly effective for prevention and treatment of many of the most prevalent and pernicious chronic diseases, including CHD (O'Keefe *et al.*, 2012:588).

2.3.3.1 Elevated cholesterol concentration (primary risk factor)

Steyn (2007:26) and the University of Maryland Medical Center (2013) reported cholesterol to be a fat-like substance created by the body as a natural component of the cell membrane. They indicated that additional cholesterol derived from certain foods increased cholesterol levels that could result in hypercholesterolemia. The ACSM (2014:46) reported a total cholesterol value of $\leq 5.2 \text{ mmol}\cdot\text{l}^{-1}$ as normal.

Atherosclerotic disease originates through the interactions of genes and modifiable as well as non-modifiable environmental exposures, which influence lipid and lipoprotein pathways that provide transport for delivery, metabolism or elimination (Grandjean *et al.*, 2013:160). Lipids are substances such as fatty acids, cholesterol, and triglycerides generated by the body and needed for crucial physiological roles such as energy storage, body insulation, maintenance of bile acids, hormone production, cell membrane structure and metabolic regulation

(Grandjean *et al.*, 2013:155,156). Lipids are not soluble in body fluids and need to combine with apolipoproteins to form lipoproteins. There are four general classes of lipoproteins viz. chylomicrons (triglyceride-rich lipoprotein), very low-density lipoproteins (VLDL), low-density lipoproteins (LDL) and high-density lipoproteins (HDL). LDL is formed in the circulation from lipid and protein exchanges and is the principle means for transporting cholesterol in the body. HDL is formed in the liver and intestine and known as anti-atherogenic as it poses antioxidant effects and transports cholesterol from the body tissues to the liver for catabolism - a process known as “*reverse cholesterol transport*” eliminating the cholesterol from the peripheral tissue (Grandjean *et al.*, 2013:155,161).

Hypercholesterolemia contributes to the development of plaque deposits along the artery walls and can therefore be associated with increased risk for CHD (Steyn, 2007:26). Blood cells that get caught in the plaque deposit formed clots which together with the plaque, could break loose and obstruct blood flow through an artery, causing an MI or stroke (Steyn, 2007:26). Gordon and Gibbons (1991:212) reported a total cholesterol value of $5.94 \text{ mmol}\cdot\text{l}^{-1}$ to have double the risk of having a MI and a value of $7.7 \text{ mmol}\cdot\text{l}^{-1}$ to have a quadruple risk for MI.

According to the American Heart Association (2010) an estimated 35 700 000 adults ≥ 20 years of age had total serum cholesterol levels $\geq 6.2 \text{ mmol}\cdot\text{l}^{-1}$ with a MI prevalence of 16.2%. While heredity could be a factor in some individuals, the University of Maryland Medical Center (2013) reported the main reasons for hypercholesterolemia are lack of exercise (sedentary lifestyle) and diets high in saturated fat. They further advocated that high cholesterol levels can be prevented with lifestyle changes (diet and exercise) or cholesterol-lowering medication.

Norman *et al.* (2007:708-713) stated that blood cholesterol levels increase with age, especially in individuals who follow a typical western lifestyle. They reported the following with regards to cholesterol levels for South Africans ≥ 30 years in 2000:

- Blood cholesterol levels varied among the different South African population groups. Black Africans had the lowest prevalence of high blood cholesterol and 24% males and 32% females had blood cholesterol levels $> 5 \text{ mmol}\cdot\text{l}^{-1}$;

- Cholesterol-attributed mortality was highest amongst Indians (22.2%), followed by the white (20.5%), coloured (8.8%) and black population (1.8%);
- The highest blood cholesterol levels were found among white males (90%) and females (88%) followed by coloured males (82%) and females (80%) and Indian males (87%) and females (77%);
- About 8 million South African adults ≥ 30 years of age, carried a risk of chronic diseases of lifestyle by virtue of their total serum cholesterol based on $5.0 \text{ mmol}\cdot\text{l}^{-1}$ as the clinical cut-off;
- Total cholesterol levels increased among white males and females between the ages of 30 and 50 and 30 and 65 years respectively where after it flattened and a similar trend was observed for Indian and coloured males and females;
- In the black population the increase in total cholesterol levels was not as prominent as in other population groups but the levels appeared to keep on increasing between the ages of 30 and 65 years.

Research by Swanepoel *et al.* (2015:1478) reported that the overall prevalence of high total cholesterol amongst employees in a South African corporate financial setting was low. The lowest value occurred in younger males (4.1%) and females (4.9%) while the highest prevalence (13.0%) was amongst older females. Employees at risk for hypercholesterolemia showed a prevalence of 30%. Astrup *et al.* (2010:685) and Lewington *et al.* (2007:1829) suggested that the risk for CHD can be reduced by lowering cholesterol concentration. The results of the study reported a 1% reduction in cholesterol concentration to be associated with a 2% reduction in risk for MI (Astrup *et al.*, 2010:685).

Mann *et al.* (2014:211) reported that PA has been shown to have a positive effect on the pathogenesis, symptomatology and physical fitness of individuals with dyslipidaemia, as exercise reduced cholesterol levels. They further indicated that regular PA has been shown to increase HDL cholesterol while maintaining, and theoretically decreasing, LDL cholesterol and triglycerides. Mann *et al.* (2014:212) indicated that PA appeared to enhance the ability of skeletal muscles to utilize lipids as opposed to glycogen, resulting in reducing plasma lipid levels. The mechanisms may include increases in lecithin-cholesterol acyltransferase (LCAT) and reductions in cholesterol ester transfer protein (CETP), the enzyme responsible for transferring HDL cholesterol to other lipoproteins (increased HDL levels), following acute

and chronic PA. This increased enzymatic activity improves the ability of muscle fibres to oxidize fatty acids originating from plasma LDL cholesterol or triglycerides and removes cholesterol from the circulation. Kraus *et al.* (2002:1486) reported that aerobic exercise at increased intensity (50% to 85% of maximum aerobic power for 20–60 min, three times a week) positively influenced lipoprotein lipase activity and HDL cholesterol levels. Mann *et al.* (2014:219) reported that during resistance training, increased volume (more sets and/or repetitions) had a greater impact on the lipid profile than increased intensity (high-weight and low repetitions). Mann *et al.* (2014:219) further indicated additional physiological and psychological benefits when aerobic exercise and resistance training were combined.

2.3.3.2 Overweight and obesity (primary risk factor)

Obesity can be diagnosed when a male has more than 25% body fat and a female more than 32% (Durstine *et al.*, 2003:149). Murdy and Ehrman (2013:113,114) claimed that most scientists used BMI (calculated by using bodyweight (kg) divided by height (meters) square), as a screening method for overweight and obesity as it was easy and user friendly to most screening conditions. ACSM (2014:63) reported the following classification of BMI:

- Normal weight - BMI $\leq 24.9 \text{ kg.m}^{-2}$;
- Overweight - BMI 25 - 29.9 kg.m⁻²;
- Obese - BMI $\geq 30 \text{ kg.m}^{-2}$.

Obesity results from a prolonged standing positive energy balance that has a myriad of causes ranging from increased availability of low-cost food, to reduced PA in the workplace or in leisure (Murdy & Ehrman, 2013:117). These authors further stated that apart from behavioural and dietary influences, various genetic and physiological factors show that neurological and peripheral endocrine messengers also influenced food intake and utilization. They referred to the production of leptin by fat cells in humans, which was associated with limiting weight reduction. Genetic causes of weight-loss can be attributed to variation in inheritable control of food intake, fat storage as well as energy expenditure. The reduction of growth hormone and gonadal hormone secretion with ageing can also contribute to increased visceral fat storage and obesity (Murdy & Ehrman, 2013:118).

Overweight and obesity were associated with increased risk for chronic diseases including hypertension, diabetes, cancer, as well as psycho-social ailments and CHD (Donnelly *et al.*, 2009:460; Kumanyika *et al.*, 2008:428,429; Must *et al.*, 1999:1523). The seriousness of obesity as a risk factor for the development of CHD was underlined when Gordon and Gibbons (1991:253) reported that an additional 450 g of body fat has an extra load on the heart muscle equivalent to that required to pump blood through an additional 1.5 km of capillaries and reasoned it as obesity contributing to heart failure. Overweight and obesity is also associated with the metabolic syndrome (MetS) also known as syndrome X, a constellation of metabolic abnormalities (abdominal obesity, dyslipidaemia, high blood sugar and hypertension) that increased the risk for development of Type 2 diabetes and CHD (Grundy *et al.*, 2004:433; Papanastasiou, 2013:33; Wilson *et al.*, 2005:3066).

Wallace (2003:149) reported that obesity has globally increased to such an extent that the American Heart Foundation has declared it a primary risk factor for CHD in 2003. Obesity has been identified as a major health problem in both developed and developing countries and genetic, behavioural, social and economic factors interacted to influence the development of obesity in populations (Anderson *et al.*, 2009a:340). The American Heart Association (2011) survey in 2008 estimated the prevalence of overweight and obesity in US adults ≥ 20 years of age as 67.3% with 33.7% classified as obese ($\text{BMI} \geq 30 \text{ kg.m}^{-2}$), affecting males as well as females. Obesity ($\text{BMI} \geq 30 \text{ kg.m}^{-2}$) was associated with excess morbidity, and even more notable was the excess morbidity associated with overweight and obesity in terms of risk-factor development and incidence of diabetes mellitus, CHD, stroke, heart failure and other health conditions including asthma, cancer and degenerative joint disease (American Heart Association (2011).

In South Africa, nutritional surveys highlighted that individuals living in urban areas were more exposed to diets rich in fat and refined carbohydrates that contributed to obesity, compared to diets of individuals living in rural areas (Steyn *et al.*, 2006:40; Steyn, 2007:12). It was estimated that obesity contributed to 4.2% of the total male deaths and 10.1% of the total female deaths in 2000 among people ≥ 30 years of age (Joubert *et al.*, 2007:686-687). Consequently, it was estimated that 32 males and 68 females died per day due to the impact of obesity among individuals ≥ 30 years. Most deaths caused by obesity occurred in the age group 45 - 59 years (Joubert *et al.*, 2007:686).

In South Africa (Figure 2.2), obesity was most common among white males followed by black and white females. It has also been concluded that only coloured- and white females reported body composition to be in line with their measured profile, whilst the remaining groups were of opinion that they were not overweight. Goedecke *et al.* (2006:65) reported South Africa to be on its way to become the country with the highest prevalence of overweight and obesity due to urbanisation and adopting Westernised eating habits, rich in saturated fats. They additionally indicated that 45% of all South Africans older than 15 years were overweight and 20% were obese (BMI > 30 kg.m⁻²), whilst 56% of females and 29% males respectively were overweight.

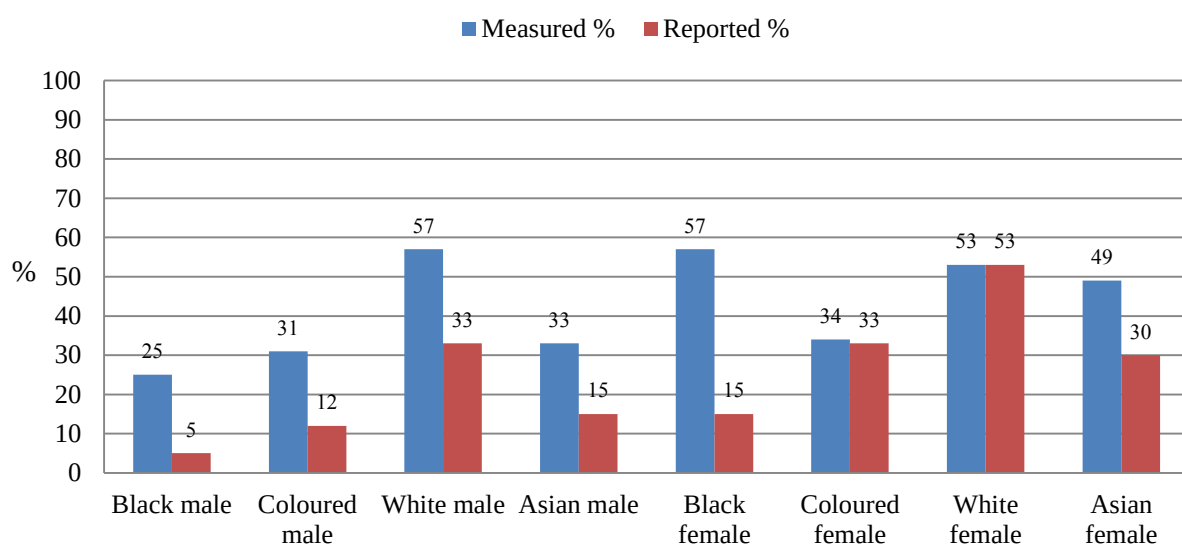


Figure 2.2 Comparison of obesity measured and reported amongst South African males and females (South African Department of Health, 1998).

Anderson *et al.* (2009a:340) described the workplace as a sedentary setting with easy access to energy-dense food and beverages. In modern society adults spend most of their time sitting (sedentary), which is associated with low energy expenditure and likely to be an important cause of obesity (Donnelly *et al.*, 2009:463; Wallace, 2003:149). Anderson *et al.* (2009a:340) reported that economic and industrial innovation has resulted in fewer workers in primary industries (agriculture, fishing, mining, or forestry). They also indicated that automation in production industries resulted in more people being exposed to a sedentary workplace. Consequently, Anderson *et al.* (2009a:340) reported this to be a contributing factor to overweight and obesity.

Epidemiologic studies of characteristics of working conditions and employee obesity have shown associations between greater BMI values and long work hours, shift work, and job stress (Schulte *et al.*, 2007:428-429). They also indicated an association between excess body weight and risk for a range of occupational conditions including injury, asthma, musculoskeletal disorders, immune response, neurotoxicity, stress, CHD, and cancer. Research in South Africa with regards to a waist circumference of ≥ 102 cm for males and ≥ 88 cm for females as criteria for obesity, reported that waist circumferences greater than the reported values have been associated with shortness of breath whilst climbing stairs, Type 2 diabetes, difficulty to meet physical requirements of day to day work, as well as increased risk for CHD (South African Department of Health, 1998). Gordon and Gibbons (1991:209-217) reported obesity's interaction with other risk factors (hypertension, diabetes, hypercholesterolemia) and the link between obesity and CVD, hypertension, dyslipidaemia, Type 2 diabetes and stroke as contributing to CHD risk (Kopelman, 2007:14). Ostbye *et al.* (2007:766-777) reported obesity as an important driver of costs associated with absenteeism, sick leave, disability, injuries, and healthcare claims. Frienden (2010:590-591) advocated population-based interventions that addressed socio-economic factors and changed the context to make individuals' default decisions healthy, as an effective intervention for weight-loss since it reaches broader segments of society. Examples of strategies to include in structuring the social environment to provide individuals with support are individual or group behavioural counselling, skill-building activities and the use of rewards or co-worker members for support, and are presented in Figure 2.3 (Anderson *et al.*, 2009a:343).

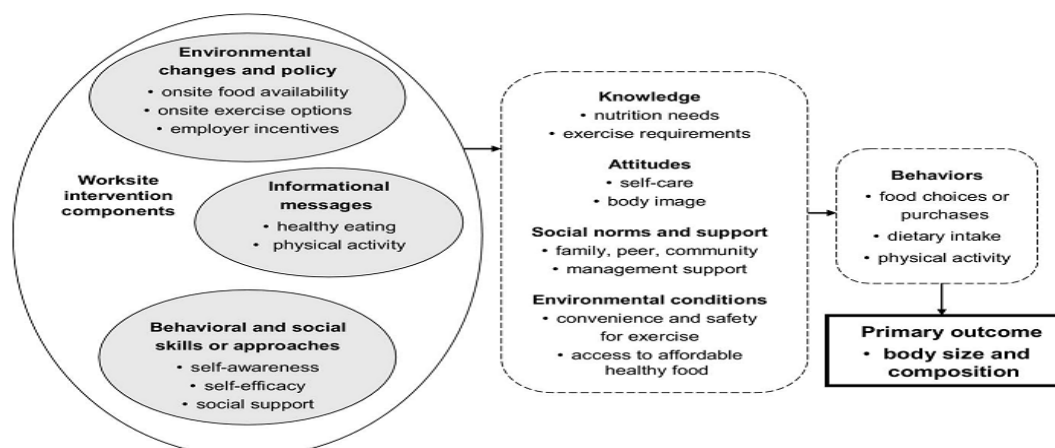


Figure 2.3 An example of an analytic framework for worksite nutrition and physical activity interventions to improve weight status (Anderson *et al.*, 2009a:343).

Franco *et al.* (2007:1377) studied the Cuban population and reported that a reduced dietary energy intake and increased energy expenditure (exercise, mainly walking and cycling), resulted in average individual weight-loss of 4.5 kg. Donnelly *et al.*, (2009:460) reported that PA of moderate intensity (3.0 to 5.9 METs) > 250 min per week was associated with clinically significant weight-loss and prevention of weight regain whilst moderate intensity PA between 150 and 250 min per week was associated with moderate weight-loss (Donnelly *et al.*, 2009:466).

Belay *et al.* (2013:63) reported weight-loss benefits in obese individuals from both aerobic (4.02%) and resistance training (3.4%). According to Wiklund *et al.* (2014:223) aerobic exercise resulted in more energy expenditure and greater metabolic stress. They reported that regular exercise (as little as 6 weeks), resulted in improved muscular mitochondrial biogenesis and enhanced fatty acid oxidation, which was associated with weight-loss and reduced CHD risk. Wiklund *et al.* (2014:220,223) indicated that even when moderate intensity aerobic exercise (Management of obesity, 2010:25) amongst obese individuals did not necessarily result in weight-loss, it was associated with health benefits such as reduced serum-free fatty acid and glucose levels. According to Belay *et al.* (2013:63) various interventions have shown the magnitude of weight-loss that is achievable with exercise alone compare to diet alone, or the combination of diet plus exercise. Wiklund *et al.* (2014:220,223) concluded that exercise therefore contributed to improved health status, even in the absence of weight-loss.

2.3.3.3 Hypertension (primary risk factor)

Hypertension can be defined as a systolic blood pressure (SBP) of ≥ 140 mmHg, or a diastolic blood pressure (DBP) of ≥ 90 mmHg (Madhur, 2013; Roger *et al.*, 2012:21). Contractor *et al.* (2013:139) and Roger *et al.* (2012:20) reported that hypertension may be primary (essential hypertension), which can develop as a result of environmental / lifestyle or genetic causes, or secondary, which has multiple aetiologies such as renal, vascular and endocrine causes. According to them, primary hypertension accounted for 90 - 95%, and secondary hypertension for 2 - 10% of adult hypertensive cases. Contractor *et al.* (2013:139) further stated that blood pressure is the product of cardiac output and total peripheral resistance.

They reported that a variety of systems such as hormonal, renal, vascular, peripheral and central andrenergic, as well as underlying inherited biochemical abnormalities such as genetic factors, inappropriate renin secretion by the kidneys and salt sensitivity are involved in the genesis and regulation of blood pressure (BP).

The ACSM (2014:46) and Chobanian *et al.* (2003:1211) reported on the classification of blood pressure for adults aged 18 years or older, based on the Seventh Report of the Joint National Committee on Prevention, Detection, Evaluation, and Treatment of High Blood Pressure (Chobanian *et al.*, 2003:1211), and defined it as follows:

- Normal blood pressure - SBP < 120 mmHg and DBP < 80 mmHg;
- Pre-hypertension - SBP 120 - 139 mmHg, and DBP 80 - 89 mmHg;
- Stage 1 hypertension - SBP 140 - 159 mmHg and DBP 90 - 99 mmHg;
- Stage 2 hypertension - SBP $\geq$ 160 mmHg and DBP $\geq$ 100 mmHg.

Chobanian *et al.* (2003:1210), in addition, reported that for every 20 mmHg systolic or 10 mmHg diastolic increase in BP, mortality from both CHD and stroke doubled, and that BP values from 130 - 139 mmHg over 85 - 89 mmHg were associated with a more than two-fold increase in CHD.

Kearney *et al.* (2005:217) anticipated that the total number of adults worldwide with hypertension will increase by about 60% between 2000 to 2025 to a total of 1.56 billion people and that 75% of the world's hypertensive population will be in economically developing countries by 2025 also indicating increased CHD risk. Madhur (2013) stated that hypertension is one of the most common diseases worldwide afflicting humans and is a major risk factor for the development of CHD, vascular and chronic kidney disease. According to Madhur (2013) the aetiology of most cases of adult hypertension is still unknown, and control of BP is sub-optimal in the general population. Hypertension was identified as one of the ten leading risk factors influencing the global burden of disease, and was estimated to lead to over 7 million deaths each year – about 13% of total deaths worldwide – indicating the importance of preventing and treating hypertension (Madhur, 2013).

Perret-Guillaume *et al.* (2009:8) reported a strong association between hypertension and high resting heart rate. Untreated hypertensive subjects had approximately a 6 beats per minute (bpm) faster resting heart rate than normotensive individuals. The Ohasama study (Hozawa *et al.*, 2004:1005) indicated that an increase in resting heart rate by 5 bpm was associated with a 17% increase in 10-year cardiovascular mortality. Perret-Guillaume *et al.* (2009:7) further reports that an increase in heart rate by 10 bpm to be associated with at least a 20% increase in risk of cardiac death and that this increase in risk was similar to that observed with an increase in SBP by 10 mmHg. Tachycardia remained a neglected cardiovascular risk factor until recently when the guidelines of the European Society of Cardiology and the European Society of Hypertension indicated that an accelerated heart rate was considered an independent risk factor and a potential target for pharmacologic therapies, especially in high-risk patients (Perret-Guillaume *et al.*, 2009:6,8). Custodis *et al.* (2013:186) similarly reported that an accelerated resting heart rate interfered at all stages of the cardiovascular disease continuum, initiating from endothelial dysfunction continuing through to the atherosclerotic lesion formation and plaque rupture resulting in a cardiac event. They also indicated that an accelerated resting heart rate increased trans-mural force imposed by pulsatile blood flow, and was closely linked to systemic inflammation and markers of endothelial dysfunction that add to the pathogenesis of arterial hypertension that increased the risk for CHD. Accelerated heart rate can also promote oscillatory endothelial shear stress that synergistically promotes atherogenesis and vascular stiffness contributing to hypertension and CHD (Custodis *et al.*, 2013:184).

Fivawo (2012:3) referred to hypertension as a “*silent invisible killer*” which rarely caused symptoms in the early stages and therefore individuals with hypertension often go undiagnosed in the absence of screening. Fivawo (2012:3) reported that hypertension can lead to MI, heart failure, kidney failure as well as stroke, and cautioned that employees often were unaware of hypertension.

According to the American Heart Association (2011) data from the National Health and Nutrition Examination Survey (NHANES) 2005 - 2008 indicated that 33.5% of US adults < 20 years of age suffered hypertension. The survey reported that among hypertensive adults, 80% were aware of their condition (of which 48% had their condition controlled), and that 71% were using anti-hypertensive medication.

Data from NHANES 2005 - 2008 showed that a higher percentage of males compared to females had hypertension until 45 years of age. From 45 to 54 and 55 to 64 years of age, the percentages of males and females with hypertension were found to be similar, and after 64 years of age a higher percentage of females than males reported hypertension (American Heart Association, 2011). They also reported that on average, every 40 seconds somebody in the US had a stroke and every 4 minutes someone died of a stroke. Xu *et al.* (2010:10) reported that black Americans had a risk of first-ever stroke almost twice that of white Americans and Pleis *et al.* (2008:10) reported that black adults globally had the highest rate of hypertension with an increasing prevalence. Although white adults also had an increasing incidence of hypertension, they developed this condition later in life, and had a lower BP level on average (Pleis *et al.*, 2008:10). Madhur (2013) summarized that hypertension was a major risk factor for stroke, CHD, vascular disease, and chronic kidney disease and that it affected approximately 75 million adults in the US.

The WHO (2013:9) reported that hypertension was globally responsible for 45% of deaths due to CHD and 51% of deaths due to stroke. They further voiced that the increasing prevalence of hypertension was attributed to by population growth and ageing as well as behavioural risk factors such as unhealthy eating habits, alcohol abuse, lack of PA, excess weight and exposure to stress (WHO, 2013:11). According to Ibrahim and Damasceno (2012:611) as well as the WHO (2011b) an estimate of 1 billion people worldwide were hypertensive and this number was expected to grow to 1.56 billion people by 2025.

Day *et al.* (2014:680) and The South African Department of Health (SADH, 2012) reported hypertension prevalence in South Africa in 2010 amongst adults ≥ 25 years of age at 40.6% (42.6% in females and 38.1% in males) and indicated that hypertension prevalence has increased with 32.3% since 1998. They anticipated that hypertension treatment coverage was poor (35.7%) and that only 36.4% of hypertensive cases on treatment were controlled. According to the South African Heart and Stroke Foundation (2014:9) hypertension affected one in three individuals ≥ 15 years of age and that 49% of females and 74% of males were unaware that they were hypertensive. Charlton *et al.* (2005:46) and Maseko *et al.* (2006:189) reported that South Africans consumed more sodium than the recommended maximum of 5 g per day (WHO, 2014a:45), and that a high salt and low potassium- and calcium intake has been associated with hypertension.

Gordon (2003:77) suggested that hypertension can be managed and even eliminated by adopting constructive lifestyle habits such as regular PA, reduced body weight, reduced alcohol intake, reduced salt intake and no smoking. WHO (2014a:67) reported in this regard that a reduction of 10 mmHg in SBP was associated with a 22% reduction in CHD and 41% reduction in stroke.

Pleis *et al.* (2008) recommend the following lifestyle modifications to lower BP and reduce CHD risk and claimed that greater results were achieved when two or more lifestyle modifications were combined:

- Weight-loss (range of approximate SBP reduction, 5 - 20 mmHg per 10 kg);
- Limit alcohol intake to ≤ 30 ml of ethanol per day for males and ≤ 15 ml for females and individuals of lighter weight (range of approximate SBP reduction, 2 - 4 mmHg);
- Reduce sodium intake ≤ 100 mmol/day (range of 2.4 to 6.0 g sodium chloride, range of approximate SBP reduction of 2 - 8 mmHg);
- Maintain adequate intake of dietary potassium (approximately 90 mmol/day);
- Maintain adequate intake of dietary calcium and magnesium;
- Stop smoking;
- Reduce dietary saturated fat intake and cholesterol;
- Engage in aerobic exercise at least 30 minutes daily for most days (range of approximate SBP reduction, 4 - 9 mmHg).

Madhur (2013) suggested hypertension to be the most important modifiable risk factor in order to lower the development of CHD, stroke, congestive heart failure, end-stage renal disease and peripheral vascular disease. Madhur and Maron (2014:2) reported that a decrease in BP of 2 mmHg reduced the risk of stroke by 15% and that of CHD by 6%.

Kolbe-Alexander and Lambert (2013:4) studied 18 South African companies and reported that 81% of employees, had normal blood pressure levels. Swanepoel *et al.* (2015: 1478) indicated that male employees ≥ 45 years of age showed the highest prevalence of pre-hypertension (SBP 51.3%) and hypertension (26.7%). A similar tendency was indicated for diastolic blood pressure with 45.6% pre-hypertensive and 28.5% hypertensive.

They reported the overall prevalence of employees at risk for hypertension in a South African corporate setting as 62.1% (SBP) and 56.6% (DBP) (Swanepoel *et al.*, 2015:1478).

Physical activity (PA) has been recommended as an important lifestyle modification in preventing and managing hypertension (Contractor *et al.*, 2013:145). During PA, nitric oxide (a short-lived gas generated within the body) is generated and stored in the blood stream and heart muscle in the form of nitrite and nitrosothiols. Nitric oxide activates chemical pathways that relax blood vessels and reduce the resistance to blood flow, lowering BP and increasing blood flow through the system. They further indicated that PA leads to a reduction in α -adrenergic receptor-mediated vascular tone, resulting in decreased arterial stiffness and reducing the risk of hypertension. Regular PA is also associated with increased glucose transport (reduced hyperinsulinemia associated with hypertension), which may reduce BP (Contractor, 2013:146). The workplace has the potential of reaching a significant proportion of employed adults for early detection of hypertension and other illnesses WHO (2013:29). Health promotion programmes in the workplace is one of the most cost-effective ways of preventing and managing NCD including hypertension (WHO, 2013:29).

2.3.3.4 Smoking (primary risk factor)

Papathanasiou *et al.* (2014:275) reported that nicotine and carbon monoxide (chemicals absorbed from cigarette smoking) can harm blood vessels and accelerate atherosclerosis, increasing the risk of CHD. They further reported nicotine from cigarettes to be addictive, and to cause the brain to develop extra nicotine receptors to accommodate large doses of nicotine. When the brain stops receiving the nicotine it's used to, it results in nicotine withdrawal, followed by symptoms such as anxiousness, irritability, and having cravings for nicotine. Papathanasiou *et al.* (2014:275) also indicated that carbon monoxide's affinity for haemoglobin is significantly higher (up to 300 times) than that of oxygen, causing carbon monoxide to bind to haemoglobin in red blood cells (preventing oxygen from binding) that reduced oxygen uptake in the blood. According to Erhardt (2009:26,27) smoking promoted CHD through several mechanisms and each cigarette smoked, raised the circulating levels of fibrinogen and adrenaline-like hormones in the blood, increasing the viscosity of blood (thickness and stickiness of blood platelets), decreasing the blood's oxygen-carrying capacity, reducing tissue oxygen uptake, lowering HDL and constricting blood vessels. Greenberg *et al.* (2004:304-306) and the University of Maryland Medical Center (2013) reported cigarette smoking as one of the best predictors for the development of CHD and that the risk was

directly related to the number of cigarettes smoked. Similarly, WHO (2008b:7) reported that smoking was associated with elevated blood pressure, impaired blood lipid levels and caused blood platelets to be more sticky, raising the risk of thrombosis. As little as three cigarettes a day can increase the risk for blood vessel abnormalities that endanger the myocardium (University of Maryland Medical Center, 2013).

Van Zyl-Smith *et al.* (2013:869) and the WHO (2008b:7) reported an estimated 1.3 billion smokers worldwide (an estimated 7 million of these smokers were in South Africa) and over 5 million deaths per year attributable to tobacco smoking. According to the American Heart Association (2011) the percentage of the non-smoking population with detectable serum cotinine (indicating exposure to second-hand smoke) from 1999 to 2004 was on average 46.4% and was the highest for children 4 to 11 years of age (60.5%), followed by those 12 to 19 years of age (55.4%). Mathers and Loncar (2006) projected tobacco-attributable deaths globally in 2030 to be in the order of 9.7 million.

According to Health24's (2013) latest national statistics (South African National Health and Nutrition Examination Survey) 32% of South Africans were smokers in 1993 compared to 16.4% in 2012. They attributed the drop mainly to stricter smoking legislation, advertising limitations and steeper tobacco prices. Similarly, Bradshaw *et al.* (2011) reported an increase in NCD risk factors for South Africa, except for smoking, and ascribed it to effective comprehensive tobacco legislation promulgated in the 1990s. Kolbe-Alexander *et al.* (2008:7) reported a smoking prevalence rate of 19.9% and Swanepoel *et al.* (2015:1478) a prevalence of 18.6% amongst employees in the corporate sector. The WHO (2008b:7) reported that tobacco smoking increase the risk for the development of TB, cancer, pneumonia, CHD and stroke, which are among the 8 leading causes of death globally. Mendis *et al.* (2011:26) demonstrated that the age of quitting among ex-smokers had a major impact on survival prospects and that those who quit between 35 and 44 years of age had the same survival rates as those who had never smoked. Mukamal *et al.* (2006) reported that the estimated effect of smoke cessation was the single change in lifestyle that gave the greatest benefit to reducing the risk of CHD.

Black *et al.* (2015:857) indicated that job displacement (downsizing, restructuring) was significantly associated with increased smoking among males and as well as females, and had a significant effect on markers for cardiovascular disease. The CDC (2011) anticipated that

smoking in the workplace affected individual health and exposed co-workers to second-hand smoke associated with lung cancer, heart disease, and respiratory illnesses. The Conference Board of Canada (2013) reported that each smoker on average cost the employer an estimated \$4,256 in 2012. More than \$3,800 of the cost was due to lost productivity related to smoking breaks, and more than \$400 due to absenteeism. They further indicated that this cost had increased by more than 25% since 2005. The cost of smoking-related disease to the SA economy was estimated at R1.2 billion in 2013 (van Zyl-Smith *et al.*, 2013:869).

Robb and Carson-Dewitt (2016), The Lung Association (2016), and Ussher *et al.* (2012) reported that PA has been known to reduce many of the negative effects of smoking cessation such as cigarette cravings, withdrawal symptoms (depression, anxiety, irritability, poor concentration), negative mood states and weight gain. They indicated that PA increased dopamine release and activates areas of the brain that stimulates the central nervous system in a similar way to cigarette smoking, resulting in feelings associated with motivation and reward. Robb and Carson-Dewitt (2016) and The Lung Association (2016) indicated the following benefits of PA on smoking:

- Reduced urge to have a cigarette even when confronted with visual triggers;
- Reduced psychological symptoms and desire to smoke, increasing your perceived coping abilities and self-esteem;
- Reduced fear of weight gain associated with quitting the smoking habit;
- Suppressed appetite while quitting;
- Reduced post-quit weight gain for up to two years after quitting the smoking habit;
- Reduced cigarette consumption by up to 50%;
- Reduced the risk of progressing from a casual to a regular smoker;
- Advanced readiness to quit;
- Increased the time between cigarettes.

Both cardiovascular and resistance training have been shown to be effective by increasing energy expenditure and curbing post-quit weight gain, with the added advantage of preserving muscle mass while keeping the weight (Lung Association, 2016). Ussher *et al.* (2012:15) concluded there is strong evidence to recommend exercise as an aid for reducing tobacco withdrawal and cravings, and that further research is needed in this regard.

2.3.3.5 Diabetes mellitus

Albright (2013:91), International Diabetes Federation Atlas (IDF Atlas, 2013:12) and WHO (2008b) defined diabetes as a chronic illness that occurs when the body does not produce enough insulin or cannot use produced insulin, leading to an increased glucose concentration in the blood. They indicated that insulin is a hormone produced by the pancreas to regulate glucose concentration (needed by muscle, fat and the liver) in the blood. Symptoms of diabetes include thirst, excessive urination, tiredness and unexplained weight-loss (Hornsby & Albright, 2003:133). Hornsby and Albright (2003:133) also reported that diabetes can be diagnosed as a fasting blood sugar level of $> 6.2\text{mmol}\cdot\text{l}^{-1}$. There are two main types of diabetes (IDF Atlas, 2013:22; Steyn, 2007:23; WHO, 2008c) e.g.:

- Type 1 diabetes;

Type 1 diabetes develops early in life in which the pancreas stops producing insulin, and it accounts for 10% to 15% of diabetic cases. According to Albright (2013:92) it was formerly known as juvenile-onset or insulin dependent diabetes and usually occurs in childhood, but can also occur at any age.

- Type 2 diabetes.

Type 2 diabetes, formerly referred to as adult-onset or non-insulin dependent diabetes, is the most common form of diabetes and affects 90% to 95% of those with diabetes (Albright, 2013:92). It usually develops later in life (after the age of 40) and mostly in individuals who were overweight or obese, followed a sedentary lifestyle and had a high risk for the development of CHD (IDF Atlas, 2013:22; Steyn, 2007:23). According to Haffner and Cassells (2003:6) Type 2 diabetes is a complex disorder characterized by impaired secretion of insulin as well as increased resistance to insulin and was associated with a two- to fourfold increased CHD risk and a fourfold increase in mortality from CHD.

Albright (2013:93) and the IDF Atlas (2013:12) also reported a third type of diabetes, viz. gestational diabetes. Gestational diabetes mellitus (GDM) appears during 2% to 10% of pregnancies and had serious health risks for the mother and infant as it increased the risk for developing Type 2 diabetes later in life. Mendes *et al.* (2011:40) reported that diabetes were more prevalent in developed countries, but modernization and lifestyle changes were likely to result in a future epidemic of diabetes in developing countries. A survey by the American

Heart Association (2011) reported that more than 170 million people in the world had diabetes and an estimated 18.3 million Americans had diagnosed diabetes mellitus in 2008, representing 8% of the adult population. An additional 7.1 million had undiagnosed diabetes, of which 36.8% were pre-diabetic with normal fasting glucose levels. Additional to this, the survey reported the prevalence of diabetes mellitus to increase over time with the increase in prevalence of overweight and obesity American Heart Association (2011).

The pathophysiology indicates that Type 1 diabetes is considered an autoimmune disease caused by the immune system attacking the body's beta cells, resulting in insulin deficiency. Insulin therefore needs to be injected or supplied with an insulin pump (Albright, 2013:92). Type 2 diabetes is recognised by insulin resistance of the peripheral tissues as well as defective insulin secretion. Albright (2013:92) reported that with insulin resistance the body cannot effectively use the insulin although sufficient insulin is produced in the early course of the disease. Over time the pancreas loses its effectiveness to produce sufficient insulin to compensate for the insulin resistance resulting in hyperglycaemia. Type 2 diabetes has a genetic track and the risk for offspring with a single diabetic parent is 3.5 times higher than those without diabetic parents and that for offspring with two diabetic parents 6 times higher (Albright, 2013:93). He also voiced that hyperglycaemia during diabetes is of primary importance in the development of chronic complications along with hypertension and hyperlipidaemia.

Diabetes is associated with CVD such as angina, MI, stroke, peripheral artery disease, and congestive heart failure, and increases the risk of cardiovascular complications (Gatineau *et al.*, 2014:5; IDF Atlas, 2013:24). Gatineau *et al.* (2014:5) reported that individuals with diabetes had a greater risk of health conditions such as blindness, amputation, kidney disease, depression and CHD.

Wild *et al.* (2004:1051) projected that the number of people with diabetes globally will double from 2000 to 2030, solely based on demographics such as age and urbanisation. The majority of people have Type 2 diabetes and this form of diabetes is preventable as it relates to a lifestyle of physical inactivity, excess calorie intake and obesity (WHO, 2008b). IDF Atlas (2013:38) reported that half of all people with diabetes were unaware of their condition while Colberg *et al.* (2010:e147) reported that at least 25% of diabetic cases in America were undiagnosed.

George *et al.* (2012:1) reported that out of 34.5 million deaths from NCDs, 1.3 million were attributable to diabetes mellitus, and deaths from diabetes mellitus to have doubled from 1990 to 2010, and that diabetes mellitus as a cause of death, rose from 15th in the global death list to 9th. The IDF Atlas (2013:34) projected the increase in the global prevalence of diabetes mellitus from 382 million in 2013 to 592 million in 2035. Engelgau *et al.* (2004:947-948) and Bertoni *et al.* (2002:473) documented that CHD was the leading cause of illness, death and hospitalization in persons with diabetes whilst Wild *et al.* (2004:1051) estimated that global diabetes prevalence would rise from 171 million in 2000 to 366 million in 2030. Although the numbers differed, both the IDF Atlas (2013:12,13) and Wild *et al.* (2004:1051) projected a significant increase in the global prevalence of diabetes mellitus for 2030.

Bertram *et al.* (2013:206,209) reported that the prevalence of diabetes in people over the age of 30 in South Africa has grown significantly and has increased from 5.5% (2000) to 9.0% (2009). They indicated that amputation and blindness from diabetes affected individuals' physical and emotional status led to reduced productivity and was a burden on the economy. Bertram *et al.* (2013:206,209) anticipated that increasing urbanisation and unhealthy lifestyle practices (viz. inactivity, poor nutrition) were contributing to the growing diabetes epidemic in South Africa. Steyn (2007:23) reported that diabetes rates varied among the South African population groups. The highest rate for diabetes (individuals ≥ 30 yrs.) in South Africa (2000) was recorded in Indian males (18%) and females (16%). The rates found in the coloured and white groups were the same, with 5% of males and 7% of females having diabetes. Diabetes was the lowest among the African population for those living in rural areas (3%) and those in the cities (6%). It has been estimated that there were about 1.5 million South Africans with diabetes and that diabetes was the most common cause of leg amputations and blindness in South Africa in 2000 (Steyn, 2007:23).

Crackel (2004:20), Dracup *et al.* (2008) and the South African Department of Health (1998) reported that employees were unaware of diabetes, hypertension, obesity and CHD risk. Swanepoel *et al.* (2015:1482) reported that more than 23.5% of males and 16.7% of females ≥ 45 years of age showed high casual blood glucose levels. These values were higher compared to the broader SA population (WHO, 2014b), viz. 11.9% (males) and 11.7% (females), indicating an increased risk in CHD risk due to diabetes. Employees with diabetes were more absent from work and had lower productivity levels while at work (presenteeism) due to inability to work as a result of diabetes (The American Diabetes Association, 2013).

Diabetes may also affect employees' physical and emotional status and lead to reduced productivity and a burden on the economy (Bertram *et al.*, 2013:206,209). Albright (2013:105), Colberg *et al.* (2010:e147) and Sigal *et al.* (2013) reported that exercise (aerobic and resistance training) has been recognized as an important part of diabetes management, preventing or delaying Type 2 diabetes, positively affecting lipids, blood pressure, weight-loss, cardiovascular events, mortality, and quality of life. Colberg *et al.* (2010:e148) anticipated that a single exercise session increases insulin action and glucose tolerance for between 24 and 72 hours and that most benefits were realized in improved insulin action that assisted in managing blood glucose levels. Exercise increased glucose uptake into active muscles balanced by hepatic glucose production, with a greater reliance on carbohydrates to fuel muscular activity as intensity increases (Colberg *et al.*, 2010:e149). ACSM (2014) similarly pointed out that PA had a profound effect on improving resting blood sugar levels and reduced the risk of diabetes and CHD. Exercise intensity predicts improvement in blood glucose level to a greater extent than exercise volume, and should therefore be at least moderate intense (40 - 60% of VO_2max) for 150 min/week (Albright, 2013:107; Colberg *et al.*, 2010:e149). They also indicated that resistance exercise should be undertaken at least twice a week on non-consecutive days, at moderate (50% of one repetition maximum) or vigorous (75 to 80% of 1 repetition maximum) intensity, 1 to 4 sets, 5 to 10 exercises of and 10 to 15 repetitions involving major muscle groups (Albright, 2013:108; Colberg *et al.* (2010:e155).

Hyperglycaemia and hypoglycaemia prior to exercise is of concern in individuals with diabetes (Albright, 2013:105; Colberg *et al.*, 2010:e148; Sigal *et al.*, 2013). Hyperglycaemia in individuals with Type 1 diabetes who are insulin deficient can be worsened by exercise (Sigal *et al.*, 2013). They anticipated that in patients with Type 1 diabetes, if capillary glucose is $> 16.7 \text{ mmol}\cdot\text{l}^{-1}$, blood or urine ketones should be assessed and if elevated, exercise should be postponed and additional insulin should be taken. The risk of hypoglycaemia during exercise is also of concern for individuals with diabetes, particularly Type 1 diabetes, and to a lesser extent Type 2 diabetes. In these individuals, when pre-exercise blood glucose levels are $< 5.5 \text{ mmol}\cdot\text{l}^{-1}$, approximately 15 to 30 gram carbohydrates should be ingested before exercising (Sigal *et al.*, 2013).

Franco *et al.* (2013:6) indicated that a population-wide loss of 4 - 5kg in body weight in a relatively healthy population was accompanied by a diabetes morbidity decline of 50% and

mortality decline of 30%. They further reported that a rebound in body weight was associated with an increased prevalence in diabetes and mortality, and a deceleration of the decline in mortality from CHD. Hornsby and Albright (2003:135) reported exercise as key in the rehabilitation of diabetes with benefits such as improved blood glucose management, better insulin sensitivity that can reduce the need for insulin, reduced body fat and even prevention of Type 2 diabetes.

2.3.3.6 Alcohol

According to Laonigro *et al.* (2009:453) alcohol could be considered a cardiotoxin, and regular heavy spirits consumption was associated with a type of non-ischaemic dilated cardiomyopathy termed alcoholic cardiomyopathy (ACM). ACM, according to Laonigro *et al.* (2009:453) was a secondary cardiomyopathy, e.g. a cardiomyopathy showing pathological myocardial involvement as part of a number of generalized systemic disorders, referred to as specific cardiomyopathies or heart muscle diseases. ACM was characterized by a dilated left ventricle (LV), normal or reduced LV wall thickness, increased LV mass and modestly posterior and septal wall thickening, all conditions that can limit normal LV function.

Gordon and Gibbons (1991:304), Laonigro *et al.* (2009:459) and the University of Maryland Medical Center (2013), confirmed that overindulging (≥ 60 ml of spirits or 5 alcoholic drinks per day) was associated with increased risk of CHD and by contrast advised that moderate alcohol consumption (≤ 2 alcoholic drinks per day where a drink is equal to 25 ml spirits, 150 ml wine or 300 ml of beer) can reduce the risk of CHD. This is confirmed by Contractor *et al.* (2013:143) and Steyn (2007:26). Contractor *et al.* (2013:143) and Steyn (2007:26) referred to a drink (tot) as equal to in the order of 340 ml beer, 125 ml wine, 60 ml sherry, 25 ml spirits and 25 ml liquor. Contractor *et al.* (2013:143-144) reported that males and females who consume alcohol should limit their intake to 2 drinks (male) and 1 drink (female) per day.

Laonigro *et al.* (2009:453,459) indicated that alcoholic patients consuming 90 ml of alcohol a day (approximately 7 to 8 drinks per day) for 5 years were at risk for the development of asymptomatic impairment of LV function. Those who continued to drink became symptomatic and developed signs and symptoms of heart failure (Laonigro *et al.*, 2009:453). According to the National Institute on Alcohol Abuse and Alcoholism (NIAAA: 2011) overindulging can affect the body in various ways:

- Cardiomyopathy, arrhythmias, stroke and hypertension;
- Steatosis, alcoholic hepatitis, fibrosis and cirrhosis of the liver;
- Pancreatitis;
- Cancer of the mouth, oesophagus, throat, liver and breasts.

Medscape (2013) confirmed long-term alcohol abuse to be a cause of LV dysfunction and indicated that the effect of alcohol on the myocardium was a direct toxic result of ethanol and its metabolites that decreased protein synthesis and mitochondrial dysfunction. The myocyte mitochondria in the heart muscles of persons exposed to alcohol abuse were abnormal in structure (Medscape, 2013).

Ramsoomar and Morojele (2012:611) reported that alcohol-related disease burden operated in two dimensions via average volume of alcohol consumed (associated with CHD) and patterns of drinking (mainly binge drinking, associated with violence and injury) whilst the NIAAA (2011) reported that the impact of alcohol consumption can vary from person to person depending on age, health status and family history. As far back as the 90's Reid *et al.* (1999:1681) stated that heavy drinking was defined as alcohol consumption that resulted in adverse events such as physical or psychological harm. NIAAA (2011) also reported the presence of heavy drinking occasions (consumptions $\geq$ 60ml of pure alcohol or 5 alcohol drinks per day) as a key characteristic of a harmful pattern of drinking and that harmful use of alcohol resulted in 2.5 million deaths annually.

Peltzer *et al.* (2011:30) reported an increase in current binge and harmful drinking prevalence rate in South Africa from 2005 to 2008. The South African National HIV, Incidence, Behaviour and Communication (SABSSM) survey in 2008 on a random population sample of 15 828 persons aged $\geq$ 15 years, reported alcohol used by 41.5% of males and 17.1% of females (Peltzer *et al.*, 2011:30):

- White males were most likely (69.8%) and Indian/Asian females least likely (15.2%) to be current drinkers;
- Urban residents were more likely (33.4%) than rural residents (18.3%) to report current drinking;

- Risky or hazardous drinking was reported by 9% of the sample group (17% males and 2.9% females);
- Among males, risky drinking was associated with the 20 to 54-year age group, the coloured ethnic group, lower economic status and lower education;
- Among females, risky drinking was associated with urban residence, the coloured ethnic group, lower education and higher income.

Alcohol abuse was ranked as the third highest contributor in terms of disability adjusted life years (DALYs) among 19 health-risk factors. The WHO (2011a:22) stressed that overindulgence was a major determinant for neuropsychiatric disorders and other NCDs such as CVD, cirrhosis of the liver and a variety of cancers. Chronic alcohol consumption weakened the immune system and increased the risk for diseases such as pneumonia and tuberculosis (WHO, 2011a:23).

Seggie (2012) reported that South Africa had a hard-drinking population that consumed in excess of 5 billion litres of alcohol annually. According to WHO (2011a:4,16) this was among the highest per capita consumption rates in the world (Central Drug Authority, 2010/2011:33,34; Eberlein, 2010:32; McCann *et al.*, 2011:46; Department of Social Development, 2012:33,35). The WHO (2011a:14-17) awarded South Africa a score of 4 (drinking ≥ 5 beers or glasses of wine at one sitting for males, and ≥ 3 drinks for females) out of 5 in their report on alcohol and health in 2011, indicating risky patterns-of-drinking. The higher the score, the greater the alcohol-attributable burden of disease for the country (WHO, 2011a:14-17). The University of Maryland Medical Center (2013) voiced that advice on the consumption of alcohol must emphasize not only the complex relation between alcohol and CHD but also the well-known association of heavy alcohol consumption with other health-risk factors (viz. hypertension and raised triglyceride levels) for the development of CHD.

Gordon and Gibbons (1991:304), Mukamal *et al.* (2006) and the University of Maryland Medical Center (2013) anticipated that the health benefit of alcohol was in moderate consumption as it improved HDL cholesterol levels, aid in the prevention of thrombosis and inflammation, and lowered the risk for CHD.

Peltzer *et al.* (2011:30) advocated that multilevel interventions were required to target high-risk drinkers and to create awareness of health risks associated with overindulgence. Mukamal *et al.* (2006) reported that males at low CHD risk on the basis of BMI, PA, not smoking, healthy nutrition and moderate alcohol intake has been associated with an even lower risk for CHD. Gordon and Gibbons (1991:304), Laonigro *et al.* (2009:459) and Steyn (2007:26) also indicated that although moderate alcohol intake can be beneficial to health, overindulging was associated with CHD risks such as hypertension, arrhythmia and raised triglyceride levels. Alcohol consumption has also been shown to have numerous other effects on the cardiovascular system such as arrhythmia, hypertension and stroke, and was associated with sudden death (Medscape, 2014).

Alcohol abuse among employees on-site and/or off-site inevitably results in decreased productivity, work errors, wasted materials and tardiness that translate into productivity losses (Eberlein, 2010:35-36; ICAP, 2013; Department of Social Development, 2012:27-36). Alcohol abuse in the workplace relates to increased costs associated with absenteeism, poor productivity, high job turnover, interpersonal conflict, injuries and damage to property (Seggie, 2012). The cost of alcohol abuse was estimated to be around R9 billion per year, equivalent to 1% of GDP (Seggie, 2012). McCann *et al.* (2011:48) estimated that more than 50% of accidents in the workplace can be alcohol abuse related, and that theft and criminal activities at work resulted from substance abuse that could cost employers a further 25% of their annual wages. Peak fitness (2010) reported that alcohol intake, chemically alters the brain to release endorphins (dopamine) which is associated with a feeling of reward and reduced feelings of anxiety and depression.

Dopamine is also released during exercise and therefore exercise provides a suitable alternative to a feeling of reward similar to that of alcohol use, and the rewarding effect of these two behaviours may partially substitute one another (Peak fitness, 2010). Wang *et al.* (2014) indicated that 35 minutes of moderate (HR = 50 - 60% VO₂max) to high-intensity (HR = 80 - 90% VO₂max) physical exercise for as little as 6 weeks, can significantly reduce withdrawal symptoms, anxiety and depression in alcohol abusers.

2.4 PSYCHO-SOCIAL HEALTH RISK FACTORS ASSOCIATED WITH CORONARY HEART DISEASE

Moretti and Postruznik (2012:1) stated that the corporate business environment demanded sustained success and that changes in customer expectations, legislation, work organization, as well as competitiveness, calls for constant alterations in the functioning of corporations as a whole, requiring high levels of employee adaptability. The employees' feelings of self-respect, job security and self-worth are constantly put under pressure by dynamic and often hostile challenges, and long-term exposure to pressure in this type of environment can lead to a range of physical and psycho-social disorders (Moretti & Postruznik, 2012:1).

Schaufeli and Salanova (2014:293) reported that the way employees feel has not only to do with who they are, but also with where they are in their work career and that employee wellbeing was affected by the interaction between the employee and the work environment. Employee wellbeing depends on the interplay of job characteristics and interpersonal relations at work. The same authors reported that for modern organizations, employees' mental fitness rather than mere physical fitness provides a decisive competitive advantage (Schaufeli & Salanova, 2014:295).

Kinley *et al.* (2015:88) reported that depression and anxiety disorders have been associated with both physiological and behavioural conditions that can be linked to CHD. Kinley *et al.* (2015:88) further reported that these associations can be inconsistent and that questions remained regarding the associations of anxiety and depression with metabolic health and CHD. Exhaustion (lack of energy) and cynicism (a negative, indifferent, overly detached attitude) were identified as two core symptoms of burnout (Schaufeli & Taris, 2005:260), furthermore exhaustion has been connected to atherosclerotic disease, elevated cortisol levels, diabetes, insomnia, and poor self-rated health (Melamed *et al.*, 2006:331). The seriousness of burnout became apparent with a finding that burnout could be a risk factor for overall survival (De Beer *et al.*, 2013:90).

Baum *et al.* (2012:67) and Melamed *et al.* (2006:328) reported a possible association between psycho-social health (stress, burnout, depression,) and the risk for CHD and cardiovascular-related events such as MI, coronary bypass surgery, percutaneous transluminal coronary angioplasty, coronary atherosclerosis, coronary stenosis and cardiac death. Prolonged

exposure to stress (challenges) often depletes the psychological resources of the employee resulting in burnout. If the employee perceives the prolonged challenges (burnout) as impossible to overcome or to cope with, the condition can result in depression (Ahola *et al.*, 2014:29,35).

Following the above discussion, stress, burnout and depression as psycho-social health risk factors will subsequently be discussed in more detail.

2.4.1 Stress

Melamed *et al.* (2006:328) reported that the definition of stress could be viewed as exceeded the adaptive capacity of individuals, resulting in psychological and biological changes that place the individual at risk for disease. Gordon and Gibbons (1991:276) reported stress to be a natural response of the body when threatened and was associated with the release of adrenalin, increased heart rate and blood pressure. They also argued that although stress was not classified as a primary risk factor for CHD, it greatly contributes to the development of other primary risk factors such as hypertension, hyper-cholesterolaemia and cigarette smoke, resulting in a MI or stroke. Hamer and Steptoe (2012:31-32) reported cortisol reactivity, an index of hypothalamic-pituitary-adrenal function, as a mechanism by means of which psycho-social stress can be associated with CHD. Psychological distress has been implicated with increased risk of CHD through various pathways such as; the adoption of unhealthy lifestyle habits (smoking, unhealthy eating, harmful use of alcohol and lack of PA), neurohumoral activation associated with catecholamine secretion or hypothalamic pituitary-adrenal axis activation and secondary through metabolic disturbance that can increase CHD risk (Stansfeld *et al.*, 2002:248-249). Empirical evidence (Belkic *et al.*, 2004:86,116,117; Kopp & Rethelyi, 2004:363; Rosmond, 2005:4-6; Strike & Steptoe, 2004:343) suggested that chronic stress was associated with increased risk of CHD morbidity and mortality.

Chronic stress (stress that lasts for a long time, occurring repeatedly or continuously leading to exhaustion) often result from the work environment from conditions such as overload, emotional demand, interpersonal conflict, ambivalent role conflicts, injustice, inequity, uncertainty, under-reward, threats of physical abuse, job insecurity, job complexity, structural constraints, and sexual harassment (Melamed *et al.*, 2006:28; Schaufeli & Salanova, 2014:296).

Further to this, economic crises have led to a decline in economic activity, rise in unemployment, depressed housing markets and poverty. As a result of these circumstances low-income individuals and individuals living near the poverty line are under great psycho-social stress (Christodoulou, 2012:15).

According to Moretti and Postruznik (2012:2) work-related stress implied nervous tension, overexertion, pressure, and is a physical and mental reaction of the body to strain that can be divided into two categories:

- Positive stress: The employees' abilities are greater than the demands – the stress reaction has a positive impact on the employee's preparedness, capability, creativity and productivity;
- Negative stress: The demands are greater than the employees' abilities resulting in emotional and mental pressure and illness and are a consequence of short or long-term exposure to stressful circumstances.

The consequences of work-related stress for the individual, the organization and the social industry (Moretti & Postruznik, 2012:2) are as follow:

- Individual consequences: Behavioural (smoking, alcohol and drug consumption, violence, harassment, maltreatment), psychological (insomnia, depression, the inability to concentrate, easy irritation, burnout), and physiological consequences (back and heart problems, weak immune system, migraines, asthma, etc.);
- Organizational consequences: Negative effects on workplace co-operation (absenteeism, employee turnover, tardiness, aggressive communication, isolation), costs (increased compensation or healthcare costs), and corporate success (decreased productivity, workplace accidents, poor decision-making, mistakes);
- Social consequences: Healthcare costs (costs of medical consultations, hospitalizations, and other forms of medical treatment and rehabilitation), absenteeism costs (loss of production costs due to employee absenteeism), and early retirement costs.

Moretti and Postruznik (2012:2) further reported that a certain amount of work pressure is needed to increase productivity and create satisfaction in reaching one's goals. When work pressure however become too extensive (e.g. economic competition, restructuring, reorganization, constant changes in technology, necessary skills, knowledge, and work conditions, work overload, inadequate information), it results in work-related stress which negatively impact on employee health status (Moretti & Postruznik, 2012:2).

Melamed *et al.* (2006:331) reported that prolonged exposure to work-related stress was associated with burnout (emotional exhaustion, physical fatigue, and cognitive weariness). The evidence concerning the association between burnout or vital exhaustion and risk of CHD or cardiovascular-related events suggested that the risk associated with burnout and vital exhaustion was equal to and sometimes exceeded the risk conferred by classical risk factors such as age, BMI, smoking, blood pressure, and lipid levels (Melamed *et al.*, 2006:331).

The WHO (Leka *et al.*, 2003:8) stated that work stress can lead to physical health consequences such as CHD, disorders of the digestive system as well as disorders of the musculoskeletal system. In a prospective study of the Whitehall II cohort, with 3 years follow-up of an occupational cohort in previously healthy patients, investigators reported that 15.9% of the patient sample developed hypertension in response to laboratory-induced mental stressors and found an association between cortisol stress reactivity and hypertension (Hamer & Steptoe, 2012:29). In the South African Banking Survey (2013:9) it was reported that the corporate sector is highly competitive and referred to the sluggish economic environment, regulatory change and competition that directly impact resourcefulness of employees. The survey also highlighted that internal efficiency drives, improved technology, automation and optimisation of staff skills will be key mechanisms to remain competitive in the industry. The survey further predicted that employee numbers will grow marginally due to cost savings and rapid implementation of automation. This survey (South African Banking Survey, 2013:9) emphasize that executives significantly value experience, leadership skills and adaptability amongst employees and that lack of qualified staff is a key concern for the bank industry when evaluating opportunities to improve their market share. According to the South African Banking Survey (2013:9) executives and employees are constantly pressured to be innovative and recruit and retain talent in order to perform better. This is in line with the results published by Bashir and Ramay (2010:122-123).

Bashir and Ramay (2010:122-123) reported that employees in the corporate financial industry are under a great deal of stress (viz. overload, role ambiguity, role conflict, responsibility for people, restructuring, lack of feedback, keeping up with modern technology, uncertainty) resulting in extreme demands on physical- and mental health. The South African Heart Foundation (2005) reported that increased work pressure and a rushed modern lifestyle can lead to high stress levels that cannot be sustained, and therefore negatively impact on employee health and productivity. Swanepoel *et al.* (2015:1469) reported that 58.3% of employees in a South African corporate setting reported moderate to high stress levels.

Goetzel and Ozminkowski (2008:307) concluded that employees with seven of the risk factors for CHD (tobacco use, hypertension, hypercholesterolemia, overweight/obesity, high blood glucose, high stress, and lack of PA) cost employers 228% more in health care costs than those lacking any of these risk factors. Moretti and Postruznik (2012:7) concluded that every organization should create a stress management strategy to raise employee engagement and reduce presenteeism, and stated that adopting an employee wellbeing programme is a key element of stress management and should include the following:

- Regular courses on stress management at the workplace;
- Regular courses for middle-management about their role in stress management and employee engagement;
- Work tasks designed in such a manner as to give the employee a sense of importance;
- Roles and responsibilities be clearly defined;
- Regular PA, a flexible work time, and regular medical checks.

Corbin *et al.* (2000:364) stated that PA resulted in reduced stress levels due to the secretion of endorphins (dopamine) during exercise. Various research sources (Anxiety and Depression Association of America, 2016; Fernandez, 2010; Harvard Health Publications, 2016) reported that exercise reduced the levels of stress hormones (adrenaline and cortisol) and stimulate the production of endorphins (body's natural painkillers and mood elevators). Weir (2011) stated that in stressful conditions, individuals respond with fear, which sets off a cascade of reactions (viz. stress hormones, sweating, and elevated heart rate) preparing for the fight-or-flight reaction that can result in a panic. Regular exercise (cardiovascular and resistance training) can assist stressed individuals to become less likely to panic when exposed to the

fight-or-flight sensation and help to manage stress (Weir, 2011). Fernandez (2010) reported that exercise can buffer the effects of stress-induced cell aging and revealed benefits of PA even at cellular level (telomeres). Telomeres are tiny pieces of DNA that promote genetic stability and act as protective sheaths by keeping chromosomes from unravelling. She also indicated that telomere length is increasingly considered as a biological marker of stress. Chronic psychological stress takes a significant toll on the human body by reducing the length of telomeres in immune cells resulting in cellular aging and illness. Fernandez (2010) anticipated that a moderate amount of intense exercise appeared to provide a critical amount of protection for the telomeres by acting as a “*stress-buffer*” that prevented shortening of telomeres due to stress. Barbour *et al.* (2013:614) indicated that gross motor activities such as walking or cycling, 40 to 60 min at a time, at 60% to 70% of heart rate reserve (difference between resting and maximal heart rate), 5 days a week can contribute to effective stress management.

2.4.2 Burnout

Burnout is a syndrome of emotional exhaustion, depersonalization, and reduced personal accomplishment that can occur among individuals who do “*people work*” (Schaufeli & Salanova, 2014:296). Burnout is associated with hypocortisolism and characterized by physical fatigue and cognitive weariness, which can result from prolonged exposure to work-related stress (Brown *et al.*, 2004:5; Melamed *et al.*, 2006:333). Burnout may be transferred from one employee to another directly or indirectly and can therefore be regarded as a public health problem that can have a negative effect on productivity (Bakker *et al.*, 2003:13). There are various explanations for burnout in the literature:

- *Burnout is a unique affective response to chronic stress at work and at it's core is the depletion of individual energetic resources, and represented by feelings of physical fatigue, emotional exhaustion, and cognitive weariness (Melamed et al., 2006:329);*
- *Burnout is a combination of physical fatigue, emotional exhaustion, and cognitive weariness, representing the depletion and draining of three closely interrelated energetic resources (Schaufeli & Salanova, 2014:302), viz:*

- Physical fatigue - feelings of tiredness and low levels of energy in carrying out daily tasks at work;
- Emotional exhaustion - interpersonal aspect of burnout, feeling one lacks the energy needed to invest in relationships with people at work;
- Cognitive weariness - feelings of slow thinking and reduced mental agility.

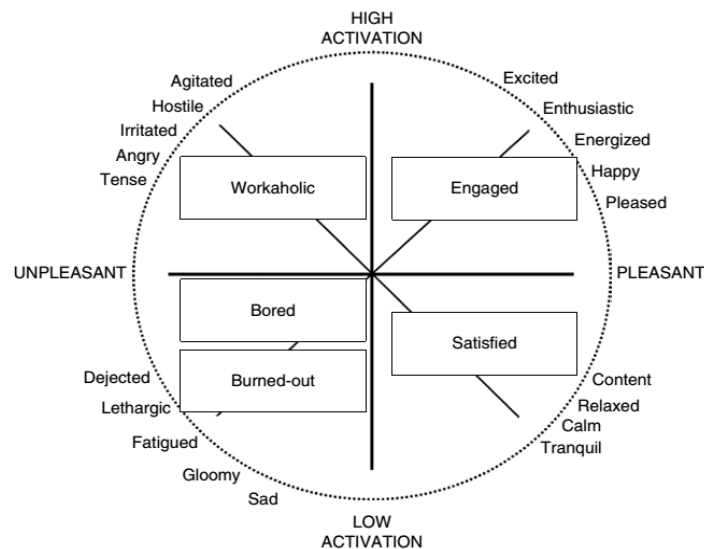


Figure 2.4 A taxonomy of work-related wellbeing (Schaufeli & Salanova, 2014:302 adapted from Russell, 1980).

According to the taxonomy of employee wellbeing (Fig 2.4) various types of work-related wellbeing, including burnout, boredom and engagement, could be mapped (Schaufeli & Salanova, 2014:302). This taxonomy enabled a discussion on the differences between the various types of employee wellbeing more systematically. The taxonomy assumed that human emotions may be plotted on the surface of a circle that was defined by two orthogonal dimensions ranging from pleasure to displeasure and from activation to deactivation, in order that every emotion was a combination of varying degrees of pleasure and activation. Excitement therefore was a pleasant and active emotion, and sadness an unpleasant and inactive emotion. Additionally, calmness was pleasant and inactive, while hostility was unpleasant and active. Employees who experience mainly negative emotions may have suffered from burnout, boredom or workaholism, whereas employees who experience mainly positive emotions may feel satisfied and engaged. Furthermore, employees may either feel activated, as in workaholism and engagement, or deactivated, as in burnout, boredom and dissatisfaction. According to this, engaged employees could be placed in the upper right

quadrant, satisfied employees in the lower right quadrant, bored or burned-out employees in the lower left quadrant and finally workaholics in the upper left quadrant. The intensity of the experience increased when moving from the centre to the surface of the circle along both diagonals. For instance, burned-out employees will feel more negative and less active than bored employees. Likewise, levels of engagement, satisfaction and workaholism may differ in intensity, depending on the distance from the centre of the circle (Schaufeli & Salanova, 2014:302,303). This taxonomy was consistent with research (Reijseger *et al.*, 2012) which showed that boredom was positively related to burnout.

Various studies support a positive association and correlation between burnout and ill-health (Ahola *et al.*, 2005:55,56; Ahola & Hakanen, 2007:104). According to Schaufeli and Taris (2005:260) the basic structure of burnout across all occupations was a combination of emotional exhaustion and depersonalization (withdrawal). Bakker *et al.* (2003:14) as well as Schaufeli and Salanova, (2014:296) voiced that exhaustion resulted from exposure to chronic stressors at work such as work overload, emotional demands and interpersonal conflicts. In an attempt to prevent further energy depletion, employees distanced themselves mentally from their work by developing depersonalizing or cynical attitudes that resulted in diminished work performance, and as a result the employee felt incompetent and inefficacious (Bakker *et al.*, 2003:14; Schaufeli & Salanova, 2014:296).

A study by Prescott *et al.* (2003:990) found that burnout was a risk factor for CHD and all-cause mortality. Schuitemaker *et al.* (2004:116) and Schwartz *et al.* (2004:420) reported that burnout was associated with increased risk of CHD. Females with CHD showed lesser burnout coping abilities as a result of emotion-focused coping abilities (self-control) and strain reduction (time to relax) (Hallman *et al.*, 2003:438-439). Burnout was found to be associated with a 3.1 and 3.4 times increase in relative risk of CHD in males and females respectively (Hallman *et al.*, 2001:43). Melamed *et al.* (1992:56) reported a positive association between burnout and fasting glucose levels and that burnout was significantly associated with increased total cholesterol, low-density lipoprotein cholesterol, triglycerides and uric acid, all risk factors for the development of metabolic syndrome and CHD. According to Grundy *et al.* (2004:433) and Miranda *et al.* (2005:33) markers of inflammation (pro-inflammatory state) and impaired fibrinolysis (prothrombotic state) also co-occurred with the metabolic syndrome and increased CHD risk.

Studies over the last 40 years have demonstrated that hyperactivity of the hypothalamic-pituitary-adrenal axis (HPA axis) was one of the most consistent biological findings in major depression psychiatry (Pariante & Lightman, 2008:464). Bradley and Dinan (2010:92) reported that during stressful situations (traumatic or psychological), the activation of the HPA axis and the sympathetic nervous system altered the function of immune organs and induced a chronic and systemic state of mild inflammation that increased CHD risk. Heim *et al.* (2008:399) and Pariante and Lightman (2008:464) found persistent HPA axis hyperactivity in subjects with burnout. Melamed *et al.* (2006:336) reported an association between burnout and elevated concentration of pro-inflammatory cytokines that can explain the chronic emotional and/or physical fatigue e.g. a feeling of lack of wellbeing, somnolence, general malaise, listlessness, sickness, tiredness, and inability to concentrate, represented by symptoms of burnout. Melamed *et al.* (2006:339) also reports an association between burnout and cardiovascular risk, and concluded that burnout can pose a risk to physical health through chronic over-activity or dysregulated activity of the stress system and increased the risk of CHD, stroke and sudden cardiac death.

Apart from findings that classical risk factors (hypertension, poor lipids profile, smoking, lack of PA, and overweight) contributed to CHD, Melamed *et al.* (2006:335) reported burnout-induced inflammatory reactions that contributed to CHD risk that can explain why approximately 40% of atherosclerotic patients had no other risk factors present apart from burnout. Insomnia and waking up exhausted (symptoms of burnout) in particular, were found to be risk indicators of future MI and indicated a link between burnout and CHD risk (Appels & Schouten, 1991:395; Carney *et al.*, 1990:603; Schwartz *et al.*, 1999:313).

Increased job strain and low social support in the workplace were found to be associated with increased concentrations of HbA1c which is associated with increased CHD risk (Palumbo *et al.*, 2003:362). Quantitative job demands (too much work to do, time pressure, long work hours and frequent contact with customers or clients) as well as qualitative job demands (conflicting work roles, inadequate information to fulfil the work role, emotionally charged situations, imbalance between work and home) led to burnout since such job demands, activated an energy depletion process whereby an employee's sustained increases in effort to meet these demands, drained their energy backup (Schaufeli & Salanova, 2014:305).

Burton *et al.* (2005:773,774) and Loeppke *et al.* (2009:427) reported that an increase in the number of health risks have a negative impact on health status and productivity. Although health was the most important factor for explaining productivity loss, other factors such as company characteristics (justice at work), stress, job characteristics and employee characteristics were all significantly related to productivity loss and impacted directly and indirectly through health on productivity loss (Allen, 2008:626,627; Bergström *et al.*, 2009:1188). According to Schaufeli and Salanova (2014:306) burnout has the following negative consequences for both the employee and the organization:

- Employee consequences:
 - Mental health (anxiety, depression, poor sleep and psychosomatic symptoms such as headaches, nausea and hypertension);
 - Physical health (CHD and common infections such flu, cold and gastroenteritis).
- Organizational consequences:
 - Employees' mental withdrawal (poor commitment and loyalty);
 - Employees' physical withdrawal (turnover and frequent sick absence).

Bakker *et al.* (2008:188), Gonzalez-Roma *et al.* (2006:166), Heriyati and Ramadhan (2012:192), Schaufeli *et al.* (2002:74) and Schaufeli and Salanova (2014:299) reported that work engagement (a positive, fulfilling, work-related state of mind) characterized by vigour (passion, energy and mental resilience), dedication (enthusiasm, inspiration, pride,) and absorption (being fully concentrated, committed, happily engrossed in work and difficulty in detaching from work) can be negatively affected by burnout, which is characterized by severe energy draining (Schaufeli & Bakker, 2004:294). According to research on the impact of future absence and a change in sickness-absence (Karlsson *et al.*, 2010:314) engagement was one of the factors that had the strongest impact on sickness-absence and can explain how burnout increased sick absenteeism. Khamisa *et al.* (2015:660), in their research on the South Africa health industry, reported a burnout prevalence of 16%. The number of males admitted to private psychiatric clinics for depression in 2013 was nearly 30% higher than in 2010 and absenteeism due to stress, particularly among executives, increased significantly (absenteeism with 600% from 98 to 578) between 2008 and 2013. ICAS (South African

employee wellness company) reported that the number of males absent from work due to stress and burnout increased significantly from 2008 to 2013 (almost 600% for the non-executives, and from 9% to 25.6% for executives) (Keeton, 2014). Swanepoel *et al.* (2015:1469) reported that 58.3% of employees in a South African corporate setting reported moderate to high stress levels.

Clymer (2005:15) reported that the employer contributes to the health care cost of the employee as well as indirect costs related to lost production, absenteeism, resignations as well as premature death. Studies that investigated the costs associated with sick absenteeism and presenteeism also showed that presenteeism accounted for a larger component of the health-related costs than sickness absence (Karlsson *et al.*, 2010:310; Loeppke *et al.*, 2009:425) and indicated the effect of burnout on health costs.

In conclusion, Karlsson *et al.* (2010:310) reported that psycho-social factors were important cofounders for productivity outcomes such as absenteeism, commitment and turnover. Lowe *et al.* (2003:391) advised that health interventions at the workplace should not only be directed at the individual, but also targeted to organizational factors (e.g. social environment, restructuring, reward etc.) as unhealthy organizations produced similar negative effects. Karlsson *et al.* (2010:310) also suggested that an increase in work demands increases the level of presenteeism, a result similar to that of a cross-sectional study in Canada reported by Karlsson *et al.* (2010:310). According to Karlsson *et al.* (2010:316) companies should consider increasing employees' level of organizational commitment, role compatibility and the social climate at work as well as decreasing the level of work demands and increase the employees' control over their work situation in order to reduce production loss. Some of these goals might be targeted through a direct change in the employees' work situation and others through work environment intervention (Karlsson *et al.*, 2010:316).

Melamed *et al.* (2006:338) indicated that poor health behaviours such as lack of PA, smoking and alcohol abuse can be a pathway of the link between psycho-social illness and physical health. Both burnout and vital exhaustion were related to disorders such as Type 2 diabetes as well as poor self-rated health (a valid measure for health status) and the impact of burnout on health may be more extensive than was originally thought (Melamed *et al.*, 2006:339). The evidence reviewed above, revealed that burnout has deleterious consequences for physical health and constituted an increased risk for CHD and cardiovascular-related events.

Physical activity leads to the secretion of endorphin and dopamine and reduces the levels of the body's stress hormones (Anxiety and Depression Association of America, 2016; Corbin *et al.*, 2000:364; Fernandez, 2010; Harvard Health Publications, 2016). Bretland and Thorsteinsson (2015:14) reported that PA had a noticeably positive effect on burnout and was an effective intervention for reducing burnout. They reported that the proportion of the sample experiencing burnout reduced by more than half (from 37.6% to 14.9%) over a 4-week intervention exercise program. Gerber *et al.* (2013:1,3,4) reported that a 12-week exercise programme of moderately intense cardiovascular exercise (ACSM, 2014:145) significantly reduced burnout symptoms. They further anticipated that aerobic exercise contributed to improved sleep and recovery, which could have resulted in decreased emotional exhaustion and that re-occurring experiences of positive mood during exercise, could have helped to disrupt negative thinking cycles, reducing symptoms of burnout (Gerber *et al.*, 2013:6). Bretland and Thorsteinsson (2015:14) anticipated that cardiovascular exercise demonstrated a greater effect on burnout than resistance exercise but that resistance exercise displayed a greater effect on personal accomplishment than cardiovascular exercise. Physical activity interventions therefore can constitute a simple and inexpensive alternative compared to pharmacotherapy or psychotherapy in the treatment of burnout as it influenced psychological and physiological wellbeing that linked burnout to CHD (Gerber *et al.*, 2013:6). This is supported by results presented by Sallis (2013) indicating that exercise is not only more effective but also more popular.

2.4.3 Depression

Depression and burnout includes common symptoms of feeling fatigued with low levels of physical energy and suggests the possibility of a degree of overlap between burnout and depression, leading to the suggestion that these two constructs are essentially interchangeable (Hemingway & Marmot, 1999:1460; Melamed *et al.*, 2006:330). According to Melamed *et al.* (2006:331) the observation that burnout and depression were related was supported by subsequent research (Bakker *et al.*, 2000:437-348; Brenninkmeijer, *et al.*, 2001:873-878). Brown *et al.* (2004:4) as well as Suls and Bunde, (2005:285) reported that depression was associated with elevated cortisol levels and hypertension that increased CHD risk. Brown *et al.* (2004:5) also states that hypercortisolaemia depressed patients had more abdominal fat than patients with normal cortisol levels, indicating that depression can increase CHD risk.

Welthagen and Els (2012:1) reported that depression affected approximately 340 million people worldwide and has a high prevalence in most societies. According to Danielsson *et al.* (2012:123) anxiety, sleeping problems and constant fatigue were common symptoms of depression, and 4% to 10% of the adult population suffered from depression. Depression was more common among females than males and it was estimated that 25% of all females and 15% of all males required treatment for depression at some point in their lives (Danielsson *et al.*, 2012:124). Lifetime prevalence rates ranged from approximately 3% (Japan) to 16.9% (United States), with most countries having a prevalence rate between 8% and 12% (Marcus *et al.*, 2012:9).

In the study of Welthagen and Els (2012:1) on depression in South African organizations, 18.3% of the population received treatment for depression, 16.7% was uncertain whether or not they suffer from depression and 65% did not suffer from depression (Welthagen & Els, 2012:9).

Depression and fatigue in the workplace were found to be among the strongest predictors of presenteeism (Loeppke *et al.*, 2009:419). The Centers for Disease Control (2011) reported that 27% of individuals with depression had difficulties in work- and home life and in a 3-month period, individuals with depression missed on average 4.8 workdays and suffered 11.5 days of reduced productivity. Depression in the workplace can manifest in performance and behaviours such as inconsistent productivity, absenteeism, tardiness, frequent absence from work stations, increased errors, diminished work quality, procrastination, missed deadlines, withdrawal from co-workers, overly sensitive and/or emotional reactions, decreased interest in work, slow thoughts, difficulty learning and remembering and frequent comments about being tired (Cox *et al.*, 2008).

Ratey and Hagerman (2010) voiced that “*exercise makes the brain function at its best and that building the muscles and cardiovascular system, are essentially side effects*”. They found it disturbing that virtually nobody recognized that inactivity was killing the brain by physically shrivelling it. These authors further reported that to keep the brain at peak performance the body needs to be exposed to PA. Mutrie (2000:62) reported that the anti-depressant effect of exercise had the same magnitude as found for psychotherapeutic interventions such as cognitive-behavioural therapy.

This finding was supported by Donaghy (2007:76,79) and Searles *et al.* (2011:142,154) who showed that exercise not only protected against depression but was also an effective intervention for the treatment of mild to moderate depression. Ratey and Hagerman (2010) reported that PA increased the levels of serotonin, norepinephrine and dopamine, crucial neurotransmitters that traffic in thoughts and emotions. They also indicated that PA unleashes a cascade of neurochemicals and growth factors that physically enhances the brain's infrastructure (Ratey & Hagerman, 2010).

A direct relation between PA and psycho-social wellbeing has been confirmed in several large-scale epidemiological studies with meta-analytic evidence showing that aerobic exercise led to a decrease in tension, depression and fatigue (Bingham, 2009:4). Mura *et al.* (2014) anticipated that low-dose exercise may be more tolerable and acceptable for depressed patients. It is noteworthy that whilst it has been hypothesized that depression can be linked to reduced hippocampal neurogenesis, research showed that exercise promoted hippocampal neurogenesis and triggered dendritic remodelling, and that the effect induced by exercise can be stronger than that of antidepressant drugs (Mura *et al.*, 2014). Ratey and Hagerman (2010) similarly reported that PA has a documented positive effect on neurochemicals and growth factors which are important for coping with stress, burnout and depression and anticipated that PA (as a treatment modality) showed better results compared to sertraline (Zoloft) medication in treating depression and that exercise has a profound impact on cognitive abilities and mental health.

Research presented by Sallis (2013) support this notion. Mura *et al.* (2014) recommended low-intensity exercise for 2 to 14 weeks for mild to moderate depression and indicated that the guideline for promoting mental health was a minimum of 150 minutes of exercise per week (accumulative) at moderate intensity, or not less than 75 minutes at vigorous intensity (bouts of at least 25 minutes over 3 to 5 days per week). According to Ratey and Hagerman (2010) muscular movement produced proteins transported through the blood to the brain where it played pivotal roles in mechanisms (insulin-like growth factor and vascular endothelial growth factor) of thought processes. Barr-Anderson *et al.* (2011:90) indicated a decrease in employees' stress, burnout and depression levels when they were exposed to PA.

From the discussion about the psycho-social risk factors on personal health and wellbeing it is clear that the psychological constructs (stress, burnout, depression) are intertwined in itself,

but also with other the risk factors and psycho-biochemical reactions. This is rooted in the body's reaction to stress, referred to as the general adaptation syndrome (GAS) which occurs in the general stages; alarm, resistance and recovery / exhaustion (Hoeger *et al.*, 2002:52).

It is further reported that through these stages of the GAS, more than 1400 physiochemical reactions arise that affects the human body as a whole. This intertwining of psycho-social risks is one of the key reasons why the assessment of the psycho-social health of employees in this study in Chapter 3 (Article 1) and Chapter 5 (Article 3) was conducted by using psycho-social ill health and psycho-physical ill health status with burnout as a symptom. Another reason for the use of the above mentioned constructs is that individuals may possess various levels of tolerance to psycho-social stressors (e.g. hardiness personality) (Hoeger *et al.*, 2002:38). This implies that stressors that may be perceived as a distress (bad stress) for some individuals, may be perceived by the hardiness personality as eustress (good stress). By using the above mentioned constructs it assessed the employees at the point where they reported to be psychological and/or physiological (psychosomatic) affected.

2.5 STRATIFICATION OF CORONARY HEART DISEASE RISK FACTORS AMONGST EMPLOYEES

Musich *et al.* (2003:293-394) studied the short-term (1 year) and long-term (5 years) transition between low-risk (0 - 2 CHD risk factors), moderate-risk (3 - 4 risks CHD risk factors), and high-risk (≥ 5 CHD risk factors) factors to examine the effectiveness of a comprehensive health promotion program. In their study an annual health-risk appraisal (HRA) was mailed to each employee to complete as intervention tool. HRAs were offered on-site with biometric screening for blood pressure and blood cholesterol levels. Overall health-risk status was determined by assessing the following health risks (Musich *et al.*, 2003:394,395):

- Lack of exercise;
- Smoking;
- Overweight;
- Excessive alcohol use;
- Lack of safety belt use;

- High blood pressure;
- High cholesterol;
- Low HDL cholesterol;
- High stress levels;
- Life dissatisfaction;
- Poor perception of health;
- Presence of medical problems, or absence because of illness.

Musich *et al.* (2003:397) reported employee health-risk status not to be static and likely to migrate between 2% to 4% annually from low- to moderate- or high-risk status in the absence of successful intervention programs. Musich *et al.* (2003:396,397) reported that the population's health-risk status at baseline was 58.9% low-risk, 28.6% medium-risk, and 12.4% high-risk. The population demonstrated a positive impact of the risk reduction program (assessment, counselling and awareness of health risks) already in the initial year and by year two, health status improved to 63.9% low-risk, 27.3% medium-risk, and 8.7% high-risk. In year five the population health-risk status improved to 69.3% low-risk, 22.6% medium-risk, and 8.2% high-risk. Musich *et al.* (2003:398) concluded a net gain in low-risk individuals of 10.4% during the study period of five years. Musich *et al.* (2003:397) reported blood pressure, stress, safety belt use, PA, life satisfaction, smoking and alcohol use, to have shown significant improvements over the short-term and continued improvements of these risks were demonstrated over the long term when exposed to health intervention. Musich *et al.* (2003:393) considered it important for the employer to know that the health-risk status of employees was not static and that the low-risk employee of today can become the high-risk employee of tomorrow. Therefore, it is important for employers to assess the health-risk status of employees in order to know:

- The health-risk profile of the company;
- The most common health risks among the employees;
- The cost implication of the health-risk profile to the company.

These authors also considered it important for an employer to monitor the migration between low-, moderate- and high-risk categories in terms of employee health-risk status (Musich *et al.*, 2003:393).

Clymer (2005:1) stated that whatever the nature of business, the employee is the most valuable asset and determined the quality of production and client service highlighting the importance of investing in employee health and wellbeing.

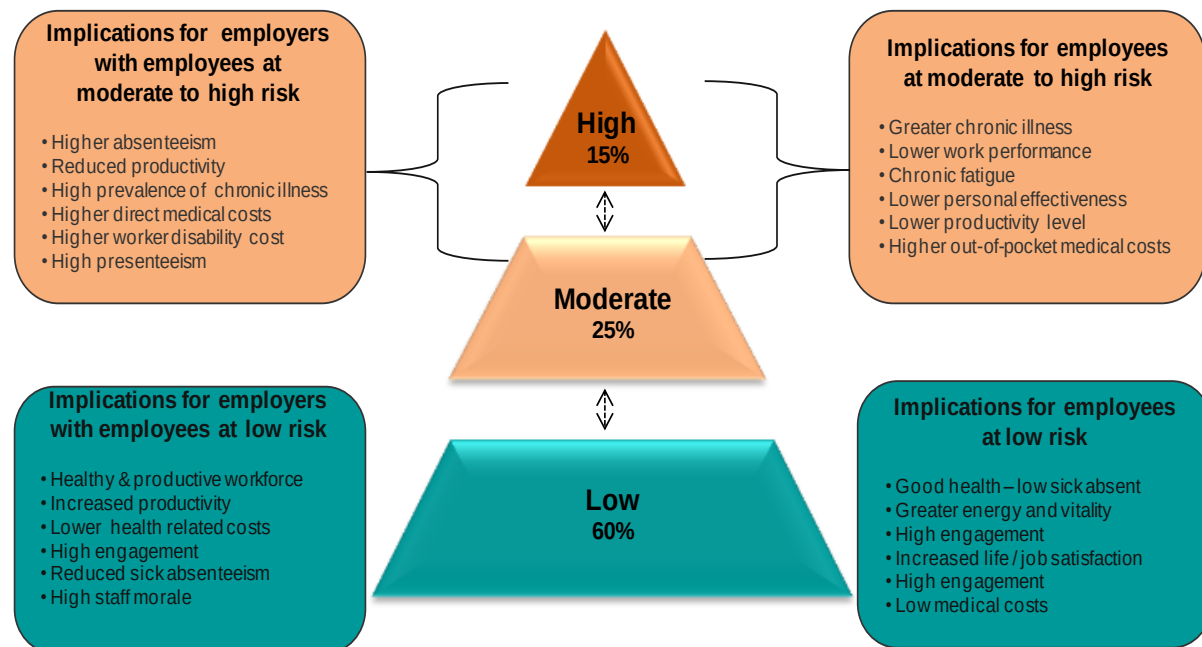


Figure 2.5 Distribution and migration of employee health-risk status (Musich *et al.*, 2003:393).

Figure 2.5 illustrates the risk stratification of employees and the implications for employers and employees. According to this model, having low-risk employees in the industry was associated with good health, increased productivity and reduced health care costs whilst having moderate-high and high-risk employees was associated with ill health, reduced productivity and increased health care costs. The model also indicates that 2% to 4% of employees may migrate towards a high-risk status if health promotion and intervention is neglected (Musich *et al.*, 2003:393).

Swanepoel *et al.* (2015:1474) indicated that the risk clustering of BMI, SBP, DBP, TC and CBG was more prominent in older males (≥ 45) than in younger males (< 45) and that of SBP, DBP, TC and CBG, more prominent in older females (≥ 45) than in younger females (< 45).

Younger employees had a greater prevalence of low risk clustering than the older group (60% vs. 41.5%) whilst older employees had a greater prevalence of moderate (48.1% vs. 36%) and high risk (10.5% vs. 4.0%) clustering. The overall risk prevalence clustering for males and females indicated that the majority of employees could be classified as low (50.7%) risk, followed by moderate (42.1%) and high (7.2%) risk clustering (Swanepoel *et al.*, 2015:1474).

Consequently, Kolbe-Alexander *et al.* (2013:6) suggested a clustering of risk factors with insufficient PA and reported that employees who were physically inactive had a higher number of modifiable risk factors for NCDs than those who were physically active. They also reported that these findings were corroborated by research on Swedish males and females where those with higher levels of PA had significantly lower triglycerides and lower lipid profiles and were 50% less likely to have an additional three or more risk factors for NCDs.

Fielding (1987:19) already reported that most chronic illnesses developed slowly over time with difficulty in rectifying it once the illness has been established. He reported a 5% possibility of surviving lung cancer (lifestyle related) and that 25% of heart attacks occur suddenly without any prior symptoms where after the individual often has to downscale both work and social responsibilities. DeVon *et al.* (2010:1) reported that almost half of patients suffering from CHD experienced sudden death before arriving at the emergency unit and highlighted the need for early recognition and effective intervention. Fielding (1987:19) stated: *“While heart disease may appear with devastating suddenness, it shares a long progressive phase that is without symptoms. It is a chronic disease although it appears as if from the blue”*. This research by Fielding was supported by research from Dracup *et al.* (2008), Crackel (2004:20) and Bove and Sherman (1998:45-53), reporting that more than 50% of employees perceived themselves to be low-risk, that CHD was a silent disease and that the very first symptom can be a MI or sudden death. Research executed by Loeppke *et al.* (2009:426) anticipated that employees should account for the impact of comorbidities as employees with one comorbid condition comprised nearly 40% of comorbid cases. Comorbidities also had a cost implication for the employer as the employer contributed to the health care cost of the employee and indirect costs related to lost production, absenteeism, resignations as and premature death (Clymer, 2005:15).

2.6 PHYSICAL ACTIVITY (PA) AS INTERVENTION MODALITY FOR EMPLOYEE HEALTH AND WELLBEING

Heath (2013:18) defined PA as “*any bodily movement produced by skeletal muscles that resulted in caloric expenditure*” and stated: “*Because caloric expenditure uses energy and energy utilization enhances weight-loss, caloric expenditure is important in the prevention and management of obesity, diabetes mellitus and CHD*”, and highlighted the need to engage in regular moderate physical activity for at least 30 minutes per day, preferably daily”.

Industrialization, urbanization and mechanization have reduced PA to such an extent that more than 60% of the global population were not sufficiently active (Mendis *et al.*, 2011:28). Gordon and Gibbons, (1991:129 &131) and McGinnes, (1992:196-200) stated the following regarding PA:

- “*There are more people at risk because of physical inactivity than any other single risk factor for chronic disease; thus physical activity may provide the shortcut we in public health have been seeking for the control of chronic disease, much like immunization has facilitated progress against infectious diseases*”;
- “*All parts of the body which have a function, if used in moderation and exercised in labours in which each is accustomed, become thereby healthy, well-developed and age more slowly; but if unused, and left idle, they become liable to disease, defection in growth, and age quickly*”.

According to Hallal *et al.* (2012:4) starting with the Industrial Revolution, the development of new technologies enabled humans to reduce the amount of physical labour needed to accomplish various tasks throughout their daily life. They further reported that as the availability of new technology (steam, gas and electric engines, trucks, trans-automobiles, elevators, television, computers, electronic entertainment, internet and wireless communication devices) increased, human energy expenditure decreased, resulting in the need to increase PA levels.

According to Booth *et al.* (2008:382,384) many of these technologies were driven by the employer’s goal to achieve greater productivity and to reduce physical hardships caused by

jobs requiring human labour. Ratey and Hagerman (2010) reported that we have engineered movement out of our lives. As a result the human body developed over the millennia in such a manner that its systems did not develop and function optimally unless it was exposed to additional physical exercise. The WHO (2009) reported that while this technological revolution was of great benefit to populations globally, it came as a major cost in terms of the contribution of physical inactivity to the global epidemic of NCDs.

Physical activity influences various body systems (cardiovascular system, musculoskeletal system, body composition etc.) positively and is also known to positively affect other lifestyle habits such as diet, alcohol consumption, sleep and smoking patterns (Powell *et al.*, 2011:351). The value of PA as an intervention modality is underlined in that it holds beneficial value for about 23 diseases or health conditions (Pratt *et al.*, 2014:171). Curry *et al.* (2012:3) reported that the introduction of workplace PA initiatives have personal benefits as well as benefits for the company.

2.6.1 Personal benefits

2.6.1.1 Physical activity and employee health status

The benefits of PA in the workplace extended beyond the organizational level to the employees themselves and included benefits such as improved- cognition/memory, self-confidence, job satisfaction, commitment, ability to cope with stress, psycho-social wellbeing and increased likelihood of meeting daily PA recommendations (Crespo *et al.*, 2011:264; Erickson *et al.*, 2011:3017,3020; Prakash *et al.*, 2011:1,7; Erickson & Kramer, 2009:2; Hertzog *et al.*, 2009:32). Kolbe-Alexander *et al.* (2008:9) reported that reductions in CHD risk factors (hypertension, dyslipidaemia, diabetes, obesity, stress, smoking) can be achieved by increasing PA and can decrease the risk of morbidity and mortality, and decrease the total number of risk factors. These results suggested that increasing habitual PA positively impacted on CHD risk factors, and subsequently lowered the overall risk for the development of CHD.

The WHO (2004:39) advocated that a moderate amount of regular PA provided protection against the ravages of a sedentary lifestyle and recommended that all adults do at least 30 minutes or more of moderate intensity PA on most days of the week and that this could happen in a single session or accumulated in multiple bouts, each lasting at least 10 minutes a

time. Physical activity was linked to longevity, independent of genetic factors (Mendis *et al.*, 2011:28) and PA, even at an older age, significantly reduced the risk of CHD, diabetes, hypertension, obesity, stress, anxiety and depression and improved blood lipid levels (Mendis *et al.*, 2011:28). They reported that by engaging in 150 minutes of moderate intensity PA, or 60 minutes of vigorous PA per week, one can reduce the risk of CHD by approximately 20% to 30%.

Bradshaw *et al.* (2011) shows that South Africa has high levels of physical inactivity (Figure 2.6) and that on average about 48% of adult males and 63% of adult females were inactive.

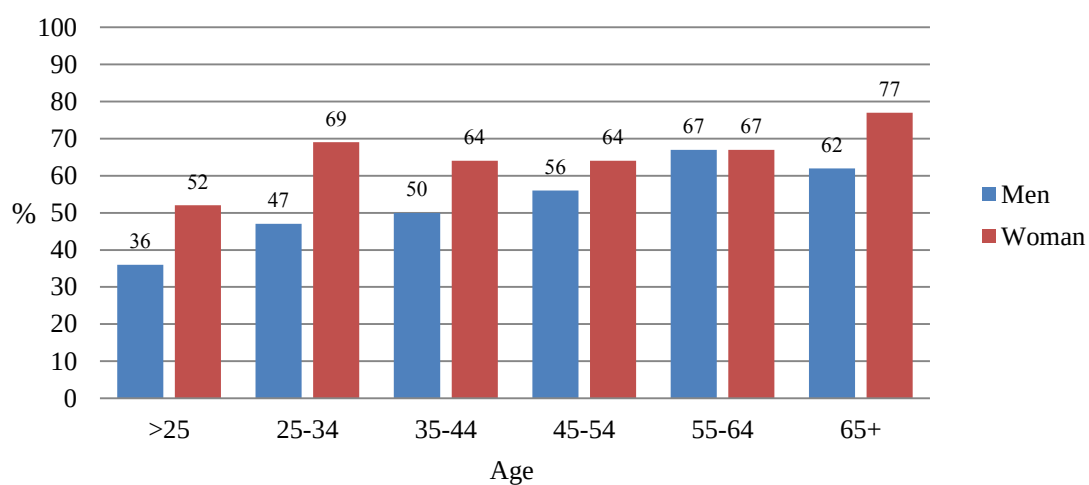


Figure 2.6 Physical inactivity levels of various age groups in SA, SADHS 2003 (Bradshaw *et al.*, 2011).

The American Heart Association (2011) reported that the proportion of youths in the US (≤ 18 years of age) who were inactive, was high and increased with age. Among adolescents (grades 9 to 12) 29.9% of girls and 17.0% of boys reported not to have engaged in 60 minutes of moderate-to-vigorous PA (defined as any activity that increased heart rate or breathing rate), even once a week despite recommendations to do so ≥ 5 days per week. Among adults, 36% reported not to engage in PA. Mendis *et al.* (2011:28) continued, saying that despite documented evidence of the benefit of PA in preventing and treating CHD, in the order of 3.2 million people died each year globally due to insufficient PA. According to Milligan *et al.* (2006:8) only 59% of all Western Australian adults reported sufficient levels of PA despite the known health benefits of exercise.

According to the WHO (2009:9) the five leading causes of mortality in the world were hypertension, tobacco use, high blood glucose, obesity and physical inactivity. They further reported that physical inactivity accounted for 6% preventable deaths (in the order of 3 million) worldwide and was identified as the fourth leading risk factor for NCDs (WHO, 2009:v). It was also estimated that physical inactivity caused 21% to 25% of breast and colon cancer respectively, 27% of diabetes and about 30% of CHD (WHO, 2009:18). Hallal *et al.* (2012:7) indicated that participation in PA for adults, recorded from 122 countries globally, were 31.1% and that physical inactivity was more frequent in people with a low income status than in those with higher income status. Ingram (2000) indicated that PA globally reduced as age increased and it is clear (Figure 2.7) that inactivity was most prominent in the age group ≥ 60 years of age while the most active group was those 15 to 29 years of age.

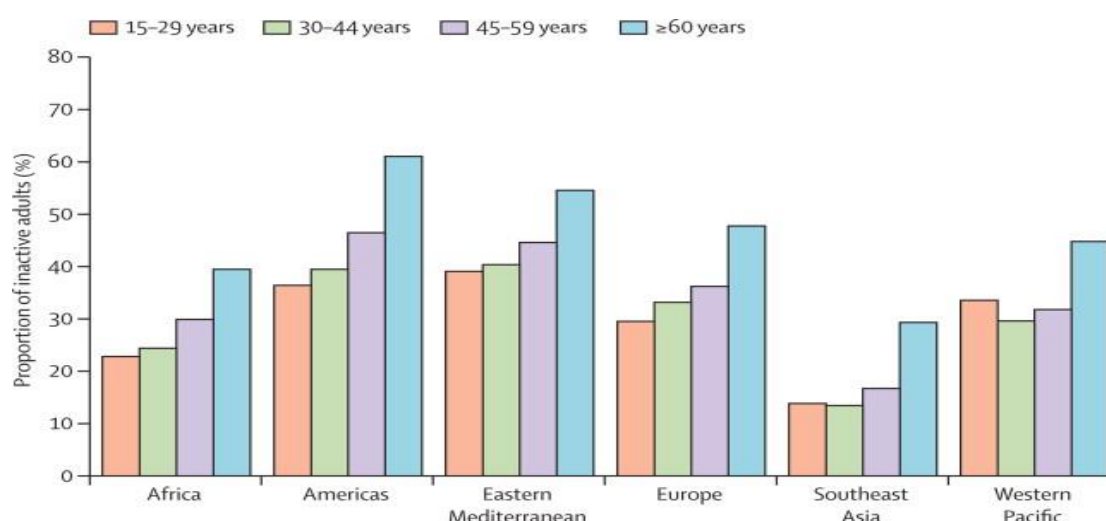


Figure 2.7 Physical activity and age (Ingram, 2000).

Anderson *et al.* (2011:1032), de Nazelle *et al.* (2011:769) and Manson *et al.* (1999:654) reported that active transportation (such as sidewalks, bike paths, parks and stores within walking distance) increased PA levels and was associated with improved health status and reduced CHD risk. They further showed that walking and cycling (energy expenditure of 8 and 9 MET-hr. per week respectively or 750 kcal) had beneficial effects on all-cause mortality and reduced CHD risk factor profiles (Anderson *et al.*, 2011:1027, de Nazelle *et al.*, 2011:772; Matthews *et al.*, 2007:1345-1346). Morris (1991:130) stated in his exercise hypothesis: “*People who exercise regularly are less prone to CHD than those who do not*”. Silverman and Deuster (2014:2,6,7) reported that regular PA stimulated the central nervous system, increased blood flow and oxygen to the brain and increased cerebral metabolic

activity that leads to the release of endorphins serotonin, acetylcholine, norepinephrine and growth hormone that created a feeling of wellbeing. He also reported that regular PA created a sense of being in control that reduce stress and anxiety levels, and improve the self-concept as well as the self-efficiency of the employee.

Hutchinson (2004:15-17) reported that regular exercisers “*feel better*”, have more energy and are more productive than non-exercisers. He also reported regular exercisers in the interest of being more resistant to mental fatigue, being capable of better decision making, experiencing low injury on duty and demonstrating stronger willingness to work hard. Medstat (<http://216.239.59.104/search/healthcare>) voiced the following: “*Exercisers could work at full efficiency for the entire day whilst non-exercisers lost 50% efficiency for the final two hours of their workday. Exercisers also showed greater stamina, performance, concentration and decision-making abilities than non-exercisers*”.

Lombard (1988:22) stated: “*Healthy workers produce more at less cost. Individual productivity increases have been as high as 31%, whilst regular exercise has been shown to reduce absenteeism 3 to 5 days per person per year*”. Physically active employees were less likely to stay away from work, and absenteeism reduced by 3% amongst inactive workers who had become active (Lechner *et al.*, 1997:827-831; Voit, 2001:279).

Pronk and Kottke (2009:316) as well as Sallis and Glanz (2009:124-125) reported that the increasingly sedentary nature of work and its impact on health and productivity indicators, is a key characteristic of the contemporary work environment and demanded the promotion of PA in the workplace. There is compelling epidemiologic and scientific evidence stating that regular PA contributed to wellbeing and it was found to be essential for good health and was associated with reduced risk for CHD and lowered all-cause mortality and morbidity (Haskell *et al.*, 2007:1081, 1083,1087; Mendis *et al.*, 2011:28), and Mendis *et al.* (2011:28) and Milligan *et al.* (2006:17) further recommended moderate-intensity aerobic PA for a minimum of 30 minutes per day on 5 days per week, or vigorous-intensity aerobic exercise for a minimum of 20 minutes per day on 3 days per week to promote and maintain health and reduce or prevent the risk of developing CHD. Gordon and Gibbons, (1991:131) and Shapiro *et al.* (1990:42-43) advocated that more lives can be saved by participation in regular PA than by treating any other health-risk factor for the development of CHD with medication.

2.6.2 Company benefits

2.6.2.1 Physical activity and productivity (absenteeism & presenteeism)

Ackland *et al.* (2005:12) reported that workplace health and PA initiatives had the potential to increase productivity and improving job performance. Pronk and Kottke (2009:317) communicated that emerging evidence indicated the positive effects of PA on work performance, absenteeism and sick leave. A meta-analysis by Hutchinson and Wilson (2011:238), which examined 29 studies on PA and productivity, concluded that the workplace was a suitable environment for making modest changes in employee PA, and that for employers, improved health outcomes associated with successful PA interventions could lead to increased productivity. A systematic review of 40 peer-reviewed articles relating to PA and work performance (Barr-Anderson *et al.*, 2011:76) indicated increased performance related to increased PA levels. This review also found that work ability and cognitive performance were improved by increasing PA level in the workplace. Brown *et al.* (2011:250) reported a positive association between health, productivity and PA because of increased work ability.

An Australian study (Medibank, 2005:6) considered the combined effects of self-rated work performance and absenteeism and found that the healthiest employees were almost three times more effective than the least healthy, with the healthiest employees working on average approximately 143 effective hours per month compared to 49 effective hours per month by the least healthy group (presenteeism). Similarly, Mills (2005) found healthy workers to be more productive at work than unhealthy workers and to have fewer short-term absences than unhealthy workers. Rapport (2016) reported the following reasons for sick leave of South African employees:

- 30% to 35% - Psycho-social conditions;
- 30% to 35% - Musculoskeletal conditions and back pain;
- 20% to 25% - Acute medical conditions;
- 10% to 15% - Because they are entitled to.

According to Brown *et al.* (2011:250) specific psycho-social conditions such as anxiety, chronic fatigue, depression, nervousness, panic attacks and low energy levels have been

associated with presenteeism. Brown *et al.* (2011:50) reported that financial losses due to workplace presenteeism were between 1.9 and 5.1 times more than costs associated with absenteeism. Regular PA has been found to improve mental health, protect against anxiety, stress and depression, reduce symptoms of fatigue and somatisation, promote coping, enhance mood, increase quality of life and reduced presenteeism (Martinsen 2008:28; Penedo & Dahn, 2005:189-199; Strohle, 2009:777-778).

Physical activity unleashes neurochemicals (serotonin, norepinephrine and dopamine) that physically enhances the psycho-social infrastructure and stimulates the brain for optimal performance (Ratey & Hagerman, 2010).

Finally, a comprehensive mixed-method study by Ackland *et al.* (2005:63) suggested that implementing workplace health and PA initiatives added benefits to the organization such as increased productivity, reduced absenteeism as well as reduced presenteeism.

2.6.2.2 Physical activity, staff turnover and disability

A systematic review by van Dongen *et al.* (2011:16) reported that workplace health promotion initiatives that promoted PA provided additional financial benefits to organizations through a reduction in staff turnover. The Australian Human Resources Institute (AHRI) (Emery, 2010:3) estimated that the cost of staff turnover in Australia was in the order of \$20 billion and was on the rise. AHRI estimated the cost of replacing an employee to be between 75% and 150% of the employees' annual salary. Research by Right Management (2009) identified an association between health and wellbeing as well as employee turnover and showed that organizations that did not manage health and wellbeing were four times more likely to lose talent in the following twelve months. Ackland *et al.* (2005:63) reported that increased employee PA reduced workers compensation costs and short-term disability rates.

2.6.2.3 Physical activity and engagement

An engaged employee is a person who is fully involved and enthusiastic about the work they do (Seijts & Crim, 2006:1) and invest the discretionary effort to exceed duty's call in order to see to it that the organization succeeds. Engagement affected the mind-set as these employees believe they could make a positive difference in their organizations. Seijts and Crim (2006:2) reported that "*engagement does not merely correlate with bottom line results, but it drives results*". Comcare (2011:1) reported that health and wellbeing programs assists to attract

quality employees who valued personal health and wellbeing and assisted in retaining existing staff members. Comcare (2011:2) and Crowther *et al.* (2004:16) reported that on-site health activities, such as PA improved workplace culture and workplace health by developing a closer congruence between employer and employee values that increased the satisfaction level of employees. Health and wellbeing programs were associated with increased employee engagement, creativity and innovation, and research found that when employee health and wellness was managed, the percentage of engaged employees can increase from 7% to 55% as it created a sense of employer care towards employee wellbeing (Comcare, 2011:2).

2.6.2.4 Physical activity and health care costs

Charlson *et al.* (2015:317) reported a mean annual expenditure of \$1437 (29.9%) for the insufficiently active, compared to \$713 (15.4%) for sufficient active adults. They concluded that levels of PA inadequate of meeting current guidelines (150 minutes of moderate-intensity aerobic activity or at least 75 minutes of vigorous-intensity aerobic activity, or an equivalent combination most days of the week), were associated with a significant financial burden on the health care system. Various studies (Anderson *et al.*, 2011:1025-1026; Anderson *et al.*, 2009a:351; Matthews *et al.*, 2007:1346) showed that PA had beneficial effects on presenteeism, absenteeism, all-cause mortality, CHD risk factors such as obesity, cigarette smoking, hypertension, diabetes and hypercholesterolemia, resulting in cost savings. The WHO (2002:8) further reported: *“More than three quarters of CHD, the world’s leading cause of death, resulted from tobacco use, high blood pressure and high cholesterol, or their interaction in combination. Overall, high cholesterol caused more than 4 million premature deaths a year, tobacco 5 million and blood pressure 7 million. Small shifts in some risks can translate into major public health benefits and health savings”*. The WHO (2002:91) further reported that reducing SBP on average by 5 – 10 mmHg, or reducing cholesterol by 0.3 - 0.6 mmol l⁻¹ can lead to a 42% saving in health care costs related to CHD.

Research at the University of Michigan reported that medical cost increased as bodyweight increased and that medical costs of obese individuals were \$1500 higher per annum compared to non-obese individuals (Kaplan-Leiserson, 2004:12). According to the SDP International Working Group (2008), estimated cost towards CHD, stroke and diabetes in 2005 in China, the Russian Federation, India and Brazil were \$18 billion, \$11 billion, \$9 billion and \$3 billion respectively. Cawley and Meyerhoefer, (2011:226) reported that the US have spent about \$190 billion on obesity-related health care in 2005.

2.6.2.5 Physical activity and return on investment (ROI)

Hallal *et al.* (2012:23) indicated that societal trends were leading towards a less physically active lifestyle and that health professionals have been unable to mobilise governments and populations to participate in sufficient PA and regard this as a serious public health issue. Brown *et al.* (2011:250) suggested that employees should be encourage to be physically active through participating in workplace initiatives which can also be cost effective. Research by Ackland *et al.* (2005:63) found that implementing workplace health and PA initiatives had an economic benefit to the organization as it improved the cost to benefit ratio. Various studies reported a return on investment per dollar spent on workplace health promotion initiatives aimed at increasing PA e.g.:

- \$1.59 USD return for every \$1 invested (Anderson *et al.*, 2009a:354);
- \$1.4 to \$4.6 USD for every \$1 invested (Van Dongen *et al.*, 2011:2);
- \$5.81 for every \$1 invested (Gardner, 2007:ii).

When the cost of absenteeism, sick leave, disability, injuries and health care claims were considered, it was clear that PA, and its impact on employee health was an important driver of reducing costs in the workplace (Anderson *et al.*, 2009a:341). Medical costs were found to decrease by \$3.3, and absenteeism costs by \$2.7 per dollar spent (Van Dongen *et al.*, 2011:2) due to the implementation of PA as intervention modality. According to Bailey *et al.* (2013:289) the full scope of the value of PA is rarely appreciated and they proposed that the outcomes of PA can be framed as differential “*capitals*” that represented investments in human domain-specific assets (emotional-, financial-, individual-, intellectual-, physical and social domains). Bailey *et al.* (2013:291) explained in his ‘Human Capital Model’ (HCM) that PA was an investment capable of delivering valuable returns to corporate human capital. Underlying in this model (Figure 2.8) is a claim that the stock of competencies, knowledge, and personal attributes were embodied in the ability to participate in PA, and that these activities produced values that are realized through increased wellbeing (Bailey *et al.*, 2013:291; Charmandari *et al.*, 2005:264).

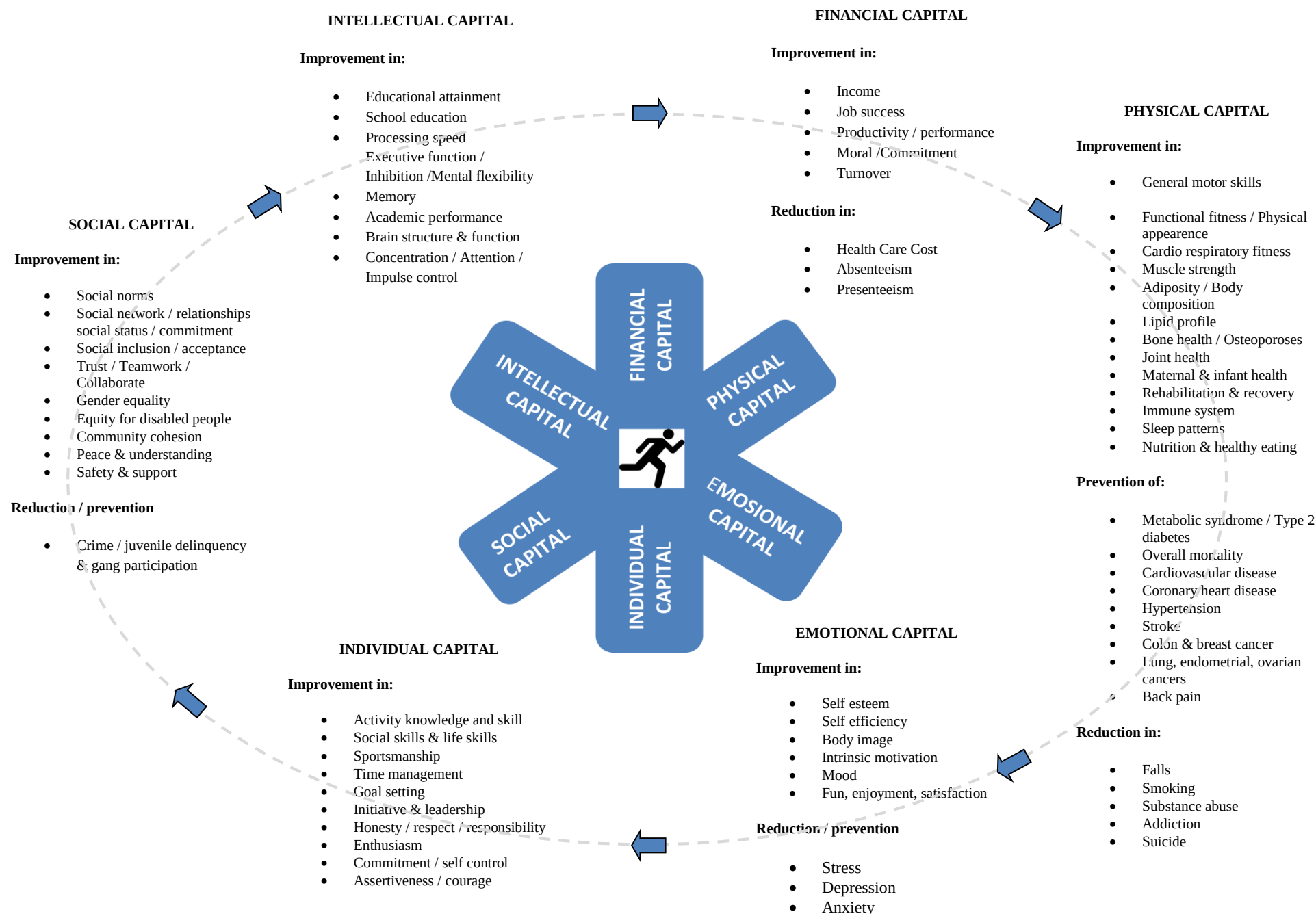


Figure 2.8 Human Capital Model and physical outcomes (Bailey *et al.*, 2013).

2.7 CHALLENGES IN THE CURRENT CORPORATE ENVIRONMENT

The corporate environment at present is facing various challenges as it affects the physical- and psycho-social health status of employees. Chronic health conditions in general are on the rise, taxing employers as they provide medical benefits for employees and absorb costs of sick- absence and presence as well as long and short term disability claims (Loeppke *et al.*, 2009:411). The confusion amongst employers and employees about what employee wellness entails can contribute to this challenge as it can negatively affect the outcome of wellness solutions. Sieberhagen *et al.* (2011:3) reported 27 different definitions for wellness amongst 16 organizations, 4 service providers and 7 labour unions and that wellness was not seen as priority as it was not core business of the corporate industry. According to Sieberhagen *et al.* (2011:3) organizations were uninformed of what employee wellness entailed and did not conduct needs analysis to understand employee health-risk status and the following could inter alia be some of the reasons:

- Employees did not consider themselves at risk even though they had several risk factors for the development of CHD (Ferreira, 2011);
- Employees were unaware of their risk to develop CHD and employees in the high risk category reported their risk as less than-, or the same as low-risk employees (Bradshaw *et al.*, 2007:700-706; Dracup *et al.*, 2008);
- Employees were in denial of the impact that destructive lifestyle habits were having on their health status (Kolbe-Alexander *et al.*, 2008:9);
- Employee participation in worksite health interventions was generally low, and employees who completed worksite interventions were generally healthier than those who dropped out (Kwak *et al.*, 2006:67).

Knowledge of CHD symptoms was limited amongst employees whilst the vast majority were not concerned about CHD (Biswas *et al.*, 2002:204-206; Centers for Disease Control and Prevention, 2008:175-179). Kolbe-Alexander *et al.* (2008:9) referred to this phenomenon as a “*knowledge-behaviour gap*”. Bradshaw *et al.* (2007:700-706) explained that the underlying pathology for CHD was atherosclerosis, which developed silently over time and was usually advanced by the time it became symptomatic (post clinical horizon).

This silent nature of the development of CHD risk factors can explain why employees were unaware of this risk. Bradshaw *et al.* (2007:700-706) also indicated that the progression of atherosclerosis was accelerated by the presence of modifiable risk factors such as tobacco use, obesity, hypertension, diabetes and dyslipidaemia. Kolbe-Alexander *et al.* (2008:1) and Loeppke *et al.* (2009:411) found that an increased number of CHD risk factors was associated with increased absenteeism, increased health-related expenditure and reduced PA levels. According to Mattke *et al.* (2013:13) these chronic diseases affected the working class and added to the economic burden because of illness-related loss of productivity resulting from sick absenteeism and presenteeism.

Earlier studies in South Africa (du Toit, 1996:60; Uys & Coetzee, 1989:85) already reported the working environment of South African management to be mainly sedentary. Modern technology made it easier for employees to be inactive (Hutchinson, 2004:17) and is a health concern to the employee and employer. Various studies reported health concerns that posed a challenge to both the employer and employee, were inter alia the following:

- 42.1% of employees had a clustering of 3 to 4 of the risk factors for the development of CHD. The majority of employees were at moderate and high risk (BMI 65.8%, SBP 62.1%, DBP 56.6%, stress 58.3%, physically inactive (55.4%), (Swanepoel *et al.*, 2015:1469);
- 57% of employees in a South African corporate setting had a moderate-high CHD risk whilst only 38% were at low-risk (Labuschagne *et al.*, 2007:72);
- Compared to the general population, males across 18 South African companies had higher rates of obesity, smoking and physical inactivity, all risks for the development of CHD (Kolbe-Alexander *et al.*, 2008:9);
- 71.6% of respondents had a vitality age higher than their actual age suggesting that most employees were losing 3.4 years of their life because of destructive lifestyle habits that increased their CHD risk (Ferreira, 2011);
- Destructive lifestyle habits such as smoking, overweight (poor eating habits) and psychological distress (common in the corporate sector) have a negative impact on employee health and productivity (Mills, 2005).

According to Hallal *et al.* (2012:4) starting with the Industrial Revolution, the development of new technologies enabled humans to reduce the amount of physical labour needed to accomplish various tasks. They further reported that as the availability of new technology increased the need for PA and human energy expenditure decreased. According to Booth *et al.* (2008:382,384) many of these technologies were driven by the employer's goal to achieve greater productivity. Owen *et al.* (2010:1-2) reported that changes in transportation, communications and workplace technologies have resulted in significantly reduced demands for PA in the workplace associated with compromising the metabolic health of employees.

Physical inactivity can therefore be considered as one of the most important health challenges of the 21st century because of its influence on chronic diseases amongst the general population as well as in the corporate environment (CDC, 2015b).

A further challenge in the corporate sector is that the health risk status of employees is not static but can migrate between 2% and 4% per annum to a higher risk category (Musich *et al.*, 2003:393). As a result, the low-risk employee of today can become the high-risk employee of tomorrow. According to these authors, it is important for employers to assess the health-risk status of employees in order to know their health-risk profile and the cost implication of the employee health-risk profile to the company and to manage these health risks by implementing strategic and timely intervention regimes.

The WHO (Leka *et al.*, 2003:8) stated that poor psycho-social health (stress, depression and burnout) was associated with physical health risks such as CHD, raised blood pressure, disorders of the digestive system as well as disorders of the musculoskeletal system. Psychological distress has been linked with increased risk of CHD through adoption of unhealthy lifestyle habits (smoking, unhealthy eating, alcohol abuse and physical inactivity) and neurohumoral activation that can increase CHD risk (Stansfeld *et al.*, 2002:248-249). Moretti and Postruznik (2012:2) reported that a certain amount of work pressure is needed for increased productivity and reaching individual goals, but when work pressure become too much (e.g. economic competition, restructuring, constant changes in technology, work overload, inadequate resources), it causes work-related stress that negatively impacted on employee health and productivity (Moretti & Postruznik, 2012:2). Boles *et al.* (2004:741)) showed that the mean percentage of presenteeism increased for each level of cumulative health risk factor, ranging from 1.3% presenteeism for individuals with zero risks to 25.9%

presenteeism for individuals with eight risks. Prochaska *et al.* (2011:740) indicated that productivity loss increased significantly as the number of risk factors increased, and that physical and emotional health decreased. Burton *et al.* (2005:773) reported that when comparing employees with different health risk levels, the medium-risk individuals (3 to 4 health risks) reported 6.2% more productivity loss compared to the low-risk individuals (0 to 2 health risks). High-risk individuals (≥ 5 health risks) reported a 12.2% higher productivity loss than low-risk individuals. Burton *et al.* (2005:773) also reported that each additional risk factor was associated with a productivity loss of 2.4%. Boles *et al.* (2004:741) stated that the possibility of having presenteeism were significantly greater among employees that were physical inactive, followed poor nutritional habits and had high stress and lack of emotional fulfilment.

Melamed *et al.* (2006:28) and Schaufeli and Salanova, (2014:296) reported that chronic stress often results in the work environment from conditions such as overload, emotional demand, cross-role conflicts, uncertainty and job insecurity (Belkic *et al.*, 2004:86,116-117; Kopp & Rethelyi, 2004:363; Rosmond, 2005:4-6; Strike & Steptoe, 2004:343) and suggested that chronic stress was associated with increased risk of CHD morbidity and mortality. Moretti and Postruznik (2012:1) reported that organizational changes such as customer needs, legislative requirements and competitiveness require high levels of employees' adaptability and resilience. Feelings of self-respect, job-insecurity and self-worth are constantly under pressure and can lead to physical- and psycho-social disorders (Moretti & Postruznik, 2012:1) that can adversely affect employee health and productivity. Melamed *et al.* (2006:331,335,337) and Schaufeli and Taris, (2005:260) agreed that psycho-social health have been associated with increased CHD risk and posed a challenge to the employee and employer in terms of health and productivity.

In conclusion it is clear that employees in the corporate environment presently are bombarded with extremely challenging demands. These challenges are affected by the competitiveness of the corporate environment and may change according to the needs and demands of this profit-driven industry. The corporate environment poses a challenge to the employee and employer as it physically and psycho-socially contributes to the development of CHD risks amongst employees and is associated with reduced productivity. The majority of employees in the corporate environment have a moderate- to high-risk for CHD, and based on a sedentary and stressful working environment, have a higher CHD risk than the general population that are

not exposed to the challenges of this environment. The employee and employer sometimes are greatly unaware of these CHD risks and often do not assess the CHD health-risk status of employees. Both the employer and employee are therefore in denial of their own health risk profile (physical or psycho-social).

One strategy that can assist employees to cope with the stressors in the workplace is to develop resilience. In this regard PA interventions has already been indicated as a successful strategy by various researchers (Barlow *et al.*, 1990) to protect against premature CHD. What is even more striking is that this protection existed even in the presence of other primary CHD risk factors (Barlow *et al.*, 1990).

2.8 SELECTED INTERVENTION STRATEGIES FOR HEALTH PROMOTION IN THE WORKPLACE

The burden of NCDs can partially be prevented by addressing certain lifestyle risk factors, including healthy nutrition, participating in regular PA and refraining from destructive lifestyle habits (Mills, 2005). Mills (2005), Proper and Van Mechelen (2008:4) and WHO (2011a:14) advocated that the workplace has been identified as a likely setting in which a large section of the adult population can be reached and positively impact the health-risk profile of individuals. Research that indicated employees are unaware and in denial of the impact their lifestyle has on their health status, highlights the need for informed interventions that focused on successful education on health-risk factors amongst employees (Kolbe-Alexander *et al.*, 2008:9). The WHO (2004:7) and WHO (2011a:41) agrees that the workplace environment serves as the ideal area for action towards health promotion and state:

- *“Health promotion and prevention of non-communicable diseases should be further stimulated in the workplace, in particular by advocating healthy diet and physical activity among workers and promoting mental health at work”.*
- *“All sectors and all levels within governments, international partners, civil society, non-governmental organizations and the private sector have vital roles to play in shaping healthy environments and contributing to the promotion of physical activity” (WHO, 2011a:41).*

Hutchinson and Wilson (2011:238) voiced that the workplace had the potential for increased access to populations that might face difficulty to engage in PA in other settings outside of work. Through the workplace, it was possible to affect health behaviours through multiple levels of influence; through direct efforts such as increasing the availability and opportunities for PA or indirectly through social support and social norms promoting healthy behaviours (Hutchinson & Wilson, 2011:246-247; WHO 2004:42).

Soler *et al.* (2010:239,240) reported that worksite health intervention programs that started with assessment of health risks with feedback (AHRF) followed by health education (AHRF Plus Model) was the most successful, and that the following health risks were recorded among participants:

- Tobacco use;
- Dietary fat consumption;
- Seat belt use;
- High blood pressure;
- Total serum cholesterol levels;
- Alcohol consumption;
- Number of days absent from work because of illness or disability;
- Improvement of employees being PA;
- Improvements in overall health and wellbeing.

Mattke *et al.* (2013:81) reported the following interventions offered by employers in the US (RAND Employer Survey of 2012):

- | | |
|-----------------------------|------|
| • Nutrition and weight-loss | 79%; |
| • Smoking cessation | 77%; |
| • Physical activity | 72%; |
| • Alcohol / substance abuse | 52%; |
| • Stress management | 52%; |
| • Other | 5%. |

The following were benefits employees derived through wellness intervention (Renaud *et al.*, 2008:73; Thøgersen-Ntoumani & Fox, 2005:50-52):

- Increased physical and mental wellness;
- Increased energy;
- Increased resilience;
- Increased life and job satisfaction;
- Reduced stress and depression.

The following were benefits, organizations derived from employee wellness intervention (Addley *et al.*, 2001:440; Goetzel & Ozminkowski, 2008:310-316; Hemp, 2004:8; Shaw *et al.*, 2007:25,26):

- Reduced absenteeism;
- Reduced presenteeism;
- Increased employee performance and productivity;
- Reduced health care costs;
- A reduction in on-site accidents.

The view of employee health intervention as a cost to be reduced, rather than an investment to be managed, needs to be reconsidered in light of the overwhelming trends towards an older workforce and growing research evidence showing substantial costs of worker health problems on work performance (Loeppke *et al.*, 2009:412). Additionally, they reported that some proactive employers have become receptive to a new model that focused on health-related productivity and not only medical and pharmacy spending as their most compelling cost issue related to worker health and that this comprehensive view of health in the workplace, placed a true business value on health and view human capital as an investment. Berry *et al.* (2010:8) estimated in this regard that by moving 10% of its employees from high- and medium-risk to low-risk status would yield a ROI of 6 to 1.

Various studies (Goetzel & Pronk, 2010:223; Mattke *et al.*, 2013:12-14; Soler *et al.*, 2010:238,247,255) reported that a health assessment with feedback as also used in this study serves as the cornerstone for health promotion from which other programs could also be

developed. Ozminkowski *et al.* (2006:1130) found that engaging employees in health promotion programs without first administering a health assessment did not produce cost savings and may in fact have led to higher health care expenditures. The researchers conjectured that administering a health assessment was a necessary first step for outcomes and that it may not be best practice to achieve behaviour change and risk reduction without an initial health assessment (Mattke *et al.*, 2013:134; Ozminkowski *et al.*, 2006:1130). A similar conclusion was drawn by Mattke *et al.* (2013:129,130) who reported that intervention, inclusive of follow-up programs were needed to increase employee health awareness and provide skills to achieve behaviour change. Goetzel *et al.* (2007:118,119) reported that effective health promotion programs offered individualized risk reduction counselling to the high-risk employees and did so within the context of broader health awareness programs and a healthy company culture.

Hutchinson and Wilson (2011:246) analysed 29 workplace intervention studies and reported that motivation enhancement such as motivational interviewing or the use of rewards were successful for workplace interventions and advised that future interventions should incorporate this approach in their programmes. Similarly Berry *et al.* (2010:1) identified the following characteristics of sustainable employee health promotion programs:

- Strategic alignment of program objectives with those of the business;
- Engaged leadership at multiple levels;
- Effective planning – broad in scope and high in relevance and quality;
- Effective practices with broad accessibility;
- Duplicate or tailor successful programs;
- Effective communication;
- Developed by health promotion program pioneers for any employer of any size.

According to Soler *et al.* (2010:240), the ultimate goal is to improve health behaviours which in turn would improve intermediate health-related outcomes including physiological indicators such as a change in blood pressure, blood sugar or cholesterol and psychological wellbeing. Research on more than 40 000 male employees found that health risk intervention was associated with a 10.2% reduction in all CHD events and a 5.3% reduction in all deaths as well as decreased self-reported injuries during work (Soler *et al.*, 2010:253). A strategy for

improving PA among employees (Crespo *et al.*, 2011:269-270; Golaszewski *et al.*, 2008:2-3; Pronk & Kottke, 2009:317; Sallis & Glanz, 2009:123,125; Tamers *et al.*, 2011:3) recommended environmental and policy changes. The following sub-sections detailed the evidence base around specific policy and environmental approaches implemented by workplaces to increase opportunities for PA as an intervention among their workforce (Anderson *et al.*, 2009a:342; Crespo *et al.*, 2011:264,269,270).

- Policy:
 - Flexible working hours;
 - Health insurance benefits;
 - Time allocated for breaks to reduce prolonged sitting;
 - Transport plans to encourage active transport;
 - Subsidies for PA participation.

- Environmental changes:
 - Onsite exercise facilities;
 - Access to healthy food;
 - Bicycle storage;
 - Stair use and walking routes;
 - Walking paths;
 - Showers and change room facilities;
 - Signage to encourage PA;
 - Childcare facilities.

According to Kaczynski *et al.* (2010:4,5) and Matson-Koffman *et al.* (2005:188), it was widely accepted that a strategy of intervening at multiple levels with comprehensive workplace approaches that used education and training to reinforce policy and environmental initiatives have been more successful in improving health-risk status.

Erqou *et al.* (2012:2161); Greenland *et al.* (2003:897); Seravalle *et al.* (2011) and Wilson (2013:25) reported that risk factors for CHD acted synergistically and not in isolation to increase CHD risk. Approximately 90% of CHD patients had prior exposure to at least 1 of these major risk factors, which include high total blood cholesterol levels, hypertension,

current cigarette use and diabetes. According to Maredza *et al.* (2011:50) recent evidence suggested that focussing on one risk factor at a time during intervention can result in under-treatment of high-risk patients and a possible over-treatment of lower-risk patients. The WHO rather advocated for an absolute risk assessment approach, aimed at balancing several CHD risk factors present in an individual, whilst also promoting a healthy lifestyle. Evidence suggested that this approach would be a more cost-effective way of managing CHD and could have a significant impact on the treatment of CHD (Gaziano *et al.*, 2005:3569, 3574; WHO, 2007:7).

To assess the absolute risk for CHD the risk factors age, gender, smoking, blood pressure, diabetes and total blood cholesterol should be considered and assessed (Gaziano *et al.*, 2005:3574; Maredza *et al.*, 2011:50; WHO, 2007:7). Vasan *et al.* (2005:398) estimated that 90% of CHD events will occur in individuals with at least 1 elevated risk factor and that 8% will occur in individuals with borderline levels of multiple risk factors. According to Lloyed-Jones *et al.* (2010:589) it is widely recognised that the majority of CHD and stroke events occur among individuals with moderate CHD risk levels.

According to the RAND Employer Survey (Mattke *et al.*, 2013:14) the strategy of employers during screening activities in the US was to use health risk assessments (HRAs), self-administered questionnaires on health-related behaviours and health risk factors inclusive of clinical screenings, to collect biometric data such as height, weight, blood pressure, and blood glucose levels in order to evaluate employees' risk and to strategize preventative interventions accordingly.

Soler *et al.* (2010:257) reported that screening activities (HRAs) and self-administered questionnaires played a crucial role in raising awareness and educating individuals about early signs of chronic lifestyle diseases, and identifying health risk factors. Additionally, they reported the number of organizations in America that offered a worksite health promotion program for their employees to have increased from 81% of worksites in 1990 to nearly 90% of all workplaces with at least 50 employees by 2000. Cooney *et al.* (2010:300,308), Genest *et al.* (2009:527) and Graham *et al.* (2007:4) stressed the need for CHD prevention guidelines to consider the impact of all risk factors before making clinical management decisions and in most cases, recommended a system of evaluating combined risk factor effects.

Golaszewski *et al.* (2008:3-5) as well as Pronk and Kottke (2009:318) agreed that “*an effective strategy to engage employees in physical activity through the workplace setting, was for executives, mid-level management and front-line leaders to demonstrate, in words as well as actions, support for an active lifestyle and incorporating physical activity objectives into the overall workplace health by linking it to business objectives and the company mission statement*”.

Soler *et al.* (2010:256) reported that economic benefits from intervention derived from direct medical costs averted and indirect productivity losses averted or both, and ranged from \$93 to \$695 per employee per year. Soler *et al.* (2010:237-262) further reports ROI ratios to range from 1.4:1 to 4.6:1 (average 3.2:1) meaning that an annual gain of \$1.40 to \$4.60 for every dollar invested in the program would be realized. Soler *et al.* (2010:257) also indicated that the cost for high-risk participants reduced between \$14 and \$73 per 1% reduction in CVD risk over a three-year period and that for moderate risk participants ranged from \$11 to \$73. They also reported that employees with one comorbid condition comprised nearly 40% of comorbid cases and generated about 15 600 lost days from absence and presenteeism whilst employees with six or more comorbidities made up about 8% of the group but contributed more than 36 000 lost days. Loeppke *et al.* (2009:423) further showed that in combining costs across 25 health conditions, on average, for every \$1 of pharmacy costs there were \$2.3 dollars of health-related productivity costs, relating to absenteeism and presenteeism. Childress and Lindsay (2006:451) as well as Loeppke *et al.* (2009:427) suggested that, on average, for every \$1 to \$2 employers spend on worker medical or pharmacy costs, they absorb at least \$2 to \$5.81 of health-related productivity costs.

According to Sieberhagen *et al.* (2011:2) less than half of South Africa’s top 100 organizations offer Employee Wellness Programs (EWPs) despite the important role intervention programmes can play in promoting employee health, and in assisting organizations and employees in adjusting to rapidly changing contexts. Research by Porter and Kramer (2011:7) as well as Sieberhagen *et al.* (2011:3) reported that in companies where EWPs existed, leadership did not always realise the extent to which employee wellness contributed to the organizations bottom line and minimized the investment in EWPs. Today leading companies realise that lost workdays, diminished employee productivity and poor health cost them more than investments in EWPs. Organizations that invested time and resources in building an employee wellness culture with the focus on being proactive rather

than reactive, could expect a return on investment in terms of reduced absenteeism, healthier employees, fewer accidents and reduced staff turnover (Arena *et al.*, 2013:607; Sieberhagen *et al.*, 2011:3). Mattke *et al.* (2013:27) indicated that research was needed on program design features as well as the impact of individual-level and workforce-level interventions to increase program efficiency. It is in the best interest of the employer and employee to respectively implement and participate in intervention initiatives with the focus on improving employee health by managing employee health-risk status (Mattke *et al.*, 2013:64).

2.9 CONCLUSION

Coronary heart disease (CHD) refers to disease of the heart and blood vessels. The most common ones are diseases of the heart muscle, strokes, heart attacks, heart failure and heart disease caused by CHD risk factors such as hypercholesterolemia, hypertension, diabetes, obesity, stress and cigarette smoking, that reduced productivity. These health risk factors are especially present amongst employees in the corporate sector. The health-risk of employees is not static and likely to migrate between 2% and 4% annually from low- to higher-risk status in the absence of successful intervention programmes. If employee low-risk status is not maintained through active intervention, low-risk employees inevitably join the ranks of the higher-risk employees. CHD risks do not manifest with alarming symptoms and employees are often unaware and in denial of their health-risk status even if they present with CHD risks. There is a link between psycho-social health, risk for CHD and cardiovascular-related events, and psycho-social health was associated with an increased risk for CHD. Employees with CHD were associated with reduced functional work capacity and reduced productivity levels.

More than half the deaths caused by chronic diseases in South Africa, including CHD, occurred before the age of 65 years and could be classified as premature deaths which affects the workforce significantly. Premature deaths caused by CHD among individuals of working age are expected to increase and heart disease will become one of the most common diseases by 2050, underlining the importance of on-going assessment to identify, prevent and manage CHD risk amongst employees in the corporate sector.

Employers should consider these changes and conditions when developing strategies to manage employee wellness, especially interventions that focus on reducing risk factors for the development of CHD.

Health interventions at the workplace should not only target employees but also organizational factors to ensure a pleasant working environment and an engaged workforce associated with increased productivity.

Therefore, it is important to conduct health screening assessments followed by effective intervention to proactively create on-going awareness and manage CHD risk factors and risk factor clustering amongst employees.

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CHAPTER 3

THE PREVALENCE OF CORONARY HEART DISEASE RISK FACTORS AMONGST EMPLOYEES IN A FINANCIAL INSTITUTION IN SOUTH AFRICA: AN ANALYSIS OVER TIME [ARTICLE 1]

The manuscript will be submitted to the journal: Ergonomics SA

Subsequently the referencing style used in this chapter will be in line with the journal's guidelines.

Short title: Coronary heart disease risk factors among employees

The prevalence of coronary heart disease risk factors amongst employees in a financial institution in South Africa: An analysis over time

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Abstract

Coronary heart disease (CHD) is globally responsible for the highest mortality rate and projected to not change in the next two decades. CHD is of major concern to the corporate environment as it may lead to premature mortality, decreased productivity and increased health care costs. The aim of this study was to determine the prevalence of selected CHD risk factors amongst employees in a financial corporate environment over a period of 7 years (2007 to 2013). This study is presented as an assessment over time and employees could have done various assessments. Therefore, the research refers to the number of assessments and not participants. Health screening assessments (N=20910) were conducted on employees aged 20 to 60 years, from 7 head offices and 628 branches nationally and participants were divided on the basis of gender and age, (≤ 45 and >45 yrs.). Data were collected on CHD risk factors e.g. body composition (BMI), blood pressure (BP), non-fasting total cholesterol (TC), blood glucose (Glu), physical activity (PA), psychological health (psycho-social and physical ill-health symptoms) and burnout. Results indicated an increase in the prevalence of CHD risk factors in the older employees and that on average, 33% of females (≤ 45 yrs.) and 57% of females (>45 yrs.) showed clustering of 3 or more CHD risk factors (moderate and high risk clustering) compared to 39% and 57% in males respectively. In view of this perturbing prevalence of CHD risk factors amongst employees, the need for strategic intervention is underlined.

Key words:

Coronary heart disease, risk factors, mortality, corporate health, intervention.

1. Introduction

The World Health Organization (WHO, 2015) indicated that at present, coronary heart disease (CHD) is the number one cause of deaths globally, and it is projected to still be the leading cause in 2030 (WHO, 2015). Together with diabetes mellitus, chronic respiratory diseases and cancer, CHD forms the major component of non-communicable diseases (NCDs), also referred to as “chronic diseases of lifestyle” (CDL) (WHO, 2014). These clinical conditions, resulting from unhealthy lifestyles, often start during adolescence (Naik and Kaneda, 2015), with gradual progression until it surfaces around the clinical horizon ($\pm$ 45 yrs.) (Booth, Gordon, Carlson and Hamilton, 2000), causing about 70% of premature deaths (Naik and Kaneda, 2015). The main causes of CDL (all modifiable) includes unhealthy diet, tobacco use, physical inactivity and excessive use of alcohol (Bradshaw, Steyn, Levitt and Nojilana, 2011; SAMRC, 2011). As the economic workforce is usually a reflection of the community, the concern regarding the prevalence of chronic diseases and associated health risk factors amongst employees comes as no surprise (Cowan, McDonnell, Levitt and Zezza, 2004; World Economic Forum (WEF), 2013; WHO, 2014). These chronic conditions may affect employees adversely, leading to decreased quality of life, premature death and disability, increased health care costs (Patel, Goetzel, Beckowski, Milner, Greyling, Da Silva, Kolbe-Alexander, Tabrizi and Nossel, 2013; WEF, 2013) as well as decreased productivity (Bloom, Cafiero, Janè-Lopis, Abrahams-Gessel, Bloom, Fathima, Feight, Gaziano, Mowafi, Pandya, Prettnner, Rosenberg, Seligman, Stein and Weinstein, 2011). Bloom *et al.* (2011) warn that the next 2 decades could be evidenced by a dramatic negative impact on productivity due to the prevalence of CDL.

This anticipated threat to economic progression, may contribute to the fact that corporate management is currently more aware of issues relating to employee health (Patel *et al.*, 2013), shifting the focus of occupational health in recent years from occupational exposures to NCDs (Kolbe-Alexander, Buckmaster, Nossel, Dreyer, Bull, Noakes and Lambert, 2008). Premature deaths, caused by CHD in individuals of working age (35 - 64 yrs.) are expected to increase by 41% between 2000 and 2030 (Steyn, 2007). This can have a potential negative impact on the economy of a country (Leeder, Raymond and Greenberg, 2004). While genetic factors played a part in CHD, 80% to 90% of people dying from this condition presented with one or more major risk factors that were influenced by lifestyle (Mendis *et al.*, 2011) and could therefore be prevented to a certain extent (Davis, 2010). What is more worrisome is

that despite easily available information on CHD risk factors, individuals are displaying a low knowledge of CHD and often reported their risk as less than or the same as healthy people of their age (Bradshaw, Norman, Pieterse, Levitt and South African Comparative Risk Assessment Collaborating Group, 2007; Dracup, Mckinley, Doering, Riegel, Meischke, Moser, Pelter, Carlson, Aitken, Marshall, Cross and Paul, 2008). Hence an educational intervention on prevention of CHD in the corporate environment may be of critical importance.

Various studies have already indicated that South African employees present with one or more risk factors associated with CHD (Grace, Wilders and Strydom, 2007; Kolbe-Alexander *et al.*, 2008; Swanepoel, Strydom and Cockeran, 2015). This implies an increased risk for CHD morbidity and mortality (Greenland, Knoll, Stamler, Neaton, Dyer, Garside and Wilson, 2003; Maredza, Hoffman and Tollman, 2011). It is also indicated that in people presenting with multiple risk factors, the chances of developing a myocardial infarction (MI) grows exponentially, suggesting the risk of a person presenting with 3 risk factors, to be 27 times higher of suffering an MI, compared to those exhibiting no risk factors (Greenland *et al.*, 2003; Maredza *et al.*, 2011). Kolbe-Alexander *et al.* (2008) as well as Swanepoel *et al.* (2015) indicated that a perturbing number of employees in South Africa displayed a multiple risk factor clustering viz. 20%, having 4 or more risk factors with 14% displaying 5 or more risk factors. This places these employees in a vulnerable stratum, not only to develop clinical conditions such as hypertension, heart disease and diabetes (Naikanishi, Suzuki and Tatara, 2003) but also showing increased rates of absenteeism (Serxner, Gold and Bultman, 2001), leading to decreased productivity (Berger, Howell, Nicholson and Sharda, 2003).

Most studies, analysing the CHD risk profile in the corporate environment were conducted on a once-off cross-sectional basis, and nothing could be found analysing the risk status over time. The situation in the South African corporate environment over the last decade was very volatile, with political and economic transition, strikes etc. contributing to excessive stressors on the workforce, which may eventually precipitate in enhanced health risk factors for CHD. In this regard Lokare, Nekar, Mulkpati and Venktesh (2012) and Shivaramakrishna, Wantamutte, Sangoli and Mallapur (2010) indicated that employees in the financial environment represent a subset of the population prone to the development of CHD. Reasons for this inter alia are the following: sedentary lifestyle, relative higher socioeconomic status and a stressful work environment (Lokare, *et al.*, 2012; Shivaramakrishna *et al.*, 2010). The

objective of this study therefore was to analyse the prevalence of CHD health risk factors amongst employees in a financial institution in South Africa over a period of 7 years (2007 - 2013) as well as to determine the clustering of CHD risk factors. Knowledge on this may guide health and wellness professionals in the corporate environment to apply strategic intervention regimes, addressing these health challenges.

2. Methodology

2.1 Research design

An ex-post facto quasi-experimental design was used, with assessments over time (2007 - 2013) on available employees in a financial institution in South Africa. However, this study is not based on a longitudinal design, as participants varied during the assessments and participation was voluntary.

2.2 Participants

This study forms part of a comprehensive health promotion program warranted by the company. A total of 20910 assessments (females = 12848; males = 8062) on employees between 20 and 60 years of age based at 628 branches and 7 head offices over the country, form part of this non-randomized available population. The cohort included males and females from various ethnic groupings in South Africa. No differentiation was however made on ethnic grounds in order to be in line with company policy. However, distinction was drawn between gender and age as it may affect the research parameters. The participants were divided into the age groups ≤ 45 year and > 45 years in order to distinguish between the pre-clinical and post-clinical horizon status as well as pre- and postmenopausal status (females), with 10751 (84%) and 2097 (16%) assessments on females and 6927 (86%) and 1 135 (14%) assessments on males in the pre- and -post subgroups respectively.

2.3 Measurements

2.3.1 Stature: Stature was measured by using a stadiometer with head in the Frankfurt plane, measured to the nearest 0.5cm. (Stewart, Marfell-Jones, Olds and De Ridder, 2011).

2.3.2 Body mass: Body mass was measured by using a calibrated electronic scale (Keiper dynamic GmbH and Co, USA) measuring to the nearest 0.1 kg. Minimal clothing without shoes was allowed. The scale was calibrated regularly with a known weight.

2.3.3 Body mass index (BMI): BMI was calculated by body mass (kg) divided by height (m) squared (kg/m^2), as suggested by the ACSM (2014). A BMI of 18.5 - 24.9 was regarded as normal (low risk), 25 - 29.9 as overweight (moderate risk) and ≥ 30 as obese (high risk) (ACSM, 2014).

2.3.4 Blood pressure (BP): BP was measured by using an aneroid sphygmomanometer and stethoscope, following the protocol as suggested by the ACSM (2014). The cut-points for hypertension in this study were the following, viz. systolic blood pressure (SBP): normal (low risk) <120 mmHg, pre-hypertension (moderate risk) 120 - 139 mmHg, hypertension (high risk) ≥ 140 mmHg. Diastolic blood pressure (DBP): normal (low risk) <80 mmHg, pre-hypertension (moderate risk) 80 - 89 mmHg, hypertension (high risk) ≥ 90 mmHg (ACSM, 2014).

2.3.5 Total cholesterol (TC) and glucose (Glu): TC and Glu analysis were conducted on capillary blood obtained from a finger prick, by using the Accutrend blood analyser (Roche, Switzerland). Calibration was applied according to the guidelines of the manufacturer (Roche, Diagnostics, 2009). Due to logistical and practical reasons the blood analysis was done under non-fasting conditions. According to Vermaak, Kotze, Van der Merwe, Becker, Ubbink, Barnard, Roux, Schoeman and Strydom (1991) non-fasting TC is acceptable in screening for CHD risk. However, since blood glucose is responsive to food intake (ACSM, 2014), risk stratification was done accordingly. The following cut-points were taken for above-mentioned parameters e.g. TC <5.2 mmol/L as normal (low risk), 5.2 - 6.2 mmol/L borderline high (moderate risk) and >6.2 mmol/L as high (high risk) (ACSM, 2014). For the non-fasting blood Glu, 4.0 - 7.7 mmol/L as normal (low risk), 7.8 - 10.9 mmol/L as moderate (moderate risk) and ≥ 11 mmol/L as high (high risk) (National Health and Medical Research Council - Australia (NHMRC-Aus), 2005).

2.3.6 Physical activity index (PAI): PAI was derived from the CHD risk index (Bjurström and Alexiou, 1978). In this questionnaire participants should indicate their on-job as well as off-job PA status on a Likert scale ranging from 0 - 8, with 0 referring to intensive

occupational and leisure-time PA and 8 indicating a complete sedentary occupational and leisure time profile. The means for PA status were calculated and classified according to the cut-points: 0 - 2 high active (low risk), 3 - 4 moderate active (moderate risk) and >4 low active (high risk) (SANGALA, 2000).

2.3.7 Smoking: Smoking status of the participants was also derived from the CHD risk index (Bjurström and Alexiou, 1978) and classified as follows, e.g. non-smoker or occasional cigarette/pipe = low risk (0 - 1), 1 - 20 cigarettes/pipe per day as moderate risk (2 - 4) and ≥ 21 cigarettes/pipe per day as a heavy smoker (high risk) (6 - 10) (SANGALA, 2000).

2.3.8 Psycho-social health: Psycho-social health status of the participants was evaluated by using the South African Employee Health and Wellness Survey Questionnaire (De Beer, Pienaar and Rothmann, 2013) that assesses psycho-social parameters (stress, burnout, depression). Participants had to reflect their psycho-social health status (psycho- and physical ill health symptoms) on a Likert scale ranging from never = 1 to frequently = 4. These assessed stress-related negative symptoms experienced by employees over the last 3 months related to psychological (e.g. constant irritability, mood swings etc.) and physical (e.g. insomnia, headaches, etc.) ill health. In order to stratify the psycho-social ill health, the following cut-points were used: 1.40 - 1.90 low risk, 1.91 - 3.00 moderate risk and >3.00 high risk, with 1.2- 2.35 as low risk, 2.36 – 3.49 as moderate risk and ≥ 3.5 as high risk for physical ill health. The means for burnout were calculated according to the cut-points of The South African Employee Health and Wellness Survey (SAEHWS) (Rothmann & Rothmann, 2007). For the statistical analysis the means were derived from categorical data regarding the following cut-points: 0 - 3 low risk, 4 - 7 moderate and 8 - 10 high risk. The psycho-social parameters were estimated as latent variables with a Two Parameter Graded Item Response Theory model (Samejima, 1969) and compared against a large South African norm group by means of percentiles. Large scores were classified at the 66th percentile and low scores at the 33rd percentile.

Risk factor clustering amongst employees was stratified according to Musich, McDonald, Hirschland and Edington (2003) e.g. employees with 0 - 2 risk factors as low risk, 3 - 4 risks as moderate and ≥ 5 as high risk.

2.4 Procedure

The information was gathered (annually) by registered Biokineticists, after attending an induction course by the chief biokineticist of the company. As this health risk appraisal was part of the company's comprehensive wellness program, employees were annually invited to participate in the health screening which was offered at the various branches regionally. They were asked to complete the questionnaires as well as the informed consent documents. This was followed by anthropometric assessment (stature and mass), blood pressure and biochemical analysis (total cholesterol and glucose). All blood tests were done under non-fasting conditions. After completion of the assessments all data were captured and submitted to the central data basis at the company's head office.

2.5 Ethical approval

This retrospective study forms part of a comprehensive wellness program offered to all employees in the company. The wellness program was mandated by the executive management and in line with the ethical considerations of the company. Before every assessment, every participant was requested to sign informed consent as required by the company. Furthermore, all researchers were registered as health professionals at the Health Professions Council of South Africa (HPCSA, 2016) and complied with the ethical guidelines set by this statutory institution. In order to comply with the regulations of North-West University, ethical approval for this study was obtained from North-West University (Potchefstroom Campus) Human Research Ethics Committee (HREC: NWU-00109-12-A1).

2.6 Statistical analyses

Data was analysed using the SAS (SAS Institute Inc., 2016) and Statistica (Dell Inc., 2015). Descriptive statistics included means, standard deviation and number of participants over time (2007 - 2013) for physical as well as psycho-social risk factors (2009 - 2013) (the reason for this difference in years is explained elsewhere), as well as the average mean of the risk factors over the 7 years are presented (Tables 3.1 - 3.4). The prevalence (%) of employees presenting with CHD risk factors over time were stratified in low-, moderate and high-risk categories according to the various cut points as indicated earlier (Table 3.5). The average prevalence over the 7 years is also provided as well as the population at risk (PAR)

representing the participants in the moderate and high-risk category (Table 3.5). Lastly the clustering (%) of risk factors in participants are presented in Figures 3.1 and 3.2.

3. Results

The results of this study are presented in Tables 3.1 - 3.5 as well as Figures 3.1 - 3.2. A total number of 20910 assessments on patients, (20 - 60 yrs.) were conducted in this 7-year study, investigating the prevalence of CHD risk factors amongst employees in a financial corporate setting. In the case of the psycho-social health risk factors, only 941 assessments were completed. The primary reason was that the company only started implementing the psycho-social health assessments in 2009. The total sample comprises 12848 (61%) assessments on females and 8 062 (39%) assessments on males. In the pre-clinical (≤ 45 yrs.) and post clinical (>45 yrs.) age groups 10751 (84%) and 2097 (16%) females together with 6927 (86%) and 1135 (14%) males were involved respectively.

Table 3.1 Descriptive data on selected CHD risk factors over time in female employees (≤ 45 yrs.) in a financial institution in South Africa

F ≤ 45	BMI (kg.m ⁻²)	SBP (mmHg)	DBP (mmHg)	TC (mmol/L)	Glu (mmol/L)	PAI	Smoking	Psycho- ill	Phys- ill	Burnout
2007	$\bar{X}$ = 27.11 SD = 6.44 N = 828	$\bar{X}$ = 114.64 SD = 14.87 N = 828	$\bar{X}$ = 74.73 SD = 10.95 N = 828	$\bar{X}$ = 4.29 SD = 0.97 N = 828	$\bar{X}$ = 4.47 SD = 1.45 N = 828	$\bar{X}$ = 4.28 SD = 0.60 N = 828	$\bar{X}$ = 1.77 SD = 1.20 N = 828			
2008	$\bar{X}$ = 27.12 SD = 6.48 N = 2189	$\bar{X}$ = 116.97 SD = 13.91 N = 2189	$\bar{X}$ = 77.12 SD = 10.30 N = 2189	$\bar{X}$ = 4.30 SD = 1.01 N = 2189	$\bar{X}$ = 4.95 SD = 1.37 N = 2189	$\bar{X}$ = 4.26 SD = 0.58 N = 2189	$\bar{X}$ = 1.69 SD = 1.20 N = 2189			
2009	$\bar{X}$ = 27.13 SD = 6.32 N = 1776	$\bar{X}$ = 117.09 SD = 13.89 N = 1776	$\bar{X}$ = 75.58 SD = 10.23 N = 1776	$\bar{X}$ = 4.26 SD = 0.90 N = 1776	$\bar{X}$ = 5.42 SD = 1.41 N = 1776	$\bar{X}$ = 4.23 SD = 0.57 N = 1776	$\bar{X}$ = 1.38 SD = 1.10 N = 1776	$\bar{X}$ = 3.33 SD = 0.96 N = 96	$\bar{X}$ = 3.43 SD = 0.92 N = 96	$\bar{X}$ = 6.83 SD = 2.52 N = 96
2010	$\bar{X}$ = 27.28 SD = 6.36 N = 1437	$\bar{X}$ = 117.21 SD = 14.37 N = 1437	$\bar{X}$ = 75.90 SD = 10.63 N = 1437	$\bar{X}$ = 4.56 SD = 0.87 N = 1437	$\bar{X}$ = 5.31 SD = 1.35 N = 1436	$\bar{X}$ = 4.21 SD = 0.51 N = 1437	$\bar{X}$ = 1.40 SD = 1.09 N = 1437	$\bar{X}$ = 3.12 SD = 1.22 N = 20	$\bar{X}$ = 3.11 SD = 1.20 N = 20	$\bar{X}$ = 6.60 SD = 2.66 N = 20
2011	$\bar{X}$ = 28.49 SD = 6.83 N = 1174	$\bar{X}$ = 116.87 SD = 13.90 N = 1174	$\bar{X}$ = 76.54 SD = 10.35 N = 1174	$\bar{X}$ = 4.58 SD = 0.82 N = 1174	$\bar{X}$ = 5.16 SD = 1.43 N = 1174	$\bar{X}$ = 4.29 SD = 0.54 N = 1174	$\bar{X}$ = 1.21 SD = 1.00 N = 1174	$\bar{X}$ = 2.58 SD = 0.64 N = 23	$\bar{X}$ = 2.58 SD = 0.63 N = 23	$\bar{X}$ = 6.43 SD = 3.04 N = 23
2012	$\bar{X}$ = 27.95 SD = 6.79 N = 1586	$\bar{X}$ = 114.67 SD = 14.76 N = 1585	$\bar{X}$ = 74.46 SD = 10.83 N = 1585	$\bar{X}$ = 4.63 SD = 0.93 N = 1586	$\bar{X}$ = 5.46 SD = 1.39 N = 1586	$\bar{X}$ = 4.26 SD = 0.55 N = 1586	$\bar{X}$ = 1.42 SD = 1.12 N = 1585	$\bar{X}$ = 2.79 SD = 0.94 N = 34	$\bar{X}$ = 2.68 SD = 0.79 N = 34	$\bar{X}$ = 6.62 SD = 2.89 N = 34
2013	$\bar{X}$ = 27.96 SD = 6.50 N = 1760	$\bar{X}$ = 115.89 SD = 14.76 N = 1761	$\bar{X}$ = 74.50 SD = 10.90 N = 1761	$\bar{X}$ = 4.57 SD = 1.02 N = 1761	$\bar{X}$ = 5.34 SD = 1.40 N = 1761	$\bar{X}$ = 4.27 SD = 0.50 N = 1760	$\bar{X}$ = 1.50 SD = 1.06 N = 1761	$\bar{X}$ = 2.63 SD = 0.83 N = 330	$\bar{X}$ = 2.72 SD = 0.76 N = 330	$\bar{X}$ = 6.00 SD = 2.83 N = 329
$\bar{X}$ Variable	27.58	116.19	75.55	4.46	5.16	4.26	1.48	2.79	2.86	6.25
$\bar{X}$ SD	6.53	14.35	10.60	0.93	1.40	0.55	1.11	0.91	0.86	2.79
$\bar{X}$ N	1536	1536	1536	1536	1536	1536	1536	100	100	100

BMI = Body mass index; SBP and DBP = Systolic and diastolic blood pressure; TC = total cholesterol; Glu= Glucose; Psycho-ill = psychological ill health; Phys-ill = Physical ill health.

Table 3.2 Descriptive data on selected CHD risk factors over time in female employees (> 45 yrs.) in a financial institution in South Africa

F > 45	BMI (kg.m ⁻²)	SBP (mmHg)	DBP (mmHg)	TC (mmol/L)	Glu (mmol/L)	PAI	Smoking	Psycho- ill	Phys- ill	Burnout
2007	$\bar{X}$ = 28.28 SD = 5.86 N = 166	$\bar{X}$ = 125.01 SD = 17.26 N = 166	$\bar{X}$ = 80.02 SD = 11.45 N = 166	$\bar{X}$ = 4.89 SD = 1.04 N = 166	$\bar{X}$ = 4.98 SD = 1.59 N = 166	$\bar{X}$ = 4.29 SD = 0.61 N = 166	$\bar{X}$ = 2.57 SD = 1.43 N = 166			
2008	$\bar{X}$ = 28.71 SD = 6.59 N = 406	$\bar{X}$ = 127.85 SD = 18.37 N = 406	$\bar{X}$ = 83.00 SD = 11.36 N = 406	$\bar{X}$ = 5.00 SD = 1.15 N = 406	$\bar{X}$ = 5.59 SD = 1.79 N = 406	$\bar{X}$ = 4.29 SD = 0.55 N = 406	$\bar{X}$ = 2.02 SD = 1.28 N = 406			
2009	$\bar{X}$ = 29.61 SD = 6.85 N = 341	$\bar{X}$ = 128.01 SD = 15.84 N = 341	$\bar{X}$ = 81.46 SD = 10.41 N = 341	$\bar{X}$ = 4.93 SD = 1.03 N = 341	$\bar{X}$ = 5.86 SD = 1.74 N = 341	$\bar{X}$ = 4.25 SD = 0.52 N = 341	$\bar{X}$ = 1.52 SD = 1.14 N = 341	$\bar{X}$ = 2.93 SD = 1.08 N = 13	$\bar{X}$ = 3.36 SD = 1.22 N = 13	$\bar{X}$ = 6.00 SD = 3.00 N = 13
2010	$\bar{X}$ = 29.09 SD = 6.13 N = 294	$\bar{X}$ = 127.01 SD = 15.95 N = 294	$\bar{X}$ = 81.84 SD = 9.75 N = 294	$\bar{X}$ = 5.21 SD = 1.00 N = 294	$\bar{X}$ = 5.74 SD = 1.75 N = 294	$\bar{X}$ = 4.23 SD = 0.51 N = 294	$\bar{X}$ = 1.46 SD = 1.15 N = 294	$\bar{X}$ = 3.22 SD = 0.76 N = 6	$\bar{X}$ = 3.15 SD = 1.12 N = 6	$\bar{X}$ = 6.33 SD = 2.80 N = 6
2011	$\bar{X}$ = 30.31 SD = 7.14 N = 218	$\bar{X}$ = 125.04 SD = 16.70 N = 218	$\bar{X}$ = 80.99 SD = 11.72 N = 218	$\bar{X}$ = 5.12 SD = 0.85 N = 218	$\bar{X}$ = 5.67 SD = 2.35 N = 218	$\bar{X}$ = 4.24 SD = 0.57 N = 218	$\bar{X}$ = 1.57 SD = 1.25 N = 218	$\bar{X}$ = 3.29 SD = 1.12 N = 5	$\bar{X}$ = 2.76 SD = 0.56 N = 5	$\bar{X}$ = 8.00 SD = 3.39 N = 5
2012	$\bar{X}$ = 29.63 SD = 6.56 N = 336	$\bar{X}$ = 125.01 SD = 16.87 N = 336	$\bar{X}$ = 80.20 SD = 10.66 N = 336	$\bar{X}$ = 5.06 SD = 1.05 N = 336	$\bar{X}$ = 6.36 SD = 2.40 N = 336	$\bar{X}$ = 4.20 SD = 0.59 N = 336	$\bar{X}$ = 1.78 SD = 1.32 N = 336	$\bar{X}$ = 2.92 SD = 1.06 N = 7	$\bar{X}$ = 2.64 SD = 0.99 N = 7	$\bar{X}$ = 4.71 SD = 3.25 N = 7
2013	$\bar{X}$ = 29.87 SD = 6.46 N = 336	$\bar{X}$ = 123.39 SD = 17.39 N = 336	$\bar{X}$ = 78.61 SD = 10.75 N = 336	$\bar{X}$ = 5.19 SD = 1.23 N = 336	$\bar{X}$ = 5.99 SD = 2.42 N = 336	$\bar{X}$ = 4.30 SD = 0.51 N = 336	$\bar{X}$ = 1.38 SD = 1.07 N = 336	$\bar{X}$ = 2.67 SD = 0.83 N = 66	$\bar{X}$ = 2.64 SD = 0.84 N = 66	$\bar{X}$ = 5.74 SD = 2.70 N = 66
$\bar{X}$ Variable	29.36	125.90	80.87	5.06	5.74	4.26	1.76	2.79	2.78	5.86
$\bar{X}$ SD	6.51	16.91	10.87	1.05	2.01	0.55	1.23	0.90	0.93	2.82
$\bar{X}$ N	300	300	300	300	300	300	300	19	19	19

Table 3.3 Descriptive data on selected CHD risk factors over time in male employees (≤ 45 yrs.) in a financial institution in South Africa

M ≤ 45	BMI (kg.m ⁻²)	SBP (mmHg)	DBP (mmHg)	TC (mmol/L)	Glu (mmol/L)	PAI	Smoking	Psycho- ill	Phys- ill	Burnout
2007	$\bar{X}$ = 25.78 SD = 5.31 N = 455	$\bar{X}$ = 123.65 SD = 14.43 N = 455	$\bar{X}$ = 79.16 SD = 10.21 N = 455	$\bar{X}$ = 4.33 SD = 0.91 N = 455	$\bar{X}$ = 4.97 SD = 1.41 N = 455	$\bar{X}$ = 4.21 SD = 0.58 N = 455	$\bar{X}$ = 2.27 SD = 1.44 N = 455			
2008	$\bar{X}$ = 25.81 SD = 4.99 N = 1299	$\bar{X}$ = 124.08 SD = 13.87 N = 1299	$\bar{X}$ = 81.64 SD = 10.47 N = 1299	$\bar{X}$ = 4.28 SD = 0.99 N = 1299	$\bar{X}$ = 5.17 SD = 1.32 N = 1299	$\bar{X}$ = 4.23 SD = 0.62 N = 1299	$\bar{X}$ = 1.95 SD = 1.23 N = 1299			
2009	$\bar{X}$ = 25.75 SD = 5.10 N = 1133	$\bar{X}$ = 123.86 SD = 14.54 N = 1133	$\bar{X}$ = 79.27 SD = 10.04 N = 1133	$\bar{X}$ = 4.28 SD = 0.89 N = 1133	$\bar{X}$ = 5.59 SD = 1.67 N = 1133	$\bar{X}$ = 4.22 SD = 0.55 N = 1133	$\bar{X}$ = 1.76 SD = 1.19 N = 1133	$\bar{X}$ = 2.59 SD = 1.14 N = 43	$\bar{X}$ = 2.56 SD = 1.14 N = 43	$\bar{X}$ = 5.47 SD = 2.96 N = 43
2010	$\bar{X}$ = 25.90 SD = 5.27 N = 1133	$\bar{X}$ = 124.89 SD = 13.59 N = 1133	$\bar{X}$ = 79.80 SD = 10.43 N = 1133	$\bar{X}$ = 4.53 SD = 0.93 N = 1133	$\bar{X}$ = 5.35 SD = 1.51 N = 1133	$\bar{X}$ = 4.18 SD = 0.57 N = 1133	$\bar{X}$ = 1.32 SD = 0.98 N = 1133	$\bar{X}$ = 2.37 SD = 0.94 N = 14	$\bar{X}$ = 2.26 SD = 0.97 N = 14	$\bar{X}$ = 4.86 SD = 3.16 N = 14
2011	$\bar{X}$ = 26.47 SD = 5.19 N = 749	$\bar{X}$ = 124.97 SD = 14.63 N = 749	$\bar{X}$ = 81.68 SD = 10.53 N = 749	$\bar{X}$ = 4.57 SD = 0.79 N = 749	$\bar{X}$ = 5.30 SD = 1.45 N = 749	$\bar{X}$ = 4.24 SD = 0.52 N = 749	$\bar{X}$ = 1.68 SD = 1.20 N = 749	$\bar{X}$ = 2.50 SD = 0.98 N = 19	$\bar{X}$ = 2.21 SD = 0.76 N = 19	$\bar{X}$ = 5.74 SD = 3.12 N = 19
2012	$\bar{X}$ = 26.56 SD = 4.97 N = 1079	$\bar{X}$ = 121.24 SD = 13.36 N = 1079	$\bar{X}$ = 78.5 SD = 10.17 N = 1079	$\bar{X}$ = 4.62 SD = 0.91 N = 1079	$\bar{X}$ = 5.53 SD = .45 N = 1079	$\bar{X}$ = 4.23 SD = 0.54 N = 1079	$\bar{X}$ = 1.95 SD = 1.29 N = 1079	$\bar{X}$ = 2.49 SD = 0.75 N = 20	$\bar{X}$ = 2.30 SD = 0.72 N = 20	$\bar{X}$ = 5.65 SD = 2.64 N = 20
2013	$\bar{X}$ = 26.45 SD = 5.09 N = 1079	$\bar{X}$ = 122.05 SD = 15.41 N = 1079	$\bar{X}$ = 77.84 SD = 10.97 N = 1079	$\bar{X}$ = 4.52 SD = 0.96 N = 1079	$\bar{X}$ = 5.20 SD = 1.26 N = 1079	$\bar{X}$ = 4.22 SD = 0.52 N = 1079	$\bar{X}$ = 1.62 SD = 1.09 N = 1079	$\bar{X}$ = 2.23 SD = 0.79 N = 198	$\bar{X}$ = 2.27 SD = 0.68 N = 198	$\bar{X}$ = 4.81 SD = 2.88 N = 198
$\bar{X}$ Variable	26.10	123.53	79.70	4.45	5.30	4.22	1.79	2.32	2.31	5.02
$\bar{X}$ SD	5.13	14.26	10.40	0.91	1.44	0.56	1.20	0.87	0.79	2.91
$\bar{X}$ N	990	990	990	990	990	990	990	58	58	58

Table 3.4 The descriptive data on selected CHD risk factors over time in male employees (>45 yrs.) in a financial institution in South Africa

M > 45	BMI (kg.m ⁻²)	SBP (mmHg)	DBP (mmHg)	TC (mmol/L)	Glu (mmol/L)	PAI	Smoking	Psycho- ill	Phys- ill	Burnout
2007	$\bar{X}$ = 28.96 SD = 4.65 N = 93	$\bar{X}$ = 132.86 SD = 16.38 N = 93	$\bar{X}$ = 85.30 SD = 10.88 N = 93	$\bar{X}$ = 4.83 SD = 0.95 N = 93	$\bar{X}$ = 5.33 SD = 1.76 N = 93	$\bar{X}$ = 4.15 SD = 0.64 N = 93	$\bar{X}$ = 1.90 SD = 1.21 N = 93			
2008	$\bar{X}$ = 28.18 SD = 4.93 N = 227	$\bar{X}$ = 129.81 SD = 16.62 N = 227	$\bar{X}$ = 84.59 SD = 10.17 N = 227	$\bar{X}$ = 4.73 SD = 1.03 N = 227	$\bar{X}$ = 5.92 SD = 2.34 N = 226	$\bar{X}$ = 4.25 SD = 0.55 N = 227	$\bar{X}$ = 1.69 SD = 1.27 N = 227			
2009	$\bar{X}$ = 27.79 SD = 4.72 N = 192	$\bar{X}$ = 131.49 SD = 17.12 N = 192	$\bar{X}$ = 84.44 SD = 10.64 N = 192	$\bar{X}$ = 4.70 SD = 0.92 N = 192	$\bar{X}$ = 6.01 SD = 2.00 N = 192	$\bar{X}$ = 4.20 SD = 0.59 N = 192	$\bar{X}$ = 1.88 SD = 1.21 N = 192	$\bar{X}$ = 2.46 SD = 0.35 7	$\bar{X}$ = 2.39 SD = 0.34 7	$\bar{X}$ = 3.86 SD = 1.86 7
2010	$\bar{X}$ = 27.93 SD = 4.66 N = 163	$\bar{X}$ = 131.49 SD = 16.09 N = 163	$\bar{X}$ = 83.94 SD = 9.72 N = 163	$\bar{X}$ = 5.03 SD = 0.97 N = 161	$\bar{X}$ = 6.13 SD = 2.23 N = 163	$\bar{X}$ = 4.20 SD = 0.57 N = 163	$\bar{X}$ = 2.07 SD = 1.26 N = 163	$\bar{X}$ = 1.41 SD = 0 N = 1	$\bar{X}$ = 1.57 SD = 0 N = 1	$\bar{X}$ = 1.00 SD = 0 N = 1
2011	$\bar{X}$ = 28.58 SD = 4.42 N = 117	$\bar{X}$ = 128.55 SD = 16.11 N = 117	$\bar{X}$ = 84.85 SD = 11.38 N = 117	$\bar{X}$ = 4.76 SD = 0.97 N = 117	$\bar{X}$ = 6.17 SD = 2.82 N = 117	$\bar{X}$ = 4.10 SD = 0.59 N = 117	$\bar{X}$ = 1.72 SD = 1.17 N = 117	$\bar{X}$ = 1.41 SD = 0 N = 1	$\bar{X}$ = 2.23 SD = 0 N = 1	$\bar{X}$ = 2.00 SD = 0 N = 1
2012	$\bar{X}$ = 29.00 SD = 5.46 N = 175	$\bar{X}$ = 127.95 SD = 17.38 N = 175	$\bar{X}$ = 84.39 SD = 11.72 N = 175	$\bar{X}$ = 5.01 SD = 0.89 N = 175	$\bar{X}$ = 6.42 SD = 2.60 N = 175	$\bar{X}$ = 4.16 SD = 0.55 N = 175	$\bar{X}$ = 0.94 SD = 0.78 N = 175	$\bar{X}$ = 2.07 SD = 0.38 N = 6	$\bar{X}$ = 1.69 SD = 0.36 N = 6	$\bar{X}$ = 3.5 SD = 2.07 N = 6
2013	$\bar{X}$ = 28.68 SD = 4.89 N = 167	$\bar{X}$ = 128.12 SD = 16.89 N = 168	$\bar{X}$ = 82.25 SD = 10.31 N = 168	$\bar{X}$ = 4.83 SD = 1.05 N = 168	$\bar{X}$ = 6.05 SD = 2.43 N = 168	$\bar{X}$ = 4.15 SD = 0.57 N = 167	$\bar{X}$ = 1.96 SD = 1.24 N = 168	$\bar{X}$ = 2.19 SD = 0.66 N = 32	$\bar{X}$ = 2.17 SD = 0.46 N = 32	$\bar{X}$ = 4.66 SD = 2.56 N = 32
$\bar{X}$ Variable	28.45	130.04	84.25	4.84	6.00	4.17	1.74	2.18	2.13	4.26
$\bar{X}$ SD	4.82	16.66	10.69	0.97	2.31	0.58	1.16	0.60	0.47	2.43
$\bar{X}$ N	162	162	162	162	162	162	162	9	9	9

Table 3.5 Coronary heart disease risk stratification (%) in female and male employees in a financial institution in South Africa: A study over time

Females ≤45 yrs																									
	2007			2008			2009			2010			2011			2012			2013			x̄			P AR
Risk stratification	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	
BMI	43	30	27	43	28	29	43	29	28	41	29	30	35	30	35	38	31	31	37	30	33	40	30	31	61
SBP (mmHg)	62	30	8	56	38	6	56	38	6	60	33	7	57	38	5	63	31	6	59	34	6	59	35	6	41
DBP (mmHg)	63	32	5	57	36	7	64	30	6	63	30	7	60	32	8	66	29	6	65	28	6	63	31	7	38
TC (mmol/L)	83	13	4	83	13	4	86	11	3	80	15	5	78	18	4	77	17	6	74	21	5	81	15	4	19
Glu (mmol/L)	75	25	0	72	28	0	56	43	1	62	38	0	65	35	0	54	45	1	60	39	1	64	36	0	36
PAI	21	8	71	25	8	67	23	8	69	24	9	67	23	12	65	21	10	69	22	10	68	23	9	68	77
Smoking	81	12	7	81	13	6	83	12	5	84	11	5	86	10	4	85	10	5	84	11	5	84	11	5	77
Psychosocial ill health							6	34	59	20	30	50	17	66	17	21	44	35	20	53	27	17	45	38	83
Physical ill health							14	38	48	25	35	40	44	52	4	38	41	21	35	47	18	31	43	26	69
Burnout							13	41	46	25	30	45	22	35	43	24	24	53	23	40	37	21	34	45	77

Females > 45 yrs																									
	2007			2008			2009			2010			2011			2012			2013			x̄			P AR
R i s k s t r a t i f i c a t i o n	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	
BMI	33	31	36	32	33	35	30	26	44	29	30	41	26	26	48	25	32	43	22	34	44	28	30	42	72
SBP (mmHg)	34	46	19	32	44	25	28	48	23	33	47	20	36	45	19	37	43	21	41	42	17	34	45	21	66
DBP (mmHg)	46	39	15	35	45	20	43	40	17	42	40	18	42	42	16	46	39	15	54	37	9	44	40	16	56
TC (mmol/L)	64	23	12	60	29	11	64	26	10	50	35	15	57	32	11	61	25	14	49	37	14	57	30	13	43
Glu (mmol/L)	69	30	1	55	43	2	44	55	1	52	46	2	56	42	2	39	56	5	48	50	2	52	46	2	48
PAI	28	11	61	30	13	57	28	13	60	29	10	61	31	16	54	26	12	62	26	16	58	28	13	59	72
Smoking	72	16	12	80	12	9	85	10	5	85	10	5	82	12	6	81	11	8	86	9	5	82	11	7	78
Psycho-social ill health							24	38	38	0	67	33	20	0	80	0	71	29	18	53	29	12	46	42	88
Physical ill health							31	31	38	17	66	17	20	80	0	57	29	14	41	47	12	33	51	16	67
Burnout							23	46	31	17	50	33	20	0	80	42	29	29	26	42	32	26	33	41	74

Males ≤ 45 yrs																									
	2007			2008			2009			2010			2011			2012			2013			x̄			PAR
Risk stratification	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	
BMI	49	34	17	47	35	18	48	34	18	46	36	18	40	40	20	40	39	21	40	39	21	44	37	19	56
SBP (mmHg)	36	49	15	35	51	14	34	52	14	32	54	14	32	53	15	44	47	9	42	47	11	37	50	13	63
DBP (mmHg)	46	44	10	37	46	17	48	41	11	48	40	12	40	45	15	51	40	9	55	36	9	46	42	12	54
TC (mmol/L)	83	14	3	84	12	4	85	12	3	78	17	5	80	17	3	78	16	6	78	18	4	81	15	4	19
Glu (mmol/L)	64	36	0	64	36	0	52	47	1	61	38	1	61	38	1	56	43	1	67	33	0	60	39	1	40
PAI	36	7	57	39	10	51	39	8	53	38	7	55	40	12	48	38	10	52	40	10	50	38	9	53	62
Smoking	74	16	10	79	14	7	79	14	7	82	13	5	82	11	7	80	13	7	83	12	5	80	13	7	20
Psychosocial ill health							30	41	29	29	42	29	37	37	26	20	55	25	45	41	14	33	43	24	67
Physical ill health							60	21	19	71	14	14	74	21	5	65	25	10	60	34	6	66	23	11	34
Burnout							30	42	28	42	29	29	31	32	37	30	45	25	39	39	22	35	37	28	6

Males > 45 yrs																										
	2007			2008			2009			2010			2011			2012			2013			x̄			PAR	
R i s k s t r a t i f i c a t i o n	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H	L	M	H		
BMI	13	53	34	27	41	32	27	44	29	28	38	34	17	50	33	18	46	36	23	42	35	22	44	33	78	
SBP (mmHg)	17	45	38	23	51	26	18	53	29	20	51	29	26	49	26	24	53	23	27	49	24	22	50	28	78	
DBP (mmHg)	27	45	28	28	49	23	30	43	27	31	44	25	31	46	23	22	52	26	39	46	15	29	47	24	71	
TC (mmol/L)	64	31	5	70	22	8	72	23	5	55	35	10	68	25	7	59	32	9	64	28	8	64	28	7	35	
Glu (mmol/L)	64	35	1	49	47	4	41	56	3	45	52	3	47	49	4	41	54	5	49	46	5	48	48	4	52	
PAI	43	46	11	42	12	46	40	15	45	38	12	50	39	19	42	38	14	48	40	15	45	40	19	41	60	
Smoking	75	16	9	80	13	8	76	16	8	76	15	9	79	13	8	88	7	5	82	14	4	80	13	7	20	
Psycho-social ill health							0	100	0	100	0	0	100	0	0	50	50	0	47	44	9	59	39	2	41	
Physical ill health							43	57	0	100	0	0	100	0	0	100	0	0	62	38	0	81	19	0	19	
Burnout							43	57	0	100	0	0	100	0	0	50	50	0	40	41	19	66	30	4	34	

Legend

L = Low risk; M = Moderate risk; H = High risk;
 BMI = Body mass index; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; TC = total cholesterol; Gluc = blood glucose;
 PAI = Physical activity index;
 Psycho-social ill health = Psychological-social ill health symptoms (stress related);
 Physical ill health = Physical ill health symptoms (stress related);
 Burnout = Psycho-social ill health symptom;
 $\bar{x}$ = average (L, M, H) over time; PAR = Population at risk for CHD (M + H);
 PAR = Population at risk for CHD (M + H);
 Percentage (%) has been rounded off to the nearest whole number, and percentages therefore might not add up to 100%.

For the younger females (≤ 45 yrs.) the average BMI over 7 years (27.58) and PAI (4.26) (Table 3.1) falls within the at-risk category, while all the other parameters were in normal range (ACSM, 2014). In the older females (>45) (Table 3.2), all parameters except non-fasting Glu concentration (5.74 mmol/L), fall within the at-risk category. When analysing the CHD risk factors over time in the younger females (≤ 45) it seems that the lowest mean in the physical parameters appears to be in the first year of assessment (2007), except for PAI (4.21 ± 0.57), smoking (1.21 ± 1.00) and TC (4.26 ± 0.90 mmol/L) which was the lowest in 2009, 2011 and 2009 respectively. For PAI and smoking in 2007 the highest mean values were (4.28 ± 0.60 and 1.77 ± 1.20 respectively). The highest mean values for the other CHD risk factors happen to be later in the study e.g. DBP = 77.12 ± 10.30 mmHg (2008), SBP = 117.21 ± 14.37 mmHg (2010), BMI = 28.49 ± 6.83 (2011), TC = 4.63 ± 0.93 mmol/L (2012), Glu = 5.46 ± 1.39 mmol/L (2012). In the psychological parameters (psycho-social ill health, physical ill health and burnout) the highest values (stress and burnout) occurred earlier in the study (2009) (psycho-social ill health = 3.33 ± 0.96 , physical ill health = 3.43 ± 0.92 , burnout = 6.83 ± 2.52) while the lower values happened to be later (2011 and 2013 respectively). In the older females (>45 yrs.) the lowest mean for BMI (28.28 ± 5.86), TC (4.89 ± 1.04 mmol/L) and Glu (4.98 ± 1.59 mmol/L) were also measured in the first year of the study (2007). However, the lowest mean values for BP (SBP and DBP) were measured in the last year of the study (2013), while the highest mean values for SBP were measured in 2009 (128.01 ± 15.84 mmHg) and DBP in 2008 (83.0 ± 11.36 mmHg). For PAI and smoking (females >45 yrs.), the lowest mean values were recorded later in the study (2012; 4.20 ± 0.59 and 2013; 1.38 ± 1.07 respectively). For the psychological parameters the highest values happened to be earlier in the study (psycho-social ill health = 3.29 ± 1.12 in 2011; physical ill health = 3.36 ± 1.22 in 2009 and burnout = 8.00 ± 3.39 in 2011). The lowest values for all three psychological parameters were recorded later in the study (2012 and 2013 respectively).

For the males in the younger age group (≤ 45 yrs.) (Table 3.3) the average BMI (26.10 ± 5.13), SBP (123.53 ± 14.26 mmHg) and PAI (4.22 ± 0.56) fall within the at-risk category, while the other CHD risk factors were within normal range. In the case of the older males (>45 yrs.) (Table 3.4), the average BMI over the 7 years of the study (28.45 ± 4.82), SBP (130.04 ± 16.66 mmHg), DBP (84.25 ± 10.69 mmHg) and PAI (4.17 ± 0.58) were in the elevated (at-risk) category, while TC and Glu were within normal range (ACSM, 2014; NHMRC-Aus, 2005). In both male groups the highest mean for SBP (124.97 ± 14.63 ; 132.86 ± 16.38 mmHg), DBP (81.68 ± 10.53 ; 85.30 ± 10.88 mmHg), smoking (2.27 ± 1.44 ; $2.07 \pm$

1.26), psycho-social ill health (2.59 ± 1.14 ; 2.46 ± 0.35) and physical ill health (2.56 ± 1.14 ; 2.39 ± 0.34) occurred early in the study, with the lowest mean later. The prevalence of CHD risk stratification over time (2007 - 2013) among the employees is presented in Table 3.5. The overall average ($\bar{x}$) prevalence for each category (low, moderate, and high risk) as well as the average for the population at risk, e.g. the average for the moderate and high-risk population together (population at risk / PAR), is also indicated (Table 3.5).

For females in the younger age group (≤ 45 yrs.), psycho-social ill health (Table 3.5) presented as the most important CHD risk factor, seeing that an average of 83% of the female participants were classified as the population at risk (moderate + high risk). The second most important risk factor was burnout with 79% of the females (≤ 45 yrs.) classified as population at risk (PAR) (moderate + high risk), with PA as the third most important risk factor, with an average prevalence of 77%. In the case of PA the mean prevalence over the 7 years of the study in both the female age groups were higher in the high-risk group than in the moderate or low-risk groups. Physical activity was the only risk factor with this particular characteristic. In the case of BMI in the younger female group, the prevalence of participants in the moderate and high-risk categories was very similar over the 7 years of the study with the majority of participants classified as low risk. Except for psychological parameters, and PA the majority of the females (≤ 45 yrs.) were grouped in the low-risk category.

For the females in the post-clinical horizon time frame (>45 yrs.) psycho-social ill health (88%) (Table 3.5) and burnout (74%) proved to be the major risk factors, followed by physical inactivity (72%), BMI (72%) and physical ill health (67%). In this group the BMI as well as physical inactivity constantly presented as risk factors over the 7 years of the study. For males in the age group (≤ 45 yrs.) the CHD risk factor with the highest prevalence for the population at risk over time (7 yrs.) was psycho-social ill health (67%) followed by burnout (65%), SBP (63%), physical inactivity (62%), BMI (56%), DBP (54%), Glu (40%), physical ill health (34%), smoking (20%), and TC (19%). Similar to the females ≤ 45 , the males in this age group also indicated that the majority of the participants in each of the 7 years of the study (2007 - 2013) can be classified as being in the high-risk group for physical inactivity.

For the older group of males (>45 yrs.) the majority of participants in the population at risk were found to have CHD risks, e.g. BMI (78%), SBP (78%) followed by DBP (71%),

physical inactivity (60%), Glu (52%), TC (35%), and smoking (20%). Figure 3.1a indicates on average that the females ≤ 45 had a greater prevalence of low risk (0 - 2 risks) clustering (67% vs. 43%) compared to females >45 (Fig. 3.1b), which showed a greater prevalence of moderate clustering (50% vs. 31%) as well as high-risk clustering (7% vs. 2%). The males in the younger group (Fig. 3.2a) showed a similar result when compared with the older males (Fig. 3.2b), with a greater prevalence of low-risk clustering (61% vs. 43%) whereas males in the older group reported a greater prevalence of moderate-risk clustering (48% vs. 35%) as well as high-risk clustering (9% vs. 4%). The average prevalence of CHD risk factor clustering for females and males respectively showed that the majority of participants had reported low-risk (55% and 52%) followed by moderate-risk (39% and 36%) and high-risk clustering (5% and 7%).

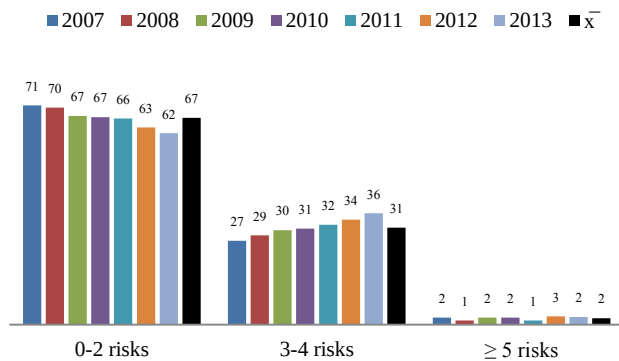


Figure 3.1a CHD risk factor clustering (%) - females ≤ 45

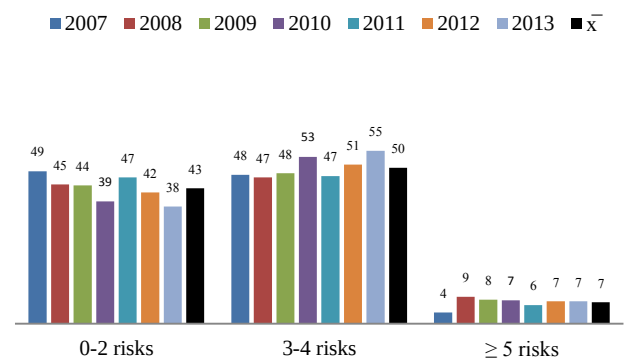


Figure 3.1b CHD risk factor clustering (%) - females >45

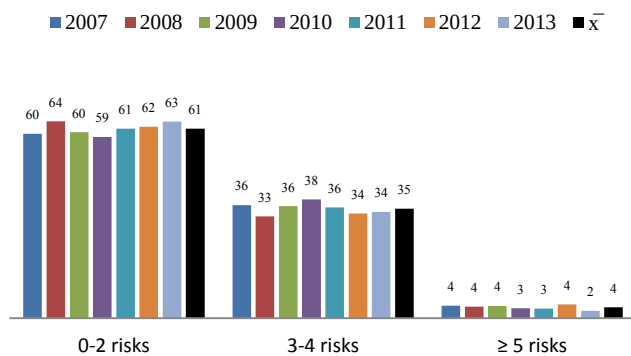


Figure 3.2a CHD risk factor clustering (%) - males ≤ 45

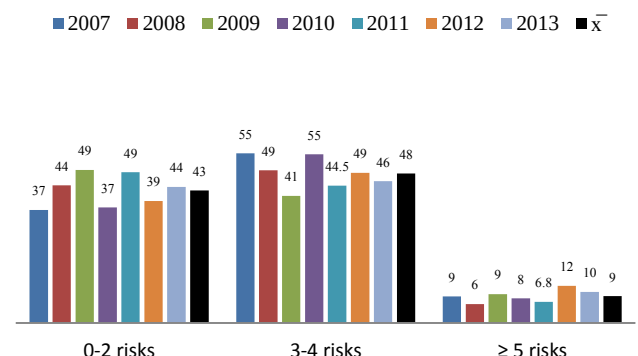


Figure 3.2b CHD risk factor clustering (%) - males >45

4. Discussion

To our knowledge this is the first study reporting on CHD risk factors amongst employees in a corporate environment over time. The results showed that the 5 primary CHD risk factors (BMI, hypertension, high cholesterol, inactivity, smoking) together with secondary CHD

risks (e.g. high glucose, and psycho-social ill health, e.g. stress, burnout, depression) (Strydom, 2000; Wallace, 2003) already reached perturbing levels amongst employees in a financial corporate setting in South Africa. The results further indicated that although the mean value of these risks may seem relatively stable over time, it aggravated with ageing, increasing the risk for CHD, which may lead to ill health and premature loss of highly skilled (rare skills) employees in the corporate setting. This is echoed by Bloom *et al.* (2011) indicating that the next two decades could be evidenced by a significant negative impact on productivity due to increased CHD.

The average BMI of females and males indicated that both genders were overweight. The mean BMI for females >45 was bordering on obesity (BMI >29) for five (2009, 2010, 2011, 2012, 2013) of the seven years during which this study was conducted. The number of participants with a normal BMI has reduced from 2007 to 2013 whilst the number of overweight and obese participants in both age groups, has increased. While the overweight (moderate risk) category for females ≤ 45 compared to females >45 seems stable over time (Table 3.5), it is obvious that less females >45 (28%) had a normal BMI compared to those ≤ 45 (44%), indicating an increase in overweight and obesity with ageing. A similar trend was also found for males ≤ 45 (44%) compared to >45 (22%). This result is supported by research (Mayo Clinic, 2015; Ogden, Carroll, Fryar and Flegal, 2015) who indicated that overweight and obesity increased with age due to metabolic changes and reduced muscle mass associated with ageing. Furthermore, with modern society becoming more sedentary, low energy expenditure (sedentary corporate industry) is likely to be an important cause of obesity (Anderson, Quinn, Glanz, Ramirez, Kahwati, Johnson, Buchanan, Archer, Chattopadhyay, Kalra and Katz, 2009; Donnelly, Blair, Jakicic, Manore, Rankin and Smith, 2009). The increase in BMI reported in this study is of concern, since overweight and obesity are associated with increased risk for chronic diseases including hypertension, diabetes, cancer, as well as psycho-social ill health, increasing the risk for CHD (Donnelly *et al.*, 2009; Kumanyika, Obarzanek, Stettler, Bell, Field, Fortmann, Franklin, Gillman, Lewis, Poston, Stevens & Hong, 2008; Must, Spadano, Coakley, Field, Colditz and Dietz, 1999). This may be a major driver of costs in the corporate sector because of absenteeism, sick leave, disability, injuries, and healthcare claims (Ostbye, Dement and Krause, 2007).

Except for females ≤ 45 , the females and males in both age groups were pre-hypertensive (moderate risk), especially with regard to SBP. Chobanian, Bakris, Black, Cushman, Green

and Izzo (2003) reported that pre-hypertension was associated with more than two-fold increase in CHD and for every 20 mmHg systolic or 10 mmHg diastolic increase in BP, mortality from both CHD and stroke doubled. Although the prevalence of hypertension (high risk) among females and males (Table 3.5) seems relatively stable over time the average high risk has increased noticeably from age ≤ 45 to >45 for females (SBP 6% to 21% and DBP 7% to 16%) and males (SBP 13% to 28% and DBP 12% to 24%). In this respect Day, Groenewald, Laubsher, Chaudhry, Van Schaik and Bradshaw (2014) as well as The South African Department of Health (SADH, 2012) indicated that the prevalence of hypertension had increased by 32.3% in South Africa from 1998 to 2010. Fivawo (2012) indicated that hypertension is a “silent invisible killer”, which rarely causes symptoms in the early stages and therefore individuals with hypertension often go undiagnosed. The WHO (2013) reported that the increasing prevalence of hypertension could possibly be attributed to ageing, unhealthy eating habits, alcohol abuse, lack of PA, excess weight and stress (psycho-social ill health) which is in line with the results of this study. The corporate business environment is stressful as a result of economic pressure, competition to maintain clients, and restructuring as reported by Moretti and Postruznik (2012), who indicated that employees’ job security and feelings of self-respect and self-worth are constantly being put under pressure by dynamic and sometimes hostile challenges of the corporate industry.

Although the majority of participants had normal cholesterol levels, the prevalence of moderate risk for TC among males and females ≤ 45 and >45 increased (Table 3.5). The prevalence of hypercholesterolemia (PAR) among females ≤ 45 compared to >45 respectively, increased from 19% to 43%, and that of males in the same age groups from 19% to 35%. Similar results were shown by Norman, Bradshaw, Steyn and Gaziano (2007), who reported that blood cholesterol levels increased with age, especially in individuals who followed a typical western lifestyle. According to University of Maryland Medical Center (2013) a sedentary lifestyle (common to the corporate environment) and diets high in saturated fat are inter alia reasons for hypercholesterolemia. Hypercholesterolemia contributes to the development of plaque deposits along the artery walls and is associated with increased risk for CHD (Steyn, 2007). This should be a concern to the corporate workforce as increased CHD risk adds to the economic burden because of illness-related loss of productivity resulting from sick absenteeism and presenteeism (Mattke, Liu, Caloyeras, Huang, Van Busum, Khodyakov and Shier, 2013).

Glucose levels (Table 3.5) showed the same trend as overweight, hypertension and hypercholesterolemia with high Glu levels more prominent in participants >45. It raises concern that a significant number of the participants (F $\leq$ 45:36%; F >45:46%; M $\leq$ 45:39%; M >45:48%) had moderate risk Glu levels, as diabetes usually develops mostly in individuals who are overweight or obese, sedentary, increasing the risk for CHD (Steyn, 2007; International Diabetes Federation Atlas, 2013). Overweight, obesity and physical inactivity in this study were prominent CHD risk factors amongst employees.

Physical activity status showed that the majority of employees (F $\leq$ 45:77%; F >45:72%; M $\leq$ 45:62% and M >45:60%) were insufficiently active, which increased their CHD risk (PAR). Similar results have been reported by Mendis *et al.* (2011) showing that more than 60% of the global population were not sufficiently active. Hallal, Anderson, Bull, Guthold, Haskell and Ekelund (2012) indicated that the development of new technologies enabled humans to reduce the amount of physical labour needed to accomplish daily tasks. Booth, Laye, Lees, Rector and Thyfault (2008) reported that many of these technologies were driven by the employer's goal to increase productivity and to reduce hardships caused by jobs requiring human labour. The concern to the corporate sector is that research (Mattke *et al.*, 2013) showed that physical inactivity is associated with increased prevalence of CHD and non-communicable diseases (NCDs) associated with decreased quality of life, disability, premature death, reduced productivity and increased health care cost.

Smoking among both gender and age groups was stable over time (Table 3.5) but smoking was more prevalent among males than females (M $\leq$ 45:20%; M >45:20%; F $\leq$ 45:17% and F >45:18%), showing no significant age-related increase in smoking for males and females ($\leq$ 45 to >45 yrs.). In this regard research by Bradshaw *et al.* (2011) reported an increase for CHD risk factors in South Africa, except for smoking and ascribed it to effective comprehensive tobacco legislation promulgated in the 1990s. Black, Devereux and Salvanes (2015) indicated that job displacement (e.g. downsizing, restructuring) (probably associated with high stress levels) was significantly associated with increased smoking both for males and females, and had a significant effect on markers for cardiovascular health. The prevalence of high stress levels in this study which affects psycho-social and physical ill health as well as burnout, highlighted the prevalence of stress in the financial corporate environment, also mentioned by Shivaramakrishna *et al.* (2010) and Lokare *et al.* (2012). Cigarette smoking is also associated with hypertension, hypercholesterolemia and increased

risk for thrombosis (WHO, 2008) and one of the best predictors for CHD (University of Maryland Medical Center, 2013; Greenberg, Dintiman and Oakes, 2004). A total of 941 participants completed the psycho-social health (stress, burnout, depression) questionnaire. A similar trend to other CHD risks (e.g. obesity, hypertension, hypercholesterolemia, hyperglycaemia, physical inactivity), was found for psycho-social health risks where the majority of participants also had a moderate to high risk to develop psycho-social ill health. Apart from males >45 where participation in the psycho-social health survey was low (N = 1) the prevalence (population at risk) of psycho-social health risk in both female age groups and males ≤45 was the highest of all CHD risks recorded (F ≤45:83%, F >45:88% and M ≤45:67%) and seems to be more prominent among females than among males. Similar results were found for physical ill health (F ≤45:69%; F >45:67% and M ≤45:34%; M >45:19%) and this trend continued for burnout risk where more females (F ≤45:79%; F >45:74%) showed a risk for burnout compared to males (M ≤45:65%; M >45:34%) (Table 3.5). This is in line with research (American Psychological Association, 2010) which reported that females are more likely than males (28% vs. 20%) to report psycho-social ill health symptoms. Almost half of females (49%) reported that their stress (psycho-social ill health symptoms) has increased over the last 5 years compared to that of males (39%). Furthermore, females are more likely to report physical and emotional symptoms of stress than males, e.g. having headaches (41% vs. 30%), feeling as though they want to cry (44% vs. 15%) or having had an upset stomach or indigestion (32% vs. 21%). Vlassoff (2007) indicated that females also had family responsibilities apart from their day-time job which they had to fulfil as well as running a higher risk of becoming victims of domestic violence, making them more vulnerable to psycho-social and physical ill health than males.

This high prevalence of psychological ill health in this study comes as no surprise, as the corporate environment demands sustained success, placing employees under constant pressure to improve their performance to meet targets (Moretti and Postruznik, 2012; Batt and Colvin, 2011). Furthermore, changes in customer expectations, legislation, work organization and competitiveness and constant alterations in the functioning of corporations as a whole (e.g. restructuring that can result in job insecurity) is needed to ensure optimal performance (Moretti and Postruznik, 2012). During the process of adapting, employees are under constant pressure, which can be associated with an increase in the prevalence of psycho-social ill health (Iliceto, Pompili, Spencer-Thomas, Ferracuti, Erbutto, Lester, Candilera and Girardi 2012; Moretti and Postruznic, 2012). Psycho-social ill health has been

associated with destructive behavioural changes (e.g. smoking, alcohol abuse) and an increased CHD risk (Moretti and Postruznik, 2012; Suls and Bunde, 2005). The prevalence of psycho-social ill health raises a concern as various studies (Areias, Pinto, Vieira, Teixeira, Coelho, Freitas, Matos, Castro, Sarmiento, Viana, Fredriksen, Mengshoel and Freydenlund 2013; Khayyam-Nekouei, Neshatdoost, Yousefy, Sadeghi and Manshaee, 2013; Melamed, Shirom, Toker, Berliner and Shapira, 2006) suggested that it increases CHD risks and cardiovascular-related events such as MI, coronary by-pass surgery, percutaneous transluminal coronary angioplasty, coronary atherosclerosis, coronary stenosis and cardiac death.

Analyses of the clustering of CHD risk factors (Fig. 3.1 & 3.2) indicated that 45% of females and 48% of males showed a moderate to high (PAR) risk clustering (≥ 3 CHD risk factors). This is supported by research of Swanepoel *et al.* (2015) indicating that $> 40\%$ of employees in a South African corporate sector showed a moderate to high CHD risk cluster. This should be a concern to management as research (Burton, McCalister, Chen and Edington 2005) reported that the CHD risk status of employees can negatively impact the productivity of a company as each additional CHD risk factor could be associated with a productivity loss of 2.4%. Furthermore, individuals at moderate and high CHD risk cluster showed 6% and 12% more productivity loss respectively, compared to individuals in the low CHD risk cluster. Lloyed-Jones, Hong, Labarthe, Mozaffarian, Appel, Van Horn, Grenlund, Daniels, Nichol, Tomaselli, Arnett, Fonarow, Michael, Ho, Lauer, Masoudi, Robertson, Roger, Schwamm, Sorlie, Yancy and Rosamond (2010) indicated that the majority of CHD and stroke events occur in individuals with a moderate-level CHD risk clustering. According to Musich *et al.* (2003) CHD risk status is likely to migrate by 2% - 4% annually in the absence of intervention.

Research also indicated that the prevalence of CHD risk factors significantly increased health-care costs and in this respect Goetzel, Pei, Tabrizi, Hneke, Kowlessar, Nelson and Metz (2012) indicated that 10 modifiable CHD risk factors inter alia obesity, physical inactivity, total cholesterol concentration, poor nutrition and high alcohol consumption were responsible for 22.4% of total medical cost. They further indicated that obesity and physical inactivity were the two main drivers of health-care costs e.g. 8.8% and 4.5% of the total annual medical expenditure respectively (Goetzel *et al.*, 2012).

5. Conclusion

The prevalence of CHD risk factors amongst employees in a corporate setting indicated that the majority of employees showed a moderate CHD risk and this profile was present over time. CHD risk factors aggravated with age and higher prevalence was reported amongst employees >45 years. The results further indicated that a large number of employees reported to be physically inactive, placing them in a high-risk category for CHD, while for TC, Glu and smoking, the majority of employees fall within the low-risk category. Furthermore, it seems that with increase in age more employees reported a higher clustering of CHD risk factors, which warrants effective and timely intervention strategies in the workplace. Although in some risk factors, the stratification happens to be relatively stable, the prevalence of risk factors seems not static.

6. Strengths and limitations

To our knowledge, this is the first study to uncover the prevalence of CHD risk factors over time in a South African corporate financial setting. Strengths of this study include the use of data on a large population, spreading the entire country.

A limitation of this study is that some CHD risk factors e.g. PAI was based on self-reported participation and not assessed by more objective procedures. However, this was part of the design of the study as more objective procedures were time consuming and expensive, which makes it not practical on this large cohort of participants.

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CHAPTER 4

THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY STATUS AND SELECTED CORONARY HEART DISEASE RISK FACTORS AMONGST EMPLOYEES IN A FINANCIAL INSTITUTION IN SOUTH AFRICA [ARTICLE 2]

The manuscript will be submitted to the South African Journal for Research in Sport, Physical Education and Recreation.

Subsequently the referencing style used in this chapter will be in line with the journal's guidelines

**THE RELATIONSHIP BETWEEN PHYSICAL ACTIVITY STATUS AND
SELECTED CORONARY HEART DISEASE RISK FACTORS AMONGST
EMPLOYEES IN A FINANCIAL INSTITUTION IN SOUTH AFRICA**

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Abstract

Coronary heart disease (CHD) is the leading cause of mortality in most countries around the world and the scope is raising concern in the corporate environment as it is associated with an increase in employee illness, absenteeism, decreased productivity, and increased health expenditure. This study assessed the relationship between physical activity index (PAI) and selected CHD risk factors viz. body mass index (BMI), systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol (TC), glucose (Glu), smoking, as well as CHD risk index (CHDRI) amongst employees of a South African financial corporate setting. Data of these CHD risk factors were collected from 14861 participants (20 - 60 yrs.). The study sample consisted of 9269 (62%) females and 5592 (38%) males, divided on the basis of gender and age (cut-point of 45 years to represent the pre- and post-clinical horizon as well as the pre- and postmenopausal status in females). Females ≤ 45 and > 45 years respectively were at risk for the following risk factors (Mean $\pm$ SD); BMI (27.44 ± 6.51 , 29.58 ± 6.82), PAI (5.81 ± 2.82 , 5.39 ± 2.86) and CHDRI (20.28 ± 6.12 , 27.03 ± 7.55), while females > 45 years additionally were at risk for SBP (126.80 ± 17.41 mmHg) and DBP (81.35 ± 11.10 mmHg). Apart from SBP (123.50 ± 14.06 mmHg) as additional risk factor in males ≤ 45 , the CHD risk factors for males were similar to that of females viz. BMI (26.02 ± 5.16 , 28.60 ± 5.02), SBP (130.99 ± 17.17 (M > 45), PAI (4.80 ± 3.10 , 4.49 ± 3.02) and CHDRI (22.07 ± 6.78 , 28.15 ± 8.19) respectively in both age groups. A small practical significance was found between PAI status and BMI ($d = 0.15$), SBP ($d = 0.04$) and DBP ($d = 0.06$) in females ≤ 45 , with a medium practical significance for the same risk factors in females > 45 years ($d = 0.31$, 0.27 and 0.27 respectively). Similar results were found for the males in both age groups. The findings also indicated a positive significant correlation in females ≤ 45 years between PAI and CHDRI ($r = 0.47$), and between PAI and BMI ($r = 0.11$), DBP ($r = 0.28$) and CHDRI ($r = 0.40$) in females > 45 years. For males in both age groups positive significant correlation was found between PAI. In view of these results, PA may be an effective intervention regime to combat CHD risk factors amongst employees in the corporate financial environment.

Key words: Coronary heart disease, risk factors, physical activity, corporate health, intervention.

Introduction

Coronary heart disease (CHD) is the leading cause of mortality in most countries around the world (Carnethon et al., 2009; Lokare et al., 2012; Shivaramakrishna et al., 2010). Together with diabetes, cancer and chronic obstructive pulmonary disease (COPD), CHD forms the major part of non-communicable diseases (NCDs) (Naik & Kaneda, 2015) raising concern in the corporate environment globally (WEF, 2013). The WEF (2013) indicated that NCDs caused approximately 63% of all deaths globally and anticipated a significant impact on the global economy over the next two decades (Bloom et al., 2011; Mannocci et al., 2015). Of further concern is that a significant number of these deaths occurred in employees during the prime of their productive life (Naik & Kaneda, 2015; UNGA, 2011; WEF, 2013). This epidemic of NCDs is fuelled by a constellation of risk factors (smoking, unhealthy diet, alcohol abuse and physical inactivity) (UNGA, 2011), intimately associated with other well-established and modifiable CHD risk factors (hypertension, dyslipidemia, obesity, diabetes, stress etc.) (Mannocci et al., 2015; Naik & Kaneda, 2015). Research further indicated that employers around the globe are concerned about employees' health (WHO, 2014; WEF, 2013), as it not only resulted in escalating health care costs (Goetzel et al., 2012), presenteeism and absenteeism (Brown et al., 2011) but also decreased personal health and quality of life of employees (Musich et al., 2003; Swanepoel et al., 2015). This global epidemic is also manifesting in African and South African (SA) companies (Patel et al., 2013; Swanepoel et al., 2015) indicating a perturbing prevalence. Except for tobacco use, the prevalence of risk factors (alcohol abuse, physical inactivity, overweight/obesity, hypertension, diabetes and elevated LDL cholesterol) is rapidly on the increase in the SA population (Bradshaw et al., 2011).

Overweight/obesity and physical inactivity seems to be the most prevalent CHD risk factors in some SA companies. Swanepoel et al. (2015) reported a prevalence of 66.8% and 44.7% in overweight/obesity and physical inactivity in a SA financial company respectively, while Patel et al. (2013) reported 69.8% and 68.0% prevalence in physical inactivity and overweight/obesity respectively in a group of SA companies. Goetzel et al. (2012), indicated that the two risk factors that contributed most per capita per year to excess medical costs were overweight/obesity (\$347.0) and PA (\$178.6), followed by depression (\$128.2) tobacco use (\$106.2), high blood glucose (\$104.1), high blood pressure (\$80.8) and stress (\$38.3).

The salutogenic impact of regular PA participation on CHD risk factors is already well-documented (Dishman et al., 2013; Ehrman et al., 2013), which may be one of the reasons why PA intervention regimes in the corporate environment gained popularity (Curry et al., 2012; McKenzie, 2012; Pratt et al., 2014). Booth et al. (2000) stated “*we know of no single intervention with greater promise than physical exercise to reduce the risk of virtually all chronic diseases simultaneously*”. Researchers have indicated some mechanisms which may be responsible for the salutogenic changes brought about by PA (Booth et al., 2000; Warburton, 2006) ranging from (but not limited to) changes in body composition (Murdy & Ehrman, 2013), improved lipoprotein profiles (Grandjean et al., 2013) and glucose homeostasis (Albright, 2013; Pedersen & Saltin, 2006), reduced blood pressure (Pedersen & Saltin, 2006) and chronic inflammation (Pederson & Pederson 2005), genetic predisposition (Li et al., 2010) and enhanced psycho-social wellbeing (Landers & Petruzzello, 1994).

Evidence exists that employees in the financial environment are particularly prone to CHD (Lokare et al., 2012; Rao & Rao, 2014) due to their sedentary status, stressful jobs, volatile fiscal environment and high socioeconomic status (Lokare et al., 2012; Shivaramakrishna et al., 2010). The objective of this study therefore was to determine the relationship between PA status and selected CHD risk factors amongst employees in a financial institution of South Africa. This may assist health-care professionals involved in corporate wellness programs to increase the effectiveness in the intervention regimes.

Methodology

Research design

An ex-post facto quasi-experimental design was used for this study which forms part of a comprehensive health-promotion program, mandated by the executive management of the company.

Participants

Employees between 20 and 60 years were part of this non-randomized available population. The data of the first assessment of 14 861 employees, based at 628 branches and 7 head offices of the company over a period of time (2007 - 2013) were analysed in this study.

The cohort included males and females from various ethnic groupings in South Africa. However, no differentiation was made on ethnic grounds in order to be in line with the company's policy. However, distinction was drawn between gender and age as it can affect the research parameters. Participants were divided into the age groups ≤ 45 and > 45 years in order to distinguish between the pre- and post-clinical horizon status as well as pre- and postmenopausal status in the case of the females, with 7 891 (85%) and 1 378 (15%) females and 4 860 (87%) and 732 (13%) males in the pre- and post-subgroups respectively.

Measurements

Stature was measured by using a stadiometer with head in the Frankfurt plane (measured to the nearest 0.5cm) (Stewart et al., 2011).

Weight was measured by using a calibrated electronic scale (Keiper dynamic GmbH & Co, USA) measuring to the nearest 0.1 kg. Minimal clothing without shoes was allowed. The scale was calibrated regularly with a known weight.

Body mass index (BMI) was determined by body mass (kg) divided by height (m) squared (kg/m^2), as suggested by the ACSM (2014). A BMI of 18.5 - 24.9 was regarded as normal, 25.0 - 29.9 as overweight and ≥ 30 as obese (ACSM, 2014).

Blood pressure (BP) was determined by using an aneroid sphygmomanometer and stethoscope following the protocol suggested by the ACSM (2014). The cut-points for BP were SBP < 120 mmHg = normal, 120 - 139 mmHg = pre-hypertension and > 140 mmHg = hypertension. For DBP the following cut-points were used, viz. < 80 mmHg = normal, 80 - 90 mmHg = pre-hypertension and > 90 mmHg as hypertension (ACSM, 2014).

Total cholesterol (TC) and *glucose* (Glu) analysis were performed on capillary blood obtained from a finger prick, by using the Accutrend blood analyser (Roche, Switzerland). Calibration is applied according to the guidelines of the manufacturer (Roche, Diagnostics, 2009). Due to logistical and practical reasons the blood analysis was done under non-fasting conditions. According to Vermaak et al. (1991) non-fasting TC is acceptable for screening for CHD. However, since blood glucose is responsive to food intake (ACSM, 2014), risk stratification should be done accordingly. The following cut-points were taken for above-

mentioned parameters, viz. TC < 5.2 mmol/L = normal, 5.2 - 6.2 mmol/L = borderline and > 6.2 mmol/L = high (ACSM, 2014), with 4.0 - 7.7 mmol/L = normal, 7.8 - 10.9 mmol/L = moderate and ≥ 11 mmol/L = high for Glu (NHMRC-Aus, 2005).

Physical activity index was derived from the CHDRI questionnaire (Bjurström & Alexiou, 1978). In this questionnaire participants indicated their on-job as well as off-job PA status on a Likert scale ranging from 0 - 8, with 0 referring to intensive occupational and leisure-time PA and 8 indicating a complete sedentary occupational and leisure time profile. The following cut-points were taken for classification, viz. high physically active (0 - 1 = low risk), moderately active (2 - 4 = moderate risk) and low active (> 4 = high risk) (SANGALA, 2000).

Smoking status of the participants was also derived from the CHDRI (Bjurström & Alexiou 1978) and classified, e.g. non-smoker or occasional cigarette/pipe = low risk (0 - 1), 1 - 20 cigarettes/ pipe day = moderate risk (2 - 4) and ≥ 21 cigarettes/pipe per day = high risk (6 - 10) (SANGALA, 2000).

Coronary heart disease risk index (CHDRI) was determined by using the questionnaire of Bjurström and Alexiou (1978), specifically developed for the corporate settings. The questionnaire comprises 14 identified CHD risk factors (modifiable and non-modifiable) and weighted according to the risk, which is then calculated to determine the CHDRI. Stratification of low, moderate and high CHDRI was determined by the following cut-points: e.g. ≤ 21 = low risk, 22 - 30 = moderate risk and ≥ 31 = high risk (SANGALA, 2000).

Procedure

The information was gathered from the 628 branches and 7 head offices of the company spreading across all provinces of South Africa. Registered biokineticists at the HPCSA were responsible for the assessments, after attending an induction course by the chief biokineticist of the company. As this health screening was part of the company's comprehensive wellness program, employees were annually invited to voluntarily participate in the health screening. They were requested to complete the various questionnaires as well as the informed consent documents. This was followed by anthropometric measurements (height and weight), blood pressure and biochemical analysis (total cholesterol and glucose).

All blood tests were done under non-fasting conditions. After completing the assessments, data was captured and submitted to a central database at the company's head office.

Ethical approval

This retrospective study forms part of the company's comprehensive employee wellness program approved by the Executive Management and conducted in accordance with the company's ethical policy. Every employee was invited to voluntarily participate in a health-risk appraisal offered annually at the various branches of the company across South Africa. Before each assessment the employees needed to sign the informed consent as required by the company. Assessments were done by registered biokineticists at the HPCSA, and all ethical issues applied to health practitioners as prescribed by the HPCSA (2016) regarding patient treatment, confidentiality, anonymity etc. were strictly adhere to. In order to comply with the regulations of North-West University regarding a PhD study, ethical approval for this study was obtained from North-West University (Potchefstroom Campus) Human Research Ethics Committee (HREC: NWU-00109-12-A1).

Statistical analyses

Data were analysed using the SAS (SAS Institute Inc., 2016) and Statistica (Dell Inc., 2015). The group was divided on the basis of gender and age (≤ 45 and > 45 yrs.) and descriptive statistics included means, standard deviation, and number of participants. The average mean of the risk factors is presented in Table 4.1. To determine the effect of PA status on the selected CHD risk factors, participants were divided into low, moderate and high-active categories and Cohen effect size (d) (Cohen, 1988) was used to calculate practical significance ($d = 0.2$, small effect size, $d = 0.5$, medium effect size; $d = 0.8$, large effect size) between the groups (Table 4.2). Pearson correlation coefficient was used to assess the correlation between the CHD risk factors (Table 4.3). Due to the large sample size p-values will not be reported but rather the r-values which can also be indicative of practical significance (Cohen, 1988), where $r = 0.1$ is regarded as a small practical significant value, $r = 0.3$ (medium) and $r = 0.5$ as large practical significant.

Results

The results are presented in Tables 4.1 - 4.3. A total number of 14 861 participants (20 - 60 yrs.) took part in this study. The sample consisted of 9 269 (62%) females and 5 592 (38%) males.

Table 4.1 Descriptive data on selected CHD risk factors in employees in a financial institution in South Africa

Variable	F ≤ 45					F > 45				
	N	$\bar{x}$	SD	Min	Max	N	$\bar{x}$	SD	Min	Max
BMI	7884	27.44	± 6.51	13.00	61.00	1376	29.58	± 6.82	14.00	56.00
SBP (mmHg)	7881	116.30	± 14.34	65.00	189.00	1374	126.80	± 17.41	80.00	210.00
DBP (mmHg)	7881	75.62	± 10.59	40.00	143.00	1374	81.35	± 11.10	40.00	132.00
Cholesterol (mmol/L)	7734	4.42	± 0.96	1.00	12.00	1350	5.09	± 1.12	2.00	15.00
Glucose (mmol/L)	7834	5.09	± 1.43	1.00	23.70	1365	5.72	± 1.87	1.10	20.40
PAI	7888	5.81	± 2.82	0.00	8.00	1377	5.39	± 2.86	0.00	8.00
CHDRI	7891	20.28	± 6.12	5.00	52.00	1378	27.03	± 7.55	9.00	69.00
Smoke	7891	0.03	± 0.17	0.00	1.00	1378	0.05	± 0.21	0.00	1.00
Variable	M ≤ 45					M > 45				
	N	$\bar{x}$	SD	Min	Max	N	$\bar{x}$	SD	Min	Max
BMI	4849	26.02	± 5.16	11.00	59.00	730	28.60	± 5.02	16.00	57.00
SBP (mmHg)	4858	123.50	± 14.06	70.00	230.00	732	130.99	± 17.17	80.00	211.00
DBP (mmHg)	4858	79.78	± 10.47	40.00	130.00	732	84.78	± 10.79	48.00	125.00
Cholesterol (mmol/L)	4761	4.43	± 0.94	1.00	14.00	721	4.79	± 0.96	2.00	8.80
Glucose (mmol/L)	4827	5.24	± 1.37	1.00	24.50	727	5.97	± 2.48	1.60	28.40
PAI	4857	4.80	± 3.10	0.00	8.00	732	4.49	± 3.02	0.00	8.00
CHDRI	4860	22.07	± 6.78	6.00	85.00	732	28.15	± 8.19	11.00	64.00
Smoke	4860	0.05	± 0.21	0.00	1.00	732	0.05	± 0.21	0.00	1.00

BMI= Body mass index; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; PAI = Physical activity index; CHDRI = Coronary heart disease risk index; F = Female; M = Male.

Table 4.2 Physical activity status and selected CHD risk factors in employees in a financial institution in South Africa

Age & gender	F ≤ 45			F > 45			M ≤ 45			M > 45			All
ExerciseClass	1.Low	2.Mod	3.High	1.Low	2.Mod	3.High	1.Low	2.Mod	3.High	1.Low	2.Mod	3.High	
BMI ($\bar{x}$)	27.61	27.48	26.62	30.11	29.43	27.91	26.15	25.83	25.91	29.13	28.02	28.19	27.23
SD	± 6.70	± 6.24	± 5.80	± 7.11	± 6.08	± 6.42	± 5.38	± 4.84	± 4.95	± 5.61	± 4.23	± 4.49	± 6.15
d	0.02	0.14	0.15	0.10	0.24	0.31	0.06	-0.02	0.05	0.20	-0.04	0.17	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	
SBP ($\bar{x}$)	116.4	116.1	115.9	128.1	126.0	123.4	123.8	123.7	122.7	132.1	130.1	129.8	120.4
SD	± 14.34	± 14.82	± 13.81	± 17.32	± 17.03	± 17.69	± 14.33	± 14.23	± 13.33	± 18.53	± 15.21	± 16.29	± 15.42
d	0.02	0.02	0.04	0.12	0.15	0.27	0.01	0.07	0.08	0.11	0.01	0.12	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	
DBP ($\bar{x}$)	75.7	75.7	75.1	82.3	80.4	79.3	80.2	80.1	78.6	85.4	85.1	83.4	78.0
SD	± 10.66	± 10.87	± 9.92	± 11.18	± 10.66	± 10.98	± 10.65	± 10.34	± 10.11	± 11.44	± 10.55	± 9.71	± 10.95
d	0.00	0.05	0.06	0.17	0.10	0.27	0.01	0.15	0.15	0.03	0.16	0.18	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	
Chol ($\bar{x}$)	4.40	4.48	4.45	5.09	5.08	5.11	4.46	4.43	4.37	4.86	4.71	4.72	4.50
SD	± 0.95	± 0.97	± 0.99	± 1.13	± 1.07	± 1.14	± 0.96	± 0.92	± 0.89	± 1.02	± 0.93	± 0.86	± 0.99
d	-0.08	0.03	-0.05	0.01	-0.02	-0.01	0.03	0.06	0.09	0.15	-0.01	0.14	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	
Glu ($\bar{x}$)	5.09	5.04	5.13	5.74	5.77	5.60	5.26	5.29	5.16	6.06	5.98	5.81	5.24
SD	± 1.41	± 1.57	± 1.33	± 1.82	± 2.10	± 1.71	± 1.39	± 1.38	± 1.32	± 2.78	± 2.43	± 1.92	± 1.54
d	0.03	-0.05	-0.03	-0.02	0.09	0.08	-0.02	0.10	0.07	0.03	0.07	0.09	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	
CHDRI ($\bar{x}$)	22.11	17.66	14.90	29.67	24.41	21.23	25.11	20.18	17.42	32.32	26.30	22.58	21.89
SD	± 5.48	± 5.75	± 4.91	± 7.03	± 6.51	± 5.97	± 6.02	± 6.22	± 5.25	± 7.93	± 6.32	± 5.86	± 7.01
d	0.77	0.48	1.31	0.75	0.49	1.20	0.79	0.44	1.28	0.76	0.59	1.23	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	
Smoke ($\bar{x}$)	0.04	0.03	0.02	0.05	0.06	0.05	0.05	0.04	0.05	0.06	0.04	0.03	0.04
SD	± 0.18	± 0.17	± 0.15	± 0.21	± 0.23	± 0.21	± 0.21	± 0.20	± 0.21	± 0.23	± 0.20	± 0.18	± 0.19
d	0.02	0.04	0.06	-0.05	0.04	-0.01	0.03	-0.04	-0.01	0.05	0.05	0.10	
	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	d(1,2)	d(2,3)	d(1,3)	

ES = Effect size; $d = 0.2$ small effect; $d = 0.5$ medium effect; $d = 0.8$ large effect; $d(i,j)$ = indicator of the d-value between the i^{th} and j^{th} physical activity groups.

For the younger females (≤ 45 yrs.) (Table 4.1) the mean BMI (27.44 ± 6.51) falls within the overweight category with PAI (5.81 ± 2.82) within the low-active category and CHDRI (20.28 ± 6.12) in the moderate-risk category. The other CHD risk factors were all within normal ranges (ACSM, 2014). In the older females (> 45 yrs.) (Table 4.1), the mean values for BMI (29.58 ± 6.82), SBP (126.8 ± 17.41 mmHg) and DBP (81.35 ± 11.10 mmHg) and CHDRI (27.03 ± 7.55) fall within the elevated (moderate) risk category, with PAI (5.39 ± 2.86) in the low-active (high-risk) category. Comparing the younger females (≤ 45) with the older females (> 45 yrs.), apart from PAI (5.81 ± 2.82 vs. 5.39 ± 2.86) the highest mean values for all the other CHD risk factors were found in the older females. A higher PAI indicates a more inactive lifestyle (elevated risk); hence all parameters showed increased risk in the older group of females.

In the younger males (≤ 45 yrs.) the mean BMI (26.02 ± 5.16), SBP (123.50 ± 14.06 mmHg), PAI (4.80 ± 3.10) and CHDRI (22.07 ± 6.78) fall into the moderate risk category while DBP, TC and Glu were within normal limits. In the older males only two (TC and Glu) of the seven CHD risk factors assessed, fall within normal limits. The mean values for BMI (28.60 ± 5.02), SBP (130.99 ± 17.17 mmHg), and DBP (84.78 ± 10.79 mmHg) were in the moderate-risk category and PAI (4.49 ± 3.02) in the high-risk category. As in the females, higher values (elevated CHD risk) for males was found in the older group except for PAI where the older males had a slightly lower mean (4.49 ± 3.02 vs. 4.80 ± 3.10 respectively), but still in the low-active category, indicating a high risk for CHD. In Table 4.2 the effect of PAI on selected CHD risk factors are presented. A small practical significance was found for BMI between the moderate and high-active group ($d = 0.24$) and the low and high-active group ($d = 0.31$) in females > 45 . For SBP and DBP, small practical significant difference was also found between the low vs. high-active groups ($d = 0.27$) in this female group. Practical significant differences (moderate and high) were also found between the various PA groups in both female groups with CHDRI. For the males (> 45 yrs.) a small ES ($d = 0.2$) existed between the low and moderate physical-active group, in BMI, while moderate and high practical significant difference existed between the various PA groups and CHDRI in both male groups.

Table 4.3 Pearson correlation coefficient (*r*) between selected CHD risk factors in employees in a financial institution in South Africa

Group		F ≤ 45								F > 45							
Variable	S	BMI	SBP	DBP	Chol	Glu	PAI	CHDRI	Smoke	BMI	SBP	DBP	Chol	Glu	PAI	CHDRI	Smoke
BMI	<i>r</i>	1	0.32	0.33	0.07	0.11	0.05	0.47	0.00	1	0.25	0.28	-0.04	0.08	0.11	0.40	-0.08
	<i>N</i>	7884	7874	7874	7727	7827	7881	7884	7884	1376	1373	1373	1349	1364	1375	1376	1376
BPS (mmHg)	<i>r</i>	0.32	1	0.71	0.02	0.05	0.01	0.39	-0.01	0.25	1	0.71	-0.01	0.02	0.10	0.45	-0.04
	<i>N</i>	7874	7881	7881	7725	7825	7878	7881	7881	1373	1374	1374	1347	1362	1373	1374	1374
DBP (mmHg)	<i>r</i>	0.33	0.71	1	0.04	0.03	0.01	0.39	-0.01	0.28	0.71	1	0.02	-0.03	0.11	0.45	-0.08
	<i>N</i>	7874	7881	7881	7725	7825	7878	7881	7881	1373	1374	1374	1347	1362	1373	1374	1374
Chol (mmol/L)	<i>r</i>	0.07	0.02	0.04	1	0.12	-0.02	0.24	0.00	-0.04	-0.01	0.02	1	0.09	-0.01	0.18	-0.01
	<i>N</i>	7727	7725	7725	7734	7699	7732	7734	7734	1349	1347	1347	1350	1344	1350	1350	1350
Glu (mmol/L)	<i>r</i>	0.11	0.05	0.03	0.12	1	0.00	0.12	-0.03	0.08	0.02	-0.03	0.09	1	0.02	0.12	-0.02
	<i>N</i>	7827	7825	7825	7699	7834	7832	7834	7834	1364	1362	1362	1344	1365	1365	1365	1365
PAI	<i>r</i>	0.05	0.01	0.01	-0.02	0.00	1	0.48	0.02	0.11	0.10	0.11	-0.01	0.02	1	0.46	-0.02
	<i>N</i>	7881	7878	7878	7732	7832	7888	7888	7888	1375	1373	1373	1350	1365	1377	1377	1377
CHDRI	<i>r</i>	0.47	0.39	0.39	0.24	0.12	0.48	1	0.10	0.40	0.45	0.45	0.18	0.12	0.46	1	0.09
	<i>N</i>	7884	7881	7881	7734	7834	7888	7891	7891	1376	1374	1374	1350	1365	1377	1378	1378
Smoke	<i>r</i>	0.00	-0.01	-0.01	0.00	-0.03	0.02	0.10	1	-0.08	-0.04	-0.08	-0.01	-0.02	-0.02	0.09	1
	<i>N</i>	7884	7881	7881	7734	7834	7888	7891	7891	1376	1374	1374	1350	1365	1377	1378	1378
Group		M ≤ 45								M > 45							
Variable	S	BMI	SBP	DBP	Chol	Glu	PAI	CHDRI	Smoke	BMI	SBP	DBP	Chol	Glu	PAI	CHDRI	Smoke
BMI	<i>r</i>	1	0.30	0.33	0.18	0.14	0.03	0.45	0.00	1	0.21	0.23	0.05	0.03	0.08	0.42	0.03
	<i>N</i>	4849	4847	4847	4750	4816	4846	4849	4849	730	730	730	719	725	730	730	730
BPS (mmHg)	<i>r</i>	0.30	1	0.66	0.06	0.10	0.03	0.42	-0.01	0.21	1	0.74	0.02	0.07	0.06	0.52	0.04
	<i>N</i>	4847	4858	4858	4759	4825	4855	4858	4858	730	732	732	721	727	732	732	732
DBP (mmHg)	<i>r</i>	0.33	0.66	1	0.12	0.05	0.06	0.49	-0.03	0.23	0.74	1	0.03	0.07	0.06	0.53	0.07
	<i>N</i>	4847	4858	4858	4759	4825	4855	4858	4858	730	732	732	721	727	732	732	732
Chol (mmol/L)	<i>r</i>	0.18	0.06	0.12	1	0.13	0.05	0.29	-0.01	0.05	0.02	0.03	1	0.05	0.06	0.18	-0.03
	<i>N</i>	4750	4759	4759	4761	4744	4758	4761	4761	719	721	721	721	717	721	721	721
Glu (mmol/L)	<i>r</i>	0.14	0.10	0.05	0.13	1	0.03	0.14	0.00	0.03	0.07	0.07	0.05	1	0.04	0.09	-0.05
	<i>N</i>	4816	4825	4825	4744	4827	4824	4827	4827	725	727	727	717	727	727	727	727
PAI	<i>r</i>	0.03	0.03	0.06	0.05	0.03	1	0.52	0.00	0.08	0.06	0.06	0.06	0.04	1	0.52	0.03
	<i>N</i>	4846	4855	4855	4758	4824	4857	4857	4857	730	732	732	721	727	732	732	732
CHDRI	<i>r</i>	0.45	0.42	0.49	0.29	0.14	0.52	1	0.06	0.42	0.52	0.53	0.18	0.09	0.52	1	0.06
	<i>N</i>	4849	4858	4858	4761	4827	4857	4860	4860	730	732	732	721	727	732	732	732
Smoke	<i>r</i>	0.00	-0.01	-0.03	-0.01	0.00	0.00	0.06	1	0.03	0.04	0.07	-0.03	-0.05	0.03	0.06	1
	<i>N</i>	4849	4858	4858	4761	4827	4857	4860	4860	730	732	732	721	727	732	732	732

BMI = Body mass index; SBP = Systolic blood pressure; DBP = Diastolic blood pressure; Chol = Total cholesterol; Glu = Glucose; PAI = Physical activity index; CHDRI = Coronary heart disease index. *r* = Correlation coefficient; *N* = Number.

In Table 4.3 the Pearson correlation coefficient between selected CHD risk factors (BMI, SBP, DBP, TC, Glu, PAI and smoking) as well as CHDRI (indicating a multiple risk index to develop CHD) are presented. The results indicated that physical activity index (PAI) showed weak positive correlations with all risk factors in all four groups. The exception is the correlation between PAI and CHDRI where $r = 0.47$ and $r = 0.46$) occurred in the older females. In the case of the males strong positive correlations were found viz, $r = 0.52$ in both male groups. A practical significant and positive correlation (Sunshine Profits, 2016) between SBP and DBP ($r = 0.71$) was also found in the younger and older female group as well as $r = 0.66$ and $r = 0.74$ for the younger and older males respectively.

Discussion

The results of this study showed an association between PA level and 5 primary CHD risks (BMI, hypertension, high cholesterol, physical inactivity, smoking), as well as with Glu, and CHDRI. The findings also indicated an association between individual CHD risk factors, underlying the intertwinement of the various CHD risk factors. This is in line with the results presented by Maredza et al. (2011).

From the results obtained in this study it seems that in the younger employees (females and males ≤ 45 yrs.), three of the CHD risk factors (BMI, PAI and CHDRI) fall within the moderate risk category. In the older group (> 45 yrs.) SBP and DBP can additionally be included in the moderate-risk category. Earlier studies confirmed that physical inactivity and overweight/obesity are probably some of the major risk factors amongst employees globally (Al-Noon et al., 2014; Mannocci et al., 2015; Shivaramakrishna et al., 2010). This is in line with other studies in South Africa indicating that 68% and 70% of SA employees can be classified as at risk for overweight/obesity and physical inactivity respectively (Patel et al., 2013). Swanepoel et al. (2015) indicated that the situation in the financial corporate environment is similar where 65% and 67% of the male and female employees were overweight/obese and 52% and 38% were physically inactive respectively. This reveals the high prevalence of those risk factors compared to the general SA population, as the SANHANES-study (2013) indicated that 28% and 45% males and females respectively can be classified as physically unfit.

The same study also indicated that the prevalence of overweight/obesity was 31% for males and 65% for females (SANHANES, 2013). Goetzel et al. (2012) indicated that these two risk factors contributed the most per capita to excess medical costs in the corporate environment. The results of this study further indicate that with ageing the prevalence of CHD risk factors increases. This is in line with the findings of Mannocci et al. (2015). In the older employees (females and males > 45 yrs.) the elevated SBP and DBP also evolved as CHD risk factors. One of the reasons for this may be that the BMI increases with age. The mean value for BMI in the younger group of female employees was 27.44 ± 6.51 while for the older group the mean value of 29.58 ± 6.82 , already reaching obesity stratification (ACSM, 2014). These results are in line with the results of various other studies (Bradshaw et al., 2007, Medscape, 2015; National Heart, Lung and Blood Institute, 2015, Squires, 2013) reporting that atherosclerosis, the underlying pathology for CHD (result of CHD risk factors, e.g.

overweight/obesity etc.), aggravates with ageing, increasing plaque build-up in the arteries that increase CHD risk. However, the mean PAI showed a slight decrease (improvement) in the older female group (5.81 vs. 5.39). The same tendency occurred in the males with a decrease (improvement) in PAI (4.80 vs. 4.49) in the older male employees (> 45 yrs.). From the research it is clear that the two CHD risk factors, e.g. overweight/obesity and physical inactivity cannot only be considered in isolation, as both are intertwined with other CHD risk factors (Booth et al., 2000; Nejat et al., 2009). However, it is agreed that these are modifiable risk factors, and some positive results have already been achieved with intervention regimes to reduce these risk factors (overweight/obesity and physical inactivity) (Carnethon et al., 2009; Swanepoel et al., 2015).

The results of this study further indicate an interrelationship between the various CHD risk factors. The correlations between the risk factors are overall weak, however in some cases significant. A high correlation occurred between the individual risk factors and the comprehensive CHDRI. This reveals the intertwining between the various CHD risk factors leading to a clustering of risk factors in employees (Kolbe-Alexander et al., 2008; Swanepoel et al., 2015). This clustering of CHD risk factors should cause concern among corporate management, as Swanepoel et al. (2015) indicated that 50%, 42% and 7% prevalence of employees in the financial sector indicated a 0 - 2, 3 - 4 and ≥ 5 CHD risk factor clustering respectively. Musich et al. (2003) stated that the risk profile of employees is not static but migrates between 2% and 4% annually in the absence of intervention strategies. This increase in CHD health risk may not only increase direct health care costs (Goetzel et al., 2012), but employers have to also absorb the indirect expenses of lost productivity due to absenteeism and presenteeism, which can escalate to 6% and 63% of total medical cost (direct and indirect) respectively (Carnethon et al., 2009). Medibank (2005) further reported that the healthiest employees were almost three times more effective than their least healthy counterparts, working on average approximately 143 effective hours per month compared to the 49 effective hours of the unhealthy employees.

In Table 4.2 the effect of PAI and selected CHD risk factors is presented. In the female group (> 45 yrs.) a small practical significant difference was found between low and high physically active groups ($d = 0.31$) in BMI while in the older males, a small practical significance was found between the low vs. moderate-active individuals. This highlights the understanding that even moderate PA can evoke positive changes (Carnethon et al., 2009). Large practical

significant differences ($d = 0.8$) occurred between low vs. moderate-active and low vs. high-active groups in the CHDRI in both groups of females and males. The CHDRI represents an assessment for 14 recognized CHD risk factors (modifiable and non-modifiable).

The significant impact of PA participation on the comprehensive assessment underlines the value of PA as intervention strategy showing that even a moderate amount of PA can positively impact on workplace health promotion (Carnethon et al., 2009). This has already led to the implementation of innovative workstation design, e.g. slow-speed treadmill walking at a working station (Carnethon et al., 2009). Other innovative strategies to implement minimal PA in the workplace include pedometers, standing work stations, centralizing office resources to encourage walking to deliver messages vs. e-mailing, and having walking meetings (Carnethon et al., 2009). A considerable amount of research has already indicated the salutogenic effect of PA on the modifiable CHD risk factors (physiological and biochemical) (Ehrman et al., 2013), but evidence also exists that PA can positively impact on the non-modifiable risk factors (age, hereditary etc.). In this respect Sallis (2013) indicated that the most remarkable contribution of PA to health and wellbeing can be noticed after 60 years of age.

The results of this study support other research indicating that PA influences various physiological systems (e.g. cardiovascular, musculoskeletal, body composition etc.) and lifestyle habits (e.g. diet, alcohol consumption, sleep, smoking) positively to reduce CHD risk (Powell et al., 2011). It also underlines the value of PA as an intervention modality in that it holds beneficial value for about 23 diseases or ill health conditions (Pratt et al., 2014).

Conclusion

The relationship between PA (low, moderate, high) and selected CHD risk factors (BMI, SBP, DBP, TC, Glu, Smoking) showed that increase in PA level had a significant positive effect on these CHD risk factors in males and females (≤ 45 and > 45 yrs.). CHD risk factors were more prominent in the older than the younger group of participants (females and males), indicating an increase in CHD risk from the pre-clinical to post-clinical horizon status (≤ 45 and > 45 yrs.). The individual CHD risk factors also showed a correlation with one another, indicating that the presence of one risk factor can aggravate the development of another risk factor (clustering of CHD risk factors). The significant higher and positive correlation found

between PA level and CHDRI indicated that a decrease in PA level was associated with multiple factor CHD risk. This underlines the salutogenic effect of PA in CHD risk factor clustering. Finally, the results highlight the value of PA in combatting CHD risk as no other medicine holds beneficial value for about 23 diseases including all CHD risk factors (Pratt et al., 2014).

Strengths and limitations

A limitation of this study is that PA and CHDRI was based on self-reported status and not assessed by more scientific procedures. This was part of the study design as more objective procedures were not suitable on this large cohort of participants.

Strengths of our study include the use of data of a large population in a financial corporate setting in South Africa, represented by employees in all the provinces of South Africa. The results of the study indicated the value of PA in combating the clustering of CHD risk factors.

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CHAPTER 5

THE EFFECT OF PSYCHO-SOCIAL HEALTH ON THE CORONARY HEART DISEASE RISK INDEX AMONGST EMPLOYEES IN A FINANCIAL INSTITUTION IN SOUTH AFRICA [ARTICLE 3]

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Short title: Psycho-social health and coronary heart disease risk factors index

**THE EFFECT OF PSYCHO-SOCIAL HEALTH ON THE CORONARY HEART
DISEASE RISK INDEX AMONGST EMPLOYEES IN A FINANCIAL INSTITUTION
IN SOUTH AFRICA**

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Abstract

Psycho-social risks (PSR) appear to be among numerous risks found in the workplace which cause a major concern and challenge to occupational health research. The purpose of this study was to describe the effect of psycho-social health on the coronary heart disease risk index (CHDRI) amongst employees in a financial institution of South Africa. A cross-sectional design was used, involving an availability sample of 956 employees, aged 20 - 60 years in one of the largest financial institutions in South Africa. Body weight (kg) and height (cm) were measured in accordance with standard procedures, and were used to calculate body mass index (BMI). The clinical measurements systolic blood pressure (SBP), diastolic blood pressure (DBP), total cholesterol concentration (TC) and blood glucose (Glu) were determined according to standard procedures. The CHDRI questionnaire comprises 14 identified coronary heart disease (CHD) risk factors (modifiable and non-modifiable) and were weighted according to the risk in order to calculate CHDRI and were stratified according to the following cut-points: ≤ 21 = low risk; 22 - 30 = moderate risk and ≥ 31 = high risk. Additionally, psychological ill health (psycho-social stress symptoms, stress-related physical ill health symptoms and burnout risk questionnaire) were used to determine the psycho-social risk status.

Results: The results show that 17% (Fig. 5.1) of the employees showed a high risk for CHD and that the risk increased in older employees (40.1%). Additionally, physical ill health and burnout risk appeared to be high, with female employees being mostly affected. Significantly high mean values ($\bar{x} = 6.50 \pm 2.51$; $\bar{x} = 5.15 \pm 2.59$) and a medium practical effect ($d = 0.52$; $d = 0.56$) for psycho-social as well as physical ill health was found in the CHDRI high-risk group compared to the low-risk group. When the ANOVA was calculated the results showed that in all three variables, statistical significant differences occurred between the groups (low- vs. high CHDRI) with psychological stress symptoms $F(2) = 16.060$, $p = 0.001$; physical stress symptoms $F(2) = 18.165$, $p = 0.001$ and burnout risk $F(2) = 3.735$, $p = 0.025$. A significant mean difference ($p \leq 0.05$) effect of psycho-social ill health in the low and high-CHDRI groups, with a medium practical significant effect size ($d = 0.53$) was found. Additionally, physical ill health showed significant mean difference ($p \leq 0.05$) effect on the low and high-CHDRI groups, with medium practical significance ($d = 0.57$). When comparing the burnout risk effect in the low and high-CHDRI group, a statistical significant difference ($p \leq 0.05$) with small practical significance ($d = 0.23$) was found.

Conclusion: It can be concluded that the presence of psycho-social ill health amongst employees in a financial institution of South Africa contributes to a high risk for CHDRI. In

view of the health implications of these findings for the total wellbeing of the employees, multiple-component interventions at work sites can potentially improve workers' CHDRI and psycho-social ill health.

Keywords: *Stress, depression, burnout, coronary heart disease risk, corporate environment.*

Introduction

Globally, the workplace has been found to be an important contributor to a multitude of illnesses (Giurgiu, Jeoffrion, Grasset, Dessomme, Moret, Rosquelaure, Caubet, Verger, Laraqui, Lombrail, Geraut & Tripodi, 2015) and the total wellbeing of individuals (Gershon, Stone, Zeltser, Faucett, Macdavit & Chou, 2007). Psycho-social risks (PSR) appear to be among numerous risks found in the workplace which cause a major public health concern and a challenge to occupational health research (Giurgiu et al., 2015). Psycho-social risks are reported as the centre of intricate architecture of the corporate work environment (Giurgiu et al., 2015). In this regard, Kinley, Lowry, Katz, Jacobi, Jassal and Sareen (2015) indicated that psychological disorders (e.g. stress, anxiety and depression) also contribute to coronary heart disease (CHD).

Coronary heart disease (CHD) remains a major threat to the health of individuals in most industrialized countries around the world, and it is projected to be the leading cause of mortality by 2030 (WHO, 2015). Various risk factors have been associated with this dreadful condition (Greenland, Knoll, Stamler, Neaton, Dyer, Garside & Wilson, 2003; Maredza, Hoffman & Tollman, 2011) varying from modifiable to non-modifiable risk factors (Bradshaw, Steyn, Levitt & Nojilana, 2011). A study in France (Eurofound, 2012) reported that workplace PSR factors contribute to the occurrence of health problems such as cardiovascular diseases, mental health disorders and muscular disorders. Hoeger, Turner and Hafer (2002) indicated that psychological disorders adversely affect various systems in the body (e.g. cardiovascular, respiratory, mentally, gastrointestinal) and can cause CHD mortality in inter alia three ways; heart rhythm disturbances, thrombus caused by unstable atherosclerotic plaque, and coronary artery spasm.

Employees in the corporate environment are under constant pressure to meet production targets (Batt & Colvin, 2011; Moretti & Postruznik, 2012). Continuous changes in customer expectations, legislation, work organization and competitiveness, require high levels of employee adaptability which may enhance psychological demands on a workforce (Schaufeli, & Bakker, 2004; Moretti & Postruznik, 2012). The process to adapt to a constantly changing environment places employees under enormous pressure, which is thought to be a contributory factor linked to psycho-social and physical ill health amongst employees (Illiceto, Pompili, Spencer-Thomas, Ferracuti, Erbuto, Lester, 2012; Wamala, Mittleman, Horsten, Schenck-Gustafsson & Orth-Gomer, 2000). Physical illness includes inter alia

metabolic disorders (obesity, insulin resistance, Type 2 diabetes), hypertension and dyslipidemia, already identified as CHD risk factors, while psycho-social illnesses include stress, anxiety, bipolar disorders and depression (De Hert, Cohen, Bobes, Cetkovich-Bakmas, Leucht, Ndeti, Newcomer, Uwakwe, Asai, Möller, Gautam, Detraux, & Correll, 2011; Melamed, Shirom, Toker, Berliner & Shapira, 2006). The condition of constant pressure on the employees can also result in exhaustion (lack of energy) and cynicism (a negative, indifferent overly detached attitude) both indicated as core components of psycho-social illness, associated with increased CHD risk (Schaufeli & Taris, 2005).

Coronary heart disease (CHD) risk factors (e.g. hypertension, high cholesterol, smoking, obesity, inactivity etc.) not only increase CHD risk, but can also be aggravated by psycho-social health risks (e.g. stress, burnout, depression) to increase CHD risk (Melamed et al., 2006; Prescott, Holst, Gronbaek, Schnohr, Jensen & Barefoot 2003; Schuitemaker, Dinant, van der Pol, Verhelst & Appels, 2004). The various pathways by which psycho-social ill health adversely affect CHD risk and co-morbidities (risk factors), showed a complicated and intertwined nature (Bailey, Hillman, Arent & Petitpas, 2013; Charmandari, Tsigpos & Chrousos, 2005). Charmandari et al. (2005) indicated that high levels of stress may disrupt hormonal regulation, leading to insulin resistance and type 2 diabetes, hypertension, dyslipidemia and obesity, all identified risks for CHD. It may further lead to imbalances in sympathetic and parasympathetic activity (which exaggerate heart rate and blood pressure) as well as the alteration of the neuro-endocrine axes (increased cortisol) and activation of inflammatory systems (elevated cytokine levels) (Bailey et al., 2013). Furthermore, chronic enhanced levels of stress may also lead to a destructive lifestyle behaviour e.g. smoking, substance abuse, and overeating (obesity) (Crackel, 2004; Lett, Blumenthal, Babyak, Sherwood, Strauman, Robins & Newman, 2004; Moretti & Postruznik, 2012) while psycho-social ill health (burnout) was found to be associated with a 3.1% and 3.4% increased risk for CHD in males and females respectively (Hallman, Burell, Setterlind, Oden & Lisspers, 2001).

The financial corporate environment is an industry that projects one of the highest burdens of stress on their employees (Moretti & Postruznic, 2012; Schaufeli & Van Dijk, 2014). In this regard employers and employees worldwide are facing escalating challenges because of ongoing economic crises, an increasingly fast-paced business environment, growing demands to improve productivity and a global rise in chronic diseases (Kirsten & Karch, 2012), including poor psycho-social health. Burton, McCalister, Chen, and Edington (2005) reported that

employees with 3 to 4 CHD risks (moderate risk) had 6.2% more productivity loss than low-risk employees (0 to 2 CHD risks) and that high-risk employees (≥ 5 health risks) had 12.2% more productivity loss than low-risk employees, while each additional risk factor can be associated with a productivity loss of 2.4%. Further to this, Boles, Thoendel and Singh (2004) showed that the mean percentage of presenteeism increased for each level of cumulative health-risk factor, ranging from 1.3% presenteeism for individuals with 0 health risk factors to 25.9% presenteeism for individuals with 8 health risk factors. The European Commission (2007) indicated that on average approximately 35% of workers feel that their job demands place their health at risk. Additionally, Leka and Cox (2008) reported that over 40 million people in the EU are suffering from the consequences of work-related stress, which translates to over €20 billion of health and absenteeism costs. Based on the cost associated with work-related illness, Giurgiu et al. (2015) stated that there is an economic and social importance of addressing the issues of work-related psychological risks. It therefore can be in the best interest of both the employer and employee to implement strategies to reduce CHD risks as well as psycho-social health risks as the one can aggravate the other.

Little information exists in South Africa on the contribution of psycho-social health to CHD risk amongst employees in the financial corporate environment. The purpose of this study therefore was to describe the effect of psycho-social health to CHD risk amongst employees in a financial corporate institution of South Africa. Information on this may assist health care professionals to implement intervention strategies, not only to enhance the health and wellbeing of employees but also to benefit employers aiming at improving productivity and lower health care costs.

Methodology

Study design

The study made use of a cross-sectional design involving an availability sample of employees in one of the largest financial institutions in South Africa.

Participants

Employees of a South African corporate financial setting were invited to participate in this on-site health screening. Participants came from 7 head office settings and 628 branches country wide. A total number of 956 employees (females = 600 (63%) and males = 356 (37%)), aged 20 - 60 years were assessed.

Procedure

Participants were assessed by biokineticists registered as independent practitioners at the Health Professions Council of South Africa (HPCSA), following an induction course by the company's chief biokineticist to ensure reliability.

Stature was measured to the nearest 0.5 cm, barefoot, using a portable stadiometer with the head in the Frankfurt position (Stewart, Marfell-Jones, Olds & De Ridder, 2011).

Body mass was assessed on an electronic scale to the nearest 0.5kg, with participants wearing minimal clothing without shoes. The electric scale and stadiometer were regularly calibrated. Body mass index (BMI) was calculated by body mass (kg), divided by stature squared (m^{-2}), as suggested by the ACSM (2014).

Resting blood pressure (systolic and diastolic) was determined by means of an aneroid sphygmomanometer and stethoscope according to the protocol described by the ACSM (2014).

Random (non-fasting) *total cholesterol* (TC) - and *glucose concentration* (Glu) were determined by using a blood specimen from a finger prick. The protocol suggested by the ACSM (2014) was followed. The Accutrend blood analyser (Roche, Switzerland) was used and regular calibration was applied in accordance with the guidelines of the manufacturer (Roche, Diagnostics, 2009).

The *coronary heart disease risk index* (CHDRI) was determined by using the questionnaire of Bjurström and Alexiou (1978), specifically developed to be used in corporate settings. The questionnaire comprises 14 identified CHD risk factors (modifiable and non-modifiable), weighted according to the risk in order to calculate the CHDRI. The actual clinical measurements (SBP, DBP, TC, Glu and body mass) were used in the CHDRI. In the stratification of low, moderate and high CHDRI, the following cut-points were used, e.g. ≤ 21 = low risk; 22 - 30 = moderate risk and ≥ 31 = high risk.

To assess the *psychological health status* participants were requested to complete the South African Employee Health and Wellness Survey (SAEHWS) (Rothmann & Rothmann, 2007). This questionnaire assessed the following constructs: *psychological ill health (psycho-social stress symptoms)*, where the participant had to indicate on a Likert scale ranging from, 1 = never to 4 = frequently, his or her experience on 13 aspects, e.g. "lack of appetite or overeating", "irritability", "mood swings" etc., over the past 3 months. *Stress-related*

physical ill health was also determined from a Likert scale indicating physical symptoms of 1 = never to 4 = frequently. *Burnout risk* was determined from the participant's experience over the last 3 months regarding 9 items with statements such as; "I feel tired before I arrive at work", using a Likert scale ranging from, 0 = never to 6 = always. Stratification for the abovementioned parameters were done according to the standardized norms of the SAEHWS (Rothmann & Rothmann, 2007), using the following cut-points: 0 - 3 low risk, 4 - 7 moderate risk and 8 - 10 high risk.

Statistical analyses

The statistical analyses of this study were performed using Statistical Package for the Social Sciences (SPSS, 2013) software. Descriptive statistics were calculated in the form of means and standard deviation according to the psycho-social ill health, physical ill health, and burnout for the CHDRI groups (low, moderate and high risk). Practical significance was also determined by using Cohen's effect size where $d \geq 0.2$ was considered a small effect, $d \geq 0.5$ and $d \geq 0.8$ represent a medium and large effect size respectively (Cohen, 1988). The one-way ANOVA was used to determine the contribution of psycho-social stress symptoms, physical stress symptoms and burnout risk on CHDRI (low, moderate and high risk). Statistical significance was set at a probability of $p \leq 0.05$.

Ethical considerations

This study was approved by the Strategic Human Resource Department of the company and all Biokineticists during the assessments conformed to the HPCSA ethical guidelines (HPCSA, 2016). All participants signed an informed consent form explaining all procedures and stating that the data obtained could be used for research, and confidentiality was assured before and after the measurements were conducted. In order to comply with the regulations of North-West University regarding a PhD study, ethical approval for this study was obtained from North-West University (Potchefstroom Campus) Human Research Ethics Committee (HREC: NWU-00109-12-A1).

Results

Figures 5.1 and 5.2 present the percentage scores for CHD risk for the total group by gender as well as age groups respectively. Of the 956 participants 17% are classified as high risk for CHD and the risk increases with ageing (≤ 45 :12%; > 45 :40%) (Fig. 5.1). Female employees were found to be fairly equally presenting with high CHD risk compared to their male counterparts (Fig. 5.2).

Figure 5.3 presents the psycho-social ill health, physical ill health and burnout risk for the total group. The results show a high percentage score (54%) of moderate risk for psycho-social ill health and a high percentage score (44%) of physical ill health followed by high risk for burnout (33%) amongst all employees (Fig. 5.3), with male employees being more affected than female employees with regard to psycho-social ill health, especially at an older age (Fig. 5.4). For physical ill health, female employees showed a high percentage score (48%) for being at high risk compared to males (38%) (Fig. 5.4). For burnout, female employees presented with higher percentage scores for being at high risk than their male counterparts across the age groups.

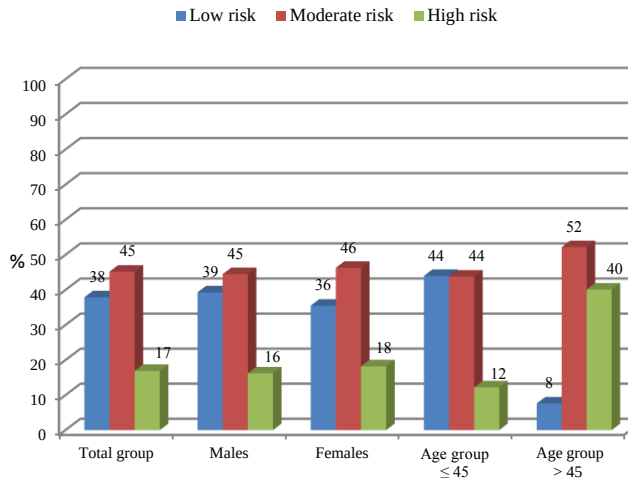


Figure 5.1 Percentage (%) score for coronary heart disease risk index (CHDRI) for the total group, gender and age groups

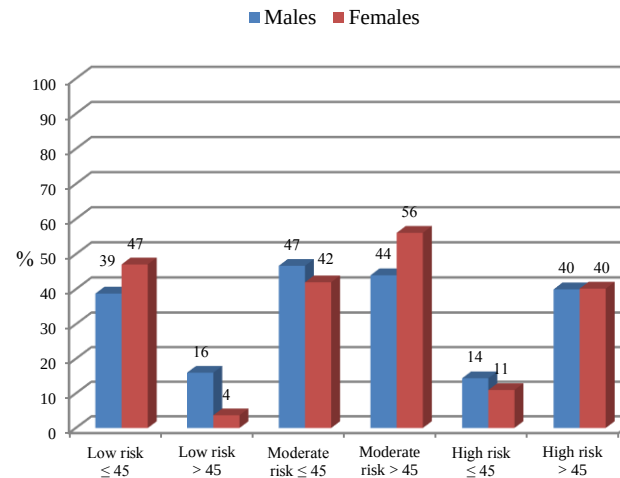


Figure 5.2 Percentage (%) score for coronary heart disease risk index (CHDRI) for males and females by age groups

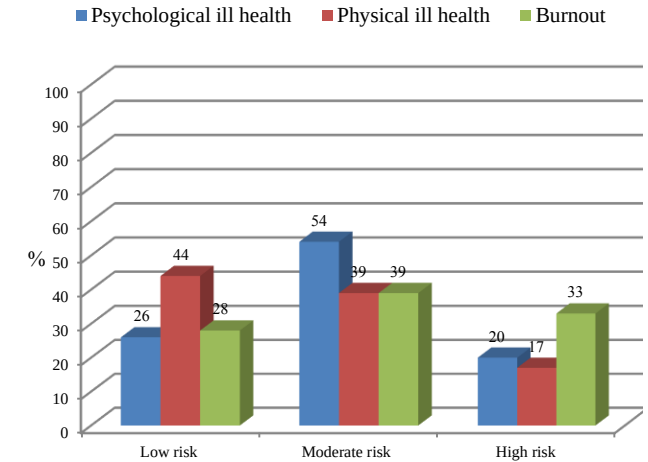
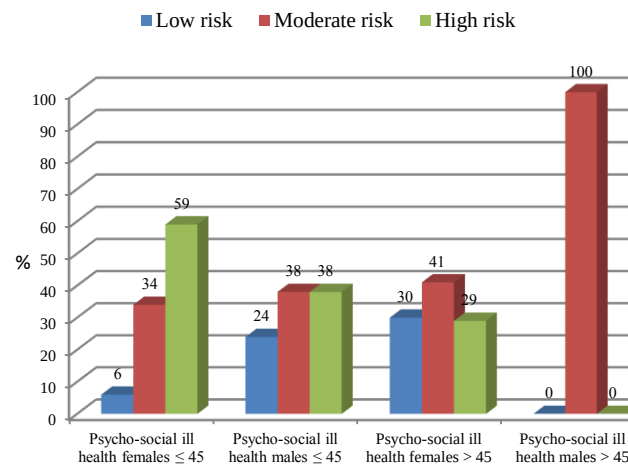
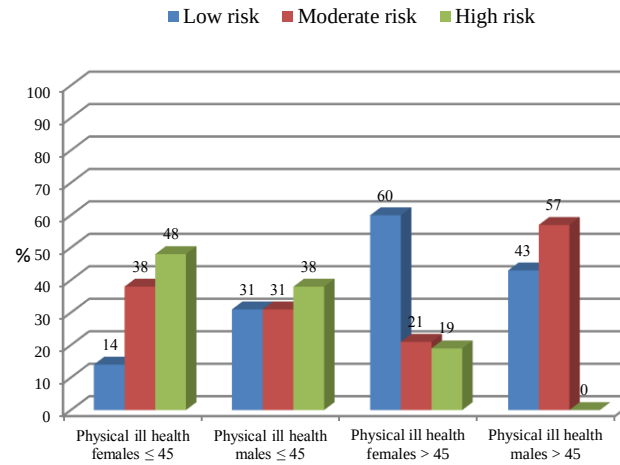


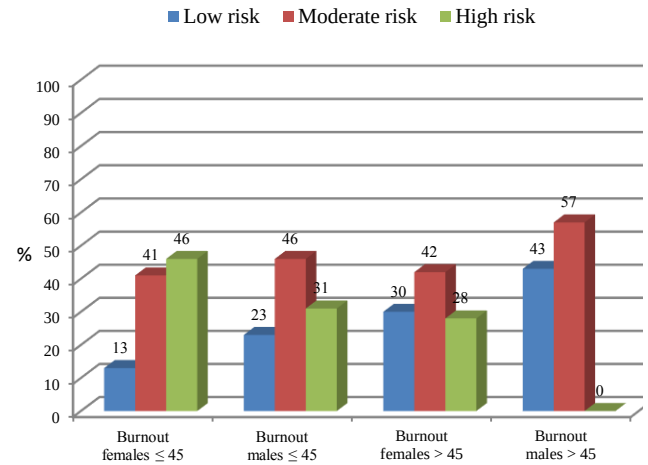
Figure 5.3 Percentage (%) score for psychological ill health, physical ill health and burnout for the total group



a). Psycho-social ill health



b). Physical ill health



c). Burnout

Figure 5.4 Percentage (%) score for psycho-social health status of stress (a), physical ill health (b) and burnout (c) according to age groups in relation to CHDRI

Table 5.1 The descriptive results and number of participants per dependent variable and coronary heart disease risk index (CHDRI) group

Dependant Variable	CHDRI Group	N	Mean	Std. Deviation	ES
Psychological ill health	Low risk	363	5.15	2.59	0.52
	Moderate risk	434	5.80	2.60	
	High risk	159	6.50	2.51	
	Total	956	5.67	2.62	
Physical ill health	Low risk	363	4.00	2.47	0.56
	Moderate risk	434	4.60	2.56	
	High risk	159	5.43	2.57	
	Total	956	4.51	2.58	
Burnout risk	Low risk	362	5.44	2.87	0.23
	Moderate risk	433	5.88	2.86	
	High risk	159	6.09	2.90	
	Total	954	5.75	2.88	
Effect size (ES) is calculated between low and high CHDRI.					
Psychological ill health, Cohen $d = 0.52$ Physical ill health, Cohen $d = 0.56$ Burnout risk, Cohen $d = 0.23$					

Table 5.1 presents the descriptive characteristics of the participants. In terms of the psychological ill health effect on CHDRI, the results show a high mean value ($\bar{x} = 6.50 \pm 2.51$) for the high-risk- compared to the low-risk group ($\bar{x} = 5.15 \pm 2.59$) with medium effect size ($d = 0.52$). For the effect of physical ill health on CHDRI, a high-risk mean value ($\bar{x} = 5.43 \pm 2.57$) was found while a lower mean value ($\bar{x} = 4.00 \pm 2.47$) was found for the low-risk group, with medium effect size ($d = 0.56$).

Table 5.2 The ANOVA results of participants per dependent variable and coronary heart disease risk index (CHDRI) group

Dependant Variable		Sum of Squares	df	Mean Square	F	Sig.(P)
Psychological ill health	Between Groups	214.350	2	107.175	16.060	.001
	Within Groups	6359.872	953	6.674		
	Total	6574.222	955			
Physical ill health	Between Groups	233.146	2	116.573	18.165	.001
	Within Groups	6115.750	953	6.417		
	Total	6348.895	955			
Burnout	Between Groups	61.651	2	30.825	3.735	0.025*
	Within Groups	7848.974	951	8.253		
	Total	7910.625	953			
Brown – Forsythe* Statistical significance $p = \leq 0.05$						

In Table 5.2 the ANOVA results for the dependent variable are presented. In all three the variables, statistical significant differences occurred between the groups (low- vs. high CHD risk) with psychological stress symptoms, $F(2) = 16.06$, $p = 0.001$; physical stress symptoms, $F(2) = 18.165$, $p = 0.001$ and burnout risk, $F(2) = 3.735$, $p = 0.025$.

Table 5.3 Bonferroni results for multiple comparison table – dependent variable and coronary heart disease risk index (CHDRI) group

Dependent Variable	CHD Risk Group		Mean Difference (I-J)	Std. Error	Sig. (P)	Sig. (D)
Psychological ill health	Low risk	Moderate risk	0.648*	0.184	.001	0.25
		High risk	1.348*	0.246	.000	0.53
	Moderate risk	Low risk	0.648*	0.184	.001	0.25
		High risk	0.700*	0.239	.011	0.27
	High risk	Low risk	1.348*	0.246	.000	0.53
		Moderate risk	0.700*	0.239	.011	0.27
Physical ill health	Low risk	Moderate risk	0.606*	0.180	.002	0.24
		High risk	1.430*	0.241	.000	0.57
	Moderate risk	Low risk	0.606*	0.180	.002	0.24
		High risk	0.824*	0.235	.001	0.32
	High risk	Low risk	1.430*	0.241	.000	0.57
		Moderate risk	0.824*	0.235	.001	0.32
Burnout risk	Low risk	Moderate risk	0.445	0.205	.089	0.15
		High risk	0.655	0.273	.050	0.23
	Moderate risk	Low risk	0.445	0.205	.089	0.15
		High risk	0.210	0.266	1.000	0.07
	High risk	Low risk	0.655	0.273	.050	0.23
		Moderate risk	0.210	0.266	1.000	0.07
*. The mean difference is significant at the 0.05 level.						

In Table 5.3 the multiple comparison between the dependent variables and CHDRI are presented. The results show significant mean differences ($p \leq 0.05$) for the effect of psychological ill health on the low and high CHDRI, with medium practical significant effect size ($d = 0.53$). Additionally, physical ill health shows significant mean difference effect ($p \leq 0.05$) on the low and high CHDRI, with medium practical significant effect size ($d = 0.57$).

When comparing the burnout risk effect on the low and high CHDRI risk group, a statistically significant difference ($p = 0.05$) though with small practical significance ($d = 0.23$) was found.

Discussion

The purpose of this study was to describe the effect of psycho-social health on CHDI amongst employees in a financial institution of South Africa. The results show that employees who presented with both psychological and physical ill health are significantly at higher risk of CHD than their counterparts. The current findings confirm what previously has been reported about the effect of psycho-social factors on the aetiology and progression of CHD (Diene, Fouquet & Esquirol, 2012). Research by Belkic, Landsbergis, Schnall and Baker (2004) as well as Kopp and Rethelyi (2004) also indicated that chronic stress was associated with increased risk of CHD. Melamed et al. (2006) similarly reported that prolonged exposure to work-related stress was associated with psycho-social ill health (emotional exhaustion, physical fatigue and cognitive weariness). A study on the association between adverse psycho-social characteristics at work and risk of CHD among males and females with low job control, reported a higher risk of newly reported CHD during follow-up (Khayyam-Nekouei, Neshatdoost, Yousefy, Sadeghi & Manshaee, 2013).

Psychological and physical ill health among employees in a financial institution contributed to higher risk for CHD (e.g. SBP, DBP, TC, Glu and body mass). Similarly, Ekpenyong and Davies (2016) reported that high social demand conferred 2.50, 4.01, 2.64 and 2.81 odds for hypertension, smoking, alcohol intake, and diabetes mellitus, respectively in obese participants. These findings are supported by the theory that a multiple psycho-social disadvantaged stage is harmful to health (Karaek, Brisson, Kawakami, Houtman, Bongers & Amick, 1998).

Various studies have revealed that the South African employee is prone to multiple CHD risk factors including; psycho-social ill health (stress, depression and burnout) (Labuschagne, Strydom & Wilders, 2011) and it seems that it is still on the increase globally (Moretti & Postruznik, 2012; Schaufeli, Salanova, González-Roma & Bakker, 2002). Raleigh (2015) indicated that employee stress, anxiety and depression increased at an alarming rate (56%) from 2012 - 2014 in various parts of the world. The number of cases dealing with employee

anxiety and stress increased by 74% and 28% respectively over the period 2012 - 2014. Furthermore, combined employee depression, stress and anxiety accounted for 55.2% of all emotional health cases in 2012 compared to 82.6% in 2014 (Raleigh, 2015). These perturbing results warrant prompt response to implement strategic interventions to enhance the psycho-social and physical ill health risk amongst employees around the globe. This concern therefore is supported by the increased calls to move beyond a single risk factor approach and focus on the co-existence of CHD risk factors (Kouvonen, Kivimaki, Virtanen, Pentti & Vahtera, 2005; Ekpenyong & Davies 2016).

Conclusion

It can be concluded that the presence of psycho-social ill health amongst employees in a financial institution in South Africa contributes to a high risk for CHD. In view of the health implication of these findings for the total wellbeing of employees, multiple-component intervention at work sites to improve workers' CHD and psychological health is urgently needed.

Strengths and limitations

To our knowledge this is the first study to uncover the contribution of psycho-social health status on CHDRI in a South African financial setting.

A limitation to the study is that physical activity (PA) level was reported in the CHDRI and not objectively measured (PWC or other physical capacity tests). However, this was part of the design of the study in order to record the PA level (and other CHD risk factors) in a widely spread workforce in order to support the employee wellbeing program of the company.

Furthermore, this study made use of a cross-sectional design and is descriptive in nature. To investigate causality, a longitudinal design is suggested for future research, i.e. follow-up over time.

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CHAPTER 6

**SUMMARY, CONCLUSIONS, LIMITATIONS,
RECOMMENDATIONS AND FURTHER RESEARCH**

6.1 SUMMARY

Non-communicable diseases (NCDs) have evolved over the last decade as a significant threat to global health. This collective name for a constellation of chronic diseases also described as “chronic disease of lifestyle” (CDL) is identified by the four main contributors, namely cardiovascular diseases, chronic respiratory diseases, cancers and diabetes mellitus. It is further resolved that the key risk factors, which were all modifiable, are tobacco use, physical inactivity, alcohol abuse and unhealthy diet. These diseases which are long in duration but slow in progress often start at an early age, as it is indicated that about 70% of all premature deaths in adults resulted from behaviors which started during adolescence. This threat also challenges the corporate environment as it is estimated that 63% of all deaths worldwide are attributable to NCDs while 50% of people who died were in the prime of their productive years. This led the World Economic Forum to conclude that over the next 2 decades employee ill health will significantly impact on productivity.

Chapter 1 provided the outline of the problem statement of this study and indicated that physical inactivity is identified as a primary but modifiable risk factor for coronary heart disease (CHD). The intertwinement of this risk factor with other co-morbidities (risk factors) for CHD was also analyzed with a further discussion of the salutogenic impact of PA as a prophylactic as well as therapeutic modality. The prevalence of CHD risk factors in the corporate environment, abroad as well as in South Africa, has already reached perturbing figures, suggesting that corporate institutions should implement timely interventions. Research data in South Africa on employee health is not readily available, and those which existed are merely based on a once-off cross sectional design. Data covering a considerable time span do not exist, leaving a “knowledge gap” in this regard. This was the motivation for this study to determine the risk profile over 7 years. The objectives of this study that were set out in Chapter 1 were to determine the prevalence of CHD risk factors over time (2007 - 2013) amongst employees in a financial institution of South Africa, as well as the relationship between PA status and selected CHD risk factors (BMI, hypertension, smoking, elevated total cholesterol and glucose levels), with the last objective to analyze the effect of psycho-social parameters (stress, burnout and depression) on the CHD risk index status among the employees. Furthermore, research hypotheses were formulated for the corresponding research objectives.

Chapter 2 reviewed related literature concerning the issues raised in the proposal and the relevant literature regarding non-communicable diseases in the corporate environment. It was indicated that CHD risk factors not only impact negatively on the company's productivity and output, but also on employee health and wellness, leading to increased health-care costs. It further stresses that the prevalence of CHD risk factors has already reached perturbing figures in South Africa and that most of the major physical and psychological risk factors can be modified by intervention strategies. From the literature review it also became clear that lack of knowledge of physical together with psycho-social risk factors appear to be most relevant among employees in the corporate environment. The salutogenic impact of PA in virtually all mentioned risk factors suggested it as a possible intervention modality, which is further explained in the literature review. Relevant information is explained and used in the respective articles discussing the data of this study. The thesis is submitted in article format, as approved by the Senate of North-West University, and therefore consists of three articles (Chapters 3, 4 and 5), which will be submitted for publication in peer-reviewed, accredited journals.

In Chapter 3 (Article 1) the prevalence of CHD risk factors amongst employees in a financial institution was analyzed over time. This article will be submitted to *Ergonomics: SA* for publication. From the results it became clear that even for the young population (≤ 45 yrs.) some risk factors (average over time) already fall within a moderate risk category, with enhanced trend towards the older employees (> 45 yrs.). It is also clear that the risk status over time is not static but varies among the different groups. Results further revealed that for the younger females the higher risk clustering (67%) happened to be in the low-risk cluster (0 – 2 risks), while 31% and 2% of the average population at risk (PAR) occurred in the moderate and high risk-clusters respectively. In the older females (> 45 yrs.) the prevalence of the PAR were 43%, 50% and 7% in the three clusters, namely low, moderate, and high risk. In the case of the males a similar tendency occurred e.g. and increase in the prevalence of the moderate and high-risk clusters with a higher prevalence (9%) in the high-risk cluster (PAR) compared to that of the females (7%) in the corresponding cluster. Chapter 4 deals with the relationship between PA and the selected CHD risk factors. In the case of females (> 45 yrs.) a small practical significant difference occurred between the low and high PA groups. For all the other parameters except CHDRI, the differences between the various PA groups (low vs. moderate, low vs. high and moderate vs. high) showed small but non-practical significant differences for all groups. In the case of CHDRI, high practical

significant differences occur between low vs. high PA levels in the female as well as male age groups ($F \leq 45$; $d = 1.31$; $F > 45$; $d = 1.2$; $M \leq 45$; $d = 1.28$; $M > 45$; $d = 1.23$). High practical significant differences also occur between the low and moderate PA levels in all groups, while moderate practical significant differences occurred between moderate and high PA levels in all the groups. For the females in both age groups significant correlations occurred between PA and CHDRI, with the same tendency in the male groups. In Chapter 5 the effect of psycho-social parameters, namely stress depression and burnout on CHD risk factor index was analyzed. In this assessment employees were asked to indicate which stress-related psychological and physical ill health symptoms they experienced over a period of 3 months. This assessment scale was preferred as individuals may have various levels of tolerance against stress. The results resolved that the psycho-social health parameters (psycho-social ill health, physical ill health and burnout) contributed significantly to the CHDRI with statistical significant differences (ANOVA) in all three psycho-social dependent variables between the low vs. high CHDRI groups with psycho-social ill health $F(2) = 16.06$, $p = 0.001$, physical-ill health, $F(2) = 18.165$, $p = 0.001$ and burnout $F(2) = 3.75$, $p = 0.025$. Female employees showed a higher percentage score (48%) for being at high risk of physical ill health, compared to males (38%) and also presented with higher percentage scores of being at high risk for burnout than their male counterparts across the age groups. These perturbing results warrant prompt response to implement strategic interventions to enhance the psycho-social and physical ill health risk status amongst employees around the globe.

6.2 CONCLUSIONS

The conclusions drawn from this thesis are presented in accordance with the hypotheses reported in Chapter 1.

6.2.1 Hypothesis -1 (Chapter 3 - Article 1). A variation in the prevalence of selected coronary heart disease risk factors over time will occur amongst employees in a financial institution in South Africa.

From the results presented, it seems that the intra-group means of each risk factor changes over time in the younger as well as the older group (males and females). When comparing the inter-group average of the risk factor mean value for males it seems that an increase occurs (≤ 45 vs. > 45 yrs.) BMI = 26.1 vs. 28.45; SBP 123.53 vs. 130.04; DBP = 79.70 vs. 84.25 etc. However, for the risk factors physical inactivity, smoking, psycho-social and physical ill

health symptoms as well as for burnout, the older group showed lower average values. In the case of females, the older group (> 45 yrs.) showed increased average mean values for BMI; 29.36 vs. 27.58; SBP; 125.9 vs. 116.19; DBP; 80.87 vs. 75.55; TC; 4.46 vs. 5.06, Gluc 5.16 vs. 5.74; smoking 1.76 vs. 1.48, compared to the younger group. Physical ill health and burnout was lower in the older group (> 45 yrs.). Hypothesis 1 is therefore accepted.

6.2.2 Hypothesis 2 (Chapter 4 - Article 2): A significant positive relationship between physical activity and selected CHD risk factors (BMI, hypertension, smoking, casual total cholesterol, blood glucose and CHDRI) will be found amongst employees in a financial institution in South Africa.

From the results presented it is clear that practical significant differences occurred only in the CHDRI (all groups) and BMI (F > 45 yrs.) between the various PA levels. Significant positive correlations presented only between PA and CHDRI for the female group. In males PA also showed only significant correlations with CHDRI in both groups. Hypothesis 2 is therefore partially accepted.

6.2.3 Hypothesis 3 (Chapter 5 - Article 3): A significant effect of psycho-social health parameters (stress, depression and burnout) will be found with coronary heart disease risk index amongst employees in a financial institution in South Africa.

From the results presented it is clear that the psycho-social health parameters (psycho-social ill health, physical ill health and burnout) contributed significantly to the CHDRI with statistical significant differences in all three psycho-social dependent variables between the low vs. high CHDRI groups (psycho-social ill health $F(2) = 16.06, p = 0.001$, physical ill health, $F(2) = 18.165, p = 0.001$ and burnout $F(2) = 3.75, p = 0.025$. Hence hypothesis 3 is therefore accepted.

6.3 LIMITATIONS

The most glaring limitation of this study probably was the self-reported PA status of the employees. An objective assessment of PA or physical fitness status would probably indicate a more reliable stratification of this risk factor as well as its association with the other co-morbidities. However, due to the magnitude of this study it was not possible as a result of time constraints and other technical limitations. However, the data collected in this study

gives a unique indication of the prevalence of CHD risk factors over time, which supplies corporate management with important data for implementing intervention strategies.

6.4 RECOMMENDATIONS AND FURTHER RESEARCH

The high prevalence of some CHD risk factors, namely physical inactivity, overweight/obesity and psycho-social parameters (stress, depression and burnout) amongst employees warrants prompt reaction from corporate management to implement structured intervention strategies. These interventions should not only target employees in the high-risk stratum but also those in the low-risk, in order to prevent them from migrating to higher risk levels. Intervention strategies should also include a change in the employees' attitudes and behaviors in order to convince and empower them to take responsibility for their own health and wellness. Further research should be directed towards the impact of intervention strategies on employee wellness, together with the return on investment in employee wellness. A longitudinal analysis of this data basis should also be considered in order to gain information in this respect.

Appendices

APPENDIX A: GUIDELINES FOR AUTHORS

(a). THE AFRICAN JOURNAL FOR PHYSICAL ACTIVITY AND HEALTH SCIENCES (AJPHEs)

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The African Journal for Physical Activity and Health Sciences (AJPHEs) is a peer-reviewed journal established to:

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accessible to make any text corrections. Photographs must be presented in *jpg* format. Original manuscripts must contain the following sections in the following sequence: Title page, Abstract, Introduction, Purpose of Research, Methodology, Results, Discussion, Practical application, Conclusions, Acknowledgements (if applicable) and References.

Title page

The first page of each manuscript should indicate the *title* in English and Afrikaans (will be translated for foreign authors), the *names* (title, first name in full and other initials, surname) of the author(s), the *telephone* numbers (work & home [& *mobile* for local authors]), *facsimile* number, *Email* address and the *field of study*. The **complete mailing address** and **telephone numbers** of the corresponding author and the institution (department, university, city, country) where the work was conducted should be provided in full. When more than one author and/or authors from various departments and institutions are involved, the **1author(s)** must be numbered according to their **1department(s)**. If any of the above-mentioned information should change during the review process, please inform the Subject Editor. A **short title** of not more than **45 characters** (including spaces), should be provided for use as a running heading.

Abstract

Each manuscript must be accompanied by an abstract of approximately 150-200 words in *English* and should be set on a *separate page* as a SINGLE paragraph (1.5 spacing). A list of three to seven **key words** in *English* is required for indexing purposes and they should be typed below the abstract. Articles in Afrikaans must include an **additional** extended **summary** (500-1000 words) in *English*. This summary must start on a new page (just before the reference list) and the *English* title of the article should be placed at the beginning.

Text

Start the text on a new page with the title of the article (centred and *without* the names of the authors). Follow the style of the most recent issue of the Journal regarding the use of headings and subheadings. Use only **one-line space** after a paragraph. Only make use of **section breaks** and not **page breaks**. The text, as well as the tables and figures, may not be in any other format than **normal**. Thus, **no style sheets** may be used.

Tables and figures

Tables and figures should be numbered in *Arabic* numerals (1, 2, etc.). Tables require the heading at the *top*, while figures have the legend *below* and both are not included in the cells of the table/figure. **Note:** Use the decimal POINT (not the decimal comma). The site where the table or figure should be placed in the text must be indicated clearly in the manuscript. All tables and figures are to be placed *after the reference list* with each on a **separate page**, always ending with a **section break**. Any preference for the use of *colour* in the case of figures or photographs must be noted and will be at an *additional cost* to the page fee. It is essential that tables/figures should be contained/fit within the page setup described earlier for this Journal. Portrait layout must be maintained for all tables/figures. Tables must use separate rows/columns (do not merge cells) for each item. Figures must be in **Word** and accessible to make corrections or changes within the figure where deemed necessary. Please ensure that the **figures** especially are of **high quality** for printing purposes.

References

In the *text*, the Harvard method must be adopted by providing the author's surname and the date placed in parentheses. *For example:* Daly (1970); King and Loathes (1985); (Botha & Sonn, 2002); McGuines *et al.* (1986) or (Daly, 1970:80) where Daly is not part of the sentence and page number is added for a direct quotation. More than one reference must be arranged **chronologically** (Daly, 1970; King & Loathes, 1985). Note that *et al.* (italics) is used in the body of the text from the beginning when there are **more than two authors**, but never in the list of references, where all authors must be provided.

List of references

Only the references cited in the text should be listed alphabetically according to surname (last name) of authors (**UPPERCASE**) after the body of text under the heading, **REFERENCES** (uppercase) starting on a new page. In the case where the TITLE of an article, book, etc., is in any other language than English, the author must also provide an **English translation** of the title in parentheses (this applies to Afrikaans titles as well). In the case of articles published in **JOURNALS**, references listed should include the surnames and initials (upper case) of **all** authors, the date of the publication in parentheses, the full title of the article, the full title of the journal (italics), the volume number, the series/issue number in parentheses (omitted **only** if the said journal does not use issue numbers), followed by a colon and a space with the first and last page numbers separated by a hyphen. The use of the correct punctuation is of

importance. If the reference is a **BOOK**, the surname (last name, upper case) and initials (without spaces) of the author or editor (Ed.) must be provided, followed by the date of publication in parentheses, the title of the book (italics) as given on the title page, the number of the edition (ed.) in parentheses, the city (and abbreviation for the state in the case of the USA OR the country) where published, followed by a colon, a space and the name of the publisher. For a **CHAPTER** in a book, the page numbers of the chapter cited must be provided in parentheses (not italics) after the title of the book. For further details, authors should consult the most recent publication of this Journal for other examples. If the reference is a **THESIS** (Master's level) or **DISSERTATION** (doctoral level), italics is **not** used in the title as it is an unpublished work. Provide the name of the city, state/country, colon, university and department/faculty. For **ELECTRONIC SOURCES**, all references start with the same information that would be provided for a printed source (if available). The web page information follows the reference. It will usually contain the name of the author(s) (if known), year of publication or last revision, title of complete work in inverted commas, title of web page in italics, Uniform Resource Locator (URL) or access path in text brackets (do not end the path statement with a full stop), full stop after the closing bracket and date of access, "Retrieved on 10 December 2015". See "How to cite information from the Internet and the Worldwide Web" at [<http://www.apa.org/journals/webref.html>] for specific examples. When citing a web site in the text, merely give the author and date. When reference is made to a specific statement (quotation) in the article/document and no page number is given, the word 'online' is used for citing in the text (e.g. Van der Merwe, 2010:online). When referencing an article in a **NEWSPAPER**, the key word of the newspaper is typed in capitals, as this is how it will appear in the **alphabetical listing** of references, namely *The CAPE ARGUS* will appear under "C" or *Die BURGER* will appear under "B". In the case of a paper presented in conference **PROCEEDINGS**, the editors and the title of the proceedings, the page numbers of the article being referred to and the details of the congress (when and where it was held) and by whom the proceedings was published should be provided.

EXAMPLES OF STYLE OF FORMULATIONS FOR DIFFERENT REFERENCES

Journal

ZHENG, N.; BARRENTINE, S.W.; FLEISIG, G.S. & ANDREWS, J.R. (2008). Kinematic analysis of swing in pro and amateur golfer. *International Journal of Sports Medicine*, 29(6): 487-493.

Book

WEINBERG, R.S. & GOULD, D. (2011). *Foundations of sport and exercise psychology* (5th ed.). Champaign, IL: Human Kinetics.

Chapter in book

SCHNECK, C.M. (2010). Visual perception. In J. Case-Smith & J.C. O'Brian (Eds.), *Occupational therapy for children* (6th ed.) (pp.373-403). Maryland Heights, MO: Mosby.

Thesis/Dissertation

SURUJLAL, J. (2004). Human resources management of professional sports coaches in South Africa. Unpublished doctoral dissertation. Johannesburg, South Africa: University of Johannesburg.

Proceedings of a conference

HARDMAN, K. & MARSHALL, J. (2001). Worldwide survey on the state and status of physical education in schools. In G. Doll-Tepner & D. Scoretz (Eds.), *World summit on physical education* (pp.15-37). Proceedings of the "World Summit on Physical Education", 3-5 November 1999. Berlin, Germany: International Council of Sport Science and Physical Education (ICSSPE).

Personal communication/correspondence/interview

BOUKES, P.B. (2015). Personal communication from the Acting Director of Sport at the Nelson Mandela Metropolitan University, Port Elizabeth on 27 February 2015. JACOBS, L. (2015). Personal interview with the Spokesperson of UNICEF, 25 August, Pretoria.

Newspaper

CAPE ARGUS, *The* (1997). 25 March, p.5.

Electronic source

DINOFFER, J. (2011). "Activities to build balance". *Prevent child obesity 101*. Hyperlink: [<http://www.preventchildobesity101.com/Activities/BalanceActivities.php>]. Retrieved on 20 November 2012.

ADMINISTRATION

If authors honour the rules and specifications for the submission of manuscripts, unnecessary delays would be avoided. Requesting „copy right“ concerning figures or photographs is the responsibility of the authors and should be indicated. A manuscript that does not meet the requirements, as set out above; will be returned to the author without being evaluated. An expert Subject Editor administers and coordinates the assessment of the referees and provides the final recommendation. The corresponding author will receive a complimentary copy of the Journal and five reprints of the article that could be shared with the co-authors. The original manuscripts and illustrations will be discarded one month after publication unless a request is received to return the original to the corresponding author. A page fee of South African **R300** per page is payable on receipt of a statement issued by the Editor.

(c). ERGONOMICS SA: PUBLISHING REQUIREMENTS AND SUBMISSION

GUIDELINES

(Title of the paper (Times New Roman 16 bold, centered))

Author(s) name

Author(s) name

Affiliation

Affiliation

Address

Address

Email

Email

Abstract_Heading (14pt, bold, align left)

Abstract_body (Times New Roman 12, justified, 1st line indented by 0.5cm) These guidelines show how a paper for the journal, Ergonomics SA should look. This is a template file. The abstract title should be Times New Roman, 14 point, bold font and left justified. The abstract body should be indented by 0.5cm on the first line, and should be in Times New Roman, 12 point and fully justified. The abstract should be 150-200 words (do not exceed 200 words). Do not number the abstract title. The text throughout the paper should be in single spacing.

Keywords: The title of the keywords should be Times New Roman 12 point, italics font, left justified only. The keywords themselves should be Times New Roman 12 point, left justified (only 5-6 keywords can be used).

Publishing requirements

Body text (Times New Roman 12) The paper limit should not exceed 3500 words for full papers and 1500 words for short papers. The word count does not include the title, abstract, references and any tables, figures, charts or diagrams. The editors may truncate any material over the word limits. Footnotes should not be used in the paper.

The level one title should be numbered, starting with “1” for the Introduction (or equivalent). The font should be Times New Roman 14 point, bold, fully justified. Insert a blank line before and after each heading. The headings should be numbered up to the Conclusion (or equivalent) with a period after the numeral.

The first letter of the heading should be a capital letter, thereafter, use small letters. Insert a blank line between headings and between paragraphs.

The title of the paper should be centred in 16 point, Times New Roman Font, with single spacing. The names of the authors should be in italics, 12 point Times New Roman and centered within the table cell. The addresses of the authors should be in normal, 12 point Times New Roman and centered within the table cell. Insert a blank line between the author name and author address. If you have more than two authors please insert another table row.

Page Set-up (level 2 heading)

The level two headings should be in Times New Roman font, 12 point, bold, left justified. Insert a blank line before heading but not after the heading. The level two headings should be numbered under the level 1 heading with a period after first numeral only.

Use A4 (210 x 297mm) paper size. Set all margins at 3cm (0.75"), Header and Footer 1.25cm. Single line spacing is a requirement; however, if equations are used, an additional line before and after the equation might be necessary for legibility. Figures and tables should be inserted in the appropriate place in the text. Save the paper as .DOC ready for submission. Use the author surname of the first author for saving the document name.

Format (level 2 heading)

Please begin your paper with the title (16 point font). For the title, please capitalise only the initial letter. Leave one blank line space between the title and the authors. If there are two authors with two different addresses, use two centered tabs.

Body Text

Text should also be fully justified across the full length of the printed area.

Heading 3

Body text (Times New Roman 12) if necessary, level 3 headings may be used. Section headings should be labeled numerically (i.e., 1., 2., etc.) as first level headings. Sub-section headings should be labeled 1.1, 1.2, etc. as second level headings. Third-level headings (12-point font, italic) should be labeled numerically (i.e., 1.1.1, etc.). The hanging indentation between the number and the text of the heading should be 0.5" (paragraph properties). It should not be necessary to use fourth level headings, instead use paragraph breaks.

Bulleted Lists

Bulleted lists should be in font size 12. The left indentation of the bullet should be 0.12cm (0,3"), while the hanging indentation between the bullet and the text should be 0.62cm (0,32") (paragraph properties). Place a blank line before and after the bulleted list. Please see the example below:

Title: Times New Roman, font size 16, bold

Name of author(s): Times New Roman, font size 12, italic

Affiliation, Address, Email: Times New Roman, font size 12

Abstract: Times New Roman, font size 12

Text: Times New Roman, font size 12

References: Times New Roman, font size 12

Tables & Figures

Tables and figures should be placed within the text where they belong and have good contrast.

Tables should have a title as heading that should appear above the table and should be numerically labeled consistently throughout the paper. Tables should not require legends. The table caption should be left justified and the table itself should be centered across the printed area. The caption should be in Times New Roman 12 point font and the table label and number should be in bold. Place a period after the number. The title is not bold.

Table 1. Summary of submission requirements and deadlines for ESSA 2007

		Deadline for	Papers
	Paper length	receipt of	available
		papers	online
Full Papers	3500 words	5 January 2007	15 February 2007
Short Papers	1500 words	5 January 2007	15 February 2007

Each table should be mentioned in the text. Tables should be separated from text by at least

one blank line space above the caption and below the table and should be placed in text as close to the reference as possible as Table 1 above shows. The font for the table should be 10-point font, Times New Roman. The column titles should be bold and centred within the cell. The row titles should be left justified within the cell. The table contents should all be centred within their respective cells. Only use horizontal lines for tables. Do not use vertical lines in the tables. Tables should not extend over more than one page. If necessary either move the table so that it fits neatly onto one page, or divide the table into two (or more) tables.

Figures should be separated from text by at least one blank line space above the figure and below the figure caption; again, numbered consistently throughout the paper. In figure captions, only the initial letter of the first word should be capitalized. All figures should be reduced to fit the normal print page size. Figures should preferably be integrated into the page but may also be sent as .jpg, .gif, .pct, or .tff formats indicating clearly where they should appear in the text and saved as the appropriate figure number. Digitized photographs should be postcard size (approx. 400 pixels wide and 300 pixels high) at around 72dpi, 256 colors.

Unless the figure is unusually large, it should occupy from 1/3 to 1/2 the size of the printed page. In submitting larger figures remember to make lettering and details large enough to be able to undergo successful reduction. Each figure should be mentioned in the text, and should be placed in text as close to the reference as possible, as below (Figure 1).

Figure 1. Title of figure

The figure caption should be 12 point Times New Roman Font. The caption label and number should be bold. The figure and caption should be left justified. Place a period after the number. Please note that figures appearing in the paper will look only as good as what you provide, therefore make sure the figures are easy to view and read. Make sure lettering and details are crisp, clear, and large enough so that they will be legible.

Equations

Equations should be numbered (with numerals in parentheses) sequentially throughout the text. When referring to numbered equations, do not abbreviate (e.g. Equation 1, not Eq. 1; the first equation).

Statistics

Statistical results are set off with commas rather than parentheses, and degrees of freedom are

included in parentheses after the statistic. Leave spaces before and after the “=” sign” and after commas. Do not use a zero in front of a decimal fraction when the number cannot be greater than 1. This includes proportions, correlations, alpha levels and other levels of statistical significance. For example: $F(2, 75) = 6.25, p < .5$. Percentages are designated by whole numbers only not fractions of percentages. Correlations and proportions should only be reported to two decimal places, as should inferential statistics. The chi-square should also include an N. or example:

$$X^2 (1, N = 43) = 8.76, p < .01.$$

Page Numbering, Headers and Footers

Please do not include page numbers, headers or footers in your manuscript. as they are already inserted in template.

Non-sexist Language

Guidelines for Non-Sexist Use of Language are available from the web site of the American Philosophical Association (APA):

<http://www.apa.udel.edu/apa/publications/texts/nonsexist.html>.

Terminology and Abbreviations

Wherever possible, try to avoid excessive use of jargon. Please also avoid the use of abbreviations except where they are widely known by your readership and are used repeatedly in your text.

References

All references (12-point font) that are cited in the text must appear in the reference list, except for personal communications. All entries that appear in the list of references must be cited in the text. Reference citations in text are necessary because they give credit to the original author. Both direct quotes and paraphrasing require reference citation. Some general rules to follow:

Authors' names:

Use only the initials of the authors' given names.

Full stops and spaces are used between initials.

Titles of works:

Use minimal capitalization for the titles of books, book chapters and journal articles.

In the titles of journals, magazines and newspapers, capital letters should be used as they appear normally

Use italics for the titles of books, journals, and newspapers.

Enclose titles of book chapters and journal articles in single quotation marks

Page numbering:

Books: page numbers are not usually needed in the reference list. If they are, include them as the final item of the citation, separated from the preceding one by a comma, and followed by a full stop.

Journal articles: page numbers appear as the final item of the citation, separated from the preceding one by a comma, and followed by a full stop.

Use the abbreviations p. for a single page, and pp. for a page range, e.g. pp.11-12.

Citing page numbers in text: Page numbers are essential if you are directly quoting someone else's words. Insert page numbers after the year, separated by a comma. When paraphrasing or summarising, page numbers may also be included. If a work being referred to is long, page numbers might be useful to the reader. In this case, include them in the in-text citation, separated from the year by a comma. Use the abbreviations p. for single page, and pp. for a page range, e.g. pp.11-12.

Whole citation:

The different details, or elements, of each citation are separated by commas.

The whole citation finishes with a full stop.

Other important points:

Arrange reference entries in alphabetical order by the surname of the first author. Single-author entries precede multiple-author entries beginning with the same surname. References with the same first author and different second and third authors are arranged alphabetically by the surname of the second author, and so on.

References with the same authors in the same order are arranged by year of publication, the earliest first. References by the same author (or by the same two or more authors in the same

order) with the same publication year are arranged alphabetically by title (excluding A or The) by adding a, b, c, etc., to the publication year. References by different authors with the same surname is arranged alphabetically by the first initial of the first author. Alphabetise corporate authors by the first significant word of the name. Only “Anonymous” works are alphabetized under Anonymous. Non-authored works are alphabetized by the first significant word of their title, as are legal works.

Examples of reference citations in text

Rajaratnam (2001) argues that, while the notion of biological time is of scientific importance, it is also economically and socially significant at a national level. He points to the health, productivity and social problems which may be attributed to individuals working 'out of phase' with their internal clocks.

Rajaratnam (2001, p. 1005) concludes that. ‘The cost to the nation’s health of working out of phase with our biological clocks is probably incalculable at present.’

Coronary Heart Disease (CHD) is prevalent in many countries, including South Africa (Poulter, 1999; Walker *et al.* 2001).

In the past decades vast research has been performed in order to analyse human characteristics and to develop the most appropriate tools and methods for analysis and application (e.g. Boff & Lincoln 1988; Wilson & Corlett 1995; Salvendy 2006).

Trunk motion data were collected using the LMM, which is essentially a tri-axial electrogoniometer that acts as an exoskeleton for the lumbar spine (Marras *et al.* 1992), which has been previously validated in several papers (Marras *et al.* 1993; Marras *et al.* 1995; Marras, Ferguson and Gupta, 1999).

Indeed the title of Garson’s (1988) book, ‘The electronic sweatshop: How computers are transforming the office of the future into the factory of the past’ is a most articulate expression of what many would see as the negation of the rich possibilities that technology can bring to the enhancement of work rather than its disintegration into the meaningless.

Table 2 below illustrates how one would reference in the text.

Table 2. Examples of reference citations in the text

Direct quote	(Bradley, 1998, p. 276) or Bradley (1998, p. 276)
Paraphrasing with one author	(Bradley, 1998)
Paraphrasing with two authors	(Bradley and Calhoun, 1998)
Paraphrasing with more than two authors	(Bradley et al., 1998)
Personal communication (e.g. via email, face-to-face conversation or telephone conversation)	W. R. Smith (personal communication, January 30, 1996) stated that ...

Examples of references

In the reference list, all references are left justified. Examples showing how one would reference different types of sources are given below.

Reference

Blainey, G., 2003b, *The rush that never ended: a history of Australian mining*, 5th edn. (Melbourne University Press). Scutt, J. A., 2003a, 'Future access - discrimination and the Disability Discrimination Act', *Access*, 5(3), 6-10.

Scutt, J. A., 2003b, 'Without precedent: sex/gender discrimination in the High Court', *Alternative Law Journal*, 28(2), 74-77.

Acknowledgements

The acknowledgements should be in the same format as a level 1 heading except that it is not numbered. The same thing applies to the references and an appendix (if you need one). The acknowledgements should appear between the last numbered part of the paper and the references. Any appendix should appear after the reference list.

Submission Guidelines

ERGONOMICS SA is a Biennial publication of the Ergonomics Society of South Africa aimed at promoting scholarly and professional interest in the domain of humans at work. Six categories of contribution are recognized: Research Papers; Review Articles; Methodological Reports; Case Studies and Observational Records; Research Notes/Updates; News and Views.

Authors should submit their full papers as an attachment via email to the journal email address, j.mcdougall@ru.ac.za. In the covering letter or email communication the author/s should state that the work is original and has not been submitted to another journal or scholarly publication and that it has not been published elsewhere.

All submitted papers should be sent in **.doc or .rtf formats**. No other formats will be accepted.

PLEASE PASTE YOUR ARTICLE HERE and then format it according to the instructions in this document.\

Thank you

APPENDIX B: LETTERS AND COMMUNICATION

(a). ETHICAL APPROVAL



Private Bag X6001, Potchefstroom
South Africa 2520

Tel: (018) 299-4900
Faks: (018) 299-4910
Web: <http://www.nwu.ac.za>

Ethics Committee
Tel: +27 18 299 4849
Email: Ethics@nwu.ac.za

ETHICS APPROVAL OF PROJECT

The North-West University Research Ethics Regulatory Committee (NWU-RERC) hereby approves your project as indicated below. This implies that the NWU-RERC grants its permission that provided the special conditions specified below are met and pending any other authorisation that may be necessary, the project may be initiated, using the ethics number below.

Project title: WAH-project (Activities for Health)																
Project Leader: Prof. Wilders																
Ethics number:	<table border="1"><tr><td>N</td><td>W</td><td>U</td><td>-</td><td>0</td><td>0</td><td>1</td><td>0</td><td>8</td><td>-</td><td>1</td><td>2</td><td>-</td><td>A</td><td>1</td></tr></table>	N	W	U	-	0	0	1	0	8	-	1	2	-	A	1
N	W	U	-	0	0	1	0	8	-	1	2	-	A	1		
Status: S = Submission; R = Re-Submission; P = Provisional Authorisation; A = Authorisation																
Approval date: 2013-05-10							Expiry date: 2018-05-09									

Special conditions of the approval (if any): None

General conditions: While this ethics approval is subject to all declarations, undertakings and agreements incorporated and signed in the application form, please note the following: • The project leader (principal investigator) must report in the prescribed format to the NWU-RERC: - annually (or as otherwise requested) on the progress of the project, - without any delay in case of any adverse event (or any matter that interrupts sound ethical principles) during the course of the project. • The approval applies strictly to the protocol as stipulated in the application form. Would any changes to the protocol be deemed necessary during the course of the project, the project leader must apply for approval of these changes at the NWU-RERC. Would there be deviation from the project protocol without the necessary approval of such changes, the ethics approval is immediately and automatically forfeited. • The date of approval indicates the first date that the project may be started. Would the project have to continue after the expiry date, a new application must be made to the NWU-RERC and new approval received before or on the expiry date. • In the interest of ethical responsibility the NWU-RERC retains the right to: - request access to any information or data at any time during the course or after completion of the project, - withdraw or postpone approval if: - any unethical principles or practices of the project are revealed or suspected, - it becomes apparent that any relevant information was withheld from the NWU-RERC or that information has been false or misrepresented, - the required annual report and reporting of adverse events was not done timely and accurately, - new institutional rules, national legislation or international conventions deem it necessary.

The Ethics Committee would like to remain at your service as scientist and researcher, and wishes you well with your project. Please do not hesitate to contact the Ethics Committee for any further enquiries or requests for assistance.

Yours sincerely

Linda du Plessis

Digitally signed by Linda du Plessis
DN: cn=Linda du Plessis, o=NWU,
ou=North-West University, ou=Potchefstroom,
ou=Faculty of Health Sciences,
ou=School of Health Sciences,
ou=NHU
Date: 2013.04.01 08:07:13 +0200

Prof Linda du Plessis

Chair NWU Research Ethics Regulatory Committee (RERC)

(b). RESEARCH AUTHORIZATION



11 June 2015

North West University – Potchefstroom Campus
Ethical Committee – PHD

To whom it may concern

Roelf Labuschagne is an employee of FNB and can use the data collected in personal health assessments conducted by him and his team in FNB for research in this Phd study with the understanding that all data will be treated as strictly confidential and necessary codes will be used where applicable to protect the ethic and privacy of the employee.

Yours sincerely

HR Executive

HR Executive, 6th Floor, 1 First Place, BankCity, Johannesburg, 2001, South Africa
P O Box 1153, Johannesburg, 2000, South Africa
Tel: +27 87 312 4844; Fax: +27 11 352 2034; Website: www.fnb.co.za

Directors: LL Dippenaar (Chairman), SE Nxasana (CEO), VW Bartlett, JJH Bester, JP Burger (Deputy CEO), MS Bomela, P Cooper (Alternate), I Crouse, JJ Durand, GG Gelink, PM Goss, NN Gwagwa, PK Harris, WR Jardine, HS Kellan, RM Loubser, EG Matenge-Sebesho, AT Nzimande, D Premnarayan (India), KB Schoeman, BJ van der Ross, JH van Greuning, C Low (Company Secretary)

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APPENDIX C: INFORMATION LEAFLET AND INFORMED CONSENT FORM

(a). INFORMATION LEAFLET

PERSONAL HEALTH RISK ASSESSMENT

Dear colleague

As a wellness offering we encourage you to complete a personal health assessment (PHA) at your earliest convenience. This assessment is a proactive measure to help you to identify possible health risks in time and seek remedial action where needed.

Why? “Medical conditions” such as atherosclerosis, hypertension, high cholesterol and diabetes do not always manifest in alarming symptoms and can be present without you even knowing it (“*silent disease*”). All of us have these “medical conditions” present as one cannot live without blood pressure, cholesterol or blood sugar - but at normal / healthy levels. When exceeding normal / healthy levels it becomes a health risk. These “medical conditions” mentioned are all known risks for the development of cardiovascular disease and if left unattended, lead to illnesses that can result in a stroke or heart attack. The majority of these risks are lifestyle related and can be managed and controlled if identified in time. You will receive feedback at point of assessment, a report, and a feedback / educational talk will be scheduled and communicated to you.

What: The PHA consists of height, weight, resting blood pressure, random cholesterol and random glucose screening assessments. A body composition / goal weight assessment, lifestyle habit index as well as a cardiovascular disease risk index and individual stress assessment, form part of the test.

Time: Approximately 15-20 min per assessment.

Health Points: You can earn health points for assessments done - please visit the Bankmed and Momentum Multiply websites for detail on points allocated.

Confidentiality: All information will be treated as strictly confidential and tests are voluntary although we strongly encourage you to have your health status assessed. For more detail in this regard please contact detail below.

Yours in health

Roelf Labuschagne | Head Biokineticist / Health Risk Analyst | FNB Wellness | FNB HR BankCity Wellness Gym, Outer Mezzanine, 4 First Place, BankCity, Cnr Simmonds & Pritchard streets, Johannesburg, 2000 | Tel: (087) 3118339 | Cell: 0829213473 | Fax: (011) 3718341
E-mail: roelf.labuschagne@fnb.co.za | Web: www.fnb.co.za | Mobile: www.fnb.mobi

(b). INFORMED CONSENT



FNB WELLNESS

Disclaimer

I acknowledge that:

1. The services provided by FirstRand Bank Limited through FNB Wellness are intended to compliment and not to replace the services offered by my own Medical service provider.
2. FirstRand Bank shall not accept any responsibility or liability for any loss or damage suffered by myself as a result of any act or omission by any staff member of FNB Wellness.
3. FirstRand Bank shall not accept any responsibility or liability whatsoever for any loss or damage suffered or caused to me by making use of the services offered by any independent consultant, who offers services to me from the premises of FNB Wellness regardless of howsoever such loss or damage arises.
4. I make use of services offered by FNB Wellness at my own risk, and the responsibility remains on me to obtain a medical opinion on any matters which may affect me.
5. In accordance with the Medical Schemes Act, ICD-10 diagnostic codes will be included on every account submitted to my medical aid. I have a choice not to have my ICD-10 diagnostic codes disclosed to the medical aid and may withdraw this consent at any time. I am, however, required to advise the FNB Wellness staff member during the consultation or any future consultations, should I wish not to have these ICD -10 diagnostic codes included on my account. In terms of the medical schemes act my medical aid will not settle any account without ICD -10 diagnostic codes and I will be responsible for full settlement of this account.
6. I hereby provide my consent for FirstRand Bank Limited to create, collect, disclose, access, maintain, use and/or store my personally identifiable information, including medical information, physically or electronically for the purpose of providing me with medical care.
7. The information contained above is classified as sensitive personal information and is subject to the provisions of the Protection of Personal Information Act (Act No. 4 of 2013). I confirm that the details that I have provided are to the best of my knowledge and belief, true and correct. I understand that it is my responsibility to inform FNB Wellness of any changes to this information.
8. It is necessary for such information to be processed and retained in accordance with legislation and ethics guidelines such as but not limited to the Protection of Personal Information Act (Act No. 4 of 2013), Occupational Health and Safety Act (Act No. 85 of 1993), HPCSA Guidelines on the Keeping of Patient Records (Booklet 14 of 2008), Compensation for Occupational Injuries and Diseases Act (Act No.130 of 1993 as amended by act 61 of 1997), Medical schemes act No. 131 of 1998 as amended. Only such data as is relevant to my medical care will be processed or retained, and signing below indicates my consent for FirstRand Bank Limited to process and retain such data.

9. FirstRand Bank Limited will implement reasonable security safeguards to ensure the integrity and confidentiality of personal and medical information.

10. I have the right at any time to withdraw my consent for processing my Personal Information as set out in this document to which FNB Wellness will oblige subject to enforcing all requirements and responsibilities required by law and guidelines of the HPCSA. Such withdrawal will however not affect any processing that had taken place before such time of the withdrawal.

Full names

Date

Signature

On behalf of FNB Wellness

APPENDIX D: DATA FORMS

(a). Bankmed Personal Health Risk Assessment (PHA) & HIV / AIDS Counselling & Testing (HCT)



Contact us

Tel: 0800 BANKMED (0800 226 5633), PO Box 1242, Cape Town, 8000, www.bankmed.co.za

Personal Health Assessment (PHA) & HIV/AIDS Counselling & Testing (HCT)

The Bankmed Personal Health Assessment (PHA) and HIV/AIDS Counselling & Testing (HCT) are health screening tools designed to identify any health risks you may have to allow for proactive intervention. Kindly take your form to your Healthcare Provider for capturing of the information below and further follow up of any risks identified.

Member details

Membership number:		Dependant code:		Date:	
Contact number:		Age:		Gender: Female	☐
First name:					
Surname:					
Identity number:					

Wellness screening

Please answer the following questions in the applicable column yes or no:

- Do you smoke? ☐ Y ☐ N
- Do you suffer from Diabetes? ☐ Y ☐ N
- Do you have any chronic condition/s for which you are on medication? ☐ Y ☐ N
- If yes, kindly indicate below:

Asthma	☐	Cardiac Disease	☐	Depression	☐
Diabetes	☐	High Cholesterol	☐	Hypertension	☐
					Other ☐

To be filled in by an accredited General Practitioner, Pharmacist, Biokineticist or Nurse

- Current weight (with normal clothing) to the nearest kg
- Height (without shoes) cm
- Body Mass Index (weight/height² – kg/m²)
- Blood pressure – Systolic mmHg
- Diastolic mmHg
- Total cholesterol mmol/l
- HDL cholesterol (optional) mmol/l
- Random blood glucose mmol/l
- Waist circumference cm

Reference	
BMI	<24,9
Total Cholesterol	<5,2
HDL	<1,6
Random glucose	<7,8
Blood Pressure	<140/90
Waist Circumference	
Women	<88 cm
Men	<102 cm

HIV Test results

What is your known HIV status?			
HIV Negative	☐	HIV Positive	☐
Screening test:	☐ Negative	☐ Positive	☐ Inconclusive
Confirmatory test	☐ Negative	☐ Positive	☐ Inconclusive
First test ever?	☐ Y	☐ N	
First test in 12 months?	☐ Y	☐ N	
HIV self-reported risk assessment	☐ High	☐ Medium	☐ Low

Maternity information

Currently pregnant	☐ Y ☐ N
Estimated date of delivery	

Wellness screening (continued)

TB Screening

Does your patient currently have TB?	☐ Y	☐ N	If yes: date TB treatment started:	☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 0
If no: does your patient have the following:	☐ Y	☐ N	Excessive night sweats?	☐ Y	☐ N								
Persistent cough for more than two weeks?	☐ Y	☐ N	Presence of blood when coughing up phlegm?	☐ Y	☐ N								
Chest pain or difficulty breathing?	☐ Y	☐ N	TB contact in the patient's household?	☐ Y	☐ N								
Fever for more than two weeks?	☐ Y	☐ N	Sputum sample taken?	☐ Y	☐ N								
Unexplained significant weight loss?	☐ Y	☐ N	Patient referred to State clinic	☐ Y	☐ N								

To be signed by the member or guardian if patient is a minor

- I acknowledge that by giving my consent on this form, I am giving my consent to the provisions outlined below which relate to the Bankmed Medical Scheme ("Bankmed"):
 - Personal Health Assessment ("PHA") health screening tool and programme; and
 - HIV counselling, testing and disease management programme ("HIV programme"), (collectively, the "Programmes").
- I acknowledge that Bankmed, its administrators and/or managed healthcare organisation (collectively, the Bankmed Parties) will administer the Programme, including the information which I have provided in this document.
- Although the Programmes are designed to:
 - Identify certain health risks I may have and enrol me in the PHA programme; and/or
 - Assess my medical risk and to enrol me on the HIV programme, any treatment or medicines prescribed (including antiretroviral treatment, if applicable), as well as the general management of my healthcare, is the sole responsibility of my healthcare provider(s), in consultation with me.
- The Bankmed Parties are accordingly not liable for any claims by me or my dependants arising from any treatment or medicines prescribed, or arising from the implementation of the Programmes, save insofar as provided in the Bankmed rules.
- I understand that no personal information provided by me in terms of the Programmes, including health status and treatment-related information, ("Personal Information"), will be disclosed to third parties (including my employer), other than Bankmed Parties and my healthcare provider(s), without my consent.
- I give my consent to the Bankmed Parties to electronically store, process and retain my Personal Information for the purposes set out in this document or as may otherwise be required to administer the Programmes.
- Whilst the Bankmed Parties will use their best endeavours to uphold the confidentiality of all my Personal Information, the Bankmed Parties will not be liable for any claims by me or my dependants arising from any unauthorised disclosure of my Personal Information to a third party.
- I can terminate my participation in the Programmes at any time with immediate effect on notice to a Bankmed Party, but understand that, in terms of the HIV programme, all benefits that I enjoyed under that programme shall immediately cease.
- I acknowledge that should I not comply with the HIV programme protocols or prescribed treatment, Bankmed, in its sole discretion, may elect to exercise its rights and limit any benefits to the prescribed minimum benefits, always subject to the applicable legislation and the Bankmed rules.
- I understand that telephone calls will be recorded for internal quality assurance purposes and, in respect of the HIV Programme, recorded calls will not be shared outside of the HIV programme unit.
- The Bankmed parties will use the information to allocate the appropriate points to Balance, the Bankmed Wellness Programme.
- I understand and acknowledge that "consent", for purposes of this document means my informed consent, in other words:
 - I have read and understood the contents of this document.
 - I understand and acknowledge the nature of the Personal Information that will be made available to and disclosed, used, processed and retained by the Bankmed Parties and my healthcare provider(s), as set out in this consent.
 - I understand and acknowledge the purpose for which the Personal Information relating to me will be made available to, and disclosed, used, processed and retained by the Bankmed Parties and my healthcare provider(s), as set out in this consent.
 - I have the legal capacity to give my informed consent, in other words, I am over the age of 18 years old and am able to fully understand and make decisions about my own healthcare

☐ Counsellor, not tested ☐ Counsellor and agree to be tested ☐ Counsellor, agree to be tested and participate in the HIVCare Programme

Signature

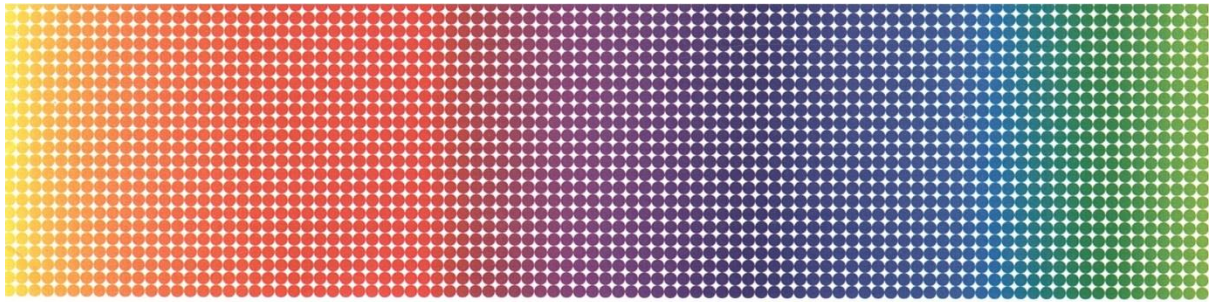
Date

☐ 1	☐ 2	☐ 3	☐ 4	☐ 5	☐ 6	☐ 7	☐ 8	☐ 9	☐ 0
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(b). Coronary Heart Disease Risk Index (CHDRI)

CORONARY HEART DISEASE RISK INDEX													
Name:	Employee Number:		Business Unit:		Date:								
By completing this information I consent to it being used for research with the understanding that it will be treated as confidential information.													
Health Risk	Coronary Risk Index						Score	Target					
Age	10 - 20 years	1	21 - 30 years	2	31 - 40 years	3	41 - 50 years	4	51 - 60 years	6	61+ years	8	
Family History: Parents & immediate family	No history of cardiovascular disease (CVD)	1	1 member with CVD over the age of 60 years	2	2 members with CVD over the age of 60	3	1 death from CVD under 60 years	4	2 deaths from CVD under 60 years	6	3 deaths from CVD under 60 years	7	
Weight	5kg under ideal	0	At ideal	1	5-10 kg	2	11-15 kg	3	16-20 kg	5	21 kg or more	7	
Smoking	Non - smoker	0	Occasional cigar or pipe	1	< 10 cigarettes/day	2	10 - 20 cigarettes/day	4	21 - 30 cigarettes/day	6	> 30 cigarettes/day	10	
Exercise	Daily intensive exercise	0	Moderate intense exercise more than 3 times a week	1	Moderate exercise less than 3 times a week	2	Light exercise less than 3 times a week	4	Light exercise a few times a month	6	No exercise at all	8	
Total Cholesterol	<5.2 mmol/l	1	Don't know	2	5.2 - 6.0 mmol/l	3	6.1 - 6.6 mmol/l	4	6.7 - 7.3 mmol/l	5	> 7.4 mmol/l	7	
Systolic BP	111 - 130 mmHg	0	131 - 140 mmHg	1	Don't know	2	141 - 160 mmHg	3	161 - 180 mmHg	5	> 180 mmHg	7	
Diastolic BP	80 - 85 mmHg	0	86 - 90 mmHg	1	Don't know	2	91 - 95 mmHg	4	96 - 100 mmHg	7	>101 mmHg	9	
Gender	Female	1	Female >45 years	2	Male	4	Bald male	5	Bald, short male	6	Bald, short, stocky male	7	
Stress	None	1	Occasional mild stress	2	Frequent mild stress	3	Frequent moderate stress	4	Frequent high stress	5	Constant high stress	7	
CVD Symptoms Present	None	0	Occasional rapid heart rate and/or irregular rhythm	2	Frequent rapid heart rate and/or irregular rhythm	4	Dyspnoea (shortness of breath) on exertion	6	Occasional angina (chest pain)	8	Frequent angina	10	
Past history of CVD (personal)	None	0	CVD symptoms not medically confirmed	2	History of CVD symptoms, confirmed by Dr.	4	Mild CVD, no present symptoms	6	CVD with symptoms	8	Hospitalised for CVD	10	
Diabetes	No family history	0	Positive family history	1	Impaired glucose tolerance	3	Diabetes: dietary control	5	Diabetes, oral medication	7	Diabetes, insulin dependant	9	
Gout	No family history	0	Positive family history	1	Elevated uric acid, asymptomatic	2	Recent onset gout	3	Repeated chronic attacks	5	Gout with renal and/or bony complications	8	

(c). Wellness Aware: The Ultimate Wellness Awareness Assessment



#WellnessAware

The Ultimate Wellness Awareness Assessment

Afriforte
Metrics That Matter

WorkWell
Research Unit for Economic and
Management Sciences

 **NORTH-WEST UNIVERSITY**
YUNIBESITHI YA BOKONE-BOPHIRIMA
NOORDWES-UNIVERSITEIT

 **Bankmed**
your good health

Hello there, let's get started

By completing this survey I understand that I am willingly participating in the Bankmed Wellness Aware Assessment (WAA) and none of the information that is collected from me will be used to identify me personally without my express consent. I understand that the WAA is an insured benefit of Bankmed Medical Scheme and by completing this survey my day to day benefits and my savings account will not be affected in any way. Furthermore I understand that Bankmed has appointed Afriforte (Pty) Ltd. to provide the WAA to Bankmed members and that my information is stored in a secure environment. The information from this assessment is used to compile an overall report that combines the results of everyone that completed the WAA. Furthermore, this report is compiled to identify trends for group-wide intervention purposes, to update norms, and for future research projects conducted by Afriforte and the WorkWell Research Unit. **If you disagree with any of the terms mentioned above, please do not complete this booklet.**

☐ I understand and accept the terms and conditions.

Your employer might provide an Employee Wellness Programme (EWP) service. If the EWP service provider has an agreement with Bankmed and Afriforte to provide feedback to people at higher risk of stress, they might contact you depending on the results of your assessment. Would you like your EWP to contact you if this service is available?

☐ Yes ☐ No

Let's get to know you

Please tell us who you are. We will use this information to register your on-line profile to capture your data.

Today's Date:	2	0	Y	Y	/	M	M	/	D	D
Bankmed No:							Dependant Code:			
ID Number:										
Name:										
Surname:										
Gender:	☐ Male ☐ Female									
Race:										
Home Language:										
Date of Birth:	C	C	Y	Y	/	M	M	/	D	D
Email Address:										
Mobile Number:				-						
Province:										
City/Town:										



Your Workplace

1. Where are you currently employed?

- ☐ In the Banking Industry ☐ Outside of the Banking Industry ☐ Unemployed ☐ I am a pensioner

Please complete the following questions on where you work. If you are a pensioner, please tell us where you worked before your retirement.

2. If you are (or were) employed inside the banking industry, please write the full name of your employer here.

Employer:

3. In which area do you work?

- | | | |
|--|--|---|
| ☐ Branch network | ☐ Finance | ☐ Operations/Group Administration |
| ☐ Business or Investment Banking | ☐ Fleet Management | ☐ Personal Banking |
| ☐ Call Centres | ☐ Human Resources | ☐ Regional/Provincial Office |
| ☐ Cash in Transit | ☐ Internal Audit | ☐ Retail |
| ☐ Cash Operations | ☐ IT | ☐ Vehicle and Asset Finance |
| ☐ Currency | ☐ Marketing/Communications | ☐ Other |

4. At which job level do you work?

- | | | |
|--|---|--------------------------------------|
| ☐ Admin | ☐ General Worker | ☐ Service |
| ☐ Broker (or commission) | ☐ Junior Management | ☐ Specialist |
| ☐ Clerical | ☐ Middle Management | ☐ Supervisory |
| ☐ Driver | ☐ Security | ☐ Top Management |
| ☐ Executive Management | ☐ Senior Management | ☐ Other |

Work-Related Well-Being

(Only complete this section if you are employed otherwise continue on page 4)

The purpose of this section is to assess your feelings about your current job. Please read each statement carefully and indicate the extent to which you experience this feeling.

0	1	2	3	4	5	6
Never	Almost Never	Infrequently	Sometimes	Quite Frequently	Regularly	Always

- I feel drained from my work 0 1 2 3 4 5 6
- I am uncertain whether my work is important 0 1 2 3 4 5 6
- I feel used up at the end of the workday 0 1 2 3 4 5 6
- I have become less enthusiastic about my work 0 1 2 3 4 5 6
- I feel tired before I arrive at work 0 1 2 3 4 5 6
- I have become less interested in my work 0 1 2 3 4 5 6

Experiences at Work

The purpose of this section is to obtain a picture of how you personally evaluate specific aspects of your work. Please read each statement carefully and indicate the extent to which you experience this feeling.

1	2	3	4
Never	Sometimes	Often	Always

- My job keeps me from spending as much time with my family as I'd like to 1 2 3 4
- My family suffers because of my work 1 2 3 4
- I miss out on important family events because of my work 1 2 3 4
- I am unsure whether I will still have a job in one year's time 1 2 3 4
- I fear that I might lose my job 1 2 3 4
- I worry that I might be directly affected by retrenchments or restructuring in this organisation 1 2 3 4



3

About your Finances

The purpose of this section is to obtain a picture of how you personally evaluate specific aspects of your financial situation.

Please read each statement carefully and indicate the extent to which you experience this feeling.

1

Strongly Disagree

2

Disagree Somewhat

3

Somewhat Agree

4

Strongly Agree

1. I worry about the amount of money that I owe.

1 2 3 4

2. I'm usually unsure whether I'm going to make it through the month financially.

1 2 3 4

3. My debt load increases every month.

1 2 3 4

Your Health

Over the last 3 months, have you experienced any of the following symptoms or changes in behaviour?

1

Never

2

Seldom

3

Sometimes

4

Frequently

1. Lack of appetite or over-eating

1 2 3 4

2. Irritability

1 2 3 4

3. Loss of sense of humour

1 2 3 4

4. Headaches

1 2 3 4

5. Tiredness

1 2 3 4

6. Muscular tension/aches and pains

1 2 3 4

7. Avoiding contact with other people

1 2 3 4

8. Insomnia (sleep difficulties)

1 2 3 4

9. Indecisiveness

1 2 3 4

10. Mood swings

1 2 3 4

Your Health Continued

Over the last 3 months, have you experienced any of the following symptoms or changes in behaviour?

1

Never

2

Seldom

3

Sometimes

4

Frequently

11. Unable to listen to other people

1 2 3 4

12. Nausea or being sick

1 2 3 4

13. Indigestion or heartburn

1 2 3 4

Orientation to Life

Here is a series of questions relating to various aspects of our lives. Please choose the number that best expresses the extent to which the statement is applicable to you.

1. Until now your life has had:

No clear goal or purpose

1 2 3 4 5 6 7

Very clear goals and purpose

2. Do you have the feeling that you are in an unfamiliar situation and don't know what to do?

Very Often

1 2 3 4 5 6 7

Very Seldom or Never

3. Do you have very mixed-up feelings and ideas?

Very Often

1 2 3 4 5 6 7

Very Seldom or Never

4. Does it happen that you have feelings inside that you would rather not feel?

Very Often

1 2 3 4 5 6 7

Very Seldom or Never

5. How often do you have the feeling that there's little meaning in the things you do in your daily life?

Very Often

1 2 3 4 5 6 7

Very Seldom or Never

6. How often do you have feelings that you're not sure that you can keep under control?

Very Often

1 2 3 4 5 6 7

Very Seldom or Never



Reasons for Stress

The potential causes of stress are numerous and highly individual. Following are general causes of stress that affect most people. In this section you have the opportunity to rate how these general causes of stress affect you.

	1 Almost never the reason	2 Occasionally the reason	3 Frequently the reason	4 Almost always the reason
1. Personal relationship difficulties.	☐	☐	☐	☐
2. Children or family stressors.	☐	☐	☐	☐
3. Work-related stressors and job stress.	☐	☐	☐	☐
4. Personal financial stressors.	☐	☐	☐	☐
5. Health-related stressors e.g. chronic illness.	☐	☐	☐	☐
6. Social stressors e.g. friends, social isolation, religious activities, etc.	☐	☐	☐	☐
7. Environmental stressors e.g. crime, pollution, living conditions, travelling, etc.	☐	☐	☐	☐

Let's get to know you better

Tell us more about you by completing the following questions.

1. Do you experience domestic abuse (i.e., physical, emotional, and/or financial abuse)?	☐ Yes ☐ No ☐ I prefer not to answer
2. Are you suffering from depression?	☐ Yes, and I am receiving treatment ☐ I am unsure if I suffer from this condition. ☐ No, I am not suffering from this condition.
3. Do you take alcohol to help you cope with life/work demands or when you feel stressed?	☐ Never ☐ Sometimes ☐ Often

4. Have you ever had a drink first thing in the morning to steady your nerves or get rid of a hangover?
- ☐ Never
- ☐ Sometimes
- ☐ Often

-
5. To what extent do you feel ready to make lifestyle-related changes? (e.g. stop smoking, use less alcohol, get more exercise)
- ☐ Not at all
- ☐ Somewhat ready
- ☐ To a large extent
- ☐ Definitely ready

Yay! All Done!

APPENDIX E: LANGUAGE EDITING



8 December 2016

I, Ms Cecilia van der Walt, hereby confirm that I took care of the editing of the thesis of Mr Roelf Labuschagne titled Physical activity and selected coronary heart disease risk factors among South African employees at a financial institution: an analysis over time.

MS CECILIA VAN DER WALT

BA (*Cum Laude*)

HED (*Cum Laude*),

Plus Language editing and translation at Honours level (*Cum Laude*),

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