

The impact of Physical Activity on selected health risk factors and medical costs of employees working within a financial institution



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Dissertation submitted in fulfillment of the requirements for the degree
MAGISTER ARTIUM at the (Potchefstroom Campus) of the North-West
University

Promoter: Prof. dr. C.J. Wilders

November 2008
Potchefstroom

Acknowledgements

I wish to express my thanks to the following persons and institutions for their guidance and assistance without which help this study would never have been possible:

Prof. Dr. Cilas Wilders (Promoter): (School for Biokinetics, Recreation and Sport Science at the North-West University, Potchefstroom Campus). For his invaluable guidance, motivation, time, assistance with the analysis of the statistical data and support at all times.

Respondents that Participated in the Project: Their involvement and co-operation made this project possible.

Dr. Glen Hagemann – MHM / Energi: For allowing me to utilize the data which have been collected over many years for this study, your research input and moral support.

Len Deacon – Bankmed: Thank you for being instrumental in allowing the dataset to be available to me as well as your moral support over the past 3 years.

Mitzi Kellerman: For the final linguistic care of this thesis.

Maureen Henshall: Thank you for assisting me with the editing of the final product, and your continual support, patience and inspiration.

My children, Trumari and Lizemari: Thank you for your love, support and sacrifices made during the period completing this thesis.

My Mother: For always believing in me, supporting me and loving me.

My sister, Annaliza: For your moral support and guidance.

My Heavenly Father: Thank you, FATHER, for giving me the intellect to complete this thesis. For showing me there's no end to your love. I honour and praise you with all my heart.

W. Marais (Wandra)

December 2008

Declaration

Hereby we the co-author

- Prof. dr. C.J. Wilders

give permission that the research articles may form part of the candidate's MA-thesis. The contribution of the co-authors was limited to their professional advice and guidance as study leaders towards the completion of the study.

Prof. dr. C.J. Wilders

Promotor

Abstract

The impact of physical activity on selected health risk factors and medical costs of employees working within a financial institution

Die impak van fisieke aktiwiteit op sekere gesondheids risiko faktore en mediese koste van werknemers werksaam in 'n finansiële instansie

For employees to optimally perform at work, it is important that they are healthy. The employee is under constant work pressures that affects their health behaviour. The aim of this research is to look at the evident health risks of employees working within a financial institution, to analyze how physical activity influences these health risk factors and their medical costs. In this study a sample of 9860 self selected employees, aged between 18 and 64 (35.3 ± 10.7 years), was used. These employees are spread over all the provinces of South Africa and from all racial groupings. Differentiation was made between employees who were on chronic medication and those who were not. The Health Risk Assessment (HRA) questionnaire developed and provided by the medical aid of the institution was used as the analysis tool. Medical expenditures of the sample group were also provided by the medical aid and investigated. A national network of registered Biokineticists administered the implementation of the HRA, based on a set protocol. ANOVA was used for statistical data analysis – providing descriptive and summarising statistics. One-way analysis of variance was used to determine relationships between variables. It is clear from the descriptive data that the tendencies of selected health risks were high.

The results also show that 37.6% (Diastolic) and 47.87% (Systolic) of the sample group comply with the normal borders of blood pressure. With regards to BMI, 32.3% were overweight and 25.3% within the boundaries of obesity. The average cholesterol of the group is 4.4mmol.L⁻¹. The Physical activity levels were determined using an activity algorithm developed by the medical aid of the institution (described in detail in the thesis). Results show a low level of physical activity index (7.18 ± 3.05) within the sample group. No statistical significance could be found between physical activity levels and medical expenditure, although those who are highly active seemed to have higher expenditure than those who are inactive.

Keywords: Physical health, physical activity, health status, health risk factors, corporate environment, medical expenditure

Sleuteltermes: Fisieke gesondheid, fisieke aktiwiteit, gesondheidsstatus, gesondheids risiko faktore, korporatiewe omgewing, mediese koste

Opsomming

Die impak van fisieke aktiwiteit op sekere gesondheids risiko faktore en mediese koste van werknemers werksaam in 'n finansiële instansie

The impact of physical activity on selected health risk factors and medical costs of employees working within a financial institution

Vir werknemers om optimaal te presteer by die werk, is dit belangrik dat hulle gesond is. Die werknemer is deurentyd onder druk by die werk en dit beïnvloed hulle lewenstyl. Die doel van die navorsing is om die gesondheids risiko's van die werknemers van 'n finansiële instelling te identifiseer, en om die invloed van fisieke aktiwiteit op geselekteerde gesondheids risiko's en mediese koste te ondersoek. Die studie maak gebruik van 9860 self geselekteerde werknemers tussen die ouderdomme van 18 en 64 (35.3 ± 10.7 jaar). Die werknemers is werksaam in alle provinsies in Suid Afrika en kom uit alle rasse groeperings. Onderskeid is getref tussen diegene op kroniese medikasie en diegene wat nie op kroniese medikasie is nie. Daar is gebruik gemaak van 'n "Health Risk Assessment" (HRA) vraelys verskaf deur die mediese fonds van die finansiële instelling om die gesondheids beeld te bepaal. Die Mediese fonds het ook mediese fonds koste beskikbaar gestel vir die studie. 'n Nasionale netwerk van geregistreerde Biokinetici is gebruik om die HRA te implementeer volgens 'n voorgeskrewe protokol. ANOVA is gebruik vir die statistiese analise om beskrywende en opsommende statistiek te verskaf. Eenrigting variansie analises is gedoen om verhoudings tussen die veranderlikes te bepaal. Dit is duidelik uit die beskrywende statistiek dat daar bepaalde gesondheids risiko's bestaan.

Die resultate toon dat 37.6% (Diastolies) en 47.87% (Sistolies) binne die normale grense van bloeddruk val. Dit dui ook aan dat 32.3% van die toetspersone binne die oorgewig kategorie val en 25.3% binne die obese kategorie. Die gemiddelde cholesterol vlak van die toetsgroep is 4.4 mmol.L^{-1} .

Die fisieke aktiwiteits vlak van die toetsgroep is bepaal deur 'n aktiwiteits algoritme ontwikkel deur die mediese fonds van die instelling (word gedetailleerd bespreek in die studie).

Die resultate toon 'n lae fisieke aktiwiteite vlak (7.18 ± 3.05) binne die toetsgroep. Geen statistiese betekenisvolheid kon gevind word tussen die fisieke aktiwiteits vlakke en mediese fonds koste nie, alhoewel diegene wat hoog aktief was hoër mediese fonds koste gehad het as die onaktiewe groep.

Sleuteltermes: Fisieke gesondheid, fisieke aktiwiteit, gesondheidsstatus, gesondheids risiko faktore, korporatiewe omgewing, mediese koste

Keywords: Physical health, physical activity, health status, health risk factors, corporate environment, medical expenditure

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List of Abbreviations

| | |
|--------------|--|
| ACSM | American College of Sports Medicine |
| AHA | American Heart Association |
| BMI | Body Mass Index |
| BP | Blood Pressure |
| CAD | Coronary Artery Disease |
| CDC | Centers for Disease Control |
| CHD | Coronary Heart Disease |
| CRA | Comparative Risk Assessment |
| CVD | Cardiovascular Disease |
| DBP | Diastolic Blood pressure |
| GP | General Practitioner |
| HDL-C | High Density Lipoprotein – Cholesterol |
| HRA | Health Risk Assessment |
| LDL | Low Density Lipoprotein |
| Max | Maximum |
| MHM | Monitored Health Risk Management |

| | |
|--------------------|---|
| Min | Minimum |
| N | Total sample number |
| OR | Odds ratio |
| P | Statistical significance |
| PAL | Physical Activity Level |
| SA | South Africa |
| SBP | Systolic Blood Pressure |
| SD | Standard Deviation |
| UK | United Kingdom |
| US | United States |
| VO2 max | Maximum volume of oxygen that the body can consume during intense whole-body exercise |
| WHO | World Health Organization |
| X | Average Mean |

Chapter 1

Statement of Problem and Objectives

1.1 INTRODUCTION

Health is one of the most valuable qualities of life and a vital component that allows individuals, organizations and society to thrive. Companies that implement effective health promotional programs that focuses on the identification of health risk and implement interventions to reduce that risk, seems to provide a meaningful return on investment (Katzmarzyk *et al.*, 2000; Musich *et al.*, 2003; Serxner *et al.*, 2003; Keyes & Grzywacz, 2005).

Convincing evidence exists proving that the corporate environment is predominantly a sedentary environment (Sparling *et al.*, 2000). Due to urbanization and industrialization the physical demand for work, domestic chores and leisure time activity have decreased dramatically. Sparling *et al.* (2000:371) indicates that Physical Activity in South Africa has been fragmented due to factors ranging from formalized health care focus for improvement of health only, the diminishing of physical activity at school level to the increase on personal risk of safety for individuals doing leisure time activity in their neighbourhoods. Strydom (2004) echo's this concern about the diminishing trend of physical activity (especially at school level) and warns that the results of hypokinetic disease (diseases caused by lack of activity) combined with an increase in medical costs are important factors that the corporate environment should take notice of.

Our bodies inherently need to be exercised in order for us to optimize our health (Sparling *et al.* 2000: 367). Research done by Rodriguez *et al.* (1994), Proper *et al.* (2003), Lee *et al.*, (2001), Blair *et al.*, (2004), all indicate that physical activity has a protective effect on coronary heart disease due to the effect that it has on other modifiable health risk factors such as hypertension, body mass index, diabetes, smoking and cholesterol.

1.2 PROBLEM STATEMENT

Although corporate wellness programmes are on the increase, only a few of these are comprehensive in nature, and evaluate the impact of these wellness interventions (Ferreira, 2006: 46). The continued increase of medical expenditure & illness necessitates corporate to have a look at the health status of their human capital as well as the impact that these escalating costs will have on the cost effectiveness of the organization. Musich *et al.* (2003:58) indicates that the health profile of an organization, the most evident health risk indicators and the cost implication of these health risks are important variables for wellness programmes.

Health related investigations done on the South African population show that disease of lifestyle (Non Communicable Diseases) account for approximately 37% of deaths (Bradshaw *et al.*, 2003: 684) and that 56% of all South Africans between the ages of 15 – 64 have at least one modifiable risk factor for chronic diseases of lifestyle (Lambert, 2001:12). Goetzel *et al.*, (1998:852) found in their research that individuals at risk for poor health outcomes had significantly higher medical expenditures than those at lower risk. Participants with extremely high or low body weight had 21% - , high blood pressure 12%-, and sedentary lifestyles 10% higher medical expenditures. Another important finding in their research was that the combination of several risk factors that culminate in specific diseases also had significantly higher expenditures such as heart diseases 228% higher and stroke 85%.

The Medical Research Council of SA (Challenge Complacency Report *In* Health24.com) indicates that the cost of cardiovascular disease reflected between 2 – 3% of the Gross Domestic Product (GDP) and roughly 25% of all health care expenditure. More important than this fact is that SA is losing more of its eligible workforce between the ages of 35 – 64, than other similar countries [http://www.health24.com/news/Heart_Cardiovascular/1-958,45005.asp Date of access 25 May 2008].

Physical inactivity has been indicated to be an important risk factor for the development of numerous chronic diseases and that the improvement of the physical activity level will result in many important health benefits (Sparling *et al.* 2000, Blair *et al.* 2004, Hu *et al.*, 2005, & Cook *et al.*, 2007). Haskell *et al.* (2007) indicates that due to the development of new technology the humans' daily energy expenditure has been reduced. Improvement of the physical activity level of individuals can therefore be expected to reduce the risk for chronic disease. This expectation

was confirmed in the research done by Rodriguez *et al.* (1994), Myers (2003), Barengo *et al.* (2004), and Lichtenstein *et al.* (2006).

Since physical activity improvement has an indirect influence on the improvement of the health status of the individual it can be expected that it will also have an indirect financial benefit in terms of medical expenditures as well as absenteeism. In this regard, Allender *et al.* (2007) found that at least one third of all deaths are due to illnesses which could be at least partly been reduced by the improvement of the physical activity level and directly responsible for 3% of morbidity and mortality in the UK. Sparling *et al.* (2000: 368) mentions that much of the inverse relationship between physical activity amount and all cause mortality is due to the inverse relationship between physical activity amount and cardiovascular disease, although some studies have also indicated that there is a significant inverse relationship between physical activity level and non-CVD mortality. Katzmarzyk *et al.* (2000: 1437) estimated the direct health care costs of treating diseases related to physical inactivity as well as the fraction of total costs that resulted from physical inactivity. Proper *et al.* (2006:177) investigated the dose response relationship between physical activity and sick leave. In terms of frequency, they found no effects of physical activity at a moderate intensity level, but a minor relationship was found between vigorous intensity physical activity up to a frequency of 3 times per week and sick leave. It seems that a higher frequency increases sick leave. This finding that vigorous activity at a frequency of 3 times per week could reduce sick leave should be important for an organization that want to implement worksite physical activity programmes.

Although no research could be found on the effect of physical activity on presenteeism only, Schultz & Edington (2007)

(<http://www.hmrc.umich.edu/research/pdf/employee%20health%20and%20presenteeism.pdf>

Date of access: 7 Oct. 2007) indicate that health risks traditionally measured by a HRA, especially physically activity and body weight, show an association with presenteeism.

The corporate environment is predominantly sedentary and the impact of inactivity on other health risks are and important variable. The impact of physical activity on the other modifiable health risks as well as on economic indicators such as medical expenditure and absenteeism can provide valuable information to prove a business case for corporate wellness.

1.3 AIMS & OBJECTIVES OF THE STUDY

The aim of this study is the following:

1.3.1. To determine the demographical health profile of an employee working within a financial institution

1.3.2. To determine the impact of physical inactivity on other evident health risk factors of an employee working for a financial institution

1.3.3. To determine the medical expenditure related to physical inactivity of an employee working for a financial institution

1.4 HYPOTHESIS

1.4.1 The health status of an employee working within a financial institution is weak

1.4.2 Physical inactivity has no meaningful impact on the health status or the medical expenditure of the employee working at the financial institution

1.5 STRUCTURE OF DISSERTATION

The structure of the dissertation will be delivered in the format of an article. The results of the study will be presented in two articles and submitted to relevant journals for publication. The dissertation will be presented in the following format:

- CHAPTER 1: Introduction and problem statement. This chapter consists of an Introduction, Problem statement, Aims and Objectives of the study, hypothesis and References based on guidelines given by the North West University, Potchefstroom Campus
- CHAPTER 2: Literature Review. This section is a literature review that will form the basis of the proposed articles. The references for this section is based on guidelines given by the North West University, Potchefstroom Campus
- CHAPTER 3: Article 1
- CHAPTER 4: Article 2
- CHAPTER 5: Conclusions, and Recommendations. In this chapter a small summary of the study will be presented with recommendations for future research
- ADDENDUMS: The Questionnaire and other relevant information will be presented in this section
- REFERENCES: All references will be mentioned that was used in preparation of this study.

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Chapter 2

Literature Review

2.1 INTRODUCTION

The concept of “Corporate Wellness” is an international term that has been defined in literature using the following terminologies: disease prevention and health promotion programmes (Riedel, et al. 2001), health management programmes (Ozminkowski et al., 2000), worksite health promotion (Musich et al., 2000), and worksite wellness programmes (Haynes et al., 1999). In the early 1970’s health promotional programmes focussed on improving a single risk factor, illness of lifestyle habit (Ferreira, 2006:12). Over the next few decades, wellness programming has evolved to include a wider range of service offerings where there is interplay of influences of lifestyle risk factors on each other as well as the development of multidisciplinary treatment of disease/ lifestyle risks (Ferreira, 2006:12). In the most recent research in “health promotion or corporate wellness”, the focus has also changed to include the impact that these programmes have on corporate culture and the financial benefits of these programmes to the company (Chapman, 2003; Haynes & Dunnagan, 2002, & Goetzel, 2001).

The focus of most corporate wellness programmes is to improve the quality of life of the workforce. Most of these programmes have as part of their foundation scientific evidence to guide and support the processes (Berger *et al.*, 2001). Watt et al. (1998) (<http://www.cmaj.ca/cgi/reprint/158/2/224.pdf>. Date of access 27 September 2007) analysed the evidence of selected wellness programmes and found that the results were inconclusive and suggested that further research is needed to confirm the impact of these programmes as well as the cost effectiveness. Central to the optimization of the wellness status of each employee, is the effective management of the health status of the individual to ensure work performance and productivity. In 1999, the U.S. Department of Health and Human Services’ Office of Disease Prevention and Health Promotion (*In Partnership for Prevention*, 2001) indicated that the predominant reason why companies invest in health promotional programmes was to keep employees healthy (84%) and reducing health care costs (76%). Studies by Fries & Wright (1993); Stein et al. (2000); Pelletier (2001); and Serxner et al. (2003) also confirms that one of

the main reasons for health promotional programmes in the corporate setting are health care cost containment. Stave et al. (2003) (<http://www.optis.com/research/publist.html>. Date of access: 7 Oct. 2007) added another dimension to health promotion programmes by focussing on the enhancement of worker productivity. Most of these programs focus on the basic fact that healthier employees cost the company less in medical expenditures and healthier employees are more likely to be at work and less absent.

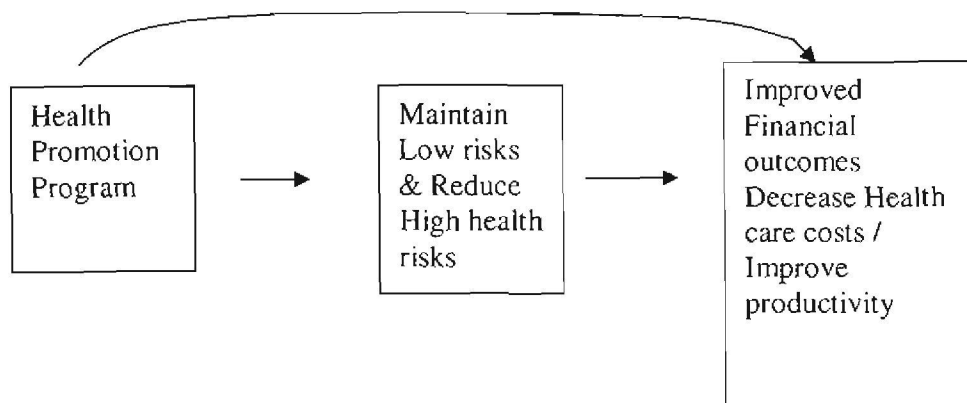
Corporate Wellness in South Africa is still a relative new concept with the most of the wellness programmes being preventative by nature. Most of these programmes focus on the assessment of health risk factors and/or combined with the development of interventions to address these specific health risks. Evidence in favour of corporate wellness that focus on the reduction of medical care costs and absenteeism management within the South African population are scarce although most of the companies with wellness programmes indicate that cost benefits are as important as the improvement of the health status of the employee (Ferreira 2006:12).

This chapter will investigate the determinants of corporate wellness programmes, the lifestyle factors influencing the wellness status of employees, the financial impact of these factors within the corporate environment; as well as the influence of physical activity/inactivity on the improvement of health status and wellness status of the organization.

2.2 DETERMINANTS OF CORPORATE WELLNESS PROGRAMMES

Corporate Wellness Programmes are determined by the focus of the specific programme.

The following model by Aldana (2001) (<http://www.sciencedirect.com/science> Date of access: 7 September 2007) gives an overview of a Health Promotion Programme:



This model highlights two main components for research related to health promotional programs.

- Research that focuses on disease management and the health status of employees. This includes studies on the maintenance the low risk status of the employees (which generally includes the majority of the workforce), but also to reduce the incidence of high risk factors per employee. Another important focus here is also the migration of the population between low and high risk status. Studies that focussed on this research include amongst others, studies by Grover *et al.*, 1998, Ozminkowski *et al.*, 2000, Riedel *et al.*, 2001, Goetzel *et al.*, 2002, Musich *et al.*, 2003b, & Aldana *et al.*, 2005.
- Research that focuses on the financial benefits of health promotional programmes. This research include two components: The focus on health care/ medical expenditure, as well as research that investigates the impact of health promotion on absenteeism and presenteeism within the organization ultimately improving the productivity of the employee. Examples of studies that focussed on this type of research include: Bonner, 1990, Goetzel *et al.*, 1998 and 2001, Pronk *et al.*, 1999, Golaszewski, 2001, Aldana & Pronk, 2001, and Haynes *et al.*, 2002.

Chapman (2003) (<http://www.billsims.com/documents/AHP36.MetaEvaluation.pdf>. Date of access: 12 Oct. 2007). indicates in his meta- evaluation of worksite health promotion economic return studies that there is a lack of standardization of worksite health promotion programmes and this will have an effect on the overall assessment of the impact of worksite wellness programmes. Analysis of health promotional programmes also indicate that the programmes could be effective at producing changed behaviour, but that there is little understanding about the reasons behind why and how they worked (Wilson *et al.*, 1996)

(<http://www.ncbi.nlm.nih.gov/pubmed/10163309> Date of access: 7 Sept. 2007.)

2.2.1 Health Risk Assessments (HRA's) as a strategy for the promotion and the reduction of Health risks

Health promotional activities traditionally include the participation in Health Risk Assessments (HRA) programmes (Schoenbach et al., 1987)

(<http://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=1065456> Date of access: 13 Nov. 2007.). Michael Patterson O'Donnell (2001:221) also indicate that many corporate health promotional programs offer health screening activities – sometimes on a stand alone basis, but also frequently in conjunction with a HRA.

The specifics of the population that attend Health Promotional activities are an important variable that could affect the outcomes of the research. Research indicates that the population groups might vary from being the healthier population or being the sicker population. In this regard, Stave *et al.* (2003) (<http://www.optis.com/research/publist.html>. Date of access: 7 Oct. 2007) found that at Glaxo Smith Kline these kinds of activities are attended more by the healthier portion of the workforce. In contrast to this, Haynes *et al.* (1999) (<http://heapro.oxfordjournals.org/cgi/content/full/14/1/43>. Date of access: 12 Oct. 2007.) indicate that individuals with more health related problems are more likely to participate in employee-sponsored wellness programmes. The reason for this diversity in attendance seems to lay within the focus of the specific health promotional activities. Some health promotional programmes focus on the management of disease with specific interventions designed to intervene at this level and therefore attended by the “sicker” population, as is the case with the research by Haynes *et al.* (1999) (<http://heapro.oxfordjournals.org/cgi/content/full/14/1/43>. Date of access: 12 Oct. 2007.). If the purpose of the health promotional activity is more on health awareness, it seems like the “healthier” population is targeted (as being the case with the Stave *et al.* (2003) research.

Research also show two types of HRA's that could be undertaken:

- The one option only include a self-reported component only, and
- The other includes a self-reported component combined with the clinical measurement of height, weight, blood pressure, and cholesterol and blood glucose levels.

Studies undertaken to show the difference in outcome for these two types of HRA interventions, were undertaken by Lynch *et al.* (1998), Nice & Woodruff (1990), and Stonecipher & Hyner (1993). They found that people at risk of disease rather seek out self reported forms of HRA

rather than HRA with clinical measurements to profile themselves better than they actually are. Marschke *et al.* (2006) challenged the findings by Lynch *et al.* (1998), Nice & Woodruff (1990), and Stonecipher & Hyner (1993) and implemented a study where volunteers completed both types of HRA methodologies (the other studies used different sample groups in their studies). They found that CVD health risk status did not appear to influence HRA type selection. Marschke (2006) (<http://www.ncbi.nlm.nih.gov/pubmed/16421655>, Date of access: 11 Oct. 2007.) also mentions that in general, participants under report their weight, over report their height and state that they exercise more than what is actually the case regardless of the HRA method chosen. The HRA tests that include the clinical measurements are more costly and time consuming, but could provide a more accurate profile of the health status of the population.

The effectiveness of worksite health promotional programmes mostly centre around the issue of whether these programmes are able to maintain the low risk groups low and whether these programmes are able to influence the high risk individuals to reduce the number of risk factors. Park, Jee & Edington (2004) (<http://www.pophealthmetrics.com/content/2/1/10>, Date of access: 20 Nov. 2008.) indicates that it is important for an organization to know that the health status of their population is a dynamic status – the low-risk population of today could be the high-risk population of tomorrow. It is therefore important that the organization determine the evident health risks and then monitor the migration between low, moderate and high risk. In this regard Musich (2003) (<http://heapro.oxfordjournals.org/cgi/content/full/18/1/57#T4>, Date of access: 10 Oct. 2008.) also indicates that the health profile of the organization, the most evident health risk indicators and the cost implication of these health risks are important variables.

Evidence to support the impact of health promotion on the maintenance of low risk and the reduction of high risk lifestyle factors can be found in the research in the Bank of America in a retiree population (Fries *et al.*, 1993), a workplace health promotion program (Bertera, 1990), Johnson & Johnson's Health and Wellness Program (Ozminkowski *et al.*, 2002), and the Citibank study (Ozminkowski *et al.*, 2000). The Bertera (1993:371) study reports significant reductions in the level of behavioural risks for six out of a possible seven risks among the higher risk employees who participated in a comprehensive workplace health promotion program over a two-year period. There was a decline of 14% in the number of high-risk employees over this period. This study also indicated that the high-risk participants regressed more than the lower-risk participants. In two studies by Ozminkowski *et al.* (2000 & 2002), it was found that there was a significant reduction in 8 of 13 risk categories examined for all employees who

participated in two health risks assessments over a 2 – 4 year period (Johnson & Johnson) and declines in risk in 8 of the 10 risk categories (Citibank).

Workplace health promotion therefore seems to have a positive influence on the reduction of the number and level of behavioural health risks within the organization.

2.2.2. Financial Outcomes of Health Promotional programmes

Health care expenditures are continually in an upward trend and this threatens the profitability and survival of companies. In many instances, health promotional programmes are used as a method to reduce employee – related costs. These specific costs relates to medical expenditure and illness related days away from work.

Goetzel (2001) makes the following statement “It seems so obvious that health care systems in the U.S. should devote itself to the improvement of the health and well-being of its citizens, and spend less time and money treating diseases that are highly preventable”

(<http://www.healthpromotionjournal.com/publications/journal/Goetzel%20hard%20to%20prove%20value202001.pdf>. Date of access: 7 October 2007).

Preventable illnesses are responsible for approximately 70% of the total disease burden and their associated costs. These illnesses include cardiovascular diseases and account for 10% of the global burden of disease (*WHO, 2005)

(www.who.int/publications/2005/9241563001_eng.pdf. Date of access: 10 June 2006.). It is estimated in South Africa that °Non Communicable Disease account for approximately 37% of deaths in the population, and cardiovascular diseases and diabetes account for almost 19% of total deaths (Bradshaw *et al.*, 2003: 684) in the population.

Financial benefits of health promotional programmes centres on the prevention of lifestyle related health risks. Musich (2003:63) investigated the relationship between health risk status and excess medical expenditures and found that more high-risk lifestyle behaviours such as obesity, high blood pressure, and high cholesterol levels are associated with higher costs than lower risk behaviours. The average costs calculated between 1995-1996 in this Australian Health Plan, amounted to an excess payment of \$1 168 378 (total annual excess health care costs incurred by moderate and high risk participants) / \$8 637 503 (total annual health risk costs by HRA and Non HRA participants = 13.5%). Goetzel *et al.* (1998:852) investigated the relationship between modifiable health risks and health care expenditures over a 3 year period.

They found that individuals at risk for poor health outcomes had significantly higher medical expenditures than those at lower risk. Participants who were depressed had 70% higher expenditures, high stress 46%, high blood glucose levels 35%, extremely high or low body weight 21%, high blood pressure 12% and those with sedentary lifestyles 10%.

Important was the additional finding in their research that the combination of several risk factors that culminate in more specific diseases had also significant higher expenditures than those without these profiles. In this regard they found that heart disease had 228% higher expenditures, psychosocial problems 147% and stroke 85%. Their research confirms the incremental effect of modifiable risk factors on medical expenditures.

It's important to take note of the dose response relationship between health promotional program participation and health care costs. Serxner et al. (2003:1198) in the Citibank Study found that participants in comprehensive health promotional programmes incur significant lower medical costs, than non participants. They also suggest an additive effect in the level of participation. Participants that have completed one HRA had lower costs than those who did no HRA's. Likewise had those who completed two HRA's, lower costs than those who completed one HRA. This finding is an important factor for companies who invest in wellness, to provide regular ongoing assessment and intervention processes to support their ultimate aim of lowering the financial costs of health of their company. They reported a difference in medical claims between those who completed three or more HRA versus those who did not complete an HRA, as \$543, an amount almost equal to 16% of the total claims cost in the group that did not participate. More significant was their finding that greater reductions were noted with participants who also participated in other wellness related activities than those who only completed an HRA. Their results show that those who completed three HRA or more and participated in additional wellness activities, had \$625 lower medical expenditures than non participants with medical claims. Their finding supports the fact that the implementation of HRA's should fall within the context of a more comprehensive wellness initiative.

*WHO = World Health Organization

†Non Communicable Diseases = Diseases of Lifestyle

2.3 DETERMINANTS OF THE HEALTH STATUS OF AN INDIVIDUAL WITHIN THE CORPORATE ENVIRONMENT

The health status of an individual is determined by the interaction between the non modifiable (genetic predisposition) and modifiable risk factors (lifestyle related)

The following table show the different modifiable and non-modifiable risk factors:

| Non Modifiable risk factors | Modifiable risk factors |
|--------------------------------|-------------------------|
| Age | Smoking |
| Gender | High Cholesterol |
| Ethnicity | Hypertension |
| Family History | Diabetes |
| Previous cardiovascular events | Obesity |
| | Physical inactivity |

The non modifiable risk factors cannot be changed due to behavioural modification processes where the modifiable health risk factors can be influenced by focussed interventions to change these behaviours. The presence of more than one of these risk factors will increase the likelihood for the development of cardiovascular disease.

It is estimated that 56% of all South Africans between the ages of 15-64 have at least one modifiable risk factor for chronic diseases of lifestyle (Lambert, 2001)

(<http://www.sajcn.com/supplement2001/sepactive.pdf>. Date of access: 6 Apr. 2008.)

The South African population is therefore at an increased risk for the development of chronic diseases and cardiovascular disease.

The first step to the risk reduction for cardiovascular disease lies in the identification of these specific individual risk factors, determining the impact that these factors have on each other as well as the implementation of lifestyle modification processes to support the long term prevention of these diseases.

2.3.1 Physical inactivity as a modifiable health risk factor

Literature indicated that physical inactivity results in an increased risk of numerous chronic diseases and the improvement of the physical activity level will result in many important health benefits (Blair *et al.* 2004; Cook *et al.* 2007; Sparling *et al.* 2000; Hu *et al.* 2005)

The improvement of physical activity levels has a positive impact on the following diseases: cardiovascular disease, stroke, hypertension, type 2 diabetes mellitus, osteoporosis, obesity, colon cancer, breast cancer, anxiety, and depression (Lichtenstein *et al.*, 2006) (<http://circ.ahajournals.org/cgi/content/full/114/1/82>. Date of access: 19 May 2007.). Rodriguez in the Honolulu Heart Programme (Rodriguez *et al.* 1994), (<http://www.circ.ahajournals.org/cgi/reprint/89/6/2540>. Date of access: 17 May 2007.) found that the impact of physical activity on coronary heart disease is mediated through its effect on hypertension, diabetes, cholesterol and body mass index. Barengo *et al.* (2004) (<http://eurheartj.oxfordjournals.org/cgi/content/full/25/24/2204> Date of access: 21 June 2006.) also that found that promoting already moderate levels of leisure-time and occupational physical activity is essential in preventing premature CVD and all-cause mortality. In this study on a population in Finland, they found that moderate and high levels of leisure time and occupational physical activity has a protective effect regardless of body mass index, age, smoking, total cholesterol, systolic blood pressure and other forms of physical activity. Myers (2003) (<http://circ.ahajournals.org/cgi/content/full/107/1/e2-e5>. Date of access: 11 November 2005.) states that although the benefits of physical activity on a single risk factor might be small, the combination thereof with other lifestyle modifications might produce a more dramatic effect on the diseases mentioned in the above.

Although limited information about the prevalence of physical activity for the South African population is available Kruger *et al.* 1999(<http://www.sciencedirect.com/science?> Date of access: 4 April 2007). in their study in the North West Province of South Africa found that the rural population was more inactive than the urban population and males more active than females. They also found that the active women had a significantly higher HDL level than the most inactive group.

Sobgnwi *et al.* (2002) (<http://www.nature.com/ijo/journal/v26/n7/abs/0802008a.html>. Date of access: 17 May 2006) studied the impact of different patterns of physical activity between the urban and rural population on obesity, hypertension and diabetes and found that there was a significant difference between the physical activity levels within these two populations. Physical

inactivity was associated with these diseases, although it was not always significant for women. In this regard Bucksch, (2005:637) found that physical activity at a moderate intensity and not less than the CDC/ACSM was sufficient to prevent premature death within the female population. It was suggested that the male population had to have a higher physical activity intensity level to generate the same benefit. This will be discussed in greater detail under the dose response benefit of physical activity on health benefit later on in this chapter.

The corporate environment is a predominant sedentary environment. With the continuous development of new technology and mechanization, the employee spends more time seated than actively walking or exercising. According to Haskell *et al.* (2007:10) frequent physical activity is an important behaviour to maintain the individual and population health. A lack of physical activity can lead to a condition of hypokinesia, which will negatively affect the individuals' health and wellness status resulting in an increased cardiovascular risk within the corporate environment (Strydom, 2000:27).

Although a study by Bolton, Wilders and Strydom (2004:65) did not show a significant association between physical activity, lifestyle and health status of top and middle level managers, it was indicated that by improving the physical activity level from a low to moderate level, there was a tendency toward the improvement of health status (although not significant).

The Centers for Disease Control and Prevention (CDC) and the American College of Sports Medicine (ACSM), in 1995, published a public health recommendation that "Every US adult should accumulate 30 minutes or more of moderate-intensity physical activity on most, preferably all, days of the week" (Pate *et al.*, 1995:406). This recommendation was published to encourage the larger US population to increase their physical activity levels in order to reduce the risk of cardiovascular disease.

In 1996, the Surgeon General's Report stated that regular exercise throughout the life span reduces the risk of all-cause mortality, as well as the incidence of, and fatality rate from, cardiovascular disease, especially coronary disease, through the direct effect on coronary atherosclerosis.

The 1995 statement by the CDC and ACSM was reviewed in 2007 (Haskell *et al.*, 2007:2) because US citizens are still not active enough with the prevalence of less than half (49.1%) of the population meeting the minimum requirements. The following statement with recommendations was published: "To promote and maintain health, all healthy adults aged 18-65 yr need moderate-intensity aerobic physical activity for a minimum of 30 min. on five days each week or vigorous-intensity activity can be performed to meet this recommendation." In addition

to this, “combinations of moderate- and vigorous-intensity activity can be performed to meet this recommendation.” They also state that a brisk walk that noticeably accelerates that heart rate is equivalent to moderate-intensity aerobic activity and can be accumulated in bouts lasting 10 minutes or more; and jogging that causes rapid breathing and a substantial increase in heart rate are considered vigorous activity. All of these are recommended in addition to routine light intensity activities of daily living including casual walking, shopping or cooking or activities lasting less than 10 minutes in duration e.g. walking around the office/home. Activities that improve muscle strengthening and endurance are also recommended for a minimum of two days per week on non-consecutive days. Additional health benefits can also be gained exceeding the basic recommendations given in the above (Haskell et al., 2007: 10).

2.3.2. The relationship between physical activity and its health benefits

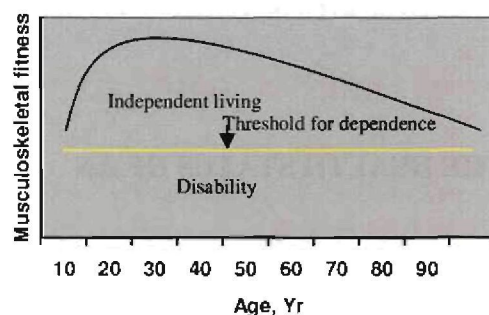
When looking at research collectively, it is evident that there is a dose- response relationship between activity levels and disease prevention. This is true for males and females and much of the inverse relationship between activity and all-cause mortality is due to the inverse relationship between the amount of physical activity and cardiovascular disease (Sparling *et al.*, 2000) (<http://her.oxfordjournals.org/cgi/reprint/15/3/367>. Date of access: 23 January 2006.) Although the relationship between physical activity and health has been established, some questions still exists on how much exercise is needed, what type is exercise in beneficial, how often it should be done, at what intensity, how long should the dose of activity be and how should this dose be quantified. Blair *et al.* (2004) (<http://www.ajcn.org/cgi/content/full/79/5/9135> Date of access: 10 May 2006.) investigated the above questions in the evolution of exercise recommendations: how much is enough? and found that 30 minutes of moderate-intensity activity per day would provide substantial health benefits for most sedentary adults, but not all. The current physical activity level of the individual and the gender of the individual can have an impact on the physical activity recommendation. I-Min Lee *et al.* (2001) (<http://jama.ama-assn.org/cgi/content/full/285/11/1447>. Date of access: 15 May 2006.) investigated the relationship between physical activity and coronary heart disease (CHD) and found that light to moderate intensity activity in women is enough to lower CHD rates in women and that 1 hour of walking per week predicted a lowered risk. This was especially true for those who were overweight, were smokers and had increased cholesterol levels.

Other benefits of increased levels of physical activity include the impact the muscular system and emotional health. Leading research on the impact of physical activity and muscular fitness on health was done by Warburton *et al.* (2001 & 2006). They found that the improvement of

musculoskeletal fitness had a beneficial effect on several other health indicators such as glucose metabolism, obesity, bone health and emotional well-being. High levels of musculoskeletal fitness were associated with a positive health status and low levels of musculoskeletal fitness with lower health status. Concerning bone health, Warburton *et al.* (2006) found that weight-bearing exercises improves bone density and will therefore have an effect on osteoporosis. Complimenting this finding, Masrour *et al.* (2003: 92) and Greg *et al.* (1998) (<http://www.annals.org/cgi/content/full/129/2/81>. Date of access: 17 Nov. 2008) also indicate that the risk of fractures is less in active people.

Warburton *et al.* (2006) (<http://www.cmaj.ca/cgi/content/full/174/6/801> Date of access: 10 Oct. 2008) also confirmed in their research that high levels of musculoskeletal fitness will be beneficial to a person throughout his/her lifespan as can be seen in Graph 2.1 (<http://www.cmaj.ca/cgi/content/full/174/6/801> Date of access: 10 Oct. 2008). With an increase in age his/her musculoskeletal fitness declines resulting in a disability. They conclude that high levels of musculoskeletal fitness will enhance the capacity of the individual to meet the demands of everyday life.

Graph 2.1: Theoretical relationship between musculoskeletal fitness and independent living across a person's lifespan. (Warburton *et al.* 2006)



Warburton *et al.* 2006; 174(6)

Concerning emotional or psychological health and physical activity, the impact of physical activity is mostly measured on the impact it has on symptoms such as depression, suicide risk, anxiety and overall emotional well-being. Warburton *et al.* (2006) states that routine physical activity is associated with an improved psychological well-being, through reduced stress levels, anxiety and depression. Brosnahan (2004) (<http://archpedi.ama-assn.org/cgi/content/full/158/8/818>. Date of access: 19 Sept. 2008.) suggests that higher levels of physical activity are one factor that is associated with a decreased risk of sadness and suicide

among adolescents. Penedo & Dahn (2005) confirms this finding in their research on exercise and well-being.

When we look at the impact of physical activity on depression specifically, Camacho *et al.* (1991) indicate that there is evidence of an activity-depression link. Paluska *et al.* (2000) (<http://www.sportsmedicine.adisonline.com/pt/re/spo/abstract>. Date of access: 15 October 2008.) found that physical activity might play a role in the management of mild- to- moderate mental health diseases, especially depression and found that people with depression tend to be less active than non-depressed individuals. They also state that aerobic exercise or strength training reduced depressive events significantly. Teychenne *et al.* (2008) (<http://aje.oxfordjournals.org/cgi/content/abstract/134/2/220>. Date of access: 15 October 2008) studied the associations between physical activity and depressive symptoms in women and found that only leisure- time activity was inversely associated with odds of depressive symptoms. After controlling for age, marital status and physical health, they found that those who reported more than 3 ½ hours of total leisure time activity per week had lower odds of depressive symptoms than those who trained less than this. They also state that this finding supports the recommended dose of national physical activity guidelines in the US, UK and Australia (at least 30 minutes on most, if not all days of the week). Their results further show reduced odds of depressive events in the highest tertiles of moderate- and vigorous-intensity leisure-time activity, and that those who performed vigorous-intensity physical activity showed an even bigger reduction in odds. (A finding supported by Brown (2005)).

2.4 IMPACT OF PHYSICAL ACTIVITY ON THE HEALTH STATUS OF AN INDIVIDUAL

The purpose of the current study is to focus on the influence of physical activity/inactivity on other modifiable health risk factors. Following will be a discussion of research findings in this regard

2.4.1. Physical Activity and BMI

Data from the South African Demographic and Health Survey 1998 (Puoane *et al.*, 2002) (<http://www.nature.com/oby/journal/v10/n10/full/oby2002141a.html>. Date of access: 13 May 2006.) indicate that there is a pattern of over nutrition rather than under nutrition evident in the South African population with a trend toward obesity within the urban environment vs non urban environment. According to Mvo *et al.* (1999) (<http://www.ncbi.nlm.nih.gov/pubmed/11040616>.

Date of access: 15 October 2008), one of the reasons for the trend toward obesity was found in the perceptions of participants regarding their body weight. In certain African cultures being overweight is seen as a positive attribute.

Another factor that impact on the overweight/ obesity levels of the population is the move toward urbanization. Urbanization is characterized by a combination of lifestyle changes that include a reduction in physical activity levels as well as extreme changes in dietary habits.

Specific findings in the research by Puoane *et al.* (2002)

(<http://www.nature.com/oby/journal/v10/n10/full/oby2002141a.html>. Date of access: 13 May 2006.) include: 1) 10% of women between the ages of 15 – 24 were obese, 2) in African women the highest rate of obesity was within the urbanized group, 3) the predominant population group that needs to be targeted for obesity interventions are the urbanized, higher educated and older white men who had by far the highest obesity rates of all the groups investigated.

The South African Medical Research Council (http://www.hst.org.za/indicators/SADHS_2003.pdf. Date of access: 13 March 2006) indicates that the data for men and women over the age of 15 indicate that 9% of adult men and 23% of adult women in South Africa are obese and 21% of men and 29% of women were overweight but not obese. These combined findings are alarming statistics for our population.

The Brisk Survey carried out in the Cape Peninsula, observed that there was no BMI differences noted between the physically active and inactive subjects based on the assessment of their occupational or leisure time activity levels only. In this study the predominant method of transport was walking in both groups (Steyn *et al.* 1998)

(<http://www.jhypertension.com/pt/re/jhypertension/fulltext>. Date of access: 13 May 2006)

Sobngwe *et al.* (2002) studying physical activity and its relationship with obesity, hypertension and diabetes in rural and urban Cameroon found that inactivity was associated with higher BMI due to lower occupational walking-related activity in the urban population. This finding was true for both sexes. It is clear that although the increase in activity levels will have an effect on the BMI the impact thereof should be seen in combination with healthy dietary recommendations. The ASCM (2006:217) also recommends that physical activity and sound nutrition should form the basis of obesity prevention and treatment.

Research indicate that physical activity of 1 hour per day in combination with a natural food diet, high in fibre-containing fruits, vegetables, and whole grains, and naturally low in fat,

containing high levels of vitamins, and minerals could result in the prevention of chronic diseases (including obesity) (Roberts *et al.* 2005).

Physical activity is also associated with total fat reductions in a dose response manner. Studies that focussed on the containment of dietary intake (to isolate the exercise effect), showed a direct relationship between physical activity and total body fat reductions (Ross & Janssen, 2001). It can therefore be expected that greater energy expenditure would likely result in a greater weight and fat losses although this result is fact is reliant on the specific individual. It is a fact that certain individuals on the same exercise programme and diet may have different results in weight loss (or weight gain). The ASCM (2006:217) states in this regard that the degree in which an individual compensates in changes in energy intake and physical activity during the remaining non exercising periods of the day, will determine the resulting weight loss experienced with exercise.

2.4.2. Physical Activity and Hypertension

Hypertension is one of the most common conditions in the world and affects approximately 1 billion individuals' worldwide (Kearney *et al.*, 2005).

Hypertension is often silent and undetected due to the fact that individual do not recognize the symptoms when they appear or do not feel affected by hypertension. High blood pressure is a key contributor to conditions such as stroke, coronary artery disease, congestive heart failure, and end-stage renal disease and that lowering blood pressure in the general population should substantially reduce the risk for disease associated with high blood pressure (Whelton *et al.*, 2002: 493).

Estimates from studies done in Zimbabwe and Nigeria show that between 10-20 million people in sub Saharan Africa suffers from hypertension and that treatment thereof could prevent 250 000 deaths per year (Cooper *et al.*, 1998) (<http://www.bmj.com/cgi/content/full/316/7131/614>).

*Obesity is defined by the Body Mass Index (or Quetelet index) of the individual, which is a calculated by mass in kilograms divided by the square of the height in meters (kg.m²). A normal BMI will be between 18.5 – 24.9 kg.m², overweight between 25-29.9 kg.m² and obesity exceeding 30.0 kg.m². (ASCM Guidelines 2006). BMI does not distinguish between body fat, muscle mass or bone, but an elevated BMI is associated with cardiovascular diseases.

The Burden of Disease Unit of the Medical Research Council of South Africa undertook a comparative risk assessment (CRA) in 2000 to estimate the contribution of selected health risk factors as part of the World Health Report of 2002. In this report it is estimated that high blood pressure is responsible for 9% of deaths annually (ranked 2) in South Africa compared to other selected risk factors (Norman *et al.*, 2000: 638). Results from the Demographic and Health Survey 1998 (Steyn *et al.*, 1998) (<http://www.jhypertension.com/pt/re/jhypertension/fulltext>. Date of access: 13 May 2006) indicate that 21% of the South African population (male and female) has hypertension (cut off 140/90mmHg). This study revealed high levels of hypertension in the South African community with inadequate treatment processes in place.

The treatment of hypertension is a very important focus given the extent of the problem in South Africa. The general protocol recommended for the treatment of hypertension include lifestyle modifications such as weight loss, reduction of dietary salt intake, limited alcohol consumption and the improvement of physical activity levels.

A meta analysis by Whelton *et al.* (2002:500) show that moderate intensity (40-70% VO₂ Max) aerobic exercise is associated with a reduction in blood pressure for hypertensive and *normotensive participants as well as in overweight and normal weight participants, but an exercise intensity above 70% VO₂ Max did not have additional benefits in terms of blood pressure reduction. They suggest that all forms of exercise seem to be effective in reducing blood pressure and that aerobic exercise should be an important strategy for the treatment and prevention of high blood pressure combined with dietary recommendations. In general changes in diet yields better results in the lowering of blood pressure than aerobic exercise (Fagard, 2005: S23). The recommended minimal frequency of exercise for blood pressure reduction is 3 session per week (Choudhury, 2005: 586).

The impact of exercise/ physical activity on blood pressure should be seen in collaboration with the impact that it will have on the reduction of body weight/fat. Weight loss results in the reduction of blood pressure with the greatest benefit in the initial phases of weight loss.

The benefits of regular moderate activity or exercise on hypertension also include a reduction in left ventricular hypertrophy, and improved exercise capacity and in general an improvement in the quality of life of the patient.

* Normotensive = Normal blood pressure

When combining exercise with diet enhancements, exercise also results in a reduction of oxidative stress and improves the overall metabolic profile of the person (Choudhury, 2005: 586).

In conclusion although it seems that the benefits of exercise as a treatment regime for hypertension are not uniform it must be emphasised that the beneficial effects of exercise revert back to the pre-training state after a period of deconditioning, and this emphasises the importance of regular moderate exercise to maintain the benefits.

2.4.3. Physical activity and Cholesterol

There is strong evidence that elevated cholesterol levels are strongly and inversely associated with the development of coronary artery disease (CAD) (ASCM, 2006: 211).

Dyslipidemia is a condition that is characterized by elevated levels of lipids including cholesterol and triglycerides in the body. Research has also indicated that dyslipidemia is one of the most important modifiable risk factors for CHD (Varady *et al.*, 2008: 1829).

Increased levels of low density lipoprotein cholesterol (LDL-C) and triglycerides combined with low levels of high density lipoprotein cholesterol (HDL-C) generally result in elevated total cholesterol levels (Real *et al.*, 2001:465)

According to Norman *et al.* (2007: 639) high cholesterol is indicative of cardiovascular risk in all population groups in South Africa. They report that about 59% of the Ischaemic Heart disease (IHD) and 29% of the Ischaemic Stroke burden in adults males and females over the age of 30 years were attributable to elevated cholesterol levels ($\geq 3.8 \text{ mmol.L}^{-1}$). It is also estimated to have caused 24 144 deaths or 4.9% of all deaths in South Africa in 2000.

*Blood pressure is defined by the systolic blood pressure (SBP) vs diastolic blood pressure measurement (DBP) in mmHg (resting values). The following categories apply (ASCM, 2006): 1) Normal blood pressure SBP <120 mmHg & DBP <80 mmHg, 2) Pre-hypertension SBP 120-139 mmHg or DBP 80-89 mmHg, 3) Stage 1 Hypertension SBP 140-159 mmHg or DBP 90-99 mmHg, and 4) Stage 2 Hypertension SBP ≥ 160 mmHg or ≥ 100 mmHg.

The common treatment regime recommended lowering elevated cholesterol levels include the use pharmaceutical agents, but due to safety concerns that arose due of the use of these, the ATP 111 recommends the inclusion of lifestyle modification treatment. This lifestyle modification programme includes 1) low saturated fat diets combined with exercise and 2) nutritional supplementation such as fish oils combined with exercise (Varady *et al.*, 2005: 1830). The combination treatment regime will have the following results: Diet treatment has a lowering effect on the LDL levels and exercise will result in elevating the HDL level (Berg *et al.*, 1997) (<http://www.ncbi.nlm.nih.gov/pubmed/9182653>. Date of access: 17 October 2007.).

Analysis of research on the dose response on total cholesterol levels suggests that regular weekly bouts of exercise have a positive effect on the blood lipid level (Durstine *et al.*, 2002) (<http://www.ncbi.nlm.nih.gov/pubmed/12464825> Date of access: 17 October 2007.) The primary effect of exercise on the total cholesterol levels of the body is due to the effect on exercise/activity on the HDL – C levels (Kodama *et al.*, 2008; Wannamethee *et al.*, 2000). O'Connor found that moderate to vigorous sporting activity appeared to be directly related to HDL-C (O'Connor *et al.*, 1995). Kodama *et al.* (2008) (<http://archinte.ama-assn.org/cgi/content/full/167/10/999> Date of access: 17 October 2007.) found that an exercise intensity of 900 kcal of energy expenditure or 120 minutes per week is the minimum exercise volume and an exercise duration of 30 minutes per session was the most important to raise the HDL-C level. This finding was especially true in individuals with initially high cholesterol levels or lower body mass index. Kokkinos *et al.* (1995) also indicated a dose response relationship between miles run per week, HDL-C and other lipoprotein- lipid levels with the most changes noted in the group that ran 7 – 14 miles per week and a mild to moderate intensity level. When compared to the non-exercising group the greatest statistical significance was noted at seven or more miles run per week.

2.4.4. Physical activity and Smoking

McGovern *et al.* (2003: 1121) indicate that smoking is the leading preventable cause of disease and death in the United States. Kaczynski *et al.* (2008: 93) also indicate that smoking and physical inactivity rank among the top 3 modifiable risk factors for chronic disease and mortality.

*The Adult Treatment Panel 111 (or ATP 111) recommends the following guidelines for cholesterol management: Desirable = < 200 mg·dL⁻¹ (5.2 mmol·L⁻¹); Borderline High = 200 – 239 mg·dL⁻¹ (5.21 – 6.2 mmol·L⁻¹) and ≥240 mg·dL⁻¹ (≥ 6.21 mmol·L⁻¹).

The Economics of Tobacco Control Project of the University of Cape Town (2001) (<http://archive.idrc.ca/ritc/sarelease3.pdf> Date of access: 11 Nov. 2008) indicate that between 1990 and 1999 the consumption of cigarettes in South Africa have decreased by approximately 40% due to the excise-induced increases in the retail price of cigarettes. In the South African context they have found that more males and smoking that females and that the coloured population have the highest prevalence of smoking. Another interesting finding in their research is that smoking is more prevalent in labour intensive industries than more professional and people orientated industries.

When we look at the interactions between smoking and physical activity, it is found that smoking and physical activity was negatively associated more specifically within the male and youth population (Kaczynski *et al.* (2008: 110). Kaczynski *et al.* (2008:110) warns though that this finding should not be generalized to all the population groups. Hsieh *et al.*, (1998) also indicate that smoking was less prevalent on the higher physically active groups. The findings is unclear though if the lower prevalence of smoking is due to smoking cessation after physical activity for the reduction of nicotine dependence or an greater concern for health by the physically active.

2.4.5. Physical activity and Diabetes

Mbanya & Ramiaya ([http:// www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=dmssa](http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=dmssa) Date of access: 12 Nov. 2008) in the report on Disease and Mortality in Sub- Saharan Africa, indicate that in the global burden of disease study by the WHO it was estimated that about 177 million people in the world had diabetes in 2000 and 194 million people in 2003 They also suggest that the age-specific levels of diabetes and hypertension in many of the urban areas of Sub-Saharan Africa are as high as than those in most Western European countries. Moderate rates of Type 2 Diabetes in South Africa have been reported between 4.8% - 8% in semi-urban and urban communities ([http:// www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=dmssa](http://www.ncbi.nlm.nih.gov/bookshelf/br.fcgi?book=dmssa) Date of access: 4 Dec. 2008).

In the Honolulu Heart project (Burchfiel *et al.*, 1995) (<http://aje.oxfordjournals.org/cgi/content/abstract/141/4/360> Date of access: 17 Nov. 2008.) it was indicated that physical activity was inversely associated with the incidence of diabetes and that this was independent of other risk factor improvement. Sobngwi *et al.* (2002)

(<http://www.nature.com/ijof/journal/v26/n7/abs/0802008a.html> . Date of access: 17 May 2006.)

also indicated a significant negative correlation between physical activity, leisure and total expenditure and fasting blood glucose in urban males, but not in rural men, urban and rural women. Sobngwi *et al.* (2002) also indicate that although the negative relationship between physical activity and diabetes was not observed in studies that used a simple classification between active and inactive groups, this relationship was indicated in investigations with more precise evaluations of physical activity.

Morrato *et al.* (2007: 206) report that it is worrying that whilst the prevalence of diabetes is increasing in the US, less than 40% of the adults with diabetes report to be physically active. They report clear health benefits of physical activity for the management of Type 2 diabetes.

2.5 FINANCIAL IMPACT OF HEALTH INDICATORS RELATED TO CARDIOVASCULAR DISEASE.

The cost analysis of cardiovascular disease can be divided into 2 categories: Direct costs and indirect costs.

Direct costs reflect the costs related to the treatment and the management of the disease. The only study done in South Africa (SA) on the direct cost of CVD was done by Pestana *et al.* (1996) reporting that the overall costs of heart disease and stroke to be between R4.135 billion and R5.035 billion in 1991. These figures exclude rehabilitation and follow up cost

Indirect costs deals with the loss of income due to illness that affect productivity or employment due to major disabilities, such as stroke or heart failure. Leeder *et al* (2004:46) in the “Race Against time” says that calculations based upon mortality data for 2000, CVD accounted for 848 000 years of potential lives lost and approximately 21% of potential lives lost to non communicable diseases.

Given the extent of the costs, it is necessary to explore the contributions of individual health risk factors.

2.5.1 Financial Impact of Obesity

It is estimated that between 2% – 7% of all medical related expenditures is related to individuals being overweight within westernized countries (Wang *et al.*, 2005a& Birmingham *et al.*, 1999). Due to the continued relationship between obesity and other diseases such as type 2 diabetes,

stroke and hypertension, it is inevitable that obesity will result in escalating medical related costs. Thompson *et al.* (1999: 2182) found that disease risks and costs increased with and increase in body mass index. They state that the risk of hypertension between the ages of 45 – 54, is roughly 2 times higher for moderately obese individuals than their non obese counterparts and the risk of diabetes 3 times higher. The risk for coronary disease and stroke is also similarly affected. This study confirms similar findings by Quesenberry *et al.* (1998) and Wolf & Colditz (1996).

When evaluating the impact of obesity and overweight in isolation on health care expenditure, we find interesting results. Wang *et al.* (2005: 1454) found in their research that only the obese group showed higher medical costs incurred than the normal weight group. They found no statistical differences between the normal weight and overweight groups, and the overweight and obese groups. The research by Wee *et al.* (2005: 163) found that health care costs associated with overweight and obesity were quite substantial. Weight- related expenditures was similar for males and females, but differed between age and racial groupings. The highest costs incurred with obesity were hospitalization costs and it was found that obesity resulted in an increase in expenditures for prescription medication. White adults with a higher BMI had higher medical expenditures in relation to Hispanic and Black adults in the sample group. Similar results of greater number of prescription medication, higher drug costs, higher hospitalization costs and overall higher health care costs incurred by the obese individuals were found in the research by Raebel *et al.* (2004) (<http://archinte.ama-assn.org/cgi/content/full/164/19/2135> Date of access: 17 October 2007.). They also indicate that higher prescription drug costs are the most important contributor to health care costs incurred by obese people over a 1 year period. Controlling for age, sex, and chronic diseases, they report that a person with a BMI over 40 incurred in the range of \$ 115 more in health care costs per year compared to a person with a BMI of 25. They also state that an additional \$ 177 per year can be added to each additional chronic disease of an obese individual. Obese individuals were found to have a 3.85 times greater risk of hospitalization than the nonobese individual (age did not have an effect on this finding) (Raebel *et al.*, 2004).

The following table by Chenoweth (2005) reflects the total economic impact of obesity (including direct and indirect costs) in California in 2000.

Table 1: Direct, Indirect and total costs for physical inactivity, obesity and overweight in California adults (in Year 2000 Dollars).

| | Medical Care costs | | Workers Compensation costs | Productivity costs | Total Costs |
|--------------------|--------------------|-----------------|----------------------------|------------------------------------|----------------|
| | Treatment | RX Cost | | Absenteeism, Short term disability | |
| Direct costs | \$135 520 641 | \$ 595 514 095 | \$ 17 658 344 | \$3364 013 159 | \$ 4112 706239 |
| Indirect costs | \$406 561 922 | \$ 1786 542 286 | \$70 633 376 | \$ 0 | \$2263 737 584 |
| Total Obesity Cost | | | | | \$6376443 823 |

<http://www.cdph.ca.gov/HealthInfo/healthyLiving/nutrition/Documents/CostofObesityToplineReport.pdf>

They estimated that in 2000 the total cost burden of obesity and overweight & physical inactivity was around the \$ 21.68 billion mark and noted that even if the prevalence of these within the population does not increase, the costs will inevitably increase due to the growth of the population, the aging of the population and medical care cost inflation – a view supported by Wee et al. (2005).

2.5.2 Financial Impact of Elevated Cholesterol Levels

To analyze the cost effectiveness of the treatment, one must consider not only the direct cost incurred, but also the benefits gained through the implementation of the process. The direct costs are often easy to determine, but the indirect costs could include productivity losses and sick benefit payments and are much more difficult to determine (McMurray, 1999)

(<http://www.nature.com/ajh/journal/v12/n10s/full/ajh19991063a.html> Date of access: 17 October 2007.)

Only limited information is available on the financial benefits of lowering of total cholesterol levels by means of lifestyle modification and most of the research deals with the pharmacoeconomic analysis of preferred treatments e.g. statins.

The financial benefits of the effective treatment of high cholesterol levels are closely linked to the treatment of other CVD risks such as diabetes and obesity. The benefits of treating this modifiable risk factor can be compared to the effect that this will have on mortality due to coronary disease (Grover *et al.*, 1998: 661). When analyzing the cost benefits of cholesterol

lowering interventions, Oster & Epstein (1986) found that no matter what the cost of the intervention, it most probably won't result in direct savings from the health care system and that the benefits of the treatment will much likelier be reflected on the improvement of quality of life and reduction of mortality. Their findings indicate that the greatest benefits, both clinical and economical will be for the young and middle aged adults. The greatest benefits resulted in a 15 % reduction in total serum cholesterol and \$3 to \$208 per person, as well as lifetime indirect benefits of \$1 to \$8946. They also found that the benefits increased with the person's initial cholesterol level and decreased with age at which the intervention was started. Oster (1996) estimated that approximately 3 million first time coronary events occur over a period of people with an elevated cholesterol level of more than 5.17 mmol/L. They further suggest that by reducing the saturated fat intake by 1 – 3% it could reduce the CHD incidence by 32 000 to 99 700 events and most probably yield economic savings in medical expenditure and lost earning to the amount of \$4.1 - \$12.7 billion over 10 years.

2.5.3 Financial Impact of Hypertension

According to the South African National Demographic and Adult Health Survey 1998 3.3 million adults (defined as a BP above 140/90 mmHg) would require hypertension treatment in South Africa (Steyn *et al.*, 2000: 18). They also estimate that the average cost per person per year for hypertension treatment, is \$ 45 (range \$30-\$60) and the total South African expenditure for hypertension approximately \$29.7 (only 19% of affected population being treated). Treating all patients with BP above 160/95 mmHg would cost an additional \$118 million.

Wexler (2007: 322) mentions that it does not require a large reduction in blood pressure to have an economic effect. He states that a reduction of 5 mmHg in systolic blood pressure can reduce mortality due to stroke by 14%, heart disease by 9% and all-cause mortality by 7%.

The predominant factors influencing the cost of hypertension treatment include the costs of prescription medications, inpatient visits and outpatient visit. The combination of these 3 factors comprises approximately 90% of the overall expenditure (Balu *et al.*, 2006:814).

Williams & Franklin (2007) (<http://www.medscape.com/viewarticle/565544> 4 Date of access: 17 May 2007.) investigated the effect of vigorous exercise on hypertensive medication usage and found that medication use was significantly inversely associated ($p < 0.001$) with activity and fitness. Compared to individuals doing ≤ 16 km/week, the odds for men were 48% and women 52% for lower medication usage for antihypertensive medication usage in the groups who

exceeded 64 km/week. Comparing the fittest vs. lowest fit, there was a 76% lower antihypertensive medication use for men and 55% for women.

Very limited detailed information is available on this subject which influences any further recommendations/discussions to be made in this regard.

2.5.4 Financial Impact of Physical Inactivity

The financial impact or cost burden of physical activity can be measured by the loss of duration or quality of life (mortality/ morbidity), the impact that it will have on a specific disease or medical costs (direct cost) as well as on the population as a whole (indirect costs). Since physical activity improvement has an indirect influence on the improvement of the health status of the individual (as discussed previously) it can be expected that it will also have an indirect financial benefit in terms of medical expenditures as well as absenteeism.

Evidence to the impact of physical activity on premature mortality and morbidity can be found in the work of Richardson *et al.* (2004) & Allender *et al.* (2007). Richardson *et al.* (2004) (http://www.medscape.com/viewarticle/493237_4 Date of access: 17 May 2007.) found that regular moderate to vigorous activity was associated with a substantially lower mortality rate (odds ratio = 0.62- 95% CI 0.44-0.86) compared to sedentary individuals and that sedentary living was associated with a higher death rate at preretirement aged US citizens. Allender *et al.* (2007: 347) found that at least one third of all deaths are due to illnesses which could be at least partly been reduced by the improvement of the physical activity level and directly responsible for 3% of morbidity and mortality in the UK. Sparling *et al.* (2000: 368) mentions that much of the inverse relationship between physical activity amount and all cause mortality is due to the inverse relationship between physical activity amount and cardiovascular disease, although some studies have also indicated that there is a significant inverse relationship between physical activity level and non-CVD mortality. Sparling *et al.* (2000: 368) mentions that the sedentary office worker would be able to reach the 1998 ACSM target of at least 30 minutes accumulative per day for most days of the week, by briskly walking 2 miles per day over lunch time. They estimated that if this amount of activity practised by 50% of the US population, it could result in a reduction of 5 – 6% of mortality for CHD, diabetes and colon cancer (using population attributable risk). They also mention that additional health benefits can be achieved by increasing exercise duration doing moderately intensity activity, or by including exercise to improve muscular strength and flexibility into the exercise routine.

When analyzing the prevalence of coronary risk factors such as obesity, hypertension, and high blood cholesterol levels in a population, we find that physical inactivity has by far the highest prevalence and therefore will have the greatest potential to effect a reduction in CAD (Katzmarzyk *et al.* 2000: 1436). Katzmarzyk *et al.* (2000: 1437) estimated the direct health care costs of treating diseases related to physical inactivity as well as the fraction of total costs that resulted from physical inactivity. In Canada, they estimated that \$2.1 billion or 2.5% of the direct health care costs in 1999 can be attributed to physical inactivity. Similar results we obtained from the United States (\$24 billion -Colditz, 1999), Australia (\$377 million – Stephenson, 2000) and the UK (£1.06 billion per year – Allender, 2007).

Katzmarzyk *et al.* (2007: 1438) also estimates that a saving of \$150 million per year can be achieved with a 10% reduction of physical inactivity levels. The impact of these saving will not be felt in the short-term, but rather over a longer period of time as the benefits of physical activity on improving health status is only noticeable in the long term.

Health care costs related to physical inactivity varies substantially across physical activity levels, age, health risks and different population groups.

Investigating the impact on an individual level Goetzel *et al.* (1998), found that the estimated annual per- capita impact of poor exercise habits amount to \$172 in an employed population. Andreyeva & Strum (2006: 6) found that health care costs due to physical inactivity for the individual between the ages of 54 – 69 years can be expected to have a 7% impact over 2 years or cost \$483 dollars in 2004.

The dose response of physical activity of health care charges also reveals some interesting findings. Our logic leads us to believe that more is better, or is it? Pronk *et al.* (1999: 2237) found that inactive individuals had 4.7% higher medical expenditure than those who were physically active 1 day per week. From a behavioural perspective they found that increasing the physical activity level of the individual will result in substantial reduction in health care charges and that it will be beneficial in the short term for the health plan to create supportive structures for the improvement of general health status.

The effect of behavioural interventions to improve the physical activity levels of the population group, might pose some relevant problems to the effectiveness in reducing costs. The following limitations can be experienced: Questions to the cost of the specific intervention vs the medical cost benefit, the effectiveness of the intervention to change the behaviour/modifiable health risk and the time lags between the intervention and the eventual change in medical care cost

Other components that contribute to the economical benefit of physical activity within a corporate environment is the influence on absenteeism and presenteeism. Proper *et al* (2006: 177) investigated the dose response relationship between physical activity and sick leave. In terms of frequency, they found no effects of physical activity at a moderate intensity level, but a minor relationship was found between vigorous intensity physical activity up to a frequency of 3 times per week and sick leave. It seems that a higher frequency increases sick leave. This finding that vigorous activity at a frequency of 3 times per week could reduce sick leave should be important for an organization that want to implement worksite physical activity programmes. The American College of Occupational and Environmental Medicine (Chapman, 2005: 2) defines presenteeism as “The measurable extent to which health symptoms, conditions and diseases adversely affect the work productivity of individuals who choose to remain at work.” An important factor that will have an effect on presenteeism is the fact that as the population ages, we would expect a higher prevalence of chronic diseases and symptoms that would have an increasing effect on presenteeism (Chapman, 2005:3). Pelletier *et al.* (2004: 752) indicate that the a reduction of one health risk factor could have a 9% reduction in presenteeism rate and that reductions in health risks generally are associated with positive changes in work productivity. Conditions that are associated with presenteeism is depression (odds ratio (OR) = 2.05); interpersonal/ mental functioning (OR = 2.50), arthritis (OR=1.56) and low-back pain (OR = 1.32) (Burton *et al.* 2004). Goetzel (2004) states that presenteeism costs were higher than medical costs in most cases and represented 18% - 60% of all costs for 10 health conditions that include heart disease, hypertension, arthritis, and other mental illnesses. Although no research could be found on the effect of physical activity on presenteeism only, Schultz & Edington (2007)(<http://www.hmrc.umich.edu/research/pdf/employee%20health%20and%20presenteeism.pdf> Date of access: 7 Oct. 2007) indicate that health risks traditionally measured by a HRA, especially physically activity and body weight, show an association with presenteeism.

2.5.5 Financial Impact of Smoking

The financial impact of smoking was measured by Musich *et al.* (2003a: 63). They found that the smoking population was slightly younger than non-smokers and somewhat less likely to me at risk for the development of any medical problems. Due to this fact they incurred less medical costs than the non- smokers. Barendregt *et al.* (1997) (<http://content.nejm.org/cgi/content/full/337/15/1052> Date of access: 17 Nov. 2007) investigated the health care costs of smoking within the general population and found a higher prevalence of

smoking in the slightly older population. They also indicate that although the per capita health care costs for smoker are higher than that of non smokers, and that the non smoking population have higher health care costs than the mixed population of smokers and non smokers. They conclude by saying that their will only in the short term savings in health care costs, if people stopped smoking.

Brunette De- Brusser (2007:95) also indicate that the effect of smoking only surfaces after a number of years of smoking, therefore the lack of smoking and health related claims found in her study. This could also have an impact on similar studies performed where the average population in the sample is of younger age.

2.5.6 Financial Impact of Diabetes

The cost of Diabetes in the population will become more evident as the prevalence of diabetes increases. The impact of Diabetes related to medical costs can create a considerable burden, when we not only take into account the direct medical costs, but also the impact that this has on workers productivity (Tunceli *et al.* 2005). The American Diabetes Association (2008: 596) indicate that the national burden of diabetes is likely to exceed the \$ 174 billion, excluding the cost of pain and suffering as well as other excess medical costs and reduced earnings through productivity loss associated with diagnosed and undiagnosed diabetes. They also indicate that people with diabetes have higher rates of health –related absenteeism than people without diabetes (approximately 1.9 more workdays lost per year per worker). The impact on disability is another factor that needs to taken into account when estimating the financial burden.

Ackemann *et al.* (2006) and Hoerger *et al.* (2007) both indicate that prevention programs could yield cost effectiveness, but the application of this intervention strategy needs to be thought through carefully. Both research articles by Hoerger *et al.*,(2007) and Ackermann *et al.* (2006) (<http://care.diabetesjournals.org/cgi/content/full/30/11/2874> Date of access: 13 Nov. 2008) demonstrates that an intensive intervention lifestyle intervention program could prevent or delay the onset of Type 2 Diabetes, but could be costly.

It seems that the prevention of diabetes through the application of medication, diet and exercise to be the best avenue for cost reduction and will also have the added benefit of preserving health status and quality of life of individuals who are at risk (Tunceli *et al.* 2005: 2666)

2.6 CONCLUSION

The human capital of an organization is a valuable asset. It is important for an organization to manage this human capital component well and to provide the employee with the opportunity to live healthy. Corporate Wellness is still a relatively new concept in South Africa with most programmes implementing health promotional activities such as health risk assessment testing. Health assessment screening can provide the organization with an overview of the health status of the organization. Providing the employee with knowledge on their evident health risks is important, but the employee needs to take self responsibility in acting on the information given on their evident health risks. Most of the diseases identified with HRA screening activities are preventable.

The corporate environment is predominantly sedentary and the impact of inactivity on other health risks are an important variable. The impact of physical activity on the other modifiable health risks as well as on economic indicators such as medical expenditure and absenteeism can provide valuable information to prove a business case for corporate wellness.

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Chapter 3

Article 1

The Physical Health profile of employees working within the corporate environment

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Physical Activity and Health Risks

ABSTRACT

For an employee to optimally perform at work, it is important that the employee is healthy. The individual is under constant pressures at work, and these pressures culminate in a decline of physical health as well as physical activity levels. Selected physical health risks were investigated by utilizing the Health Risk Assessment tool provided by the medical aid of the financial institution. Health risks such as body mass index (BMI), blood pressure, diabetes risk and total cholesterol levels, were investigated. Administration of the testing was done by registered biokineticists on 9897 self selected subjects with a mean age of 35.3 ± 10.7 years. Testing was done on a voluntary basis. The subjects completed a questionnaire on lifestyle habits and their levels of physical activity. The Physical activity levels were determined using an activity algorithm developed by the medical aid of the institution (described in detail in the article). Results show a low level of physical activity index (7.18 ± 3.05) within the sample group. The results also show that 37.6% (Diastolic) and 47.87% (Systolic) of the sample group comply with the normal borders of blood pressure. With regards to BMI, 32.3% were overweight and 25.3% within the boundaries of obesity. The average cholesterol of the group is 4.4mmol.L-1. Although no statistical significant interactions were found, the tendencies of selected high health risks were high. The development of an effective intervention programme to reduce these health risks will not only be beneficial to the organization in terms of productivity improvement, but also to the individual.

KEY WORDS: Physical Health, Physical activity, health status, coronary risk factors, corporate environment

3.1 INTRODUCTION

The focus of most corporate wellness programmes is to improve the quality of life of the workforce. Most of these programmes have as part of their foundation, scientific evidence to guide and support the processes. Watt, Verma & Flynn (1998) analysed the evidence of selected wellness programmes and found that the results were inconclusive. They suggested that further research is needed to confirm the impact and cost effectiveness of these programmes. Chapman, 2003; Haynes *et al.*, 2002, Goetzel *et al.*, 2001 also states that it is important for an organization to know how these programmes will have an impact on corporate culture and the financial benefits of these programmes. Central to the optimization of the wellness status of an organization, is the effective management of the health status of the individual to ensure work performance and productivity. The effectiveness of worksite health promotional programmes mostly centre around the issue of whether these programmes are able to maintain the low risk groups low and whether these programmes are able to influence the high risk individuals to reduce the number of risk factors. Musich *et al.* (2003) indicates that it is important for an organization to know that the health status of their population is a dynamic status – the low-risk population of today could be the high-risk population of tomorrow. It is therefore important that the organization determine the evident health risks and then monitor the migration between low, moderate and high risk. In this regard Musich also indicates that the health profile of the organization, the most evident health risk indicators and the cost implication of these health risks are important variables.

Some health promotional programmes focus on the management of disease with specific interventions designed to intervene at this level and therefore attended by the “sicker” population, as is the case with the research by Haynes *et al.* (1999). If the purpose of the health promotional activity is more on health awareness, it seems like the “healthier” population is targeted (as being the case with the Stave *et al.* (2003) research.

The reality in the corporate workplace is that this environment places very little emphasis on physical health and physical activity. A combination of social, economic and environmental issues influenced physical behaviour in such a way, that sedentary living becomes commonplace. Common causes of physical inactivity are improved mechanization and industrialisation of most occupational physical actions, compounded by the fact that for the sedentary majority barriers like inconvenience (lack of accessible facilities) and safety (the rise of crime, stairwells in buildings closed to reduce risk of injury) are on the increase. Sparling *et al.* (2000) mentions that

the promotion of physical activity within South African population are influenced by lack of infrastructure in peri-urban and urban communities, and a high prevalence of urban violence and risk to personal safety.

Investigating the influence of physical activity levels within the corporate working environment, can be quite challenging due to the limited information available.

Mostly the promotion of physical activity levels within the corporate environment are guided by the belief that it will have a positive effect on other coronary health risk factors and thereby influencing the medical cost profile of the organization.

The objective of this study is to investigate the prevalence of selected health risks within the financial corporate sector with special reference to the level of physical activity as one of these health risks.

3.2 MATERIALS AND METHODS

3.2.1 Study Population

The study population of 9860 in this study comprises of men and women of all culture groups that worked for this financial institution in 2005/6 and belonged to the medical aid of the institution. Due to a company policy not to differentiate between ethnic groupings, the group was treated as such. The participation was on a voluntary basis and therefore the sample group self selected. Differentiation was made between participants on chronic and not on chronic medication.

3.2.2 Procedures and Instruments

Assessment of physical activity and other selected health risk factors was done according to the health risk assessment (HRA) methodology developed by the company Monitored Health Risk Managers (MHM) for the medical aid (Bankmed) of the financial institution. The tests were administered by contracted biokineticists that were trained on the specific requirements for implementation of the toolkit.

The HRA tool is a technique for estimating the odds that an individual with certain characteristics will die from selected causes within a given time span.

It provides group data that summarizes the major health problems and risk factors of a selected group

The Body mass Index (BMI) were determined as weight in kilograms divided by height in meters squared. The following classification was used: Underweight <18 kg·m⁻²; Normal 19-24 kg·m⁻²; Overweight 25-29 kg·m⁻², Obese >30 kg·m⁻². (ACSM Guidelines, 2006, p58)

For systolic (SBP) and diastolic blood pressure (DBP) ratings the following classification was used: Normal SBP <120 mm Hg, DBP <80 mm Hg; Pre hypertension SBP 120-139 mm Hg, DBP 80-89 mm Hg; Stage 1 Hypertension SBP 140-159 mm Hg, DBP 90-99 mm Hg; Stage 2 Hypertension SBP ≥160 mm Hg, DBP ≥100 mm Hg. (ASCM Guidelines, 2006, p44)

Total Cholesterol level classification was determined by desirable being <5.2 mmol.L⁻¹; borderline high 5.2 – 6.2 mmol.L⁻¹ and high >6.2 mmol.L⁻¹

(ASCM Guidelines, 2006, p45)

The Diabetes risk was determined using the following scoring method.

| | | |
|---|----------------|-------------------|
| <i>Age</i> | <i>46 – 65</i> | <i>- 5 points</i> |
| | <i>> 65</i> | <i>- 9 points</i> |
| <i>BMI</i> | <i>> 25</i> | <i>- 5 points</i> |
| <i>Sibling(s) with DM (q8.1)</i> | | <i>- 1 point</i> |
| <i>Parent with DM (q8.2)</i> | | <i>- 1 point</i> |
| <i>PAL</i> | <i>> 1</i> | <i>- 5 points</i> |
| <i>Baby weighing > 4.0 kg</i> | | <i>- 1 point</i> |
| <i>(or gestational diabetes) (q8.3)</i> | | |
| <i>Random blood glucose > 8-</i> | | <i>10 points</i> |

Low risk 0 – 2

Moderate risk 2 – 10

High risk 11 - 32

3.2.3 Statistical procedures

A STATISTICA-computer program (Statsoft., Inc., 2003) at North-West University, Potchefstroom Campus, was used for analysing the data. For the purpose of this study a one-way analysis of variance was computed (Thomas & Nelson, 1996:155-161).

3.3 RESULTS

The Descriptive Statistics of the sample group is indicated in Table 1

Table 1: Descriptive Statistics of Health Indicators evident within the male and female population working within a financial institution

| | | \bar{x} | N | SD | Min | Max |
|-------------------|----------|-----------|------|------|-----|-----|
| Age | Female | 35.1 | 6524 | 10.6 | 19 | 64 |
| | Male | 35.9 | 3336 | 10.9 | 19 | 64 |
| | All Grps | 35.3 | 9860 | 10.7 | 19 | 64 |
| Diabetes Risk | Female | 8.4 | 6524 | 4.4 | 0 | 38 |
| | Male | 8.3 | 3336 | 5.0 | 0 | 37 |
| | All Grps | 8.4 | 9860 | 4.6 | 0 | 38 |
| BMI | Female | 26.5 | 6493 | 6.1 | 14 | 50 |
| | Male | 26.3 | 3330 | 4.9 | 14 | 50 |
| | All Grps | 26.4 | 9823 | 5.8 | 14 | 50 |
| PAL | Female | 7.5 | 6514 | 2.8 | 1 | 9 |
| | Male | 6.5 | 3334 | 3.4 | 1 | 9 |
| | All Grps | 7.2 | 9848 | 3.1 | 1 | 9 |
| Systolic BP | Female | 116.3 | 6524 | 15.5 | 80 | 208 |
| | Male | 124.2 | 3336 | 15.1 | 80 | 220 |
| | All Grps | 119.0 | 9860 | 15.8 | 80 | 220 |
| Diastolic BP | Female | 75.0 | 6524 | 11.4 | 32 | 139 |
| | Male | 79.8 | 3336 | 11.2 | 40 | 140 |
| | All Grps | 76.6 | 9860 | 11.5 | 32 | 140 |
| Total Cholesterol | Female | 4.4 | 6524 | 0.9 | 2 | 10 |
| | Male | 4.4 | 3336 | 0.9 | 2 | 10 |
| | All Grps | 4.4 | 9860 | 0.9 | 2 | 10 |

BMI: Body Mass Index

BP: Blood Pressure

PAL: Physical Activity Level

In Table 1 we can see that the age of the population ranges between the ages of 19 – 64 years of age with a mean age of 35.3 ± 10.6 and the average male population slightly older than the females. The differentiation between the males and females show that 66.2% of the sample was

females compared to 33.8% males. The mean age and sample distribution between males and females, is also representative of the overall population of the financial institution.

The average values of the different indicators for the males and females indicate that the males sample are slightly more active than the female population and the males display an average systolic blood pressure value that falls within the pre hypertensive category (ACSM Guidelines, 2006). The average systolic blood pressure value for the female population within this sample falls within the normal category (ACSM Guidelines, 2006).

The average BMI for both the male and female population indicate that they fall within the overweight category (ACSM Guidelines, 2006).

The Diabetic risk index show that the total sample is at moderate risk. This factor analysis was influence by the average BMI of this sample being $> 25 \text{ kg}\cdot\text{m}^{-2}$ as well as the sample being predominately inactive (80.8% of the total sample).

Table 2: Differentiation between participants self reporting that they are on chronic medication and those not on chronic medication

| Chronic Medication | Count | Cumulative | Percent | Cumulative |
|--------------------|-------|------------|----------|------------|
| N | 8268 | 8268 | 83.85396 | 83.8540 |
| Y | 1592 | 9860 | 16.14604 | 100.0000 |

Table 2 indicate that 16.1% of the sample is on a chronic medication programme. Following the descriptive statistics where differentiation was made between these 2 categories.

Table 3: Descriptive statistics of Health indicators of the sample population not on chronic medication

| | | \bar{x} | N | SD | Min | Max |
|-------------------|----------|-----------|------|------|-----|-----|
| Age | Female | 32.7 | 5423 | 9.0 | 19 | 64 |
| | Male | 33.8 | 2845 | 9.7 | 19 | 63 |
| | All Grps | 33.1 | 8268 | 9.3 | 19 | 64 |
| Diabetes Risk | Female | 7.8 | 5423 | 3.8 | 0 | 36 |
| | Male | 7.5 | 2845 | 4.3 | 0 | 35 |
| | All Grps | 7.7 | 8268 | 4.0 | 0 | 36 |
| BMI | Female | 26.1 | 5403 | 6.0 | 14 | 50 |
| | Male | 25.7 | 2840 | 4.8 | 14 | 46 |
| | All Grps | 26.0 | 8243 | 5.6 | 14 | 50 |
| PAL | Female | 7.6 | 5415 | 2.8 | 1 | 9 |
| | Male | 6.5 | 2843 | 3.4 | 1 | 9 |
| | All Grps | 7.2 | 8258 | 3.0 | 1 | 9 |
| Systolic BP | Female | 115.1 | 5423 | 14.9 | 80 | 195 |
| | Male | 123.4 | 2845 | 14.9 | 80 | 220 |
| | All Grps | 117.9 | 8268 | 15.4 | 80 | 220 |
| Diastolic BP | Female | 74.3 | 5423 | 11.2 | 32 | 139 |
| | Male | 79.3 | 2845 | 11.2 | 40 | 140 |
| | All Grps | 76.0 | 8268 | 11.4 | 32 | 140 |
| Total Cholesterol | Female | 4.3 | 5423 | 0.9 | 2 | 10 |
| | Male | 4.4 | 2845 | 0.9 | 2 | 10 |
| | All Grps | 4.3 | 8268 | 0.9 | 2 | 10 |

Table 3 indicate the descriptive statistics of the sample group (83.9%) that are not on any chronic medication programme. The following difference with the total sample is noted (as seen in Graph 1): 1) this sample group is slightly younger than the total sample with a mean age of 32.7 ± 9 years. 2) The BMI, Diabetes risk, Systolic – and Diastolic blood pressure and the PAL of this group is slightly lower, but still within the same risk categories (ACSM Guidelines, 2006).

Table 4: Descriptive statistics of Health indicators of the sample population on chronic medication

| | | \bar{x} | N | SD | Min | Max |
|-------------------|----------|-----------|------|------|------|------|
| Age | Female | 46.4 | 1089 | 9.9 | 21.0 | 62.0 |
| | Male | 47.3 | 503 | 9.6 | 23.5 | 63.0 |
| | All Grps | 46.7 | 1592 | 9.8 | 21.0 | 63.0 |
| Diabetes Risk | Female | 11.8 | 1089 | 5.5 | 0 | 38 |
| | Male | 12.0 | 503 | 5.9 | 0 | 37 |
| | All Grps | 11.9 | 1592 | 5.6 | 0 | 38 |
| BMI | Female | 28.5 | 1089 | 5.7 | 15 | 48 |
| | Male | 28.9 | 503 | 6.0 | 15 | 48 |
| | All Grps | 28.6 | 1592 | 5.8 | 15 | 48 |
| PAL | Female | 6.9 | 1089 | 3.2 | 1 | 9 |
| | Male | 7.0 | 503 | 3.2 | 1 | 9 |
| | All Grps | 6.9 | 1592 | 3.2 | 1 | 9 |
| Systolic BP | Female | 124.8 | 1089 | 16.6 | 80 | 200 |
| | Male | 123.9 | 503 | 16.2 | 80 | 180 |
| | All Grps | 124.5 | 1592 | 16.5 | 80 | 200 |
| Diastolic BP | Female | 79.7 | 1089 | 11.4 | 44 | 126 |
| | Male | 79.5 | 503 | 11.6 | 45 | 120 |
| | All Grps | 79.6 | 1592 | 11.5 | 44 | 126 |
| Total Cholesterol | Female | 4.7 | 1089 | 1.0 | 2 | 8 |
| | Male | 4.8 | 503 | 1.0 | 2 | 8 |
| | All Grps | 4.7 | 1592 | 1.0 | 2 | 8 |

Table 4 and Graph 1 indicate that the average age of the population sample that is on chronic medication is 46.7 ± 9.8 years of age. This is significantly higher than the total sample's average age of 35.5 ± 10.7 years of age. The age of the male population in this sample is also slightly older than the female sample. The average Diabetes risk index for this sample of 11.9 ± 5.6 is also significantly higher than the levels of the total sample as well as the sample that's not on chronic medication. In this case the average risk index falls within the high risk category. The average BMI of this group of $28.6 \text{ kg}\cdot\text{m}^{-2} \pm 5.8$ is also higher than the other two sample groups. This average still falls within the overweight categories as per the ACSM Guidelines 2006.

Graph 1: Means of the total sample, the sample on chronic medication and the sample that's not on a chronic medication programme:

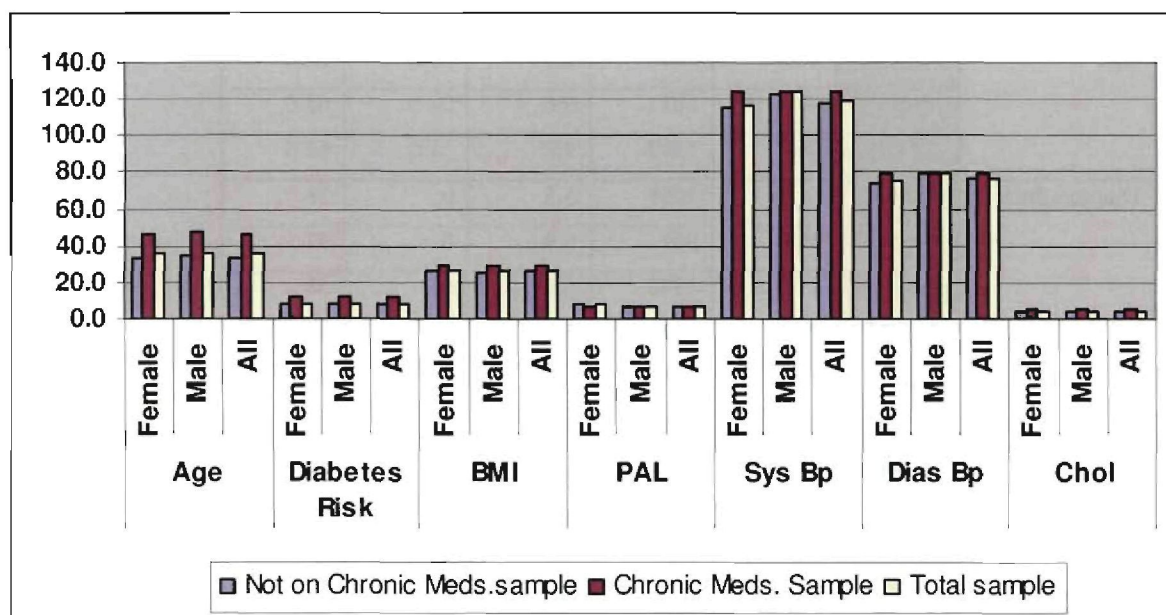


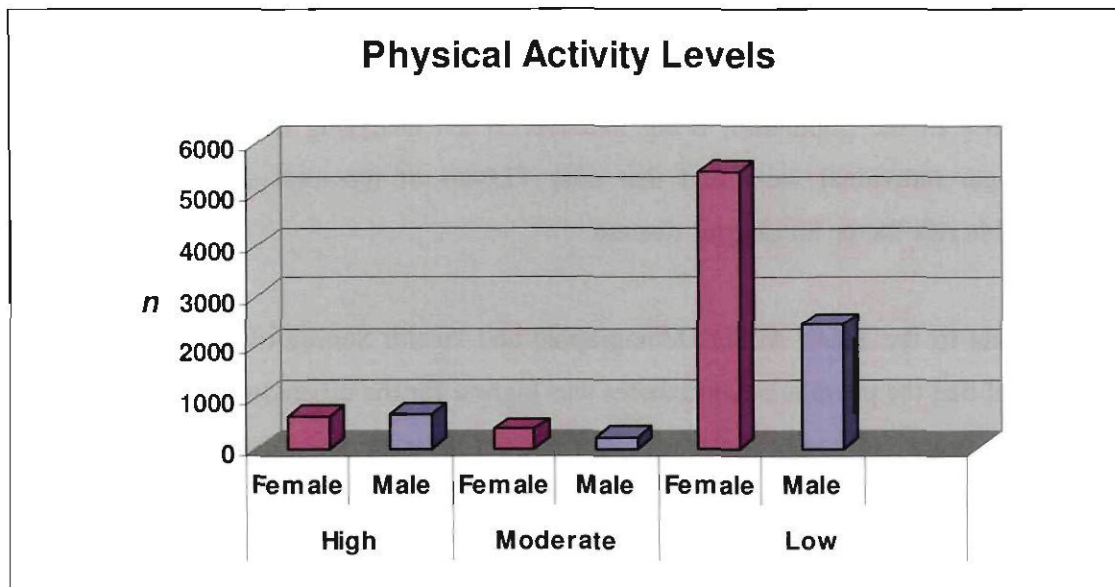
Table 5: Smoking habits of the total sample group

| Smoking | | Count | N | % |
|---------|--------|-------|------|----------|
| No | Male | 2290 | 2290 | 68.64508 |
| | Female | 5031 | 5031 | 77.11527 |
| Yes | Male | 1046 | 3336 | 31.35492 |
| | Female | 1493 | 6524 | 22.88473 |

Of the total sample 74.2% do not smoke at all. Predominately the male population (31.35%) smokes more than the female population (22.9%).

The levels of Physical Activity are presented in Graph 2. The majority of the sample group experience low levels of physical activity (80.8%) with the female population being more inactive (84.5%) than the male population (73.7%). Only 13.2% of the sample population reported participating in regular physical activity more than three days a week, for longer than 30 minutes at a time. Of the total sample that has high levels of physical activity, only 9.7% are females and 20.0 % are males.

Graph 2: Physical Activity levels of the total sample group



3.4 DISCUSSION

The first step to the risk reduction for cardiovascular disease lies in the identification of these specific individual risk factors, determining the impact that these factors have on each other as well as the implementation of lifestyle modification processes to support the long term prevention of these diseases. The HRA was implemented to assist the organization to determine the evident health risks. When we take into account the research by Stave *et al.* (2003) and Haynes *et al.* (1999) it could be argued that there could be a population bias towards either a healthier or sicker population due to the population that traditionally will opt to undergo a HRA screening. Taking into account that 83.9% of the sample group was not on any chronic medication programme, it could suggest that this would represent a healthier population, but the results of this sample indicate that this sample had a high prevalence of health risk factors combined with a high tendency towards physical inactivity.

Musich (2003) investigated the relationship between health risk status and excess medical expenditures and found that more high-risk lifestyle behaviours such as obesity, high blood pressure, and high cholesterol levels are associated with higher costs than lower risk behaviours. Due to the high incidence of high risk lifestyle behaviours of the sample group, it can therefore be expected that this will imply higher medical costs for this organization. Lambert (2001) estimated that 56% of all South Africans between the ages of 15-64 have at least one modifiable risk factor for chronic diseases of lifestyle. This study findings is similar, confirming the above

finding as the tendency toward selected health risks was high with 22.9% of the female population and 31.4% of the male population being smokers; 32.3% are overweight and 25.3% within the boundaries of obesity; 17.5% has an elevated cholesterol level (above 5.2 mmol.L⁻¹); and 80.8% of the population being inactive. When analysing the amount of modifiable risk factors per individual we found that only 12.98% of the total sample group did not have modifiable risk factor for chronic disease.

According to the South Africa Demographic and Health Survey of 1998 (DOH, 2002), it was indicated that the prevalence of diabetes was highest for the urban dwellers of the age group 15 – 64 years of age. Although the assessment did not measure the prevalence of diabetes per se, it was indicated that there is a tendency toward a higher prevalence of diabetes in this sample group.

The present study done within the corporate environment of the financial industry, confirms the findings of similar studies done in the urban environment regarding the prevalence of physical inactivity (Lambert *et al.*, 2001; Levitt *et al.*, 1993; Sparling *et al.* 1994; Koekemoer *et al.*, 2004; and Labuschagne *et al.*, 2007). The differences in activity levels for the males and females also show that females are less active than their male counterparts (Wilcox *et al.*, 2000; WHO Physical Inactivity Prevalence 2003; Sobngwi *et al.* 2004). Burton *et al.* (2004) indicate that physical inactivity could reflect negatively on work performance (presenteeism) and result in an increase in indirect medical costs. It is therefore important for an organization to address physical inactivity if they want to improve the work performance of their employees as well as reduce medical related expenditure.

3.5 CONCLUSION

It is recommended that future interventions within the corporate environment should focus on the reduction of these specific evident health risks. Myers (2003) state that the real effect of physical inactivity on cardiovascular risk it should not be seen in isolation, but in combination with other lifestyle modifications such as proper nutrition, smoking cessation and medication usage.

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Chapter 4

Article 2

The interaction of Physical Activity on Selected Health Risks in the Corporate Environment

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Physical Activity and Health Risks

ABSTRACT

Physical inactivity is known to be one of the leading causes of chronic conditions such as obesity & cardiovascular disease. The employee within the corporate environment is under constant pressure to perform at his/her workstation, and therefore given limited time to be physically active. The company implemented a Health Risk Assessment (HRA) to determine the health risk evident within their environment. In this survey conducted over a period of one year, 9860 employees from all ages, and racial groupings completed this HRA on a voluntary basis. This sample represented 51% of the total population of the organization. We divided the sample into those who are on chronic medication and those who are not and looked at the impact of different physical activity levels on selected health risk factors. No statistical significance ($p \leq 0, 05$) could be found between the different activity levels and BMI, Systolic blood pressure, Diastolic blood pressure and Total cholesterol levels. Diabetes risk showed statistical significance between high levels of physical activity and inactivity for both the participants on chronic- and not on chronic medication, indicating a decline in diabetic risk as physical activity levels improve. It is recommended that the improvement of health status be attained by using physical activity as part of a comprehensive programme that also focuses on weight reduction, improvement of dietary habits, and the reduction of stress levels.

Key words: Health risk factors, physical activity, health, corporate environment physical inactivity, high blood pressure, high blood cholesterol and obesity

4.1 INTRODUCTION

Globally the rapid rates of urbanization, especially in the developing countries, are threatening the prevalence of physical activity levels in the evident populations (Sparling, Owen, Lambert & Haskell, 2000 ; Sobngwi, Mbanya, Unwin, Aspray & Alberti, 2001; Sobngwi, Mbanya, Unwin, Kengne, Fezeu, Minkoulou, Aspray & Alberti, 2002 ; Sobngwi, Mbanya, Unwin, Porcher, Kengne, Fezeu, Minkoulou, Tournoux, Gautier, Aspray & Alberti, 2004; Vorster 2002 ; Yusuf, Reddy, Ôunpuu, & Anand, 2001). The corporate environment also places less and less emphasis on physical activity. The workload of the average employee increases, reducing their time to spend away from their desks. Rothmann (2003) state that the current South African environments in which employees operate demands more of them that previously. It is also mentioned that employees have to cope with many demands with, in many cases, limited resources as well as a lack of control over their circumstances. The urban environment places a demand on transportation to get to and back from work, and it is the norm for the employee to spend more time at work in order to avoid the rush hour traffic thereby reducing their leisure time available during which most of them could have participated in some form of physical activity (Handy, Boaret, Ewing, & Killingsworth, 2002).

Chronic Disease is estimated to be responsible for approximately 60% of the total deaths in 2005 of which 80% will occur low and middle income countries (Preventing chronic diseases: a vital investment *In* WHO, 2007). Estimates in South Africa indicating the burden of disease (Deaths and disability –adjusted life years) attributable to physical inactivity show that 30% of ischaemic heart disease, 27% of colon cancer, 22% of ischaemic stroke; 20% of type 2 diabetes, and 17% of breast cancer is related to physical inactivity (Joubert, Norman, Lambert, Groenewald, Schneider, Bull, Bradshaw & South African Comparative Risk Assessment Collaborating Group., 2007).

In its Global Strategy on Diet, Physical Activity and Health (2004), the WHO states that the most important risk factors leading to non communicable diseases includes: high blood pressure, high concentrations of cholesterol in the blood, inadequate intake of fruit and vegetables, overweight and obesity, physical inactivity and tobacco use. Furthermore, five of these risk factors relate to diet and physical activity, and additional benefits can be gained from physical activity that are independent of nutrition and diet (WHO., 2004).

Grundy, Pasternak, Greenland, Smith, & Fuster (1999) in their assessment of the causes for Coronary Heart Disease (CHD) indicate that smoking, elevated blood pressure; elevated serum total cholesterol, diabetes mellitus and advancing age are major and independent risk factors. Additionally there are other factors that are also associated with and increased risk and they categorized these into two groups: there are conditional risk factors and predisposing risk factors. Conditional risk factors are associated with an increased risk for the development of CHD and the predisposing risk factors are those that worsen the independent risk factors. Obesity and physical inactivity are two of these predisposing risk factors, designated major risk factors by the American Heart Association (AHA) (Grundy *et al.*, 1999).

The current study aims to investigate the interaction of physical inactivity, high blood pressure, high blood cholesterol and obesity within the corporate environment.

4.2 METHODS

4.2.1. Study Population

The study population of 9860 in this study comprises of men and women of all culture groups that worked for this financial institution in 2005/6 and belonged to the medical aid of the institution. Due to a company policy not to differentiate between ethnic groupings, the group was treated as such. The participation was on a voluntary basis and therefore the sample group self selected. Differentiation was made between participants on chronic and non-chronic medication.

4.2.2. Procedures and Instruments

Assessment of physical activity and other selected health risk factors was done according to the health risk assessment (HRA) methodology developed by the company Monitored Health Risk Managers (MHM) for the medical aid (Bankmed) of the financial institution. The tests were administered by contracted biokineticists that were trained on the specific requirements for implementation of the toolkit.

The HRA tool is a technique for estimating the odds that an individual with certain characteristics will die from selected causes within a given time span.

It provides group data that summarizes the major health problems and risk factors of a selected group

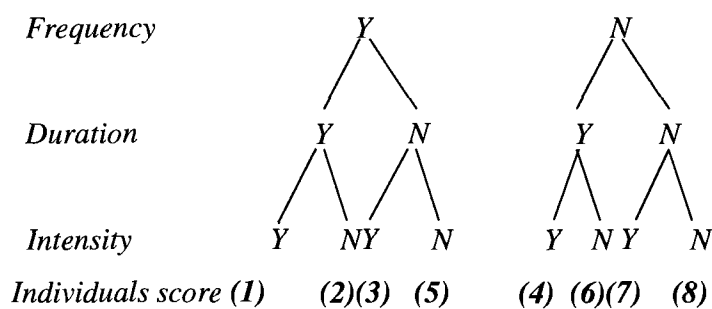
The HRA questionnaire asks questions about lifestyle factors such as personal or family health history, other risk factors and demographics. It also requires the measurement of clinical data such as blood pressure, height and weight, blood glucose and cholesterol. Other questions included in the questionnaire are information about your eating habits, stress management and activity levels and habits.

The questionnaires were captured online via the medical aid website and feedback reports were generated indicating their related risks for developing cardiac risks. Data were presented in an excel spreadsheet for analysis.

The Physical activity levels were determined using the following questions in the HRA:

- Do you participate in regular physical activity?* Y / N
- If you answered YES to the above question:*
- Do you exercise 3 times or more per week?* Y / N
- Does each exercise session last at least 30 minutes?* Y / N
- Do you ever exercise at a moderate to vigorous intensity (i.e. at a level that raises a sweat and you are able to talk, but not sing)?* Y / N

An algorithm was developed by Monitored Health Risk Management (MHM) (2005) to determine physical activity levels. The algorithm includes the following



Score: 1 - 2 (high level of physical activity) physically active

3 – 4 (moderate level of physical activity)

5 – 9 (low level of physical activity) physically inactive

Participants that were measured scoring equal or less than two were considered physically active (high level of physical activity)

The Body mass Index (BMI) were determined as weight in kilograms divided by height in meters squared. The following classification was used: Underweight $<18 \text{ kg}\cdot\text{m}^{-2}$; Normal $19\text{-}24 \text{ kg}\cdot\text{m}^{-2}$; Overweight $25\text{-}29 \text{ kg}\cdot\text{m}^{-2}$, Obese $>30 \text{ kg}\cdot\text{m}^{-2}$. (ACSM 2006:58)

For systolic (SBP) and diastolic blood pressure (DBP) ratings the following classification was used: Normal SBP $<120 \text{ mm Hg}$, DBP $<80 \text{ mm Hg}$; Pre hypertension SBP $120\text{-}139 \text{ mm Hg}$, DBP $80\text{-}89 \text{ mm Hg}$; Stage 1 Hypertension SBP $140\text{-}159 \text{ mm Hg}$, DBP $90\text{-}99 \text{ mm Hg}$; Stage 2 Hypertension SBP $\geq 160 \text{ mm Hg}$, DBP $\geq 100 \text{ mm Hg}$. (ASCM 2006:44)

Total Cholesterol level classification was determined by desirable being $<5.2 \text{ mmol}\cdot\text{L}^{-1}$; borderline high $5.2 - 6.2 \text{ mmol}\cdot\text{L}^{-1}$ and high $>6.2 \text{ mmol}\cdot\text{L}^{-1}$ (ASCM 2006:45)

The Diabetes risk was determined using the following scoring method.

| | | |
|---|----------------|-------------------|
| <i>Age</i> | <i>46 – 65</i> | <i>- 5 points</i> |
| | <i>> 65</i> | <i>- 9 points</i> |
| <i>BMI</i> | <i>> 25</i> | <i>- 5 points</i> |
| <i>Sibling(s) with DM (q8.1)</i> | | <i>- 1 point</i> |
| <i>Parent with DM (q8.2)</i> | | <i>- 1 point</i> |
| <i>PAL</i> | <i>> 1</i> | <i>- 5 points</i> |
| <i>Baby weighing > 4.0 kg</i> | | <i>- 1 point</i> |
| <i>(or gestational diabetes) (q8.3)</i> | | |
| <i>Random blood glucose > 8-</i> | | <i>10 points</i> |

Low risk 0 – 2

Moderate risk 2 – 10

High risk 11 - 32

4.2.3. Statistical procedures

A STATISTICA-computer program (Statsoft., Inc., 2003) at North-West University, Potchefstroom Campus, was used for analysing the data. For the purpose of this study a one-way analysis of variance was computed (Thomas & Nelson, 1996:155-161).

4.3. RESULTS

The study population comprised of 9860 male and female participants. The majority of the sample group is inactive (7900 participants or 80.1%) and 1294 participants highly active. Highly active is defined in this study as participation in regular physical activity with a frequency of three (3) times or more per week, a session lasting at least thirty (30) minutes at a time and at all intensity levels. The group that fell in the moderately active group was found to be those who exercise three (3) times or less per week, with duration of thirty minutes (30) or less, and at an intensity level of moderate to vigorous intensity. The low active (or inactive) sample who do/ or do not exercise at all, do/or do not exercise three (3) times per week, whose exercise session do not last 30 minutes at a time and when they per occasion do any form of activity, will exercise at any intensity level.

A statistical significant difference, between the highly active group and inactive group, was found with regards to diabetes risk in the study population (Table 1.)

It was found that the Body Mass Index (BMI) for all the activity groups fell within the overweight category (ACSM 2006:58) with no significant differences between the different activity levels. The systolic blood pressure levels of the highly active and moderately active groups fell within the prehypertensive category and the inactive group within the normal category. The diastolic blood pressure levels were for all the activity groups within the normal category (ACSM, 2006: 44). The total cholesterol levels fell within the desirable category for all the levels of activity (ACSM, 2006: 45)

The sample group was divided into different categories based on the fact that they are on chronic medication or not. This differentiation was made to see if the impact of being on chronic medication or not, could have an influence on your health status; as well as looking at the influence of different physical activity levels on the outcome. A further differentiation was made between male and female. Table 2 and Table 3 indicates the significance of physical activity levels on selected health risk factors for the sample group on chronic medication and those who are not on chronic medication

Table 1: Interaction of different physical activity levels on selected health risk factors

| | N | Diabetes Risk | | BMI | | Sys. Bp | | Dias. Bp | | Total Cholesterol | |
|-------------------|------|---------------|-----|------|-----|---------|------|----------|------|-------------------|-----|
| | | x | SD | x | SD | X | SD | x | SD | x | SD |
| Highly Active | 1294 | 4.0 | 4.1 | 26.2 | 5.0 | 120 | 15.0 | 77 | 10.8 | 4.36 | 0.9 |
| Moderately active | 578 | 9.1 | 4.4 | 26.0 | 5.2 | 120 | 16.4 | 77 | 12.0 | 4.44 | 1.0 |
| Inactive | 7900 | 9.0 | 4.2 | 26.5 | 5.9 | 119 | 15.9 | 76 | 11.6 | 4.42 | 0.9 |

- Significant differences with groups were indicated under the average means of each group by a group code of that group were the significance appears

Table 2: The impact of physical activity levels on selected health risk factors within the sample group that is on chronic medication

| | | Participants on Chronic Medication | | | | | | | | | | | |
|-------------------|---------|------------------------------------|------------|------|-------------------|----|----------|---------------|------|-----|------------|------|------|
| | | Inactive | | | Moderately active | | | Highly active | | | | | |
| | | N | x | SD | N | X | SD | N | x | SD | | | |
| Diabetes Risk | Females | 866 | a c*d*f* | 12.2 | 4.9 | 88 | b c*d*e* | 10.8 | 4.4 | 130 | c a*b*d*e* | 6.7 | 5.3 |
| | Males | 351 | d a*b*c*f* | 14 | 6.1 | 36 | e b*c*f* | 13.8 | 4.9 | 102 | f a*b*c*d* | 8.0 | 5.2 |
| BMI | Females | 866 | g | 28.6 | 6.4 | 88 | h | 27.7 | 6.1 | 130 | i j* | 27.5 | 6 |
| | Males | 351 | j i* | 29.6 | 4.9 | 36 | k | 27.9 | 3.5 | 102 | l | 28.1 | 3.8 |
| Systolic BP | Females | 866 | m p* | 123 | 17 | 88 | n p* | 120 | 14.9 | 130 | o p* | 123 | 16.1 |
| | Males | 351 | p m*n*o* | 130 | 15.6 | 36 | q | 129 | 16.9 | 102 | r | 126 | 14.8 |
| Diastolic BP | Females | 866 | s v* | 78 | 11 | 88 | t v*w* | 77 | 11 | 130 | u v* | 79 | 11 |
| | Males | 351 | v s*t*u* | 83 | 11 | 36 | w t* | 84 | 9 | 102 | x | 80 | 10 |
| Total Cholesterol | Females | 866 | y | 4.78 | 1 | 88 | z | 4.77 | 1 | 130 | aa | 4.6 | 1 |
| | Males | 351 | ab | 4.74 | 1 | 36 | ac | 4.79 | 1 | 102 | ad | 4.63 | 0.8 |

- Significant differences with groups were indicated under the average means of each group by a group code of that group were the significance appears
- Statistical significance ($p \leq 0.05$) were indicated with a *

Table 3: The impact of physical activity levels on selected health risk factors within the sample group that is not on chronic medication

| | | Participants not on Chronic Medication | | | | | | | | |
|-------------------|---------|--|--------------|------|-------------------|--------------|------|---------------|------------------|------|
| | | Inactive | | | Moderately active | | | Highly active | | |
| | | N | \bar{x} | SD | N | \bar{X} | SD | N | \bar{x} | SD |
| Diabetes Risk | Females | 4590 | a c*f* 8.3 | 3.5 | 285 | B c* f* 8.4 | 3.9 | 499 | c a*b*d*e*f* 3.3 | 3.6 |
| | Males | 2093 | d c* f* 8.5 | 3.8 | 169 | e c* f* 8.6 | 4.1 | 563 | f a*b*c*d*e* 3.4 | 3.4 |
| BMI | Females | 4590 | g 26.2 | 6.1 | 285 | H 25.6 | 5.2 | 499 | i 26 | 5.5 |
| | Males | 2093 | j 25.8 | 4.9 | 169 | K 25.3 | 4.8 | 563 | l 25.7 | 4.3 |
| Systolic BP | Females | 4590 | m p*q*r* 115 | 14.9 | 285 | N p*q*r* 116 | 15.3 | 499 | o p*q*r* 116 | 14.5 |
| | Males | 2093 | p m*n*o* 123 | 15 | 169 | Q m*n*o* 125 | 16.8 | 563 | r m*n*o* 123 | 14.2 |
| Diastolic BP | Females | 4590 | s v*w*x* 74 | 11 | 285 | t v*w*x* 75 | 11 | 499 | u v*w*x* 75 | 10 |
| | Males | 2093 | v s*t*u* 79 | 11.3 | 169 | W s*t*u* 81 | 12 | 563 | x s*t*u* 78 | 10 |
| Total Cholesterol | Females | 4590 | y ab* 4.33 | 0.9 | 285 | z 4.35 | 0.9 | 499 | aa 4.31 | 0.8 |
| | Males | 2093 | ab y* 4.42 | 0.9 | 169 | ac 4.35 | 1 | 563 | ad 4.29 | 0.8 |

- Significant differences with groups were indicated under the average means of each group by a group code of that group where the significance appears
- Statistical significance ($p \leq 0.05$) were indicated with a *

Significant differences between the average means are seen between the highly active group and the inactive group for both the male and females in the groups on chronic medication or not on chronic medication ($p \leq 0.05$). It seems that the diabetes risk declines as the activity level increases for both these groups. The inactive females who are on chronic medication show an average mean for diabetes risk of 12.2 vs. the highly active female on chronic medication group of 6.7. Similarly the inactive males of the group not on chronic medication have an average mean significantly higher than the highly active group.

Statistical significances were measured within both sample groups (male and females) in relation to diabetes risk, BMI, Systolic Blood pressure (Sys. Bp), and Total cholesterol levels ($p \leq 0.05$). This difference could be due to the fact that the sample group that is on chronic medication is much smaller than the sample not on chronic medication and this could lead to bias in this regard.

When analysing the average means for both these groups we find that the means for all the different health risk factors are higher in the group that is on chronic medication vs. the group

that is not on chronic medication. Important to note here is that the average means for most health risk factors indicated here, are still elevated after taking chronic medication. Important to note though is that health factors such as BMI and the diabetes risk index, are not directly influenced by taking chronic medication.

4.4 DISCUSSION

Preventative wellness activities should focus on the treatment of the major risk factors. If these risk factors are left untreated for period of time, it could produce the development of CVD (Grundy *et al.*, 1999). The implementation of HRA testing within the corporate environment will therefore benefit the organization by 1) identifying the high risk employees who would need interventions, 2) provide insight to those employees who do not regularly go for medical check-ups, and 3) the summation of risk factors gives an overall view of risk categorization.

As Grundy has indicated it is important that the individual start acting on the specific risk factors indicated in the HRA screening and this is the reason that some of these individuals were placed on a chronic medication programme. It was not clear in the survey, for how long these participants have been on the chronic medication programme, for this to have an effect on the reduction of health risk factors.

Regular Physical activity has been indicated to have a protective role to play in the development of CVD (Lee 2000; Wannamethee, 2001; Manson, 2002; Myers, 2003; Hu, 2005). Barengo *et al.* (2004) found that moderate and high levels of leisure time and occupational physical activity has a protective effect regardless of body mass index, age, smoking, total cholesterol, systolic blood pressure and other forms of physical activity. In this sample the impact of physical activity on specific health risk indicators could not be seen, but in this regard Myers (2003) also mentions that the real effect of physical inactivity on cardiovascular risk should not be seen in isolation, but in combination with other lifestyle modifications such as proper nutrition, smoking cessation and medication usage. When looking at the research of Sobngwi *et al.* (2002) we also find another important variable that should be taken into account. They reported that urbanization is associated with a drastic decrease in physical activity levels, change in dietary habits and added psychological stress. They suggest that both lifetime exposure to the urban environment and recent migration are potential risk factors for obesity and diabetes mellitus and could be due to an accumulative effect over years of dietary changes, decreased physical activity levels and increasing stress levels. Although the factors such as dietary habits, smoking, and stress were

also assessed in the questionnaire, we did not include that in for the purpose of this survey. The reason for the exclusion of these was due to the fact that the impact of these on CVD risk can only be seen if an individual have been doing these lifestyle changes consistently over a period of time. The participants were not asked to comment on how long they have been practising these healthy habits (including physical activity). Only as part of the section on Stages of Change, were they given the option to indicate this. It therefore appears that the physical activity data obtained from this survey, has limited validity. Although Shephard (2003) also suggests that with a large sample you can overcome limited validity, it does not appear to be the case here.

4.5 CONCLUSION

As the research by Anderson & Straufacker (1996) indicates, the impact of the implementation of HRA's on health related outcomes are weak. The value of the HRA upon changing health behaviour lies within the implementation of this as part of a comprehensive worksite health promotional programme. The HRA will only give the individual insight into the evident health risks, but specific intervention programmes that focuses on the specific population (low, moderate or high risk), should be developed to effectively address the health risk. The greatest value of an HRA lies in the ability of the instrument to provide insight into health benefits gained due to the intervention strategy. The impact of physical activity on the specific health risk factors were not statistically significant and only evident where physical activity was a component of a clustered approach. The diabetes risk is determined by a combination of factors such as BMI, age, and physical activity level and therefore could provide statistically significance.

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Chapter 5

Article 3

The impact of Physical Activity on Medical expenditure of a sample group working within a financial institution

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Physical Activity and Health Risks

ABSTRACT

Companies are under constant pressure to survive amidst attacks on their profitability. Health promotional programmes can assist to support the organizations in this regard by ensuring that medical expenditures are contained. We implemented a Health Risk Assessment process as part of a health promotional programme and looked at the current medical expenditures of the participants in this programme. The sample included 9860 employees of all ages and racial groups that participated on a voluntary basis. The impact of the different physical activity levels of the participants on their medical expenditures was investigated. Participants were divided into 2 groups: Those who are on a chronic medication programme and those who are not as this will have an impact on the results.

No statistical significance could be found between physical activity levels and medical expenditure, although those who are highly active seemed to have higher expenditure than those who are inactive.

Key words: Health risk factors, physical activity, health, corporate environment, medical expenditure.

5.1 INTRODUCTION

Health care expenditures are continually in an upward trend and this threatens the profitability and survival of companies (Musich, Hook, Barnett & Edington, 2003). In many instances, health promotional programmes are used as a method to reduce employee – related costs (Sethi, 2001). In 1999, the predominant reason why companies invest in health promotional programmes was to keep employees healthy (84%) and reducing health care costs (76%) (Partnership for Prevention, 2001). Studies by Fries and Wright (1993); Stein, Shakour and Zuidema (2000); Pelletier (2001); and Sexner *et al.* (2003) confirms that one of the main reasons for health promotional programmes in the corporate setting are health care cost containment. Musich *et al.* (2003) indicated a significant relationship between health risk factors and medical costs. They implemented a Health Risk Assessment protocol and found that low-risk participants were associated with lower medical costs compared to medium of high-risk workers.

Pronk *et al.* (1999) found that inactive individuals had 4.7% higher medical expenditure than those who were physically active 1 day per week. Katzmarzyk *et al.* (2000) indicates that a reduction in the prevalence rate of physical inactivity could potentially reduce direct health care expenditure. Since physical activity improvement has an indirect influence on the improvement of the health status of the individual it can be expected that it will also have an indirect financial benefit in terms of medical expenditures (Rodriguez *et al.*, 1994; Lichtenstein *et al.*, 2006). The increase of an individual's physical activity levels will result in substantial reduction in health care charges; beneficial in the short term for the health plan to create supportive structures for the improvement of general health status (Pronk *et al.*, 1999).

The current study investigated the medical expenditure incurred by employees working within a financial institution that participated in a health promotional programme, and looked at the impact of their different physical activity levels on this expenditure.

5.2 METHODS

5.2.1 Study Population

The study population of 9860 in this study comprises of men and women of all culture groups that worked for this financial institution in 2005/6 and belonged to the medical aid of the institution. Due to a company policy not to differentiate between ethnic groupings, the group

was treated as such. The participation was on a voluntary basis and therefore the sample group self selected. Differentiation was made between participants on chronic and not on chronic medication.

5.2.2 Procedures and Instruments

Assessment of physical activity and other selected health risk factors was done according to the health risk assessment (HRA) methodology developed by the company Monitored Health Risk Managers (MHM) for the medical aid (Bankmed) of the financial institution. The tests were administered by contracted biokineticists that were trained on the specific requirements for implementation of the toolkit.

The HRA tool is a technique for estimating the odds that an individual with certain characteristics will die from selected causes within a given time span.

It provides group data that summarizes the major health problems and risk factors of a selected group

The HRA questionnaire asks questions about lifestyle factors such as personal or family health history, other risk factors and demographics. It also requires the measurement of clinical data such as blood pressure, height and weight, blood glucose and cholesterol. Other questions included in the questionnaire are information about your eating habits, stress management and activity levels and habits.

The questionnaires were captured online via the medical aid website and feedback reports were generated indicating their related risks for developing cardiac risks. Data were presented in an excel spreadsheet for analysis.

The Physical activity levels were determined using the following questions in the HRA:

Do you participate in regular physical activity? Y / N

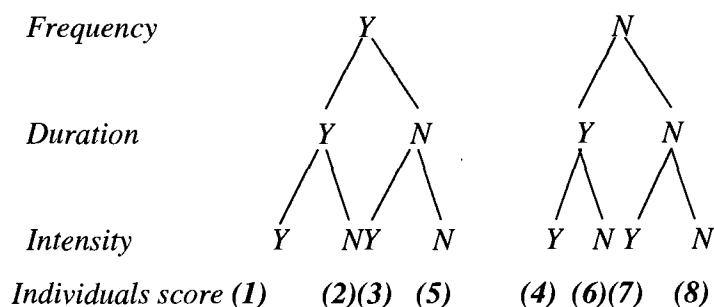
If you answered YES to the above question:

Do you exercise 3 times or more per week? Y / N

Does each exercise session last at least 30 minutes? Y / N

Do you ever exercise at a moderate to vigorous intensity (i.e. at a level that raises a sweat and you are able to talk, but not sing)? Y / N

An algorithm was developed by Monitored Health Risk Management (MHM) (2005) to determine physical activity levels. The algorithm includes the following



Score: 1 - 2 (high level of physical activity) physically active

3 – 4 (moderate level of physical activity)

5 – 9 (low level of physical activity) physically inactive

Participants that were measured scoring equal or less than two were considered physically active (high level of physical activity)

The Body mass Index (BMI) were determined as weight in kilograms divided by height in meters squared. The following classification was used: Underweight <18 kg·m⁻²; Normal 19-24 kg·m⁻²; Overweight 25-29 kg·m⁻², Obese >30 kg·m⁻². (ACSM Guidelines, 2006, p58)

For systolic (SBP) and diastolic blood pressure (DBP) ratings the following classification was used: Normal SBP <120 mm Hg, DBP <80 mm Hg; Pre hypertension SBP 120-139 mm Hg, DBP 80-89 mm Hg; Stage 1 Hypertension SBP 140-159 mm Hg, DBP 90-99 mm Hg; Stage 2 Hypertension SBP ≥160 mm Hg, DBP ≥100 mm Hg. (ASCM Guidelines, 2006, p44)

Total Cholesterol level classification was determined by desirable being <5.2 mmol.L⁻¹; borderline high 5.2 – 6.2 mmol.L⁻¹ and high >6.2 mmol.L⁻¹ (ASCM Guidelines, 2006, p45)

The Diabetes risk was determined using the following scoring method.

- | | | |
|------------|---------|------------|
| <i>Age</i> | 46 – 65 | - 5 points |
| | > 65 | - 9 points |
| <i>BMI</i> | > 25 | - 5 points |

Sibling(s) with DM (q8.1) - 1 point

Parent with DM (q8.2) - 1 point

PAL > 1 - 5 points

Baby weighing > 4.0 kg - 1 point

(or gestational diabetes) (q8.3)

Random blood glucose > 8- 10 points

Low risk 0 – 2

Moderate risk 2 – 10

High risk 11 - 32

The medical expenditure was divided into the following groups:

- GP and Pharmacy costs,
- Pharmacy costs,
- Hospital claims, and
- Total medical costs.

Medical expenditure was defined as the following:

- Total medical expenditure for a year period between June 2005 – June 2006
- GP costs were included with pharmacy costs and included visits to a GP in this period
- Pharmacy claims – included prescribed medications, and over the counter medications claimed for in this period
- Hospital Claims – costs incurred during admission to a hospital
- Total claims – including all claims related to hospital costs, GP costs, and pharmacological costs during this period

5.2.3 Statistical procedures

A STATISTICA-computer program (Statsoft., Inc., 2003) at North-West University, Potchefstroom Campus, was used for analysing the data. For the purpose of this study, a one-way analysis of variance was computed (Thomas & Nelson, 1996:155-161).

5.3 RESULTS

Fifty seven percent of the sample (n=5662) had no medical fund expenditure and the highest total medical expenditure (R133975.20) was incurred by a female participant that was inactive.

Table 1 show us the statistics of medical expenditure incurred by the sample group that is on chronic medication; and Table 2 medical expenditure for the sample that is not on chronic medication. The sample show quite a large margin of variability in medical expenditure as seen in the large standard deviations measured.

A bigger proportion (83.9%) of the sample is not on chronic medication. As expected, the sample that is on chronic medication, have higher medical expenditure than the sample that is not on chronic medication. A higher average medical expenditure reported for the male than the female population, on chronic medication (Table 1). It was just the other way round for males and females not on chronic medication (Table 2)

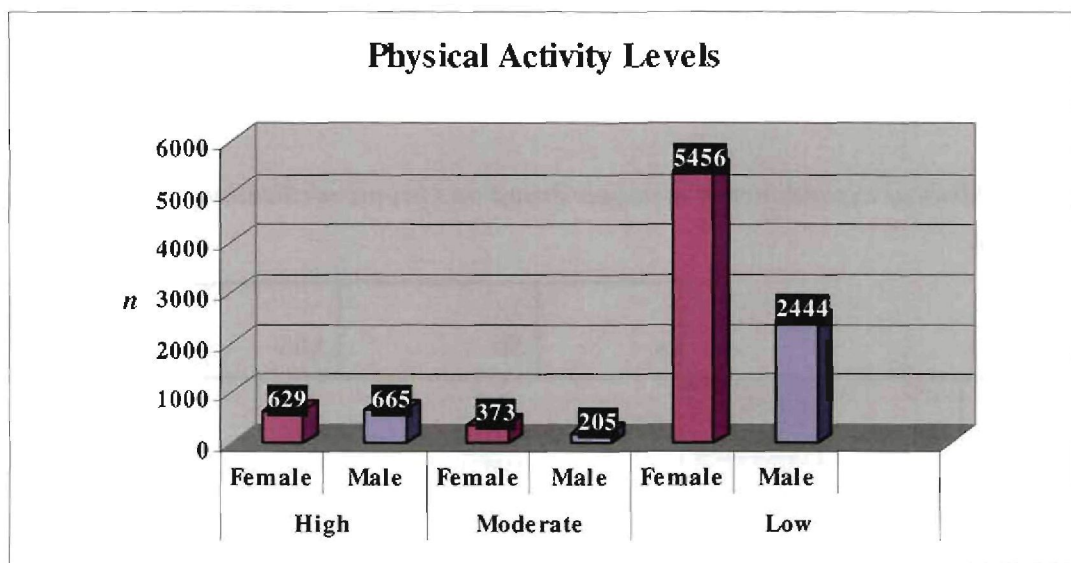
Graph 1 indicates the physical activity levels of the sample group. The majority of the sample is inactive (80.8%) and proportionally more females is inactive than males.

Table 1: Medical expenditure of a sample group on chronic medication working in a financial institution

| | | | – x | SD | Min | Max |
|-----------------------|---------------------|--------|---------|---------|-----|----------|
| On Chronic Medication | GP & Pharmacy costs | Female | 1050.25 | 1180.58 | 0 | 11887.01 |
| | | Male | 1187.68 | 1539.71 | 0 | 14990.33 |
| | Pharmacy costs | Female | 789.11 | 1000.39 | 0 | 11407.14 |
| | | Male | 980.93 | 1436.59 | 0 | 14990.33 |
| | Hospital Claims | Female | 649.64 | 4237.24 | 0 | 81583.72 |
| | | Male | 721.71 | 5207.37 | 0 | 83484.51 |
| | Total | Female | 2911.57 | 6581.83 | 0 | 133975.2 |
| | | Male | 3114.58 | 8038.93 | 0 | 118095.4 |

Table 2: Medical expenditure of a sample group not on chronic medication working in a financial institution

| | | | – | | | |
|---------------------------|---------------------|--------|--------|---------|-----|----------|
| | | | x | SD | Min | Max |
| Not on Chronic Medication | GP & Pharmacy costs | Female | 199.73 | 437.35 | 0 | 6690.39 |
| | | Male | 132.82 | 355.82 | 0 | 4571.39 |
| | Pharmacy costs | Female | 99.89 | 274.23 | 0 | 5868.68 |
| | | Male | 67.64 | 236.39 | 0 | 4571.39 |
| | Hospital Claims | Female | 253.71 | 1900.8 | 0 | 50802.52 |
| | | Male | 189.21 | 2306.35 | 0 | 65816.05 |
| | Total | Female | 905.72 | 3468.01 | 0 | 119885.8 |
| | | Male | 639.63 | 3613.44 | 0 | 88591.4 |



Graph 1: Physical Activity levels of the total sample group

Table 3: Physical activity levels of the different sample groups

| | | On Chronic medication | | | Not on chronic medication | | |
|----------------|---|-----------------------|-------------------|---------------|---------------------------|-------------------|---------------|
| | | Inactive | Moderately active | Highly active | Inactive | Moderately active | Highly active |
| Females | N | 866 | 88 | 130 | 4590 | 285 | 499 |
| Males | N | 351 | 36 | 102 | 2093 | 169 | 563 |
| Total | N | 1217 | 124 | 232 | 6683 | 454 | 1062 |

Table 4: Medical expenditure in different activity levels for participants that is on chronic medication

| | | Participants on Chronic medication | | | | | | | | |
|-----------------------|--------|------------------------------------|--------------|---------|-------------------|-----------|---------|---------------|---------------|----------|
| | | Inactive | | | Moderately active | | | Highly active | | |
| | | N | X | SD | N | X | SD | N | X | SD |
| GP & Pharmacy costs | Female | 876 | a 1042.44 | 1171.12 | 89 | b 1012.19 | 1255.51 | 130 | c 1105.39 | 1151.92 |
| | Male | 352 | d 1210.96 | 1651.43 | 36 | e 1177.85 | 1240.46 | 102 | f 1121.86 | 1213.16 |
| Pharmacy costs | Female | 876 | g 781.66 | 979.35 | 89 | h 742.96 | 1069.96 | 130 | i 919.57 | 1029.99 |
| | Male | 352 | j 990.37 | 1151.06 | 36 | k 1015.32 | 1115.76 | 102 | l 945.85 | 1099.47 |
| Hospital Claims costs | Female | 876 | m 662.88 | 4276.66 | 89 | n 919.5 | 6144.55 | 130 | o 405.63 | 1775.54 |
| | Male | 352 | p r* 432.25 | 3341.94 | 36 | q 1261.96 | 4413.49 | 102 | r p* 1537.06 | 9215.22 |
| Total Claims costs | Female | 876 | s 2953.42 | 6752.49 | 89 | t 3259.97 | 8504.27 | 130 | u x* 2431.43 | 3183.25 |
| | Male | 352 | v x* 2680.08 | 5303.41 | 36 | w 4066.55 | 7359.19 | 102 | Xu*v* 4307.96 | 13946.32 |

- Significant differences with groups were indicated under the average means of each group by a group code of that group where the significance appears
- Statistical significance ($p \leq 0.05$) were indicated with a *

Table 5: Medical expenditure in different activity levels for participants that is not on chronic medication

| | | Participants not on Chronic medication | | | | | | | | |
|-----------------------|--------|--|---------------|---------|-------------------|----------|---------|---------------|---------------|---------|
| | | Inactive | | | Moderately active | | | Highly active | | |
| | | N | X | SD | N | X | SD | N | X | SD |
| GP & Pharmacy costs | Female | 4610 | a d* 194.58 | 435.22 | 285 | B 157.22 | 373.21 | 499 | e d*P* 265.08 | 477.57 |
| | Male | 2098 | d a*c* 134.69 | 356.73 | 169 | E 97.46 | 320.11 | 563 | f c* | 131.16 |
| Pharmacy costs | Female | 4610 | g 96.65 | 273.51 | 285 | H 77.72 | 200.66 | 499 | i 141.86 | 313.72 |
| | Male | 2098 | j 66.41 | 236.63 | 169 | K 54.11 | 217.76 | 563 | l 75.63 | 242.51 |
| Hospital Claims costs | Female | 4610 | m 265.28 | 1933.23 | 285 | N 117.89 | 974.75 | 499 | o 237.91 | 2046.88 |
| | Male | 2098 | p 194.95 | 2448.05 | 169 | Q 77.06 | 901.95 | 563 | r 206.53 | 2075.62 |
| Total Claims costs | Female | 4610 | s 881.43 | 3104.08 | 285 | T 575.66 | 1731.56 | 499 | u 1277.69 | 6271.48 |
| | Male | 2098 | v 651.53 | 3878.28 | 169 | W 370.99 | 1804.03 | 563 | x 673.22 | 2990.32 |

- Significant differences with groups were indicated under the average means of each group by a group code of that group where the significance appears
- Statistical significance ($p \leq 0.05$) were indicated with a *

In Table 3 it is seen that a bigger proportion of participants, on chronic medication, is highly active (19.06%) compared to only 15.89% of participants that is not on chronic medication. The average age of the participants on chronic medication is older (46.7 ± 9.8 years of age) than those not on chronic medication (32.7 ± 9 years of age). The possible reasons behind this finding could be that the older population, as well as population that are on chronic medication, are more aware of the destructive lifestyle behaviours and are more likely to accept self responsibility for their health status (Labuschagne, Strydom & Wilders, 2006). Bertoldi *et al.* (2006) indicate in their research that even after the chronic disease is present, active individuals are less likely to use medications, reflecting an awareness of physical activity as a treatment modality in the management of the individuals' chronic disease.

In the next two Tables 4 and Table 5, distinction made between the participants concerning different activity levels and their respective medical expenditure.

The results (Table 5) indicate that the highly physically active population seem to have higher medical expenditure than the inactive group – although not statistically significant ($p \leq 0,05$). In a similar study, Brunette-de Busser (2007) also found that the pharmacy claims and total health care claims were higher for the physically active group versus their inactive counterparts.

It also seems that the male population on chronic medication has higher medical claims than their female counterparts, but the reverse tendency in the group that is not on chronic medication.

5.4 DISCUSSION

According the ACSM (2006), adults are considered physically active if they participate in moderate physical activity for at least 30 minutes at a time on most days of the week. Based on this recommendation, the physical activity levels of the participants are mainly inactive (80.8%), with some 6.0% moderately active and only 13.2% meet the requirements set by the ACSM (2006).

Katzmarzyk *et al.* (2000) estimated the direct health care costs of treating diseases related to physical inactivity as well as the fraction of total costs that resulted from physical inactivity. In the current study no significant difference between medical expenditure for the physically active group, moderately active and the inactive group is found for all cost categories. Although it is not statistically significant, the active group has slightly higher total claims costs than the inactive group (Table 4 & Table 5) with the only exception the total claims costs for the female

participants on chronic medication (Table 4). A possible explanation for this could be that the physically active group could be far more health conscious than the inactive groups and therefore would incur higher costs; as well as the fact that the active group would also be more prone to injuries due to their activity and would therefore incur additional medical costs. The same tendencies were found for both the groups (those on chronic medications and those who were not). Brunette- de Busser (2007) also mentions in her research that physical inactivity may have been both an effect and cause of disabling health conditions.

The differences in costs between the two groups could be expected due to the cost of chronic medication as well as the fact that the group on chronic medication is also traditionally an older age group than those not on chronic medications. It is also important that the measurement of the impact of physical activity on medical utilization should be seen within the context of an intervention programme. The measurement of lifetime physical activity was not included in this survey and could therefore have caused a certain bias in the outcome of the research. Some of the participants that indicated that they are physically active could have been active only for a limited time, therefore limiting the impact it will potentially have on their medical expenditure. Proper *et al.* (2006) in their research on the impact of dose- response relation between physical activity and sick leave indicate that the impact of these initiatives can only be seen over the long term. The same criteria could apply to the impact of physical activity on medical utilization.

5.5 CONCLUSION

The current study could not confirm the findings by Katzmarzyk *et al.* (2000) and Musich *et al.* (2003) related to the impact of physical activity on medical expenditure. It is expected that other health risk factors might have played a more prominent role to drive the medical cost utilization. The mere fact that it was unclear for how long the highly active population have been active, suggests that the true impact of physical activity could only be evident in a longitudinal study, were the impact of lifetime participation in physical activity could have an impact on medical expenditure. This could be a limitation of this study. A longitudinal study concerning all variables suggested for future research.

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Chapter 6

Conclusions and Further Research

6.1 CONCLUSION

Studies by Fries & Wright (1993); Stein, Shakour, Zuidema (2000); Pelletier (2001); and Sexner *et al.* (2003) all confirmed that the main reasons why companies invest in corporate wellness programmes, is to keep the employees healthy as well as health care cost containment. Physical inactivity is one of the risk factors evident in the corporate setting (Haskell *et al.* 2007) (<http://circ.ahajournals.org/cgi/reprint/CIRCULATIONAHA.107.185649v1.pdf> Date of access 23 Aug. 2007.) caused by the development of new technology and mechanization. Strydom (2000) also indicated that this lack of physical activity could result in the development of hypokinetic diseases that would ultimately negatively affect the employee's health status and therefore influence lead to an increased cardiovascular risk within the corporate environment.

The research questions that were addressed for this study included an analysis of the current physical wellness status of the employees working within a financial institution. Then we looked at the impact of physical inactivity on specific health risk factors. Thirdly we also had a look at the impact of physical inactivity on medical expenditure for this sample group working within this financial institution.

In Chapter 2 we discussed current research regarding corporate wellness and specifically focussed on the determinants of corporate wellness programmes, the impact of physical inactivity on other health risk factors as well as the financial implications on medical expenditure. Katzmarzyk *et al.* (2000: 344) indicated that physical inactivity had the highest prevalence when analyzing the prevalence of coronary risk factors such as obesity, hypertension, and high blood cholesterol levels in a population, and therefore will have the greatest potential to effect a reduction in Cardiac Artery Disease. From a behavioural perspective Pronk *et al.* (1999: 2238) found that increasing the physical activity level of the individual will result in substantial reduction in health care charges and that it will be beneficial in the short term for a health plan to create supportive structures for the improvement of general health status. The effect of physical

inactivity and other health risk factors were discussed with specific reference to the impact of physical inactivity on medical expenditure, productivity and presenteeism.

In Chapter 3 (Article 1) looked at the physical wellness profile of the employee working with a financial institution. We indicated that although no statistical interaction between health risks factors could be found, the tendencies of selected health risk factors were high.

Chapter 4 (Article 2) investigated the impact of physical activity on selected health risks in the corporate environment. We made a distinction between employees on chronic medication and those that were not due to the biasness that this could have on the results. Statistical significance was found between diabetes risk and physical activity level for both the employees on chronic – and not on chronic medication indicating a decline in diabetic risk as physical activity level increase.

In Chapter 5 (Article 3) the impact on physical activity on medical expenditure for this sample group was investigated. No statistical significance could be found between physical activity levels and medical expenditure, although those who were highly active seemed to have higher expenditure than those who were inactive.

6.2 RECOMMENDATIONS

The following recommendations are made from this study:

- **Hypothesis 1: Physical activity influence the health risk status of the subjects working within the financial institution**

The descriptive statistics of this sample group indicate that the physical wellness status of the sample is weak and that physical activity only had an impact on the diabetic risk index of the employee.

Hypothesis 1 is partly accepted

- **Hypothesis 2: Physical activity have a significant financial impact on the health risks of employees working within the financial institution**

When we looked at the impact of physical activity on the medical expenses incurred by employees working within a financial institution, we found no statistical significance. We did find though that the highly active employees had a slightly higher medical expenditure than

those who were inactive. The same tendencies were found for those who were on chronic medication and those who were not.

Hypothesis 2 is rejected.

6.3 FUTURE RESEARCH

The current study highlighted the following needs for future research

- A Longitudinal studies to measure the impact of lifetime commitment to physical activity on the physical wellness status of an employee within the financial corporate environment
- A study to determine to impact of physical activity on absenteeism and presenteeism within the financial corporate environment
- A study to confirm the real economic impact of physical inactivity within the financial corporate environment
- A study to measure the effectiveness of physical wellness initiatives implemented as part of health promotional processes in relation to behavioural change of the employee.

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APPENDIX A GUIDELINES FOR AUTHORS

The African Journal for Physical, Health Education, Recreation and Dance (AJPHERD) is a refereed journal established to:

- i) provide a forum physical educators, health educators and dance specialists, and other related professionals in Africa (including sports) the opportunity to report their research findings based on the African setting and also exchange ideas among themselves.
- ii) afford the professionals and other interested individuals in these disciplines the opportunity to learn more about the practice of disciplines in the different parts of the continent.
- iii) allow the rest of the world to learn more about the practice of the disciplines in Africa.

AJPHERD publishes research papers that contribute to knowledge and also develops theory either as new information, reviews, confirmation of previous findings, application of new teaching/coaching techniques and research notes.

SUBMISSION OF MANUSCRIPTS

Manuscripts should be typed with one and a half spacing in 12-point Times New Roman letter size and printed on A4-size white paper in laser quality. Three copies of the manuscript must be submitted. Length must not exceed 10 pages (tables, figures, references, etc. included). Authors are levied a page charge of US \$10.0 per every extra page. Longer manuscripts may be accepted for multiple studies and research reviews. All correspondence including original manuscripts (in English), which have not been submitted or published elsewhere, and should be sent to the Editor-In-Chief:

Professor L.O. Amusa

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Articles can also be submitted by e-mail. Authors are normally advised about the decision on their manuscripts within 60 days. Authors are, however, reminded to return revised edition soonest.

PREPERATION OF MANUSCRIPT

The author should ensure that the LANGUAGE of the manuscript has been thoroughly edited at the time of submission. On receiving a written notification that the article has been accepted, a final copy of the manuscript on a diskette (virus checked) should be submitted using MS-WORD, Office 97 or Office 2000 as a DOC-file. Authors will be requested to pay a publication charge of US \$100.0 to defray the very high cost of publication.

Title page

The first page of the paper should show the title, author's name/authors name and address(s). Authors are advised to include their telephone (work and home), fax numbers and e-mail addresses. Multiple authors should be listed in order of proportionate work commitment. The mailing address of the first named author and the institution where the work was conducted

should be provided in full. A short title of not more than 45 characters should be provided for use as a running head.

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 (one and a half spacing). A list of three to seven key words is required for indexing purposes and should be typed below the abstract.

Text

Start the text on a new page with the title of the article (centred and *without* the names of the authors). Make use of headings and subheadings. DO NOT justify the text and do NOT underline the text, as the manuscript may be scanned. Submitted manuscripts must conform to the **Publication Manual of the American Psychological Association** (4th ed.) and prepared in the following order: (1) title page (2) abstract (3) text including tables, figures etc., (4) references and (5) author notes (if any).

Tables and figures

Tables and figures should be numbered in *Arabic* numerals (1, 2, etc.) and each be prepared on a SEPARATE page (also on the diskette). A table requires a heading at the *top* and figures a legend *below* and separate from the figure. For *figures* kindly supply the values of the co-ordinates of line or bar graphs in a separate MS EXCEL (.exl) or WORD file (.doc) while also including the actual figures in the same file. Only original and high-resolution laser quality copies of figures and drawings and *original* photographs can be accepted (photocopies or negatives are unacceptable) for scanning. Indicate where the table or figures must feature in the text. Tables must be *without lines* for scanning purposes. The names of the authors must be

indicates clearly on the back of the copy of each table and figure. **Note:** Use the decimal point (not the decimal comma).

References

In the text the style of the American Psychological Association (APA) should be used by citing authors' surnames and the year of publication placed in parentheses. *For example:* Daly (1970); King & Loathes (1985); McGuines, Johnson & Bookerman (1990), when cited for the first time in the text; McGuines *et al.* (1990), for subsequent citations or (Daly, 1990), when Daly is not part of the sentence. Multiple references must be arranged chronologically, with the most recent reference listed last. Note that *et al.* is used in the body of the text when there are more than two authors, but never in the list of references.

List of references:

Only the references cited in the text should be listed alphabetically according to surname (last name) of authors after the body of text under the heading. **References** (capitals) starting on a new page. In the case of articles published in *JOURNALS*, references listed should include the surnames and initials of all authors, the year of the publication in parentheses, the full title of the article, the full name of the journal (*italics*), the volume number, the issue number in parentheses (omitted only if the said journal does not use issue numbers), followed by a comma and the first and last page numbers separated by a hyphen.

Example:

Van Wyk, G. J. & Amooore, J.N. (1995). A practical solution for calculating instantaneous values of tension in the extensor muscles of the knee joint during extension and flexion. *South African Journal of Research in Sport, Physical Education and Recreation*, 18(1), 77-97.

If the reference is a *BOOK*, the surname (last name) and initial of the author or editor (Ed.) must be given, followed by the year 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 country) where published, followed by a colon and the name of the publisher.

Example:

Jewett, A.E., Bain, L.L. & Ennis, C.E. (1995). *The Curriculum Process in Physical Education* (2nd ed.), Madison, WI: WBC Brown & Benchmark.

For a *CHAPTER* from a book, the page numbers of the chapter cited must be provided in parentheses (not italics) after the title of the book.

Example:

De Ridder, J.H. (1999). Kinanthropometry in exercise and sport. In L.O. Amusa, A.L. Toriola & I.U. Onyewadume (Eds.), *Physical Education and Sport in Africa* (pp. 235-263). Ibadan, Nigeria: LAP Publications.

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) and date of access. See "How to cite information from the Internet and the world wide web" at <http://www.apa.org/journals/webref.html> for specific examples. When citing a web site in the text, merely give the authors surname and year of publication in parentheses. Note that personal communications such as e-mail are cited only in the text and are not included in the list of references.

Example of Web Page:

Ackerman, E. (1996). "Writing your own Web Pages" Creating Web Pages. Hyperlink [http://www.mwc.edu/ernie/writeweb/writeweb.html. Retrieved 22 October 1999.

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APPENDIX B: QUESTIONNAIRE



PERSONAL HEALTH assessment

Congratulations on deciding to complete your Bankmed Personal Health Assessment. This service is covered in full by your insured benefits.

Your journey to good health begins here

The insight you will gain from your Personal Health Assessment will help you know what you have to do to achieve and maintain good health. Good health is your greatest asset in life and your Personal Health Assessment is the key.

There is a growing realisation that good health is not incidental, but largely the result of sensible living and conscious choices. Your Personal Health Assessment is a scientific measure of your health status and critical assessment of your lifestyle choices. It highlights your health risks - current and potential - and your lifestyle choices contributing to this risk.

Good health advice and recommendations

With your Personal Health Assessment you will receive recommendations on what you can do to improve your health. Should you need to make significant changes to your diet and lifestyle, you will also receive telephonic support from dedicated Bankmed health coaches and be introduced to the Bankmed SWITCH programme - a programme that helps you make key

How to get started

All you need to do is go to your nearest clinic, pharmacist or biokineticist to test your blood pressure, blood cholesterol level (total) and blood sugar level (random). Finger prick tests are adequate.

You also need to complete this questionnaire. Make sure that all questions are answered as incomplete questionnaires cannot be processed. Should you require additional forms, please call 0800 Bankmed (0800 226 5633). Return your completed questionnaire to Bankmed Personal Health Assessment, PO Box 1242, Cape Town, 8000 or fax to 031 309 5128.

For your convenience, you can also go on-line to complete this questionnaire at www.bankmed.co.za

Please note

All information submitted will be treated as confidential. Also, only members and their dependants over the age of



For office use only

Form completion instructions: In order to speed up processing, this form will be computer processed, so please: Write neatly, using capital letters in black ink. Do not write outside the blocks.

MEMBERSHIP NUMBER:

DEPENDANT CODE: **IDENTITY NO.:**

SURNAME:

FIRST NAME:

DATE OF BIRTH: (DDMMYYYY)

GENDER: M F

POSTAL ADDRESS:

CODE:

TEL: (W) (H)

E-MAIL ADDRESS:

EMPLOYER:

BRANCH: **BRANCH CODE:**

1. CHRONIC DISEASES

Do you require or do you currently receive treatment for any of the following conditions:

| | Y | N |
|------------------------------------|--------------------------|--------------------------|
| Heart attack | <input type="checkbox"/> | <input type="checkbox"/> |
| Coronary artery disease (angina) | <input type="checkbox"/> | <input type="checkbox"/> |
| Stroke | <input type="checkbox"/> | <input type="checkbox"/> |
| Diabetes | <input type="checkbox"/> | <input type="checkbox"/> |
| TIA (temporary or "mini" stroke) | <input type="checkbox"/> | <input type="checkbox"/> |
| Intermittent claudication | <input type="checkbox"/> | <input type="checkbox"/> |
| Hypertension (high blood pressure) | <input type="checkbox"/> | <input type="checkbox"/> |
| Aortic aneurysm | <input type="checkbox"/> | <input type="checkbox"/> |
| Depression | <input type="checkbox"/> | <input type="checkbox"/> |

2. CLINICAL MEASUREMENTS

To be completed by a medical professional.

Please record the following measurements:

Current weight (with minimal clothing) to the nearest kg

Height (without shoes) cm

Blood pressure – Systolic (upper no.) mmHg

– Diastolic (lower no.) mmHg

Total cholesterol (e.g. 4.8) mmol/l

HDL cholesterol (e.g. 1.7) (optional) mmol/l

Random blood sugar (e.g. 6.4) mmol/l

3. CORONARY HEART DISEASE RISK

Do you smoke cigarettes, cigars or a pipe? If yes, how many a day?

Y N Per day

If you smoked previously, have you quit within the last month?

Y N

How many alcoholic drinks do you consume in a typical week?
(1 drink = 1 glass of wine, 1 can of beer or 1 tot of alcohol)

Per week

Have any of your family (brother, sister, parent or grandparent) died from coronary heart disease before the age of 55 if male, or before 65 if female?

Y N

4. DIABETES RISK

Do you have a sister or a brother with diabetes?

Y N

Do you have a parent with diabetes?

Y N

If female, did you have high blood glucose (sugar) during your pregnancy, or have you given birth to a baby weighing more than 4.0 kg?

Y N

5. STRESS SCREEN

Select ONE of the following statements that is most appropriate to you:

- My life is currently very stressful and I am not coping at all well
- My life is currently very stressful, but I am coping adequately
- My life is somewhat stressful but my coping attempts are not effective
- My life is not currently very stressful, but I am not coping nonetheless
- My life is not stressful and I am coping very well

Possible causes for my stress are (select as many as you wish):

- Work issues
- Financial worries
- Ill health
- Family problems
- Marital problems
- Crime or violence
- Study
- Transport

6. DEPRESSION SCREEN

Over the past 2 weeks, how often have you been bothered by each of the following problems?

| | Not at all | Several days | More than half the days | Nearly every day |
|---|--------------------------|--------------------------|--------------------------|--------------------------|
| Little interest or pleasure in doing things | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Feeling down, depressed or hopeless | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Trouble falling or staying asleep, or sleeping too much | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Feeling tired or having little energy | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Poor appetite or overeating | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Feeling bad about yourself, or that you are a failure, or have let yourself or your family down | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Trouble concentrating on things, such as reading the newspaper or watching TV | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Moving or speaking so slowly that other people could have noticed, or the opposite, being so fidgety or restless that you have been moving around a lot more than usual | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Thoughts that you would be better off dead, or hurting yourself in some way | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

7. EXERCISE ASSESSMENT

- Do you participate in regular physical activity? Y N
- If you answered YES to the above, please complete the following questions:
- Do you exercise 3 times or more per week? Y N
- Does each exercise session last at least 30 minutes? Y N
- Do you ever exercise at a moderate to vigorous intensity? Y N
- (Intensity at a level that raises a sweat and you are able to talk but not sing)

8. DIETARY INDEX

Consider your dietary habits over the past 6 months. Think about what foodstuffs you eat and answer each of the following questions:

- On average, do you eat at least five portions of fruit and/or vegetables each day?
(portion = 1 cup fresh, 1/2 cup cooked, 1 medium sized fruit) Y N
- Do you eat 3 meals every day with healthy snacks between meals? Y N
- Do you consciously try to reduce the amount of fat in your diet by choosing low fat dairy products? Y N
- Do you eat red meat less than 3 times per week? Y N
- Do you eat fish at least once a week? Y N
- Do you usually choose whole-wheat products (e.g. whole-wheat bread and pasta, brown rice, oatmeal porridge, high fibre cereals) instead of refined products (e.g. white bread and rolls, white rice, typical breakfast cereals, cakes)? Y N
- Do you consciously limit the amount of salt you ingest? Y N
- Do you eat take-aways/fast foods less than twice a week? Y N
- Do you avoid fried foods? Y N
- Do you remove the visible fat/skin from meat and chicken? Y N

9. QUALITY OF LIFE

- How many days' work did you miss in the last 6 months due to ill health or injury?
- None 1 - 3 4 - 7 8 - 10 > 10 Not applicable
- In the last month, has your physical health adversely affected your work/daily activities in any way? Y N
- In the last month, has your emotional health adversely affected your work/daily activities in any way? Y N

10. STAGES OF CHANGE

Are you interested in making a change in the following lifestyle areas? Indicate below where you are on the path to good health in each area:

| | Not interested | Thinking about it | Planning it | Making the change | It changed >6 months ago |
|-------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| Alcohol use | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Weight management | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Healthy nutrition | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Physical activity | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Stress | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Smoking | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

On a scale of 0 to 10, how ready are you to address those lifestyle behaviours that impact on your health? (0 = Totally unwilling and 10 = Will do everything I can to become healthier) | e.g. 8

11. CONSENT AND SIGNATURE

I exercise my own judgment in participating in this assessment with the understanding that it cannot take the place of a medical consultation with my doctor. I hereby give consent for a Bankmed Health Coach to contact me telephonically to discuss health-related issues raised in this report if the need should arise. The relevant Bankmed insured benefit will cover the cost of this interaction."

Signature : _____ Date : _____