Chronic Non-Communicable Diseases (NCDs), Absenteeism and Workplace Wellness Initiatives at a Consumer Goods Company in South Africa

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DECLARATION

I, Mbali Maseko, do hereby declare that this dissertation is the result of my investigation and research and that this has not been submitted in part or in full for another degree or for any other degree to another university.

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ABSTRACT

Background: Non-communicable diseases (NCDs) are the leading causes of deaths worldwide and are shown to be responsible for approximately 71% of deaths globally. NCDs mainly affect individuals of working age, resulting in high sick leave absences and loss of productivity in the working environment. This presents a major barrier to economic growth, particularly in low- and middle-income countries where the impact is greatest. Among the interventions identified in the South African Strategic Plan for the control of NCDs, is the implementation of wellness initiatives (i.e. diet and exercise interventions) in the workplace. This has been to improve overall productivity and decrease absenteeism. This study was therefore aimed at investigating the effect that participating in workplace wellness initiatives targeted at employees, particularly those that are overweight, hypertensive and diabetic at Nestlé, had on the number of working days lost due to sick leave from NCDs.

Methodology: A retrospective cohort study design was used to conduct the study. A review of the Nestlé employee's de-identified records was undertaken to capture data on NCDs and NCD risk factors, participation in wellness initiatives (namely, eating healthily and participating in physical activities) and absenteeism during the period of January 2014 to December 2016. The outcome variables of interest were thus body weight (BMI), blood glucose and blood pressure as well as sick leave days. 722 employees were chosen to participate in the study and were assigned to one of two groups based on exposure to workplace nutrition and physical activity initiatives. Analyses were performed using the software package SPSS and involved a comparison of the above outcome variables between those who participated in the wellness programme and those who did not and between baseline and the intervention phase.

Results: The study shows that participation in workplace wellness programmes reduced mean BMI, although not significantly, in employees who took part in workplace wellness programmes i.e. 30.74kg/m² (30.24, 31.31), 30.48kg/m² (29.99, 31.03), 30.33kg/m² (29.84, 30.86), 30.3kg/m² (29.79, 30.79) at baseline, in 2014, 2015 and 2016 respectively. There was a significant difference in blood glucose (5.68mmol/L vs 6.33mmol/L in 2016) and blood pressure (122.54/78.11mmHg vs 125.22/80.32mmHg at the end of the study period) and sick leave absenteeism (6.16 days vs 7.96 days at the end of the study period) in employees taking part in workplace wellness programmes when compared to employees who did not take part in these programmes over the study period.

Conclusion: Findings suggest that workplace wellness initiatives were effective in reducing the prevalence of overweight and obesity, high blood glucose and high blood pressure. These programmes also proved effective in the reduction of sick leave absenteeism.

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CHAPTER 1

INTRODUCTION

1.1. Background to the study

Profit making entities contribute significantly to the economic growth of many countries. Corporations do this through products and services they produce and sell using various inputs such as raw material, labour and machinery. Labour plays a crucial role in the productive capacity of these corporations and as such its productivity and health are important to governmental organisations and the economy alike. Non-communicable diseases (NCDs) are responsible for over 71% of deaths globally and account for 46% of the global burden of disease, which measures the financial, mortality and morbidity impact of disease (World Health Organisation (WHO), 2014a). The WHO (2014a) projects a 15% rise in NCD related deaths globally by 2020. A significant proportion of individuals living with NCDs are in the economically actively population. Recognising this and the impact of NCDs on productivity, corporations have put in place workplace wellness programmes to aid the management of NCDs in the working population (NCD Alliance, 2017).

An overview of the impact of non-communicable diseases

"Non-communicable diseases are the leading cause of death and disability worldwide and are responsible for a staggering global loss in output – equivalent to about 5% of global GDP in 2010" (NCD Alliance, 2016:6). This statement by the NCD Alliance summarises the global impact of NCDs on the population through mortality and morbidity and on the economy through their effect on the productive capacity of the world. Due to the characteristic long duration of chronic NCDs, they significantly reduce the quality of life adding to the already high burden of disease (Galea, 2016).

According to the WHO (2018), NCDs are responsible for the deaths of 41 million people each year across the globe and it is expected that by 2030 NCDs will be responsible for 75% of deaths globally. As indicated previously, NCDs are responsible for many preventable disabilities globally and result in impairments such as blindness and amputations from poorly managed diabetes and reduced mobility and speech impairments from strokes (WHO, 2015). Richards, Gouda, Durham, Rampatige, Rodney and Whittaker (2016) state that disabilities that exist independently of NCDs may increase the risk for NCDs due to impaired mobility and the reliance of individuals living with disabilities on others for healthy diets and nutrition, thus causing a vicious cycle between NCDs and disabilities.

The WHO (2018) argues that due to the high health care costs associated with NCDs, poorer households struggle to get out of poverty despite the presence of social initiatives aimed at alleviating poverty. These health care costs may be direct such as the cost of treatment, expenditure on transportation to access public health facilities, or indirect such as lost wages due to health facility visit, hospitalisation (where an unmanaged chronic condition leads to hospitalisation) and unemployment due to the inability of individuals to work due to ill-health from NCDs and taking care of those living with NCDs. This makes the impact of NCDs in low resource settings greater than in more affluent settings.

Chronic NCDs, defined as diseases that develop slowly over time and are not transmittable from person to person, are responsible for 71% of deaths globally, and continue to be the leading cause of deaths worldwide (WHO, 2014a). Wandai and Day (2015) report that two in every five deaths in South Africa are related to NCDs, and according to the WHO (2014) NCDs accounted for 43% of South African deaths in 2012.

There are four main categories of chronic NCDs noted by the WHO (2015) noted as cardiovascular diseases (including hypertension), diabetes, cancer and chronic respiratory diseases. The World Health Organisation (2015) also confirms that NCDs often have co-morbidities and lead to disability. They have multiple risk factors and causes which are also shared with many other diseases, making their etiology complex.

Non-communicable diseases can be successfully managed, and approximately 80% of deaths associated with NCDs are preventable. The main risk factors for NCDs are lifestyle-related including unhealthy diets, low physical activity, tobacco smoking, excessive alcohol consumption, overweight/obesity, high blood pressure, high blood glucose, and high cholesterol (dyslipidaemia) (Mahan and Escott-Stump, 2007). The World Economic Forum (2011) reports that the cost of managing NCDs in low- and middle-income countries (LMICs) constitutes approximately 4% of GDP. Non-communicable diseases consume as much as 30% – 50% of the monthly income of South African housesholds (Kankeu et al., 2013).

1.2. Problem statement

According to the WHO (2015), diets high in fat, salt and sugar have a direct impact on the development of the risk factors for NCDs noted earlier. The increased accessibility of convenient foods high in fat, salt and sugar in workplace settings (such as vending machines, onsite coffee shops and canteens) has contributed to the increasing prevalence of NCDs within the working population. Mhurchu, Aston and Jebb (2010) and Hofman (2014) report that NCDs impact negatively on employers through increased sick leave absences from work and excessive employee turnover due to high morbidity and mortality from NCDs in the economically active population. This has negative financial implications for organisations (Anderson et al., 2009; Discovery Health, 2015).

The World Economic Forum, in association with the WHO, encourages private organisations to contribute to the management of NCDs using the workplace as an intervention setting. Although Nestlé (the company where this research was conducted) offers several workplace initiatives for its employees, it is uncertain whether taking part in these initiatives has had any effect on NCDs and NCD risk factors and absenteeism for high risk employees. The purpose of the study is to therefore investigate the effect of workplace wellness initiatives targeted at overweight, hypertensive and diabetic employees at Nestlé, on the number of working days lost due to sick leave from NCDs.

1.3 Research setting

Nestlé is a private company that specialises in the production of fast-moving consumer goods and is a strategic partner to the World Economic Forum. Nestlé manufactures and sells some of the world's leading brands in food and confectionaries, many of which are high in fat, salt and sugar. According to Nestlé's annual wellness day statistics (Nestlé South Africa, 2017) the prevalence of NCDs at Nestlé (overweight and obesity at 70%, hypertension at 30% and diabetes at 17%) is higher than that of the general population in South Africa (overweight and obesity at 40.2% and 64.1% in males and females respectively, hypertension at 27.4% and 26.1% in males and females respectively, and diabetes at 9.8% (Wandai and Day, 2015)).

Nestlé employees live in both rural and urban areas as well as in formal housing, with a negligible amount living in informal housing. The socio-economic breakdown of employees ranges from very low to very high income.

Like many of the members of the World Economic Forum's Workplace Wellness Alliance, Nestlé has made a commitment to promote the wellness and improve the health of its employees (World Economic Forum; 2013:4). This is in line with Nestlé's ambition to be recognised globally as the leading nutrition, health and wellness company for consumers and employees. Nestlé has implemented a variety of workplace wellness initiatives (outlined below) that are aimed at not only promoting general employee health and wellbeing, but also preventing and managing chronic non-communicable diseases through the management of overweight/obesity, diabetes and hypertension in the workplace.

There are nine Nestlé offices and production sites across the country represented in seven of the nine provinces in South Africa. Each regional office has onsite health and wellness centres which support Nestlé's workplace physical health initiatives for its employees. As a minimum, these centres have an occupational health nurse managing the health and wellness centre daily, and a medical doctor visiting the facility once or twice a week based on staff numbers at each facility, with most also having onsite dieticians and physiotherapists to provide their respective services (Business Insider, 2018)).

There are also gyms in four of its offices and production sites. The company also provides alternatives to gyms in the form running, cycling and sports clubs where there are no gym facilities. To encourage healthy eating, healthy meals and salads are offered at discounted prices in all canteens. However, many of Nestlé's products are made easily accessible to staff in the form of staff discounts and onsite staff sales facilities, creating an obesogenic environment for employees.

There is an internal process of verifying sick notes and recording reasons for absences using the third-party occupational healthcare nurse who manages the onsite clinics. This process is strictly managed by the occupational healthcare nurse to ensure that staff medical data and information is kept confidential between the employee and health professionals. An absence report is then prepared monthly outlining overall, the main reasons for sick leave absences. The uptake of onsite clinic services is relatively high, particularly in the low-income groups based at the company's remote production facilities, with employees using onsite clinics as their regular healthcare provider (the cost being covered by the company) (Nestlé South Africa, 2017).

Given the prevalence of NCDs in the workforce and the wellness programmes implemented by Nestlé to address these NCDs and associated risk factors, Nestlé was an ideal setting for carrying out a study that will contribute significantly to research on workplace wellness programmes in South Africa which according to literature as presented in chapter two is currently lacking. Additionally, Nestlé was chosen as the setting for the study due to the somewhat contradiction of the nature of its business of being a large manufacturer of high energy, high sugar products and its endorsement and enforcement of workplace-based interventions for the management and control of NCDs. Over and above this, at the time of study initiation, the researcher was responsible for the management of these wellness programmes and was keen to establish the effect of these programmes on the management of NCDs.

1.4 Significance of the study

The significance of the study on the association between chronic NCDs, absenteeism and workplace wellness initiatives, relates to the effect that the management of chronic NCDs will have in the workplace through reduced absenteeism and improved productivity. Several studies that are presented in the chapter that follows outline the impact of NCDs on companies, indicating that businesses incur high costs due to absenteeism, low engagement and productivity due to uncontrolled chronic NCDs.

The study aimed to identify the workplace wellness programmes that had the greatest impact on managing NCDs. This will not only benefit companies through reduced absenteeism and improved productivity, but the greater population as well by addressing NCDs in the working-class population.

Furthermore, there may be an opportunity to identify and review those wellness programmes that are not adding value, which will provide valuable insight for other companies implementing workplace wellness programmes.

Employee wellness programmes in South Africa and other developing countries are limited and not wide in scope (Conradie, van der Merwe Smit and Malan, 2016). Conradie, van der Merwe Smit and Malan (2016) state that research on the impact of the programmes on the South African population is therefore also limited. This study will thus contribute significantly to knowledge and further research in this area.

1.5 Aim of the study

The aim of the study was to investigate the effect that participating in workplace wellness initiatives targeted at employees, particularly those that are overweight, hypertensive and diabetic at Nestlé, has on the number of working days lost due to sick leave from NCDs. The aim was also to compare the health outcomes and number of sick leave days of these employees to employees who did not take part workplace wellness initiatives.

1.6 Research objectives

- To describe the workplace wellness programmes aimed at addressing chronic non-communicable diseases
- To determine the health outcomes of employees taking part in workplace wellness programmes and those not taking part in these programmes including weight status, blood pressure and blood glucose over the study period between 1st of January 2014 and the 31st of December 2016
- To determine sick leave absenteeism trends of employees over the study period
- To investigate the relationship between obese, hypertensive and diabetic employees, absenteeism and workplace wellness programmes at baseline (January 2014) and first follow-up December 2014; second follow-up December 2015 and final follow up at December 2016
- To compare the weight status, blood pressure, blood glucose and absenteeism outcomes between employees who took part in wellness programmes and those who did not take part in workplace wellness programmes between the 1st of January and the 31st of December 2016
- To develop recommendations on the improvement of workplace wellness interventions for the management of NCDs among employees to improve absenteeism.

1.7 Chapters outline

This report is presented as outlined below, with each chapter focusing on a specific area of the research.

Chapter 1: Introduction

This section of the dissertation introduces the topic under discussion and gives the background to the study, defines the problem statement, outlines the significance, aims and objectives of the study as well as provides a breakdown of the chapters.

Chapter 2: Literature review

In this chapter, previously published works related to the subject is presented and critically analysed. This includes the introduction to NCDs and their risk factors, discussions on the prevalence of NCDs globally and in the South African context as well as the impact of workplace wellness programmes on the management of NCDs.

Chapter 3: Research design and methodology

This chapter focuses on the research design, research methods, sampling strategy, the data collection instruments used, the analysis of the data and the pilot study conducted in testing the feasibility of the research.

Chapter 4: Results

The results from the research conducted are presented in this chapter. These findings have been interpreted and presented using tables and figures.

Chapter 5: Discussion

This chapter discusses the results of the study in detail and aimed to identify trends and link the findings to the research topic, aims and objectives. The chapter also summarises the findings from literature and discusses the study results in relation to these findings and outlines the limitations that may have prevented some of the objectives from being achieved.

Chapter 6: Conclusion and recommendations

Based on the findings, interpretations of the results and discussions, a conclusion to the study is drawn, and recommendations made. This chapter provides answers to the research questions and provides guidance as to the extent to which some of the objectives have been achieved.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter gives an overview of current literature on NCDs, their impact on the wider population in general and the economically active population in particular, the workplace wellness programmes aimed at addressing these conditions and the documented impact on their management of these conditions.

2.2 Non-communicable diseases and their risk factors

The Centre for Disease Control (CDC) (2006) defines risk factors as those aspects of a person's behaviour or lifestyle, environmental exposure or hereditary nature which result in an increase in disease occurrence. According to Hofman (2014), mortality from NCDs can be significantly reduced, by as much as 20%, by addressing these risk factors. According to Riley et al. (2016), NCDs can be addressed effectively by managing their risk factors and this can be done at a low-cost using government initiatives and existing resources.

Below is an overview of the risk factors for chronic NCDs. They are grouped into behavioural and metabolic as categorised by the WHO (2018).

The behavioural risk factors for NCDs are:

- Physical inactivity
- Unhealthy diets
- Harmful alcohol and tobacco use

The metabolic (intermediate) risk factors for NCDs are identified as:

- Raised blood pressure
- Overweight/obesity
- Raised blood glucose (hyperglycaemia)
- Raised blood lipids (hyperlipidaemia)

Raised blood pressure as a risk factor is responsible for the greatest number of deaths, resulting in approximately 19% of all deaths globally (WHO, 2018). This is followed by overweight/obesity and raised blood glucose.

Some of the main risk factors are discussed further for two of the four major NCDs in the section that follows. These are cardiovascular diseases and diabetes specifically as these diseases are the focus of this study.

2.2.1 Cardiovascular diseases

In the four major categories of chronic NCDs, cardiovascular diseases are the leading cause of deaths from NCDs globally, followed by cancer, respiratory diseases and diabetes (WHO, 2015). Cardiovascular diseases (CVDs) are diseases of the heart and blood vessels and include coronary heart disease, cerebrovascular disease, and peripheral arterial disease, among others (WHO, 2015). According to the WHO (2017), a majority of deaths from CVDs were due to heart attacks and strokes. The WHO (2018) mentions that in 2016 CVDs were responsible for 19% of all South African deaths, 6.5% of which were attributable to stroke and 4.8 % to ischaemic heart disease.

The World Heart Federation (2012) points to behavioural risk factors such as the intake of unhealthy diets, lack of physical activity tobacco smoking and the harmful use of alcohol, and metabolic risk factors such as overweight/obesity high blood pressure, high cholesterol and high blood glucose as the modifiable risk factors for CVDs. These risk factors are the same as the risk factors for NCDs outlined previously and are discussed in more detail next.

Unhealthy diets

Diets high in saturated fats, salt and sugar, and low in fruit, vegetables, fish, nuts and fibre have been linked to increased BMI and risk for CVDs and other NCDs (Lachat, et al., 2013). Diet and nutrition are therefore key to the management of CVDs by addressing the metabolic risk factors associated with their development. These metabolic risk factors are high blood pressure, through the intake of foods high in sodium (such as salt and processed foods), high blood glucose through the intake of refined sugars and fats and high cholesterol through the intake of foods high in saturated and trans fats (Reddy and Katan, 2007).

Anand et al. (2015) posit the price and availability of food as a reason for the increased intake of refined carbohydrates, packaged foods and decreased fruit and vegetable intake, leading to an increased risk of CVDs. They further state that environmental changes have had a specific impact on the price and availability of fruit and vegetables making them more expensive for households to procure, thereby contributing to their lower intake. This is confirmed by the WHO (2009) which claims that the intake of fruit and vegetables reflects the impact of the economic, cultural and agricultural environments on diets. The WHO (2009) states that low fruit and vegetable intake is responsible for 11% of ischaemic heart disease deaths and 9% of all stroke deaths.

The DASH (Dietary Approaches to Stop Hypertension) and Mediterranean diets have been identified by Adar et al. (2013) as appropriate and key diets for the management of CVDs and related risk factors. These diets essentially encourage the intake of unsaturated fats, fruit and vegetables, whole grains, legumes, nuts and low-fat dairy products and are low in fat, salt, meat, sweets (and other refined carbohydrates) and sodas. They have been associated with decreased body weight, improved blood pressure and blood glucose, reduced oxidation, thrombosis and inflammation and increased short chain fatty acids (SCFA) which are all key to the management and prevention of CVDs (Adar et al., 2013). Nuts have been specifically associated with a 35% reduction in CVD risk (Casa, Castro-Barquero, Estruch and Sacanella, 2018).

Also important for, and complementary to diet and nutrition interventions for the management and prevention of CVDs, is physical activity.

Physical inactivity

According to the WHO (2002), physical inactivity doubles the risk of CVDs while physical activity and regular aerobic exercise reduce the risk of fatal and non-fatal cardiovascular events.

Wahid, Manek, Nichols, Kelly et al. (2016) has identified physical inactivity as the 4th leading risk factor for mortality in the world after high blood pressure, tobacco use and high blood glucose. According to the WHO (2009) physical inactivity is responsible for 30% of the global burden of ischaemic heart disease.

According to Rocha (2015), exercise is beneficial in reducing the risk both in individuals without NCDs and those with CVDs and other NCDs. Over and above this, physical activity (at regular and adequate levels), improves cardiorespiratory fitness, bone, muscular and functional health, reduces the risk of mental ill-health and is fundamental to energy balance and weight control (WHO, 2018). It is thus important for the prevention and control of CVDs and other NCDs. The current recommendations for physical activity are 150 minutes of moderate or 75 minutes of vigorous physical activity per week. However, according to Katzmarzyk, Church, Craig and Bouchard (2009) the amount of sitting time typical in modern society cannot be compensated for by the above minimum recommended levels of physical activity. They state that sitting time, irrespective of physical activity, is associated with the increased risk of developing metabolic syndrome (associated with the development of CVDs and other NCDs). Sitting time involves sedentary activities which results in most adults and children spending approximately 55% of the day sitting (Katzmarzyk et al., 2009). Wahid et al. (2016) posit that for previously inactive individuals, increasing physical activity by 11.25 MET[1] hours per week (equivalent to approximately 3 hours of brisk walking per week) can reduce the risk of CVDs by 23% and the risk of diabetes by 26%.

Harmful tobacco and alcohol use

According to the WHO (2015) tobacco use contributes 9% to deaths from CVDs globally due to there being a link between nicotine products and the development of atherosclerosis which increases the likelihood of CVDs such as stroke and ischemic heart disease (Mahan and Escott-Stump, 2007). According to Wandai and Day (2015), approximately 10% of South African females and 33% of South African males smoke tobacco. Alcohol consumption above the recommended daily allowance (no more than one standard drink measure[2] for females and two drink measures for males per day) has been found to be hazardous to health because of its negative effect on the liver. Wandai and Day (2015) associated alcohol consumption with inflammation of the liver and liver scarring when taken in excess amounts. Parry, Patra and Rehm (2011) also linked excessive alcohol intake to CVDs such as ischaemic and hypertensive heart disease.

Overweight/obesity

Overweight is defined by the WHO (2012) as a body mass index (BMI) that is within 25 to 29.9kg/m² and obesity as a BMI that is 30kg/m² and above. Overweight/obesity, which is a metabolic risk factor, has been identified by Skolnik (2008) as the single most important risk factor for NCDs. It results from excessive energy intake and sedentary living. The link between obesity and NCDs is related to high blood glucose, cholesterol and blood pressure that arise from increasing BMI (Mahan and Escott-Stump, 2004).

Based on the WHO (2017) estimates, the prevalence of overweight and obesity in South Africa is 40.2% and 64.1% for males and females respectively. Obesity has been linked to greater morbidity than has smoking, excessive alcohol consumption and poverty (Lavie, Milani and Ventura, 2009). Lavie et al. (2009), indicate that there is a U-shaped association between BMI and all-cause and CVD mortality in hypertensive individuals, stating that at very low BMI and at BMIs above 30kg/m², the risk for mortality after CV events is greatest. The lowest risk for mortality is therefore observed in individuals with a BMI between 25 and 30kg/m². Despite this obesity paradox however, Lavie et al. (2009) indicate that weight reduction and weight management are still crucial to the prevention and control of cardiovascular diseases.

[1] MET: metabolic equivalent time, defined as 1kcal/kg/hour and is equivalent to energy expenditure while at rest.

[2] A standard drink measure is equivalent to a small glass of wine (125ml), 330 ml of beer or a tot (30ml) of spirits (gin, vodka, whisky or brandy

High blood pressure

Blood pressure measures the force with which blood moves in the blood vessels through the body to supply the organs with oxygen (American Heart Association, 2016). According to the new American College of Cardiology and the American Heart Association Task Force guidelines (Carey and Whelton, 2017), high blood pressure (BP) is defined as a systolic BP ≥ 130 mmHg or diastolic BP ≥ 80 mmHg and is the leading risk factor for CVDs. Carey and Whelton (2017) further define hypertension by categorising it into stage one and stage two. They define stage one hypertension as a systolic pressure between 130 to 139 mmHg or a diastolic pressure between 80 to 89 mmHg and stage two hypertension as a systolic pressure of 140 mmHg or higher or a diastolic pressure of 90 mmHg or higher.

The WHO (2009) accords the risk for stroke, heart diseases and other diseases to structural changes in the arteries caused by the widening and thickening of the arteries to compensate for high blood pressure. The World Health Organisation (WHO) (2009) indicates that diets, particularly those high in salt, alcohol consumption, lack of physical activity and overweight and obesity as the determining factors of high blood pressure. According to Rapsomaniki, Timmis, George, Pujades-Rodriguez, et al. (2014), hypertension increases the risk of cardiovascular diseases by 63.3% in individuals with blood pressure levels above 140 mmHg/90 mmHg in comparison to 46.1% in hypertensive individuals with normal blood pressure. They claim that those individuals with blood pressure levels above 140 mmHg/90 mmHg developed CVD diseases five years earlier than their normotensive counterparts. The WHO (2009) states that high systolic blood pressure is responsible for 51% of stroke deaths and 45% of ischaemic heart disease deaths. They also stress that this mortality risk is two times higher in LMICs. The WHO (2012) notes that approximately 13% of CVD deaths worldwide are caused by hypertension. In South Africa alone, 27.4% of males and 26.1% females present with hypertension (Wandai and Day, 2015). High blood pressure, through the presence of fatty deposits in the blood vessels, is directly linked to hyperlipidaemia.

Hyperlipidaemia

Hyperlipidaemia is defined as total blood cholesterol level above 5mmol/L and is another risk factor for heart diseases and stroke (WHO, 2012). The World Health Organisation (2012) states that high blood cholesterol is responsible for a third of the ischaemic heart disease prevalence and an estimated 2.6 million deaths globally. Hyperlipidaemia is influenced by the excessive intake of foods high in cholesterol, saturated and trans fats as well as a lack of physical activity (Mahan and Escott-Stump, 2007). In addition to the aforementioned, Nelson (2013) claims alcohol consumption and excessive energy intake as secondary causes of hyperlipidaemia. Some chronic conditions such as diabetes mellitus, renal disease and obesity are identified as the other secondary causes of hyperlipidaemia.

However, genetics are indicated to be the primary cause of high blood cholesterol (Nelson, 2013). Hyperlipidaemia is responsible for a third of ischaemic heart diseases and unlike hypertension, the prevalence of heart diseases due to high cholesterol is higher in middle income countries than in low income countries (WHO, 2009).

High blood glucose

The American Diabetes Association (undated) defines high blood glucose, also termed hyperglycaemia, as high sugar levels in the blood due to the body's inability to produce adequate amounts of insulin or when the body is unable to properly utilise insulin.

Individuals with high blood glucose, with or without the presence of a diabetes diagnosis, are at an increased risk for CVD. High blood glucose is responsible for 22% of ischaemic heart disease deaths and 16% of stroke deaths. Bornfeldt (2016) states that hyperlipidaemia and the other risk factors for CVDs are more likely to have a larger impact on CVDs than hyperglycaemia.

According to the WHO (2009), high blood glucose is responsible for all diabetes deaths and 65% of people living with diabetes die from heart disease or stroke, thus indicating a direct link between hyperglycaemia and CVD. Diabetes and the impact of high blood sugar are discussed in more detail below.

2.2.2 Diabetes mellitus

Diabetes mellitus is defined as a condition of persistently raised blood glucose levels characterised by impairment in carbohydrate, fat and protein metabolism (Wu, Ding, Tanaka and Zhang, 2014). According to American Diabetes Association (2019), this results from complete or partial insulin resistance or insufficiency.

Diabetes is grouped into two forms; insulin dependent (type I) and non-insulin dependent (type II) diabetes. Type I diabetes is a consequence of complete insulin resistance and as such is managed primarily through insulin therapy. Type II diabetes is characterised by insulin resistance, where the body produces enough insulin (and sometimes higher than normal levels of insulin in order to compensate for the resistance) but is unable to use it appropriately (American Diabetes Association, 2015).

Of the two forms of diabetes, type II is the most common which, according to Wu et al. (2014), accounts for up to 95% of all diabetes cases. According to these authors, type II diabetes is expected to continue increasing over the next few years, with more than 70% of cases expected to be from low- and middle-income countries. The WHO (2012) states that diabetes is responsible for 1.3 million deaths globally. In South Africa, the WHO (2017) estimates the prevalence of high blood glucose at

9.8%, a 0.8% increase from four years earlier. Green (2017) reports that South Africa has the highest diabetes prevalence on the African continent, with over four million South Africans living with diabetes.

The major risk factors for diabetes (particularly type II diabetes) have been identified as overweight/obesity, tobacco smoking, lack of physical activity, high blood pressure, high cholesterol, alcohol consumption and the intake of unhealthy diets (Wu et al., 2014). These risk factors can be altered and are therefore termed the modifiable risk factors for diabetes. Diabetes that is left unmanaged has several complications identified by Wu et al. (2014) as the increased risk of the development of CVDs, diabetes neuropathy, diabetes nephropathy, diabetes retinopathy and some cancers.

There are several lifestyle interventions that have been recommended for the management of diabetes, most of which relate to behaviour change. Raveendran et al. (2018) identify these interventions as: weight management through physical activity and healthy eating, behaviour change such as tobacco smoking cessation and the reduction of excessive alcohol intake.

2.3 Non-communicable diseases in low- and middle-income countries

Despite communicable diseases (CDs) being a major concern in Africa, NCDs are steadily rising and are expected to surpass CDs and become the leading causes of deaths in LMICs by the year 2030 (WHO, 2010). According to Martin Silink, President, International Diabetes Federation (2009:3), "Four in five deaths from NCDs now occur in low- and middle- income countries. Without decisive action, the NCD burden threatens to undermine the benefits of improving standards of living, education and economic growth in many countries". Boutayeb (2006) states that NCDs will cause seven in ten deaths in developing countries by the year 2020. These countries are therefore not only overburdened with communicable diseases, but by NCDs as well. This transition in prevalence from communicable diseases to NCDs in LMICs is stated to be a result of economic development, globalisation and urbanisation (Islam, Dannemann Purnat, Phuong and Mwingira, 2014). These authors state that the impact of economic development on the rising incidence of NCDs in these countries is related to the increased availability and intake of processed foods, decreased physical activity and a change in cultural norms. Anonymous (2017) identify this transition (which they term the nutrition transition) as a key driver for NCDs in LMICs as it increases the prevalence of overweight and obesity, diabetes and CVDs.

Although the prevalence of NCDs is currently lower in the African region compared to other developed regions, its overall impact is much greater due to the lack of resources to manage NCDs in these regions. According to the Daniels et al. (2014) NCDs in LMICs accounted for approximately

80 – 90% of deaths and were responsible for approximately 66% of disabilities. This is further exacerbated by the high incidence of low birth weight in LMICs, which increases the risk of overweight and obesity and NCDs in the population in later years. The South African National Department of Health (2013) further indicates that mortality from NCDs in LMICs affects the population at younger ages than it does in high income countries and resulted in approximately 29% of deaths in people under the age of 60 years compared to 13% in higher income countries in 2008.

According to Islam et al. (2014), health systems in LMICs are not prepared to adequately deal with the high and still rising burden of NCDs. Anonymous (2017) indicates that urban cities in LMICs are at a higher risk of NCDs due to the greater impact of nutrition transition in urban areas. Given that LMICs are faced with different challenges such as still dealing with the burden of communicable diseases and competing priorities for resources, interventions from HICs may not adequately address the NCD burden in LMICs (Allotey, Davey and Reidpath, 2014). Allocating resources to acute and chronic care for individuals with NCDs as opposed to spending resources on the prevention of NCDs worsens the problem.

In a study on NCDs in LMICs, Nyaaba, Stronks, Aikins, Kengne and Agyemang (2017) found that policies on NCDs in LMICs are inappropriate, fragmented and not broad enough to address the range of NCD issues experienced in these settings. Nyaaba et al. (2017) state that only 13% of the African countries studied implemented tobacco control measures aimed at decreasing affordability and only 20% of the countries implemented strategies to reduce the harmful use of alcohol. They further noted that only 28% of the countries had interventions to reduce the intake of unhealthy diets and only 24% implemented campaigns for promoting physical activity.

Below is a detailed discussion on some of interventions that are aimed to address NCDs.

2.4 Recommended strategies to address non-communicable diseases

The WHO (2013), through the NCD Global Monitoring Framework, outlines the process for the management of NCDs as detection, screening and treatment and providing appropriate palliative care to individuals where such care is indicated. Among the initiatives aimed at reducing NCD prevalence recommended by the WHO (2015) are population-based initiatives that directly address modifiable risk factors. These initiatives include: the scaling up nutrition education to reduce salt, sugar and fat intake; the promotion of physical activity in community health clubs or gyms, in the workplace and at schools; the introduction of additional tax on tobacco and its products to make them more expensive and less easily accessible to the community; and endorsing communication campaigns and pricing adjustments of alcoholic beverages to reduce their consumption. Community-based interventions are targeted at specific groups in the community and include school- and workplace-based interventions.

Individual-based interventions are targeted at individuals either as part of health promotion and awareness interventions or as part of disease management and control. They entail one-on-one consultations with and individual treatment by health care practitioners (i.e. physician, dietician, physiotherapist consultations) and the management of disease conditions with drug therapy (South African National Department of Health, 2013).

To have the greatest impact on the management of NCDs, focus should be given to those interventions which benefit the highest number of individuals at the lowest possible cost, while assisting those individuals who require individual support in the most cost-effective way.

2.4.1 South African initiatives for the prevention and control of non-communicable diseases

The South African National Department of Health (2013) aims to address the impact of NCDs in South Africa through three main interventions, namely: upstream interventions, midstream interventions and downstream interventions.

Upstream interventions

These interventions focus on the larger population in general and look at factors in the community, environment and society to address NCDs. They are therefore structural in nature and will involve population-based initiatives outlined previously such as scaling up nutrition education, promoting physical activity, reducing the use of tobacco and alcohol consumption through price adjustments (due to additional taxation) aimed at the general population making use of these products. The South African National Department of Health (2013) indicates that population-based strategies are more cost effective than other interventions targeted at communities and individuals, they however have a moderate impact on the management of NCDs.

Midstream interventions

These interventions focus on the social aspect of NCDs and on groups of people such as communities or institutions. Corporate interventions will therefore fall within this area given that the workforce of a certain corporation constitutes a group of people or community in its own right. Worksite and other community/group-based interventions have a moderate cost (estimated at an average of R4.50 per person) and have a moderate impact on the management of NCDs (South African National Department of Health, 2013).

Community level interventions are recommended by Puoane et al (2017) for the successful identification, prevention, management and control of NCDs, particularly in resource poor settings. Puoane et al (2017) do however note that public health facilities such as community health centres are not being optimally utilised in addressing NCDs, stating that although basic monitoring is in place (i.e. weight, height, Blood pressure and blood glucose) initiatives such as thorough nutrition education and the promotion of physical activity and other preventive measures are still in their infancy. They state the training and retraining of community healthcare workers, appropriate supervision and a clear scope of work as key to the success of programmes for the management of NCDs. The authors further posit that the effective management of NCDs at community health centre level will likely have a positive impact on easing the disease burden on the tertiary public health system.

Downstream interventions

These interventions are behavioural in nature and are thus targeted at addressing individual behaviour to prevent and control NCDs. Interventions that address individual risk factors are costlier than group or structural interventions as they benefit only the individual affected and at a much higher cost due to their being reactive and curative in nature rather than proactive and preventative. According to the South African National Department of Health (2013), these interventions have the largest impact on the management of NCDs but an average cost of R11.80 and R11.10 respectively per person. This is higher than the average cost of both upstream and midstream interventions discussed above.

2.5 Work based wellness activities and the management of non-communicable diseases

According to Anthony et al. (2015), 77% of workers have health conditions associated with NCDs (i.e. asthma, high blood pressure, high cholesterol, obesity and depression amongst others). In addition, the WHO (2014) acknowledges employment and working conditions as key determinants of health and state that they have a significant impact on NCDs. Given the impact of the health of the workforce on economic development, production, adequate household income and social wellbeing, there is a good business case for corporations to intervene in the management of NCDs. Additionally, due to the amount of time economically active individuals spend in the work environment, which represents a quarter of employed adults' lives, and due to the negative impact of NCDs on employing organisations, the workplace has been identified as an important setting for implementing wellness initiatives aimed at decreasing NCDs (Schulte et al., 2007).

The Workplace Wellness Alliance (2013) and Goetzel and Ozminkowski (2006) emphasise this new focus on the workplace for managing NCDs, stating that keeping workers healthy through managing and preventing non-communicable diseases has become vital to not only improving the health of individuals but to improving their overall productivity and reduce absenteeism as well. It is further recommended by the World Economic Forum, as noted by the WHO (2008), that employee wellness programmes focus on lifestyle risk management, by focusing on diet and exercise to improve productivity and decrease illness related absenteeism. Similarly, Arena et al. (2015) indicate that the workplace presents an optimal environment given that in this setting there is a captive audience that can be easily targeted for wellbeing interventions.

Tyron, Bolnick, Pomeranz, Pronk and Yach (2014) acknowledged the prevalence of health behaviours, risk factors and NCDs among the working population, indicating that the prevalence of NCDs and risk tended to increase with an increase in the age of the working population. The authors contended that smoking tended to increase initially with increasing age and then decreased from the age group between 30-40 years gradually up to retirement age. On the other hand, physical inactivity tended to increase with increasing working age, indicating that individuals in the working population tended to exercise less as they got older.

Employee wellness programmes are defined as initiatives implemented by corporations in order to promote and improve the health of employees (Cascio, (2010). These programmes can be very effective in the management of NCDs in individuals across all socio-economic classes and can particularly assist those individuals who would otherwise not be able to access these services (De Villiers, Senekal and Fourie, 2011). Merrill, Anderson and Thygerson (2011) have shown that participants who took part in employee wellness programmes in the United States tended to exercise more frequently and consume healthier diets than employees who did not. The same study also showed that those employees who participated in employee wellness programmes were more likely to have improved health. This was then shown to be beneficial to the employer given that it reduced absenteeism, healthcare costs as well as medical aid claims.

According to Wipfli et al. (2018), only 29% of corporations have implemented wellness programmes across the globe compared to 51% of companies in the United States. Of the United States companies, 49% indicated healthcare cost savings in the first year and 80% reported savings in five years. There was also a reported decrease in sick leave absenteeism, presenteeism and attrition. The impact of these programmes in the LMICs studied was not reported by the study. However, the authors indicated that data collection tools, skills and methods were underdeveloped in these countries and required support to improve.

Mattke et al. (2013), who conducted a Workplace Wellness Programs Study in the United States, recommended the following as some key elements to be included in a comprehensive workplace wellness programme;

- Health screenings and assessments
- Immunisations
- Physical and exercise interventions
- Health and nutrition education

- Healthy canteens
- Stress and mental health management services

Schouw, Mash and Kolbe-Alexander (2018) who conducted a study at a South African power plant, recommend that multi-component interventions are needed in order to ensure that health behaviours are embedded in the workplace and thus in the day to day routines and habits of employees. Inclusive and collaborative solutions where employees are involved in programme development and implementation have proven successful, as they foster an environment of ownership and accountability.

Patel et al. (2013) notes that research and therefore evidence of the adoption of workplace wellness programmes by South African companies is lacking, which limits the evidence available on the impact of such programmes in the South African context. The authors state that this leads companies to minimise the importance of these programmes in managing NCDs and to neglect their implementation in the workplace setting.

2.5.1 Workplace wellness programmes, non-communicable diseases and the management of sick leave absenteeism

A study by Losina, Yang, Deshpande, Katz and Collins (2017) indicates that employees who participated in physical activity initiatives implemented by the workplace, and achieved the minimum recommended level of physical activity of 150 minutes/week took off fewer hours (an average of five hours) from work as result of illness compared to employees who achieved fewer than 150 minutes of activity per week (who averaged 11 to 19 hours of sick leave hours).

Losina et al. (2017) further found that although employees with at least one chronic condition took off more hours from work due to illness than employees without chronic conditions, employees with one or more chronic conditions who exercised for a minimum of 150 minutes/week took off less hours from work due to illness than their counterparts who exercised for fewer than the above recommended minutes per week. The authors conclude by stating that sick leave absenteeism was 2.4 times higher in employees who exercised for 75 – 149 minutes/week and 3.4 times higher in employees who exercised for fewer than 75 minutes/week compared to those employees who exercised for a minimum of 150 minutes/week.

Based on a study by Cloete (2015) which investigated the impact of workplace wellness programmes on absenteeism and employee psychosocial wellbeing, there was a 32% reduction in the number of sick leave days taken by employees since the implementation of a workplace wellness programme. On the contrary, a study by Song and Baicker (2019) showed that although employees who took part in workplace wellness programmes higher rates of healthy behaviours (i.e. increased physical activity, reduced smoking and alcohol consumption) were reported. There were no significant differences in health outcomes or absenteeism between the exposed and unexposed groups after 18 months of implementing the programme.

Mitchell, Ozminkowski and Serxner (2013) state that employees who participated in workplace wellness programmes and successfully improved their lifestyles, had reduced sick leave days. Jones, Molitor and Reif (2018) indicate in a study of over 5000 employees, that there was a reduction in medical expenses and significant improvements in healthy behaviours in individuals who participated in workplace wellness programmes versus non-participants.

Based on the above, most studies indicate a positive impact of workplace wellbeing programmes on employee health and wellbeing and a reduction in the number of sick leave absences in employees who participated in these programmes compared to those who did not participate.

2.5.2 Key factors for the successful implementation of work-based wellness programmes

Ammendolia et al. (2016) identity the key components and prerequisites of a successful comprehensive wellness programme in the work environment as: health education, supportive physical and social environments for heath improvement, the integration of wellness into the structure and culture of the organisation, and the opportunity for screening for lifestyle and chronic diseases supported by adequate treatment and follow-up. Additional factors that improve the success of workplace wellness programmes and therefore the success of the management of NCDs in the workplace, are discussed below. They are:

- *Leadership support*

The WHO (2010) define healthy workplaces as supportive environments that discourage long working hours, are flexible in allowing for frequent and long breaks to promote physical activity, ensure the availability of healthy snacks and storage facilities to promote healthy eating. Leadership support is key in achieving the above. Patel et al. (2013) rate leadership support highly in its importance in helping to achieve a healthy workplace, constituting 50% of the score in the Healthy Company Index, with the other 50% being the availability of workplace wellness programmes to the workforce. They identify factors such as leadership commitment to the programmes, alignment of programmes with business objectives, training of leaders on the importance of health and wellness and providing incentives as key factors to prompting employee health and wellbeing.

- *Communication, marketing and advertising of wellness services*

A South African study by Mchunu and Uys (2008) indicates that as much as 95% of employees in some of the companies they studied were not aware of wellness related programmes in place and were therefore not taking part in any such initiatives. It is against this backdrop that the authors recommend raising awareness as a first component to a comprehensive workplace wellness programme. The NCD Alliance (2017) states that messaging on wellbeing initiatives needs to also be culturally appropriate to encourage programme participation.

- *Interventions that adequately address the needs of the workforce*

Mchunu and Uys (2008) further state that in their research, they found that more than 50% of the companies they studied only offered programmes aimed at addressing communicable diseases such as HIV/Aids and only offered informal physical activity programmes. They state that none of the companies offered weight management services or other programmes aimed at addressing chronic NCDs. If programmes are not designed to address the biggest need in the business, then the high prevalence of NCDs in the working population will not be adequately addressed. It is also recommended by the NCD Alliance (2017) that workplace wellness programmes be targeted at prioritised needs.

- *Appropriate monitoring and evaluation of programme performance*

This provides data which is important in adequately identifying the extent of the NCD problem and informs strategy. Miller and Foster (2010) state that the current tools and methods for measuring the effectiveness of wellness programmes can be confusing and may lack aspects of culture that may be important in a diverse setting like South Africa. Given the importance of adequate and reliable data in decision making, appropriately monitoring and evaluating programme performance is key to the success of such programmes.

Below is a discussion on specific health and wellness interventions that have been recommended by Bezner (2015) for the workplace setting to address NCDs. These interventions are centred on the eight dimensions of wellness, seven of which were identified by Swarbrick (2006) to be appropriate for holistically promoting wellness. Some of these dimensions are discussed below in the context of addressing NCDs in a captive work environment.

Physical wellbeing interventions

The WHO (1948) defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". From a workplace wellness perspective, physical wellbeing can be provided for as recommended by the WHO (2010), through:

- Onsite gym facilities
- Healthy canteen initiatives
- Health/medical centres (for day to day primary health care needs)
- Specialised wellness services (onsite physiotherapist, biokineticist services)

Psychosocial wellbeing services

Psychosocial wellbeing refers to coping adequately with life and related challenges and being able to keep an optimistic outlook in the face of those challenges; and to relate to others in a meaningful way (Burns, 2016). Psychosocial ill-health (i.e. anxiety, depression and stress) has been associated with key behavioural risk factors for NCDs such as smoking and excessive alcohol consumption (Stein, Benjet, Gureje, Lund, Scott, Poznyak and van Ommeren, 2019). Stein et al. (2019) also makes an association between common mental disorders and severe mental health illnesses and CVDs, diabetes, cancer and respiratory illnesses.

The workplace can be a significant source of psychosocial ill-health and may lead to mental health issues that are linked to the development of NCDs. Psychosocial wellbeing is key to the management of stress and mental health. Dickson, Fox, Marshall, Welch and Willis (2014) state that an organisational culture which supports the psychosocial wellbeing of employees is a significant factor for the success of any workplace wellness programme. Employers can rely on services such as employee assistance programmes (EAP) services to promote psychosocial wellbeing. These services are aimed at assisting employees with personal and relationship issues and include, but are not limited to, the following components:

Employee Assistance Programmes

- Counselling services (telephonic and face-to-face)
- Legal support
- Assistance with traumatic events
- Financial wellbeing support
- General life management services (adopting a child, moving to a new home)

Financial wellbeing initiatives

From a workplace perspective, financial wellness includes initiatives such as basic financial literacy, education and training, financial coaching and debt management initiatives. Financial wellbeing initiatives are important tools for managing NCDs in the working population. The high cost of NCDs management outside the workplace is also significantly influenced by workplace financial wellbeing as NCDs are strongly linked to poverty (South African National Department of Health, 2013). Due to poor access to resources, poverty results in the late identification of disease conditions and poor access to healthcare support (Bradshaw and Steyn, 2001).

Vocational wellbeing initiatives

Vocational/occupational wellbeing refers to one's experience in the working environment. According to Bezner (2015), people experience vocational wellbeing when they can participate in meaningful work and make use of their skills to contribute to the achievement of business goals and objectives. A lack of vocational wellbeing can lead to mental issues with repercussions as noted earlier.

Environmental wellbeing initiatives

Environmental wellness is defined by the National Institutes of Health (2018) as the presence of an environment that positively influences health and wellbeing, is free from harmful elements that may impact health and an environment where individuals also take steps that promote the health of their environment.

It has become apparent, as previously outlined in the literature from a study by Anand et al. (2015), that there are certain environmental factors (in both the built and natural environments) which promote the development of certain NCDs (e.g. climate changes impacting the growth of certain foods, pesticides used in agriculture). Human beings interact regularly with their environment, whether at home, at work or in the general outdoors and if the environment is not conducive for health and wellbeing, it will influence the development of chronic NCDs and other illnesses.

Intellectual wellbeing initiatives

Intellectual wellness is defined as being open to new ideas and being able to expand one's knowledge, skills and thinking. It involves seeking ideas that will challenge one's current thinking and encourage them to seek new and creative ways of navigating daily tasks and challenges. Level of education has been identified as a key determinant of health by the WHO (2018) and strongly influences the development and management of NCDs.

2.5.3 Barriers to the implementation of workplace wellness programmes

According to Schouw, Mash and Kolbe-Alexander (2018), policies on workplace wellness in South Africa have focused largely on what should be done to incorporate wellbeing in the workplace rather than on how it should be done. Furthermore, due to wellbeing programmes being embedded in the human resources functions, many human resource practitioners lack the training, knowledge and skill to effectively implement wellness plans. Additionally, these practitioners may not have the necessary leadership position in the organisational structure to influence programme decisions.

There are several other barriers to the successful implementation of workplace wellness programmes. Tyron et al. (2014) identified these barriers in the United States setting as limited leadership and advocacy, poor alignment between financial incentives and disease prevention, limitations in research quality and investment, poor partnerships between communities and employers and regulations that do not support evidence-based practice. Quirk et al. (2018) and Ammendolia et al. (2016) further identified the following as key barriers to the workplace wellness programme implementation from their studies in the United Kingdom and Canada respectively:

- *Busy and pressurised work environments that result in time limitations.*

Work environments that push for long working hours and do not provide onsite facilities to encourage physical activity and healthy eating, promote sedentary living and poor dietary intake.

- *Financial constraints and reluctance by management and leadership to invest in staff health and wellbeing (poor management and leadership support).*

This relates to organisations that view workplace wellness programmes as costs that can be avoided rather than viewing them as investing in the health and wellbeing of the workforce. Conradie, van der Merwe Smit and Malan (2016) state in a South African study, that the cost of unmanaged NCDs to companies far exceeds the cost of basic workplace wellness programmes and that the benefit to organisations would therefore outweigh the costs of implementing these programmes.

- *Difficulty in accessing services due to inconveniently located wellbeing facilities.*

Individuals who already lead healthy lifestyles easily take part in healthy initiatives, irrespective of the location or convenience thereof. For individuals who are not active however, it is important that wellness facilities and initiatives be conveniently located and made available at convenient times in the week and during the day.

- *Poor communication with the workforce on the programmes available to them.*

Where workplace wellness programmes are in place but are not communicated effectively to the workforce, participation is likely to be low and have minimal impact on the management of NCDs and related absenteeism. This will result in a low return on investment of wellness programmes and erroneously encourage a reduction by management and leadership of the financial investment in wellness initiatives.

Only by adequately addressing these barriers can workplace wellbeing programmes be implemented successfully.

2.5.4 Recommended frameworks for workplace wellness programmes

De Villiers, Senekal and Fourie (2011) recommend the following model which can be used in the implementation of workplace interventions to address chronic NCDs.

Step 1: Assessing the needs of the workplace

This may be in the form of health risk assessments or medical surveillance where the health status of employees is gauged against NCD risk. The assessments may include blood pressure, cholesterol, blood glucose and BMI monitoring, the results of which can be used to prioritise problems and interventions.

Step 2: Specification of the programme objectives

Once the main health issues have been identified (e.g. high blood pressure, high blood glucose, overweight and obesity), objectives for programmes can be set (e.g. increase physical activity and improve dietary intake). These objectives can then be used in the planning of intervention programmes.

Step 3: Identify and select the theory-based methods and practical strategies

This will involve some research into the various methods and tools available for reducing the health problem among employees in the workplace (e.g. healthy canteens).

Step 4: Develop the programme and outline methods of monitoring and evaluation

Here the detail of the intervention programme will be outlined, with details of how progress will be tracked and controlled specified (e.g. incentivised scheme for the purchase of low salt meals in the staff canteen, where a point system is used for each purchase. Monitoring may involve regular BP checks at the clinic to track progress).

Step 5: Implement the programme

In this step the programme is implemented and should include communication to employees on programmes details.

Step 6: Evaluate the plan and make necessary adjustment to the programme

The progress of the project is evaluated at this stage and success, or otherwise, is measured. Issues identified here are reviewed and changes made to plan accordingly (e.g. no improvement in hypertension due to poor uptake of the incentive scheme which may necessitate review of the scheme).

Another framework for the implementation of workplace wellness programmes is one by the WHO (2010) which recommends the following five step (keys) approach to promoting healthy workplaces.

Key 1: Leadership commitment and engagement key

The first key involves obtaining senior management buy-in, permission and resources. This key requires that senior leaders align wellbeing to business strategy to ensure commitment to its achievement.

Key 2: Involve workers and their representatives key

This key entails ensuring that employees are part of the planning of wellbeing initiatives to ensure ownership and accountability.

Key 3: Business ethics and legality key

This outlines the importance of complying with ethical practices and ensuring that the health and wellbeing is not compromised while they are on the premises of the organisation or in the conduct of their duties, even at locations outside the workplace.

Key 4: Use a systematic, comprehensive process to ensure effectiveness and continual improvement key

The key is in the planning and implementation of these programmes and outlines the detailed plans for implementing wellness initiatives such as assessing the current state of wellbeing in the organisation, identifying the goals and objectives of the programme, identifying and obtaining the resources that will be required to implement the programme, implementing the programme and continuously monitoring the programme against objectives for effectiveness.

Key 5: Sustainability and integration

This key involves further programme monitoring and evaluation, entrenching programmes in business strategy and culture, collaborating wellness programmes with other programmes in the organisation and collaborating with public health programmes to promote wellbeing in community settings which employees could be accessing outside work.

According to Arena et al. (2015), worksite programmes can be administered directly by the company, can be outsourced to an external vendor on behalf of the company or can be administered using a hybrid approach where a combination of the above approach is used. Arena et al. (2015) further state that these programmes can be administered onsite using company facilities, or offsite using external facilities. In order to be successful however, programmes must emulate a healthy lifestyle by offering healthy food, walking paths, a smoke free policy and exercise facilities.

2.6 Conclusion

Non-communicable diseases are responsible for the deaths and disability of millions of people globally and affect the lives of different population groups, with the greatest impact indicated to be in LMIC. Non-communicable diseases can be effectively managed by addressing the risk factors associated with their development and impact. According to literature, the management of these risk factors occurs at three levels; the population, community and individual levels and vary in terms of cost and impact. In this regard, the importance of the workplace as a setting for implementing initiatives aimed at addressing NCDs in the population was also identified. The reasons identified for this were that the greatest proportion of individuals affected by NCDs are in the working class and thus spend a large amount of their time in the workplace. Additionally, workplaces are more likely to have the resources required to support colleagues with NCDs than are the individuals affected by NCDs given that corporates employ individuals from various economic classes. Due to the impact of health and wellness on absenteeism and on company performance, companies also have an interest in ensuring the effective management of chronic diseases in the workplace. This can be done through comprehensive wellbeing programmes that have appropriate leadership support and buy-in (which also allows employees time to engage in these initiatives), health risk identification, monitoring and evaluation tools and are effectively communicated and marketed to employees.

As indicated in the literature, there are clear gaps in the number and breadth of studies in developing countries aimed at addressing NCDs and their management in the workplace. Although several guidelines are presented in the text on the management of NCDs, many authors have identified a need for more research in this area and identify LMICs as key beneficiaries for research outcomes given the rise of NCDs in these countries and the lack of resources to aid in disease management. They also identify the need for innovative and high impact solutions if the NCD epidemic is to be appropriately controlled.

Given the limited number of studies on the management of NCDs in workplace settings in South Africa and other LMICs, the study is expected to contribute significantly to research in this area and improve the prevention and management of NCDs in these populations.

The section that follows discusses the methodology of the study, outlining the process with which the study was conducted.

CHAPTER 3

METHODOLOGY

3.1 Introduction

This chapter describes the way the study was conducted. It outlines the methods through which participants were selected to participate in the study, the process of data collection and the data collection instruments used. Next, a description of the data analysis methods and how validity and reliability was ensured are described followed by ethical the considerations of the study.

Nestlé site description

Nestlé was established in 866 in Switzerland by a pharmacist named Henri Nestlé (Nestlé; 2014). Nestlé operates in more than 83 countries worldwide; employing over 300 000 people globally. It established its presence in the South African market in 1916 and today has operations in seven of the nine provinces in South Africa namely; Eastern Cape, Gauteng and North West, KwaZulu-Natal and Free State and Western Cape. Nestlé operates from its Head Office in Bryanston, Johannesburg. It operates three distribution centres in Durban, Cape Town and Johannesburg, and operates seven factories located in East London, Mossel Bay, Cape Town, Potchefstroom, Hammanskraal, Estcourt and Harrismith.

A list of the products manufactured in each of the factories is given below:

- East London – Confectionary products (chocolates and sweets)
- Mosselbay –breast milk substitutes and culinary milks such a condensed milk
- Ndabeni – Pet foods
- Potchefstroom – Coffee creamers
- Hammanskraal – Noodles, sauces, cereals and coffee creamers
- Estcourt – Coffee, hot chocolate, coco malt beverages and the production of tin containers
- Harrismith – Breast milk substitutes, baby foods and cereals

The above regional offices are grouped further by proximity of the provinces of the regional offices to each other and by numbers in each regional office (where numbers are small, the office's region is grouped with the region of the nearest office i.e. Potchefstroom in North West which is grouped with regional offices in Gauteng) as indicated below;

- Gauteng and North West – Head Office, Longmeadow distribution centre, Babelegi and Potchefstroom factories,
- KZN and Free State – Estcourt, New Germany and Harrismith factories,

- Eastern Cape – East London factory and
- Western Cape – Bellville distribution centre, N'dabeni and Mossel Bay factories.

Nestlé employs 3,167 employees nationally. The employees live in both rural and urban areas as well as in formal housing, with a negligible amount living in informal housing. The socioeconomic breakdown of employees ranges from very low to very high income[3].

Like many of the members of the World Economic Forum's Workplace Wellness Alliance, Nestlé has made a commitment to promote the wellness and improve the health of its employees (World Economic Forum; 2013:4). This is in line with Nestlé's ambition to be recognised globally as the leading nutrition, health and wellness company for consumers and employees. Nestlé has implemented a variety of workplace wellness initiatives (outlined below) that are aimed at not only promoting general employee health and wellbeing, but also preventing and managing chronic NCDs through the management of overweight and obesity, as well as diabetes and hypertension in the workplace. Given the nature of Nestlé's products, the high prevalence of the above mentioned NCD risk factors in the workforce, as well as the offered wellness programmes by Nestlé to address these NCDs and associated risk factors; Nestlé was an ideal setting to conduct the current study. Its outcomes will contribute significantly to the research gap on the effectiveness of workplace wellness programmes in South Africa that is highlighted in Chapter 2 of the current document.

3.2 Study design

For this study, a retrospective cohort study design was used to determine NCD outcomes between two employee research groups, the exposed (i.e. those employees that participated in the Nestlé workplace wellness initiatives) and unexposed (i.e. those employees that did not participate in the Nestlé workplace wellness initiatives) between the 1st of January 2014 and the 31st of December 2016. This study design was chosen to gain an insight on the effectiveness of engaging in wellness programmes at Nestlé. By retrospectively reviewing the employee data the researcher was able to develop an understanding of the relevance of wellness programmes at Nestlé and other similar organisations. This study design was also feasible since there was detailed data already available from the employee records. This data was available for use with permission from Nestlé's managers. Furthermore, Song and Chung (2010) identified some of the advantages of a retrospective cohort study design as follows which was applicable for this this study:

[3] Very low income is defined as an annual income of R0 – R20,500.00, low income is an annual income of R20,501.00 – R89,000.00, and middle income is an annual income of R89,001.00 – R707,000.00. High income is an annual income of R707,001.00 – R2,414,000.00 and very high income is an annual income of R2,414,001.00 and above.

Advantages

- Requires less time to complete
- The study is relatively inexpensive
- Can examine multiple outcomes for an exposure
- Allows the estimation of population at risk, incidence and relative risk

The period of three years (i.e. from the 1st of January 2014 to the 31st of December 2016) was ideal to show some form of change in NCD profile of the employees. Moreover, this period represented a period during which wellness programmes became more structured and comprehensive at Nestlé, where both physical activity and diet intervention programmes were incorporated with the employee assistance programme (EAP). Employees included in this study are those that joined the Nestlé organisation a year prior to the 1st of January 2014. On joining the organisation, employees are required to undergo baseline medical surveillance and it is expected that a follow-up review be conducted annually thereafter.

Selecting a period of at least three years with a requirement for employees to have been with the organisation for at least one year prior, the monitoring period was long enough to consider the following:

- The lead-time between employees joining the organisation and being sensitised to the workplace wellness programme and the benefits thereof,
- Employees deciding to join the workplace wellness programme,
- The availability of baseline and annual follow-up data of at least two years and other data for more regular follow–up periods (i.e. monthly or quarterly for employees in the chronic disease management programme) and
- The results of participating in the wellness programme indicating an impact on health.

3.3 Study population and sampling procedures

Using Nestlé's health and wellness participation records and registers, those employees who had one or more NCD risk factors were identified. In addition, those employees who had previously participated in diet and/or exercise interventions on site were identified by reviewing the access control log for the gym, participant and activity lists for the running, cycling and sport clubs and through the weekly dietetic report from the onsite dietetic consultation. Participant records were selected according to the following inclusion criteria:

Inclusion criteria

- Employees who were employed by the organisation over the study period (between the 1st of January 2014 and the 31st December 2016)
- All overweight and obese employees (employees who had BMIs of 25kg/m² and above) irrespective of chronic disease status
- All employees with one or more of the NCD risk factors (i.e. those with hypertension and or type 2 diabetes mellitus) irrespective of weight status
- Employees who had been with the organisation for more than a year prior to the 1st of January 2014

Exclusion criteria

The records of the following employees did not meet the inclusion criteria:

- Employees who were not employed by the organisation over the study period (between the 1st of January 2014 and the 31st December 2016)
- Employees who had been with the organisation for less than a year prior to the 1st of January 2014
- Employees for whom no NCD, absenteeism, overweight and obesity data that existed

All employees who met the inclusion criteria were selected to participate in the study. The sample therefore included overweight and obese employees (those who had BMI of 25kg/m² and above) irrespective of their NCD risk factor profile, as well as all employees with one or more NCD risk factor(s) such as elevated blood pressure and / or high blood glucose (i.e. hypertension, type 2 diabetes mellitus).

The employees were grouped together based on whether they were exposed or non-exposed. The exposed cohort in this study were employees with one or more of the following NCDs risk factors: i.e. elevated blood pressure, high blood glucose and / or BMI = 25kg/m² and above. These employees also needed to have participated in workplace wellness programmes, meaning that they had exercised at least three times a week and obtained food and nutrition related advice from a dietician for at least six times during the study period. The unexposed group of employees were those employees who also presented with the afore-mentioned NCDs risk factors but had not participated in any of the afore-mentioned workplace wellness programmes during the study period.

The minimum number of records required for an adequate sample was 385 based on the following sample size calculation; $n = (z - score)^2 * (SD * (1 - SD))/(margin\ of\ error)^2$
Where the z-score is 1.96, based on a confidence level of 95%,

The SD (Standard Deviation) is assumed to be 0.5 for the purposed of the study and the margin of error (confidence interval) was placed at 5%.

As indicated previously, 35% of employees at Nestlé are obese, all whose records were included in the study sample (N=1 120). An additional 30% of employees are hypertensive and their records would ideally also be included in the sample. However, according to a similar study by Wilson et al. (2002), 28% of hypertensive individuals are also obese and would thus already be included in the n = 1 120 sample size. Therefore, only records of 72% of hypertensive employees were added to the sample to avoid duplication. An additional n = 691 hypertensive employees' records were thus added to the sample. Wilson et al. (2002) also indicate that approximately 13% of obese individuals are diabetic. Similarly, to avoid duplication, only an additional 87% of diabetic employees were added to the sample. This would give an additional n = 473 employees' records to be included in the sample. The total sample for the study would therefore ideally be n = 1 120+691+473 = 2 284.

According to the data collected however, only 361 employees with at least one chronic disease and/or are obese took part in workplace wellness initiatives. These are the employees that form part of the exposed cohort and were compared to a comparative group of employees (unexposed cohort) who did not take part in any workplace wellness initiatives. The final sample was therefore 722 employees, 361 in each cohort.

3.4 Data collection procedure

Data for the current research was extracted from Nestlé's occupational medical database where data on annual health risks assessment is stored. The data stored in the database includes data on anthropometry (weight, height and BMI) and NCD risk factors such as blood pressure and blood glucose. Sick leave absenteeism data is stored in employee leave records in the human resource database. This information is made available to the Wellness team monthly to measure the effect of wellness programmes in reducing absenteeism. Data on nutrition and physical activity initiatives uptake is sourced from the gym, dieticians and canteen. The detail of how this information is collected and used is presented in sections 3.4.1 to 3.4.4.

The data included baseline outcome measures collected in January 2014, followed by data collected at every follow-up period. The follow-up data included outcome measures collected in December 2014, then in December 2015 and lastly in December 2016.

The study was conducted using data already collected previously and was thus a secondary analysis research study. According to Lowrance (2003), there are some advantages to following this research method.

Advantages

- Data is already gathered so the study can be conducted relatively quickly and cheaply
- There is a wider selection of data thus the size of the sample can be bigger than would have been possible with primary research due to resource constraints

3.4.1 Anthropometry data collection

Anthropometric data included the weight and height status of the employees. This data was used to calculate the BMI of the participants. This data was collected by trained occupational healthcare nurse in the respective onsite clinics using the methods prescribed by Lee and Nieman (2013).

Weight

Weight was measured early in the day and with an emptied bladder where possible and follow-up measurements taken at the same time of the day of the initial measurement to ensure consistency and reliability. Weight was taken using a calibrated electronic scale[4] which is serviced at required intervals to ensure validity. The scale was placed on hard even tiled floor and individuals weighed with minimal clothing and with no shoes. Participants were asked to remove any heavy clothing and objects from the pockets to ensure weight was as accurate as possible. Weight was measured twice to ensure to ensure accuracy and reliability, with both weights being no more 100g from each other. Weight was measured and recorded using kilogram units.

Height

Height was measured using a wall mounted stadiometer[5]. Participants were requested to stand upright against the wall with shoulders square, shoes removed and shoulders and buttocks against the wall as much possible. They were instructed to place their feet slightly apart in line with the hips. Hairstyles and accessories that may interfere with the measurement were adjusted and/or removed where possible. The participants were then asked to breathe in and hold the breath while the measurements were taken. Height was measured and recorded using meter units.

BMI

Body mass index was calculated by dividing the weight in kilograms with the squared height in metres. The criteria in Table 3.1 were used to categorise adults 19 years and above. These criteria were based on classifications by the Centre for Disease Control (CDC) (2017).

[4] Seca, 813 electronic flat scale, Germany
[5] Seca, 222 Wall-Mount Extra-Tall Stadiometer Telescopic Height-Rod, Germany

Table 3.1: BMI categories

BMI	Weight Status
Below 18.5kg/m²	Underweight
18.6 – 24.9kg/m²	Normal weight
25.0 – 29.9kg/m²	Overweight
30.0 and above	Obese

[Source: Centre for Disease Control (2017)]

Obesity is further classified by the CDC (2017) as;

Class 1 obesity: BMI of 30 to < 35

Class 2 obesity: BMI of 35 to < 40

Class 3 obesity: BMI of 40 and above (morbid obesity)

Classification in the study was however limited to one obesity class, which is BMI above 30kg/m² but was inclusive of all the other obesity classes.

3.4.2 Blood glucose and blood pressure data collection

The classifications of blood glucose and blood pressure are also presented as used in the study to categorise the study sample.

Blood glucose

Fasting blood glucose readings were measured by the occupation healthcare nurse. In this case, a portable device called a blood glucose meter[6] was used to analyse the blood obtained through a finger prick via the test strip. The results obtained were measure in mmol/L.

The criteria to categorise blood glucose status for adults is presented in Table 3.2.

Table 3.2: Blood glucose categories (for individuals without diabetes)

Blood glucose level		Status
Fasting	1 – 2 hours after a meal	
< 4 mmol/L		Low blood glucose (hyperglycaemia)
4 – 5.5 mmol/L	5 – 7.8 mmol/L	Normal
5.6 – 6.9 mmol/L	7.8 – 11 mmol/L	Prediabetes
> 7 mmol/L on two occasions	> 11 mmol/L	Diabetic

[Source: Centers for Disease Control (2019)]

[6] Roche, Accu-Chek Active blood glucose meter, Germany

Blood pressure

A fully automated blood pressure monitor[7] with appropriate cuff size was used to measure blood pressure. Table 3.3 outlines the criteria used to measure the cuff size and this is based on the British Hypertension Society (2004) guidelines.

Table 3.3: Cuff size guideline for blood pressure machines

Cuff Size	Indication	Width	Length	Guidelines inflatable bladder width and length (cm)	Arm circumference
	Small Adult/Child	10-12	18-24	12 x 18	<23
	Standard Adult	12-13	23-35	12 x 26	<33
	Large Adult	13-16	35-40	12 x 40	<50

Participants were asked to remove heavy clothing around the arm to ensure little interference in accessing the arm circumference above the elbow. Participants were not to have taken any caffeinated drinks, smoked cigarettes or taken part in physical activity 30 minutes prior to blood pressure monitoring. Participants were seated with the arm resting on a flat surface (level to the lower end of the breast bone) and were asked to remain silent and still with both feet firmly on the ground while the blood pressure was being taken on the left arm. The readings were measured using the mmHg units and were taken twice (within a few minutes waiting time in between) and only recorded when both measurements were within 0.1mmHg of each other. The criteria used to classify blood pressure levels are outlined in Table 3.4 and are based on the classification by Whelton and Carey (2018).

Blood pressure monitoring was done early in the morning between 6:00 and 10:00am.

Table 3.4: Blood pressure categories

Systolic blood pressure levels	**Diastolic blood pressure levels**	**Blood pressure status**
<90 mmHg	<60 mmHg	Below normal blood pressure (hypotension)
90 – <120 mmHg	60 – <80 mmHg	Normal blood pressure

[7] Omron Intellisense Automatic Upper Arm Blood Pressure Monitor M3 HEM-7131-E model, made in Kyoto, Japan, 2013

120 – 129mmHg	60 – <80 mmHg	High blood pressure: at risk of hypertension (prehypertension)
130 – 139 mmHg	80 – 89	Stage 1: Hypertension
≥140 mmHg	≥90 mmHg	Stage 2: Hypertension

[Adapted from Whelton and Carey (2018)]

3.4.3 Sick leave data collection

Sick leave absenteeism was recorded on the Systems, Applications and Products (SAP)[8] employee services portal under leave management. When an employee is booked off sick, they advise their line manager or supervisor of their sick leave absence and informs the line manager of how long they will be away from work. The line manager then either logs the employee's absence on SAP on their behalf or the line manager waits for the employee to return to work to log their own sick leave absence. The latter, if not followed up closely can lead to some absences not being logged and sick leave being underreported. Where absences are longer than two days (or one day if occurring within a six-week cycle), a medical certificate also must be provided.

3.4.4 Nutrition and physical activity data collection

Nutrition and physical activity data were collected by the canteen, dietician and gyms (sports champions where there are no gyms) respectively.

Nutrition interventions

<u>Onsite dieticians</u>

All sites where the staff complement makes up ten or more percent of the total company population or where there is a high prevalence of overweight and obesity (where more than half of the population is overweight and/obese), onsite dietetic services were made available to employees to use at no cost to them. Employees who were identified as high risk during the health risk assessment are referred to these dietetic services for further management and support. The dietician provided monthly reports to the Wellness department on the employee attendance of the services and their progress in the programme (i.e. weight loss). Employees were seen by the dietician for an initial assessment and were then followed up weekly initially and then monthly for a minimum of six sessions, until they were ready or deemed ready to be discharged from the programme, in that they had adopted the healthy behaviours taught.

[8] Systems, Applications and Products (SAP) is an enterprise resourcing planning that helps business to manage operations such as payroll, leave management and supply chain services.

Subsidised healthy meal and healthy canteens

To encourage healthy eating, all canteens offer healthy meals and salads as an option and offer sugar-free drinks. The company offers these meals and drinks at discounted rates to encourage uptake. All healthy meal options are prescribed and reviewed by the food service dietician to ensure that they comply with the energy and nutritional requirements of what constitutes a low-calorie healthy meal.

Data on the purchase of these items is obtained from scanned data when employees use their staff cards to pay for meals. This is the only form of payment accepted at canteen facilities. This means that all purchases are linked to each employee's profile and can thus be used to determine participation in nutrition interventions. For purposes of this study, employees were deemed exposed if they purchased the healthy meal or salad for at least four out of the five days and/or made use of the dietetic services as outlined above.

Physical activity interventions

Physical activity initiatives included the use of on-site gym facilities, membership in the company running club and in the company sports clubs (namely soccer, netball and rugby clubs).

Onsite gym

Nestlé has onsite gyms in four factories/distribution centres aimed at promoting physical activity in the workplace. These gyms are located at the Bryanston head office, in the Durban distribution centre, at the coffee plant in Estcourt and at the infant milk factory in Harrismith. Data on the use of the gyms and the duration was obtained from the access log as all employees who are gym members scan in and out of the gym when accessing the services. Shower facilities are located outside the gym building so that other employees who are not gym members can also access these facilities. This helped to improve the reliability of the data as employees are then only accessing the facility to use the gym and not use the shower facilities. Data that was obtained from the access logs thus included frequency of gym usage and duration of the usage. Data on the intensity of the activity (i.e. light, moderate and intensive) was provided by the respective gym managers who monitor the performance and progress of gym members.

Running, cycling and sports clubs

Nestlé acknowledges that not all factories are able to cover the cost of onsite gym facilities and not all employees prefer using gyms for physical fitness, and therefore an alternative in the form running, cycling and sports clubs is also provided. These clubs are regionalised, with occasional inter-regional tournaments between employees in the different regions (namely, Gauteng, Cape and Kwa-Zulu Natal regions).

Data on participation in running, cycling and sports clubs is provided by the sports champions monthly to the Wellness department and records data such as frequency, duration and intensity of events per employee per week.

3.5 Data analysis

All data collected were entered on an Excel spreadsheet. This data was then analysed using the statistical analysis software package IBM SPSS (the Statistical Package for Social Sciences), version 25.

The data was cleaned and prepared as follows before it was entered in SPSS for analysis;

Table 3.5 presents the methods used to analyse the data to achieve the outcomes for all the study objectives.

Table 3.5: Data analysis plan

	Objective	Analysis needed
1	To determine the health outcomes of employees including weight status, blood pressure and blood glucose over the study period between 1st of January 2014 and the 31st of December 2016	**Descriptive statistics:** 1. Mean values for: BMI, blood pressure, blood glucose 2. Prevalence of: • Underweight, normal weight, overweight and obesity; • Low, normal and high blood glucose and • Low, normal and high blood pressure Cross tabs: 1. Prevalence and Mean values by socio-demography of: • Underweight, normal weight, overweight and obesity; • Low, normal and high blood glucose and • Low, normal and high blood pressure **Cross tabs** for the comparison of the afore-outcomes at 4 time points: i.e. at baseline with those after year 1 (measured in Dec 2014), year 2 (Dec 2015) and year 3 (Dec 2016) **Cross tabs** for the comparison of the outcomes for individuals engaged in wellness programs (exposed) and those who did not (non-exposed)
2	To determine sick leave absenteeism of employees over the study period	**Descriptive statistics:** 1. Mean leave days absent per annum by total population, study population and

		exposure to workplace wellness initiatives 2. Prevalence of leave days absenteeism
3	To investigate the relationship between socio-demographical factors, overweight obese, hypertensive and diabetic employees, absenteeism and workplace wellness programmes at baseline (January 2014) and first follow-up December 2014; second follow-up December 2015 and final follow up at December 2016	**Descriptive Statistics and Cross Tabs:** 1. Presenting BMI outcomes for the exposed vs non-exposed 2. Presenting blood glucose outcomes for exposed vs non-exposed 3. Presenting blood pressure outcomes for the exposed vs no-exposed 4. Presenting sick leave absenteeism outcomes for the exposed vs non-exposed Also Presenting BMI, blood pressure and blood glucose by socio-demography
4	To compare the weight status, blood pressure, blood glucose and absenteeism outcomes between employees who took part in wellness programmes and those who did not take part in workplace wellness programmes between the 1st of January and the 31st of December 2016 (comparing cases and controls)	**Comparison of the afore-outcomes at four time points:** 1. **Paired t-test analysis:** at baseline with those after year 1 (measured in Dec 2014), year 2 (Dec 2015) and year 3 (Dec 2016) **Comparing the afore-outcomes of individuals between the exposed and non-exposed groups** (i.e. those who engaged in workplace wellness programmes and those who did not) 1. **Independent t-test analysis:** at baseline and at three follow-up time intervals for BMI, blood glucose, blood pressure and sick leave absenteeism.
5	To develop recommendations on the improvement of workplace wellness interventions for the management of NCDs among employees to improve absenteeism	**Recommendations:** the recommendations presented indicate what can be done (targeted interventions) to increase uptake and adherence to wellness program with the goal to reduce metabolic disorders and overweight and obesity and reduce sick leave absenteeism. All the recommendations were backed up by relevant literature and were based on key outcomes from the analysis done.

Data were presented in counts, % (prevalence), means, standard deviations, error of means. Data were considered significantly different when the confidence intervals did not overlap and where the p values were less than 0.05.

3.6 Validity

Validity in research indicates the extent to which a study measures what it means to measure. In this study, validity indicates the degree to which the impact of diet and exercise on disease management and absenteeism is effectively measured using appropriate tools. In this study, validity was improved by using a large sample. As outlined above, an adequate sample size for this study was 385, however a sample of 722 was used, thus improving the validity of the study.

To further improve validity, use was made of valid measures of physical activity such as the minimum amount of exercise required per week and nutrition intake measures (food frequency measures, diet history records).

3.7 Reliability

Reliability indicates the consistency of the results of the study. This means that the study, if reliable, should produce the same results no matter who conducts the study or when the study is conducted. Reliability in this study was improved by using calibrated and reputable measuring instruments. Moreover, one person (i.e. a trained occupational nursing practitioner) collected the data and another party (the primary researcher) checked the accuracy of the information collected and captured this data on an Excel spreadsheet. The data captured was then checked for accuracy by the supervisor of the researcher. Moreover, the reliability of the data in the company's records was ensured using the electronic systems (which are more accurate than manual systems) i.e. card scan systems for healthy food purchase history records, and staff cards scans used to access gym facilities and to purchase meals at the canteen).

3.8 Generalisability of the study results

All employees eligible for entry into the study were included, irrespective of geographic location. This ensured that the sample was representative of all employees at Nestlé and therefore the results easily generalizable to the entire employee population of Nestlé. The study results should also be generalisable to other fast-moving consumer goods (FMCG)[9] companies like Nestlé. It is however important that any generalisation be done with caution, particularly when these organisations differ in certain characteristics from Nestlé.

3.9 Ethics statement

Permission was sought from the University of the Western Cape (UWC) Biomedical Research Ethics Committee and permission to access and use the data from employee health records obtained from Nestlé's Wellness Manager (Sample attached as Appendix II) and a consent form signed in this regard (Appendix III). An information sheet on the study (Appendix I) was provided to the Wellness

[9] Fast-Moving Consumer Goods (FMCGs) are products that are turned over relatively quickly and are sold at low costs. They include household items like toiletries (deodorant) and packaged foods (sweets and chocolates).

Manager to ensure that permission was granted based on complete understanding of the proposed research.

There was no direct contact with employees, and all data was treated with total confidentiality. Records were accessed only at Nestlé's onsite clinics and at times convenient for the clinic nurses. All data was de-identified and anonymised and is electronic in nature and will be stored (for no more than five years) in a password protected electronic file on the primary researcher's computer. The results of the study will be communicated to the company and shared with the Nestlé's Employee Wellness Team for programme review and enhancement purposes. No employee details (i.e. names, ID numbers or employee numbers) were used during outcome reporting (i.e. thesis document writing, Nestlé report writing and respective article publication). Facility details were however used in analysing and presenting the study results. This was done only to identify potential trends related to location specific factors.

The main ethical concern surrounding the use of secondary health data is the consent to use/reuse the data for the current research as indicated by Law (2005). This is related to the difficulty in obtaining consent from research subjects. This emanates from the fact that subjects may have exited the research organisation where data is held and may have since changed contact details and addresses, making it difficult for them to be contacted. According to Law (2005) and Lowrance (2003), there are several options under which secondary data can be used while ensuring safeguards such as privacy and confidentiality. They are;

- Obtain consent from subjects and then use the data
- Anonymise the data and then use it
- Use the data under the public interest mandate without explicit consent

This study made use of secondary data by anonymising the data, which was done by the data custodian (the occupational healthcare provider who manages the onsite clinics in the research organisation and collects the primary data and has primary consent and permission to collect and consolidate the data for organisational reporting purposes) so that the researcher only had access to anonymised data.

3.10 Conclusion

This chapter gave an overview of the research methodology followed in conducting the study.

The following chapter of the study describes and interprets the results of the study.

CHAPTER 4

RESULTS

4.1 Introduction

This chapter presents the outcomes of the current study. These are presented and interpreted based on the objectives of the study. The chapter begins by presenting demographic data by age, gender and area of location. Non-communicable disease and risk factor data is also presented and is followed by data on sick leave absenteeism. The descriptive statistics, and analytics data is presented in counts, percentages, means and standard deviations. Significant difference is shown by confidence intervals that do not overlap and *p* values that are less than 0.05.

4.2 Demographic information

The demographic information of the study sample includes age, gender and area of distribution. Table 4.1 shows that the total number of employees at Nestlé at the time of the research was 3167, distributed in 6 regional locations namely: Gauteng, North West, Western Cape, Eastern Cape, KwaZulu-Natal and Free State. Most employees (*n* = 1270 [40.1%]) worked in the Gauteng and North West region. Overall, the regions had a range of 1 to 3 sites that employed a range of 51 up to 576 employees.

In the current study, 722 employees were included based on a criterion of having one or more NCDs/risk factors. In the study sample, there were more than twice as many male employees as there were female employees (69.7% males versus 30.3% females). The largest proportion of employees (*n* = 210, 61.0% males and 39.0% females) recorded from one site was from East London, in the Eastern Cape. The smallest proportion (*n* = 15, 80.0% males and 20.0% females) captured from one site was from Bellville in the Western Cape.

Table 4.1: Study sample distribution by area and gender

Region	Office Sites	Total employees per site	The current sample per site	Male	Female
Gauteng & North West	Nestlé - Babelegi	374	67	64.2%	35.8%
	Nestlé - Head Office	518	60	40.0%	60.0%
	Nestlé - Longmeadow	242	38	65.8%	34.2%
	Nestlé - Potchefstroom	136	68	85.3%	14.7%
	Regional Total	**1270**	**233**	**64.4%**	**35.6%**
Western Cape	Nestlé - Bellville	51	15	80.0%	20.0%
	Nestlé - Mossel Bay	260	63	81.0%	19.0%
	Nestlé - Ndabeni	120	27	74.1%	25.9%
	Regional Total	**431**	**105**	**79%**	**21%**

Eastern Cape	Nestlé - East London	576	210	61.0%	39.0%
	Regional Total	**576**	**210**	**61.0%**	**39.0%**
KZN & Free State	Nestlé - Estcourt	434	71	91.5%	8.5%
	Nestlé - Harrismith	365	79	76.0%	24.0%
	Nestlé - New Germany	91	24	70.8%	29.2%
	Regional Total	**890**	**174**	**81.6%**	**18.4%**
Total		**3167**	722	69.7%	30.3%

4.2.1 Age distribution

The average age of the participants was 45.95 years (approximately 46 years). The largest proportions (27.8% and 36.3%) of participants were within age groups 35-44 and 45-45 years, respectively. The smallest proportions of the participants (0.6% and 0.4%) were within age groups 20-24 and >64 years, respectively. This data is presented in Figure 4.1.

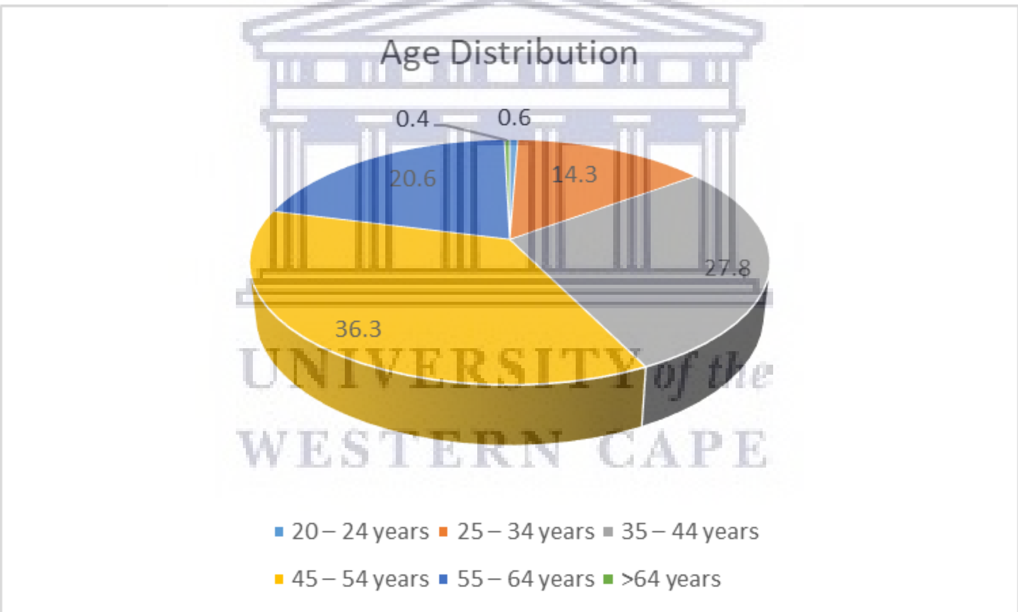

Figure 4.1: Age distribution of the Nestlé participants

Table 4.2 shows the age distribution of participants by gender. There were only a few young adults (0.6% for males and 0.5% for females) and older adults (0.4% for males and 0.5% for females) in the current sample. Most of the sample for both genders was within the age groups 35 to 64 years.

Table 4.2: Age distribution by gender in the sample

Age Group	**Male** (%) *n*	**Female** (%) *n*
20 – 24 years	(0.6) 3	(0.5) 1
25 – 34 years	(11.5) 58	(20.5) 45
35 – 44 years	(26.0) 131	(32.0) 70
45 – 54 years	(40.8) 205	(26.0) 57
55 – 64 years	(20.7) 104	(20.5) 45
>64 years	(0.4) 2	(0.5) 1
Total	(69.7) 503	(30.3) 219

4.3 Non-communicable disease risk factor status

Table 4.3 presents the NCD risk factor status of employees included in the current analyses. Overall, there was a slight decrease in the number of participants per NCD risk factor in 2016 when compared to the baseline (January 2014).

Table 4.3: Chronic disease status summary of sample

Chronic disease status	**Baseline** (%) *n*	**2014** (%) *n*	**2015** (%) *n*	**2016** (%) *n*
Obesity	(54.7) 395	(54.3) 392	(54.2) 391	(54.0) 390
Diabetes mellitus	(25.1) 181	(25.1) 181	(25.1) 181	(24.2) 175
Hypertension	(24.4) 176	(24.4) 176	(25.1) 181	(23.8) 172

4.3.1 Prevalence and descriptive statistics for BMI, diabetes and hypertension categories for the sample

Table 4.4 presents the NCD risk factors for the 722 participants. Overall, more than half the of the participants were obese at all the time points when the measurements were taken. These proportions were shown to be significantly different (i.e. the confidence intervals were not overlapping) when compared to all other BMI categories (i.e. they were different from underweight, normal weight and overweight groups from baseline and 2014 to 2016). There also seemed to be slight but steady decrease in obesity prevalence and the mean BMI of the participants from baseline to 2016. However, these differences were not significant as indicated by the overlapping confidence intervals in each BMI category at all the time points when the measurements were taken.

Table 4.4 also indicates that a majority of the participants had blood glucose measurements that were within the normal range in 2016. There were significant differences between normal glucose proportions and the other blood glucose categories as the confidence intervals were not overlapping. The prevalence of diabetes decreased slightly while the mean blood glucose increased steadily from baseline to 2016. There were no significant differences however, in each blood glucose category at different measurement points.

With regards to systolic blood pressure, a majority of the participants had prehypertension. There were no significant differences between prehypertension and normal blood pressure groups between the two groups (36.1, 43.1 and 32.3, 39.3). There were however significant differences in proportions between prehypertension and the other blood pressure categories (low systolic blood pressure, normal blood pressure and hypertension). Stage 1 hypertension and mean blood pressure decreased slightly from baseline to 2016 but the differences were not significant (i.e. confidence intervals were not overlapping).

More than half of the participants had normal diastolic blood pressure. There were significant differences in the proportions between the diastolic blood pressure groups (i.e. they were different from below normal blood pressure, prehypertension and hypertension groups from baseline and December 2014 to December 2016). Overall, the prevalence of hypertension and mean blood pressure decreased over the years from baseline to 2016, although the decrease in prevalence was not significant given that the confident intervals were overlapping.

<u>Table 4.4:</u> Prevalence and descriptive statistics for BMI, diabetes and hypertension categories

	$\frac{Sample}{N}$	Baseline		2014		2015		2016	
BMI	**722**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**
Underweight		(0.41) 3	(0.0, 1.0)*	(0.41) 3	(0.0, 1.0)*	(0,3) 2	(0.0, 0.7)*	(0.3) 2*	(0.0, 0.7)*
Normal weight		(18.4) 133	(15.5, 21.2)*	(18.4) 133	(15.5, 21.2)*	(19.1) 138	(16.1, 22.0)*	(19.3) 139*	(16.2, 22.2)*
Overweight		(26.5) 191	(23.3, 30.1)*	(26.9) 194	(23.5, 30.5)*	(26.5) 191	(23.1, 29.9)*	(26.5) 191*	(23.3, 30.1)*
Obese		(54.7) 395	(51.1, 58.4)*#	(54.3) 392	(50.6, 58.0)*#	(54.2) 391	(50.4, 57.9)*#	(54.0) 390*#	(50.3, 57.8)* #
Mean		30,36	(29.95, 30.81)#	30.24	(29.83, 30.68)#	30.16#	(29.76, 30.60)#	30.13#	(29.73, 30.58) #
Min		17,1	-	17.10	-	17.10	-	17.10	-
Max		60,0	-	60.00	-	60.00	-	60.00	-
Standard Deviation (SD)		5,627	(5.266, 6.030)	5.556	(5.182, 5.975)	5.534	(5.157, 5.951)	5.522	(5.140, 5.940)
Blood glucose	**722**								
Below normal		(4.0) 29	(2.6, 5.5)*	(4.0) 29	(2.6, 5.5)*	(3.7) 27	(2.5, 5.3)*	(3.7) 27	(2.5, 5.3)*
Normal		(49.4) 357	(45.6, 52.9)*	(49.4) 357	(45.6, 52.9)*	(49.7) 359	(46.0, 53.3)*	(48.6) 351	(44.7, 52.2)*
Prediabetes		(21.5) 155	(18.4, 24.5)*	(21.5) 155	(18.4, 24.5)*	(21.5) 155	(18.4, 24.7)*	(23.4) 169	(20.5, 26.5)*
Above normal (diabetes)		(25.1) 181	(22.0, 28.3)* #	(25.1) 181	(22.0, 28.3)* #	(25.1) 181	(21.9, 28.3)* #	(24.2) 175	(21.3, 27.3) *#
Mean		5.99	(5.86, 6.12) #	5.99	(5.86, 6.12) #	6.01	(5.88, 6.15) #	6.01	(5.88, 6.15) #
Min		1.9	-	1.9	-	1.9	-	1.9	-
Max		14.0	-	14.0	-	14.6	-	14.0	-
Standard Deviation (SD)		1.843	(1.711, 1.969)	1.843	(1.711, 1.969)	1.897	(1.749, 2.023)	1.88	(1.735, 2.014)
Blood pressure	**722**	**Systolic (%) n**	**95% CI**	**Systolic (%) n**	**95% CI**	**Systolic (%) n**	**95% CI**	**Systolic (%) n**	**95% CI**
Below normal		(0.28) 2	(0.0, 0.7)*	(0.28) 2	(0.0,0.7)*	(0.14) 1	(0.0,0.4)*	(0.42) 3	(0.0,1.0)*

Normal		(35.9) 259	(32.3, 39.3)* #	(35.9) 259	(32.3, 39.3)* #	(36.3) 262	(32.8, 39.8)* #	(35.5) 256	(31.9, 38.9) *#
Prehypertension		(39.5) 285	(36.1, 43.1) #	(39.5) 285	(36.1, 43.1) #	(38.5) 278	(35.2, 42.0)#	(40.3) 291	(36.7, 44.0) #
Above normal (Stage 1 hypertension)		(11.9) 86	(9.4, 14.4)* #	(11.9) 86	(9.4, 14.4)* #	(11.8) 85	(9.3, 14.3)* #	(11.2) 81	(8.9, 13.7)* #
Above normal (Stage 2 hypertension)		(12.5) 90	(10.0, 15.0)*	(12.5) 90	(10.0, 15.0)*	(13.3) 96	(10.9, 15.8)*	(12.6) 91	(10.2, 15.1)*
Mean		123.92	(122.9, 125.0) #	123,92	(122.9, 125.0) #	123.94	(123.0, 125.0) #	123.90	(122.9, 124.9) #
Min		77	-	77	-	81	-	81	-
Max		199	-	199	-	199	-	199	-
Standard Deviation (SD)		14.220	(13.10, 1.32)	14,220	(13.10, 1.32)	14.316	(13.23, 15.33)	14.020	(12.96, 15.05)
Blood pressure		**Diastolic (%) *n***		**Diastolic (%) *n***		**Diastolic (%) *n***		**Diastolic (%) *n***	
Below normal		(0.14) 1	(0.0 ,0.4)*	(0.14) 1	(0.0,0.4)*	(0.4) 3	(0.0,1.0)*	(0.4) 3	(0.0, 1.0)*
Normal		(52.6) 380	(49.0, 56.5)*	(52.6) 380	(49.0, 56.5)*	(54.7) 395	(50.7, 58.6)*	(53.9) 389	(50.0, 57.5)*
Above normal (Stage 1 hypertension)		(31.7) 229	(28.1, 35.2)*	(31.7) 229	(28.1, 35.2)*	(29.8) 215	(26.5, 33.2)*	(31.2) 225	(27.7, 34.9)*
Above normal (Stage 2 hypertension)		(15.5) 112	(12.7, 18.0)*	(15.5) 112	(12.7, 18.0)*	(15.1) 109	(12.5, 17.7)*	(14.5) 105	(11.9, 17.0)*
Mean		79.47	(78.80, 80.18) #	79.47	(78.80, 80.18) #	79.04	(78.36,79.72) #	79.21	(78.48, 79.87) #
Min		52	-	52	-	52	-	54	-
Max		114	-	114	-	114	-	114	-
Standard Deviation (SD)		9.112	(8.595, 9.559)	9.112	(8.595, 9.559)	9.536	(8.970, 10.027)	9.084	(8.6548, 9.591)

* Significant difference observed (Confidence Intervals do not overlap) # Slight prevalence differences but no significant difference (Confidence Intervals overlap)

4.3.2 Prevalence and descriptive statistics for BMI, diabetes and hypertension categories by gender and age

Table 4.5 shows the mean values for the NCD risk factors by gender between the baseline and the 2016 data collection periods. Females appeared to have significantly higher mean BMI values that were on the obese side of the BMI spectrum when compared to the mean BMI values that were on the overweight side of the BMI spectrum of their male. The mean values for both males and females decreased only slightly between baseline and 2015. However, the decreases were not significant.

Table 4.5 also indicates however, that males had slightly higher mean blood glucose values when compared to the mean blood glucose for females, but both means (in males and females), were on the prediabetic side of the blood glucose spectrum. The mean value for males increased slightly between baseline and 2016, the increase was however not significant. The mean value for females remained constant at 5.9mmol/L between baseline and 2016.

With regards to blood pressure, Table 4.5 indicates that males had a higher mean blood pressure for both systolic and diastolic blood pressure readings when compared to females in all the years from baseline to 2016. However, both males and females had SBP means in the prehypertension range and DBP means in the normal range. In males, SBP increased between 2014 and 2015 and decreased in 2016. The opposite was true for females in that SBP decreased between 2014 and 2015 but increased in 2016. The increased value was however below the baseline and 2014 values. In both males and females, DBP decreased between 2014 and 2015, but increased slightly in 2016 with both values (in males and females) still below the baseline and 2014 values.

Table 4.5: Prevalence and descriptive statistics for BMI, diabetes and hypertension categories by gender

	Sample / N	Baseline				2014				2015				2016			
BMI	**503/219**	**Male kg/m²**	**95% CI**	**Female kg/m²**	**95% CI**	**Male kg/m²**	**95% CI**	**Female kg/m²**	**95% CI**	**Male kg/m²**	**95% CI**	**Female kg/m²**	**95% CI**	**Male kg/m²**	**95% CI**	**Female kg/m²**	**95% CI**
Mean		29.4	(28.9, 29.9)*#	32.5	(31.8, 33.3)*ǂ	29.3	(28.9, 29.7)*#	32.4	(31.7, 33.2)*ǂ	29.2	(28.8, 29.7)*#	32.3	(31.6, 33.1)*ǂ	29.2	(28.8, 29.6)*#	32.3	(31.5, 33.1)*ǂ
Min		17.1	-	19.0	-	17.1	-	19.0	-	17.1	-	19.0	-	17.1	-	19.0	-
Max		50.0	-	60.0	-	50.0	-	60.0	-	50.0	-	60.0	-	50.0	-	60.0	-
Standard Deviation (SD)		5.131	(4.8, 5.5)	6.111	(5.4, 6.9)	5.033	(4.7, 5.4)	6.111	(5.3, 6.8)	5.011	(4.7, 5.4)	6.085	(5.3, 6.8)	4.992	(4.6, 5.4)	6.072	(5.3, 6.8)
Blood glucose	**503/219**	**Male (%) *n***	**95% CI**	**Female (%) *n***	**95% CI**	**Male (%) *n***	**95% CI**	**Female (%) *n***	**95% CI**	**Male (%) *n***	**95% CI**	**Female (%) *n***	**95% CI**	**Male (%) *n***	**95% CI**	**Female (%) *n***	
Mean		6.0	(5.9, 6.2) #	5.9	(5.7, 6.1) #	6.0	(5.9, 6.2) #	5.9	(5.7, 6.1) #	6.1	(5.9, 6.2) #	5.9	(5.7, 6.1) #	6.1	(5.9, 6.2) #	5.9	(5.7, 6.1) #
Min		1.9	-	2.8	-	1.9	-	2.8	-	1.9	-	2.9	-	1.9	-	2.9	-
Max		13.4	-	14.0	-	13.4	-	14.0	-	14.6	-	12.8	-	14.0	-	12.0	-
Standard Deviation (SD)		1.828	(1.7, 2.0)	1.880	(1.6, 2.1)	1.828	(1.7, 2.0)	1.880	(1.6, 2.1)	1.962	(1.8, 2.1)	1.735	(1.5,1.9)	1.948	(1.8, 2.1)	1.691	(1.5, 1.9)
										Females							
Blood pressure	**219**	**Systol.**		**Diastol.**		**Systol.**		**Diastol.**		**Systol.**		**Diastol.**		**Systol.**		**Diastol.**	
Mean		122,48	(120.9, 124.0)	79.1	(77.9, 80.2)	122,48	(120.9, 124.0)	79,1	(77.9, 80.2)	122,28	(120.8, 123.8)	78,2	(77.0, 79.3)	122,43	(121.0, 123.8)	78.6	(77.4, 79.7)
Min		94	-	52.0	-	94	-	52,0	-	93	-	60,0	-	98	-	59.0	-
Max		171	-	102.0	-	171	-	102,0	-	170	-	102,0	-	170	-	105.0	-
Standard Deviation (SD)		11,664	(9.9, 13.3)	8.3	(7.5, 9.1)	11,664	(9.9, 13.3)	8,344	(7.5, 9.1)	11,061	(9.7, 12.5)	8,628	(7.8, 9.4)	10,837	(9.4, 12.3)	8.643	(7.7, 9.5)
										Males							
Blood pressure	**503**	**Systol.**	**95% CI**	**Diastol.**	**95% CI**	**Systol.**	**95% CI**	**Diastol.**	**95% CI**	**Systol.**	**95% CI**	**Diastol.**	**95% CI**	**Systol.**	**95% CI**	**Diastol.**	**95% CI**
Mean		124.5	(123.3, 125.9)	79.7	(78.8, 80.5)	124.5	(123.2, 125.9)	79.7	(78.8, 80.5)	124.7	(123.2, 126.0)	79.4	(78.5, 80.5)	124.5	(123.2, 125.9)	79.5	(78.6, 80.3)
Min		77	-	60	-	77	-	60	-	81	-	52	-	81	-	54	-
Max		199	-	199	-	199	-	199	-	114	-	114	-	114	-	114	-
Standard Deviation (SD)		15.167	(13.7, 16.5)	9.429	(8.8, 10.0)	15.167	(13.7, 16.5)	9.429	(8.8, 10.0)	15.475	(14.1, 16.8)	9.890	(8.8, 10.5)	15.163	(13.2, 16.5)	9.267	(9.2, 9.8)

* Significant difference observed (Confidence Intervals do not overlap) # ǂ Slight mean value differences but no significant difference (Confidence Intervals overlap)

<u>Table 4.6:</u> Prevalence and descriptive statistics for BMI, diabetes and hypertension categories by age group

	Sample / *N*	Baseline %												2014 %											
		<24	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
BMI	**722**																								
Mean		26.4	(21,10 34,00) #	30.6	(29,48 31,59) #	31.1	(30,267 31,993) #	30.0	(29.363, 30.815)	29.9	(29.076, 30.725) #	27.3	(23,00 31,00) #	26.4	(21.10, 34.00)	30.4	(29.30, 31.37)	30.9	(30.094, 31.771)	30.0	(29.260, 30.717)	29.9	(29.024, 30.657)	27.0	(23.00, 30.00)
Min		21.1		19		17.1		18		19		23		21.1		19.0		17.1		18.0		19.0		23.0	
Max		34		50		51		60		45		31		34.0		50.0		51.0		60.0		45.0		30.0	
Standard Deviation (SD)		5.526		5.495		5.615		5.972		5.036		4.041		5.526		5.381		5.525		5.920		5.009		3.606	
Blood glucose	722	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	**<24**	**CI**	25-34	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
Mean		4.8	(4.40, 5.50)*	5.4	(5.17, 5.64)*	5.8	(5.54, 5.98)*	6.1	(5.87, 6.37) #	6.5	(6.19, 6.84) #*	6.3	(3.80, 7.70)#	4.8	(4.40, 5.50)*	5.4	(5.17, 5.64)*	5.8	(5.54, 5.98)*	6.1	(5.87, 6.37) #	6.5	(6.19, 6.84) #*	6.3	(3.80, 7.70) #
Min		4.4		2.8		1.9		3.1		3.4		3.8		4.4		2.8		1.9		3.1		3.4		3.8	
Max		5.5		10.2		14.0		13.4		11.2		7.7		5.5		10.2		14.0		13.4		11.2		7.7	
Standard Deviation (SD)		0.507		1.212		1.614		2.047		1.974		2.196		0.507		1.212		1.614		2.047		1.974		2.196	
		Systolic BP																							
Blood pressure	722	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	**<24**	**CI**	25-34	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
Mean		122.0	(117.00, 126.00) #	123.1	(121.59, 124.77)*	123.0	(121.07, 124.79)*	125.7	(123.62, 127.84) #	122.5	(120.30, 124.90)*	131.7	(125.00, 141.00) #*	122.0	(117.00, 126.00) #	123.1	(121.59, 124.77)*	123.0	(121.07, 124.79)*	125.7	(123.62, 127.84) #	122.5	(120.30, 124.90)*	131.7	(125.00, 141.00) #*
Min		117.0		104.0		94.0		77.0		81.0		125.0		117.0		104.0		94.0		77.0		81.0		125.0	
Max		126.0		150.0		170.0		199.0		171.0		141.0		126.0		150.0		170.0		199.0		171.0		141.0	
Standard Deviation (SD)		3.742		7.772		13.230		16.819		14.016		8.327		3.742		7.772		13.230		16.819		14.016		8.327	
		Diastolic BP																							
Blood pressure	**722**	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	**<24**	**CI**	25-34	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
Mean		75.5	(71.00, 84.00) #	77.3	(75.98, 78.73) #	79.4	(78.13, 80.69) #	79.9	(78.86, 81.07)	80.3	(78.83, 81.86) #	80.0	(74.00, 84.00) #	75.5	(71.00, 84.00) #	77.3	(75.98, 78.73) #	79.4	(78.13, 80.69) #	79.9	(78.86, 81.07)	80.3	(78.83, 81.86) #	80.0	(74.00, 84.00) #
Min		71.0		61.0		60.0		60.0		52.0		74.0		71.0		61.0		60.0		60.0		52.0		74.0	
Max		84.0		102.0		114.0		107.0		108.0		84.0		84.0		102.0		114.0		107.0		108.0		84.0	
Standard Deviation (SD)		5.802		7.078		9.240		9.505		9.452		5.292		5.802		7.078		9.240		9.505		9.452		5.292	

	Sample *N*	2015 %												2016 %											
		<24	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
BMI	**722**																								
Mean		26.7	(21.10, 34.00) #	30.3	(29.16, 31.25) #	30.8	(30.012, 31.703) #	29.9	(29.200, 30.646) #	29.8	(28.992, 30.610) #	26.7	(23.00, 29.00) #	26.7	(21.10, 34.00) #	30.2	(29.08, 31.13) #	30.8	(30.004, 31.689) #	29.9	(29.170, 30.620) #	29.8	(28.944, 30.576) #	26.7	(23.00, 29.00) #
Min		21.1		19.0		17.1		18.0		19.0		23.0		21.1		19.0		17.1		18.0		19.0		23.0	
Max		34.0		50.0		51.0		60.0		45.0		29.0		34.0		50.0		51.0		60.0		45.0		29.0	
Standard Deviation (SD)		5.403		5.369		5.502		5.894		5.005		3.215		5.403		5.333		5.502		5.885		4.983		3.215	
Blood glucose	722	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	<24	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
Mean		4.8	(4.40, 5.50) #	5.4	(5.18, 5.64) #	5.8	(5,58 6,04) #	6.1	(5.86, 6.36) #	6.6	(6.22, 6.89) #	6.9	(3.80, 10.10) #	4.8	(4.40, 5.50)	5.5	(5.28, 5.78)	5.7	(5,49 5,92)	6.2	(5.92, 6.42)	6.5	(614, 6.82)	7.2	(3.80, 10.70)
Min		4.4		2.8		1.9		3.1		3.4		3.8		4.4		2.8		1.9		3.1		3.4		3.8	
Max		5.5		10.8		12.0		14.6		12.0		10.1		5.5		13.0		11.9		14.0		12.4		10.7	
Standard Deviation (SD)		0.507		1.200		1.620		2.110		2.079		3.150		0.507		1.314		1.518		2.120		2.023		3.453	
		Systolic BP																							
Blood pressure	722	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	>64	**CI**	**<24**	**CI**	25-34	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
Mean		122.0	(117.00, 126.00) #	122.0	(120.49, 124.39) #	122.4	(122.06, 125.74) #	123.8	(123.47, 127.73) #	125.6	(120.16, 124.29) #	122.2	(111.00, 142.00) #	122.0	(117.00, 126.00) #	122.1	(120.9, 124.01)*	123.6	(121.80, 125.49) #	126.0	(124.09, 128.05) #*	121.8	(119.65, 124.01)*	124.0	(102.00, 145.00) #
Min		117.0		117.0		94.0		93.0		97.0		81.0		117.0		100.0		85.0		97.0		81.0		102.0	
Max		126.0		126.0		150.0		170.0		199.0		160.0		126.0		150.0		170.0		199.0		155.0		145.0	
Standard Deviation (SD)		3.742		3.742		9.326		12.979		17.211		13.237		3.742		9.584		12.855		16.456		13.096		21.517	
		Diastolic BP																							
Blood pressure	**722**	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**	**<24**	**CI**	**25-34**	**CI**	**35-44**	**CI**	**45-54**	**CI**	**55-64**	**CI**	**>64**	**CI**
Mean		75.5	(71.00, 84.00) #	76.5	(75.05, 78.07) #	79.5	(78.14, 80.83) #	79.7	(78.14, 80.83) #	79.1	(77.60 80.71) #	86.7	(78.00, 100.00) #	75.5	(71.00, 84.00)	78.0	(76.45, 79.38)	78.7	(77.52, 79.95)	80.1	(77.52, 79.95)	79.2	(77.84 80.75)	78.3	(65.00, 88.00)
Min		71.0		62.0		52.0		59.0		59.0		78.0		71.0		59.0		54.0		59.0		60.0		65.0	
Max		84.0		102.0		114.0		112.0		108.0		100.0		84.0		102.0		114.0		107.0		108.0		88.0	
Standard Deviation (SD)		5.802		7.663		9.911		9.809		9.513		11.719		5.802		7.957		9.045		9.383		9.310		11.930	

* Significant difference observed (Confidence Intervals do not overlap) # Slight prevalence differences but no significant difference (Confidence Intervals overlap)

Table 4.6 shows that the mean BMI was the highest in 35 – 44-year-old participants in all the years when the measurements were taken. However, there seemed to be no significant differences in the mean BMI levels of participants in the different age groups and at different time points when the measurements were taken.

Table 4.6 also shows that the mean blood glucose was the highest in 55 – 64-year-old participants in the first two years when measurements were taken, and the difference was statistically significant between participant 55 – 64 years old and participants in the age groups <24 years to 44 years old, but not in participants between 45 and 54 years old. Participants that were older than 64 years of age had the highest blood glucose prevalence in the last two years when measurements were taken, differences were however not significant. Mean blood glucose therefore increased with increasing age from 2015 to 2016 (from age group <24 years to >64 years), but only increased with increasing age up to the age of 64 years (and decreased at ages >64 years) at baseline and in 2014.

Mean systolic blood pressure was the highest in participants older than 64 years of age at base and in 2014 (131.7mmHg) and differences were statistically significant between this age group and participants aged 25 – 35 years, 35 – 44 years and 55 – 64 years. In 2015 however, the mean systolic blood pressure was the highest in participants aged 55 – 64 years (125.6mmHg) but it was not significantly different form participants in other age groups. In 2016 the mean systolic blood pressure was the highest in participants aged 45 – 54 years (126.0mmHg) and was significantly difference from participants aged 24 – 34 years and 55 – 64 years. The mean systolic blood pressure decreased steadily in the age group 55 – 64 years where measurements taken from baseline to 2016. In the other age groups however, the mean systolic blood pressure decreased from base to 2015 and increased in 2016. These declines were however not statistically significant.

The mean diastolic blood pressure was the highest in employees aged 55 – 64 years at baseline and in 2014 (80.3mmHg), was the highest in participants older than 64 years in 2015 (86.7mmHg) and participants aged 45 – 54 years in 2016 (80.1mmHg). The mean differences were however not significant at all points were measurements were taken. Diastolic blood pressure increased with an increase in age at baseline and in 2014, but not for the measurements taken in 2015 and 2016 (it increased with increasing age but then decreased at ages >64 years in 2015 and 2016).

4.3.3 Prevalence and descriptive statistics for BMI, diabetes and hypertension categories by regional location

Table 4.7 shows that the Eastern Cape region had the highest prevalence of obesity with a mean BMI 31.8kg/m². This mean BMI was not significantly different from the mean BMI of the participants in the Gauteng and North West region. However, it was significantly higher than the mean BMIs of the participants in KZN, Free State and the Western Cape. The mean BMI values seemed to decrease slightly at different time points when the measurements were taken until December 2015. However, there were also no significant differences observed in this case.

The Eastern Cape region also had the highest prevalence for hyperglycaemia as indicated by a mean blood glucose value of 6.4mmol/L which was significantly different from the mean blood glucose value in the Gauteng and North West and Western Cape regions. There was however no significant difference in the mean blood glucose between the other three regions (Gauteng & North West, KZN & Free State and Western Cape).

The KZN & Free State region had the highest mean systolic blood pressure at all time periods where measurements were taken. There was however no statistically significant difference between the other regions at baseline and in 2014. The mean systolic blood pressure in the KZN & Free State region was however significantly different from the mean systolic blood pressure in the Eastern Cape and Western Cape regions in 2015 and was significantly different from the Western Cape region only in 2016.

Table 4.7: **Prevalence and descriptive statistics for BMI, diabetes and hypertension categories by regional location**

		Eastern Cape				Gauteng & North West				KZN & Free State				Western Cape			
		BMI	**BG**	**Sys BP**	**Dia BP**	**BMI**	**BG**	**Sys BP**	**Dia BP**	**BMI**	**BG**	**Sys BP**	**Dia BP**	**BMI**	**BG**	**Sys BP**	**Dia BP**
Baseline	Mean	31.8	6.4	122.3	78.8	30.4	5.7	125.1	79.1	29.4	6.0	125.3	81.0	29.0	5.8	122.3	79.0
	Min	19	2.8	77	52	17.1	2.8	98	60	18	3.1	93	60	18.0	1.9	94	61
	Max	60	11.7	180	106	50	11.6	199	103	44	14	183	114	50.0	12.3	173	101
	SD	5.698	1.985	14.277	8.541	5.655	1.563	14.017	8.324	5.386	2.017	15.020	10.434	5.210	1.674	12.819	9.382
	Mean 95% CI	31.05[#*]	6.159*	120.513[#]	77.639	29.685[#]	5.493[#]*	123.218[#]	78.080	28.558[*]	5.704[#]	123.215[#]	79.620	28.085[*]	5.515[#]*	119.955[#]	77.201
		32.521	6.685	124.169	79.995	31.202	5.913	126.841	80.112	30.223	6.294	127.525	82.574	30.075	6.123	124.813	80.934
	SD 95% CI	4.920	1.815	12.266	7.735	5.044	1.370	11.757	7.597	4.802	1.663	13.023	9.292	4.204	1.318	10.169	8.211
		6.488	2.150	16.277	9.475	6.228	1.760	16.199	8.967	5.938	2.347	17.007	11.602	6.145	2.013	15.290	10.422
	% of study sample	30.4%	31.2%	28.7%	28.8%	32.3%	30.6%	32.6%	32.1%	23.3%	24.1%	24.4%	24.6%	13.9%	14.1%	14.4%	14.5%
2014	Mean	31.7	6.4	122.3	78.8	30.3	5.7	125.1	79.1	29.3	6.0	125.3	81.0	28.8	5.8	122.3	79.0
	Min	19	2.8	77	52	17.1	2.8	98	60	18	3.1	93	60	18.0	1.9	94	61
	Max	60	11.7	180	106	50	11.6	199	103	44	14	183	114	50.0	12.3	173	101
	SD	5.658	1.985	14.277	8.541	5.556	1.563	14.017	8.324	5.3437	2.017	15.0204	10.4342 2	5.0676	1.674	12.8188	9.38183 7
	Mean 95% CI	30.97[#]	6.159*[#]	120.513[#]	77.639	29.525	5.493*	123.218[#]	78.080	28.498	5.704[#]	123.215	79.620	27.948	5.515*	119.955[#]	77.201
		32.433	6.685	124.169	79.995	31.009	5.913	126.841	80.112	30.143	6.294	127.525	82.574	29.889	6.123	124.813	80.934
	SD 95% CI	4.880	1.815	12.266	7.735	4.939	1.370	11.757	7.597	4.751	1.663	13.023	9.292	4.070	1.318	10.169	8.211
		6.454	2.150	16.277	9.475	6.139	1.760	16.199	8.967	5.878	2.347	17.007	11.602	6.045	2.013	15.290	10.422
	% of study sample	30.5%	31.2%	28.7%	28.8%	32.3%	30.6%	32.6%	32.1%	23.4%	24.1%	24.4%	24.6%	13.9%	14.1%	14.4%	14.5%
2015	Mean	31.6	6.4	122.4	78.1	30.1	5.7	124.5	79.2	29.3	6.0	126.7	80.0	28.8	5.9	121.3	78.9
	Min	19	3.4	81	52	17.1	2.8	93	61	19	3.1	98	59	18.0	1.9	94	60
	Max	60	13	180	112	50	12	199	112	44	12.8	183	114	50.0	14.6	173	101
	SD	5.647	2.103	13.737	9.359	5.508	1.481	14.444	8.835	5.3280	2.1	14.5875	10.5348	5.0843	1.8549	14.0227	9.62021

	Mean 95% CI	30.892#	6.1586#	120.52*	76.91	29.422	5.499*	122.57#	78.10	28.442	5.741#	124.78*	78.49	27.864	5.553#	118.70*	77.13
		32.3393	6.72	124.34	79.46	30.888	5.888	126.44	80.33	30.084	6.353	128.94	81.41	29.827	6.228	124.04	80.79
	SD 95% CI	4.8588	1.8784	11.933	8.326	4.8827	1.2779	12.207	8.056	4.7360	1.7769	12.614	9.309	4.0941	1.3514	11.446	8.397
		6.4413	2.2947	15.525	10.429	6.1112	1.6779	16.555	9.614	5.8621	2.3306	16.541	11.774	6.0569	2.3327	16.444	10.615
	% of study sample	30.5%	31.2%	28.7%	28.8%	32.3%	30.5%	32.4%	32.3%	23.4%	24.2%	24.6%	24.4%	13.9%	14.2%	14.2%	14.5%
2016	Mean	31.6	6.4	121.8	78.8	30.1	5.7	125.1	79.1	29.2	6.1	125.8	80.0	28.8	5.8	122.1	79.2
	Min	19	3.4	81	60	17.1	2.8	98	59	19	3.1	85	54	18.0	1.9	94	59
	Max	60	14	180	105	50	11.9	199	103	44	13	183	114	50.0	13.7	173	101
	SD	5.652	2.123	13.591	8.228	5.491	1.445	13.476	8.274	5.30464	2.083	15.4308	10.7764	5.07099	1.6853	13.0008	9.42317
	Mean 95% CI	30.862#	6.118*#	120.104*	77.647	29.391	5.532*	123.344#	78.076	28.407	5.779#	123.780*	78.474	27.864	5.467*	119.831#	77.370
		32.311	6.700	123.771	80.029	30.856	5.900	126.803	80.117	30.032	6.389	128.139	81.588	29.814	6.104	124.757	81.103
	SD 95% CI	4.873	1.879	11.731	7.421	4.861	1.279	11.189	7.505	4.719	1.754	13.359	9.559	4.093	1.257	10.407	8.265
		6.449	2.360	15.355	9.063	6.095	1.631	15.691	8.937	5.835	2.366	17.140	11.921	6.043	2.112	15.437	10.443
	% of study sample	30.5%	31.0%	28.6%	28.9%	32.3%	30.6%	32.6%	32.3%	23.4%	24.4%	24.5%	24.3%	13.9%	14.0%	14.3%	14.5%

* Significant difference observed (Confidence Intervals do not overlap) # Slight prevalence differences but no significant difference (Confidence Intervals overlap)

4.4 Comparative statistics for BMI, diabetes and hypertension by exposure to workplace wellness initiatives

The data presented in the following tables indicate the differences in NCD outcomes of the participants who participated in the workplace wellness initiatives and the outcomes of those who did not.

According to the data, 62% of Nestlé employees took part in workplace wellness programmes over the study period. This includes employees who did not show NCD risk factor profiles and with BMIs below 30kg/m². However, these employees were not included in the study. The study sample included employees that took part in wellness programmes and those that did not take part in wellness programmes but presented with NCD risk factor profiles and had BMI ≥30kg/m^2. Therefore, 50% (361 employees) of the study sample participated in wellness programmes and were classified as exposed in that they took part in regular physical activity and saw a dietician and/or were purchasing the healthy meals at the staff canteen.

Table 4.8 outlines the prevalence and descriptive statistics for BMI, diabetes and hypertension by exposure to workplace wellness initiatives. Overall, the majority of the participants in the exposed group were obese at all time points when the measurements were taken. These proportions were shown to be significantly different from all the other BMI categories (i.e. underweight, normal weight and overweight). There also seemed to be a noticeable steady decrease in obesity prevalence and the mean BMI of the participants from baseline to 2016. However, these differences were not significant.

When it came to those participants who were not exposed, while the majority were overweight and obese, there was almost an equal spread of those who were overweight and obese. The proportions were significantly different between these groups and those who were underweight and those who had normal weight. However, no decreases in overweight/obesity prevalence and mean BMI of the participants were observed from baseline to 2016 in the unexposed group. All changes between the weight categories in the total sample (both exposed and unexposed) seem to be attributable to changes in the exposed group. This can be observed in the changes of three cases between baseline and 2014, a change of five cases between 2014 and 2015 and a change of one between 2015 and 2016 in both the total sample and the exposed sample. This change is not observed in the unexposed group.

Table 4.8: Prevalence and descriptive statistics for BMI, diabetes and hypertension by exposure to workplace wellness initiatives

	$\frac{Sample}{N}$	Baseline		2014		2015		2016	
				Exposed Cohort					
BMI	**361**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**
Underweight		(0.3) 1	(0.0, 0.8)$^{*\#}$	(0.3) 1	(0.0, 0.8)$^{*\#}$	(0.0) 0	(0.0, 0.0)	(0.0) 0	(0.0, 0.0)
Normal weight		(15.2) 55	(11.4, 19.1)$^{*\#}$	(15.2) 55	(11.4, 19.1)$^{*\#}$	(16.6) 60	(12.5, 20.8)$^{*\#}$	(16.9) 61	(12.7, 21.1)$^{*\#}$
Overweight		(20.8) 75	(16.9, 24.7)*	(21.6) 78	(17.5, 25.8)*	(20.8) 75	(16.9, 24.9)*	(35.2) 75	(16., 24.9)*
Obese		(63.7) 230	(59.3, 69.0)$^{\#o}$	(62.9) 227	(58.2, 68.1)$^{\#o}$	(62.6) 226	(57.9, 67.9)$^{\#o}$	(62.3) 225	(57.6, 67.6)$^{\#o}$
Mean		30.74	(30.24, 31.31)^{ǂo}	30.48	(29.99, 31.03)^{ǂo}	30.33	(29.84, 30.86)^{ǂo}	30.3	(29.79, 30.79)^{ǂo}
Min		18.0	-	18.0	-	19.0	-	19.0	-
Max		50.0	-	50.0	-	50.0	-	50.0	-
Standard Deviation (SD)		5.170	(4.758, 5.556)	5.030	(4.613, 5.428)	4.989	(4.558, 5.392)	4.964	(4.533, 5.358)
				Unexposed Cohort					
BMI	**361**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**
Underweight		(0.6) 2	(0.0, 1.4)$^{*\#}$	(0.6) 2	(0.0, 1.4)$^{*\#}$	(0.6) 2	(0.0, 1.4)$^{*\#}$	(0.6) 2	(0.0, 1.4)$^{*\#}$
Normal weight		(21.6) 78	(17.5, 26.3)$^{*\#}$	(21.6) 78	(17.5, 26.3)$^{*\#}$	(21.6) 78	(17.5, 26.3)$^{*\#}$	(21.6) 78	(17.5, 26.3)$^{*\#}$
Overweight		(32.1) 116	(27.1, 37.1)*	(32.1) 116	(27.1, 37.1)*	(32.1) 116	(27.1, 37.1)*	(32.1) 116	(27.1, 37.1)*
Obese		(45.7) 165	(40.4, 50.7)$^{\#ǂ}$	(45.7) 165	(40.4, 50.7)$^{\#ǂ}$	(45.7) 165	(40.4, 50.7)$^{\#ǂ}$	(45.7) 165	(40.4, 50.7)$^{\#ǂ}$
Mean		29.99	(29.36, 30.54)^{ǂ}	29.99	(29.36, 30.54)^{ǂ}	29.99	(29.36, 30.54)^{ǂ}	29.99	(29.36, 30.5)^{ǂ}
Min		17.1	-	17.1	-	17.1	-	17.1	-
Max		60.0	-	60.0	-	60.0	-	60.0	-
Standard Deviation (SD)		6.033	(5.450, 6.653)	6.033	(5.450, 6.653)	6.033	(5.450, 6.653)	6.033	(5.450, 6.653)
				Exposed Cohort					
Blood glucose	**361**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**	**(%) n**	**95% CI**

Below normal		(2.8) 10	(1.1, 4.7)*#	(2.8) 10	(1.1, 4.7) *#	(2.2) 8	(0.8, 3.9) *#	(2.2) 8	(0.8, 3.9) *#
Normal		(55.1) 199	(49.9, 60.1) *#	(55.1) 199	(49.9, 60.1) ǂ	(56.5) 204	(51.2, 61.5) ǂ	(54.3) 196	(49.0, 59.6) ǂ
Prediabetes		(26.0) 94	(21.6, 30.5) *#	(26.0) 94	(21.6, 30.5)	(25.5) 92	(21.1, 29.6)	(29.4) 106	(24.7, 33.8)
Above normal (hyperglycaemia)		(16.1) 58	(12.5, 20.2) *#	(16.1) 58	(12.5, 20.2)	(15.8) 57	(11.9, 19.7)	(14.1) 51	(10.5, 18.0)
Mean		5.7	(5.52, 5.87) ǂ	5.7	(5.52, 5.87) ǂ	5.7	(5.53, 5.84) ǂo	5.68	(5.55, 5.85) ǂo
Min		2.8	-	2.8	-	2.8	-	2.8	-
Max		14.0	-	14.0	-	11.1	-	11.8	-
Standard Deviation (SD)		1.584	(1.391, 1.782)	1.584	(1.391, 1.782)	1.531	(1.358, 1.699)	1.479	(1.301, 1.650)
Unexposed Cohort									
Blood glucose	**361**	**(%) *n***	**95% CI**	**(%) *n***	**95% CI**	**(%) *n***	**95% CI**	**(%) *n***	**95% CI**
Below normal		(5.3) 19	(3.0, 7.8)*#	(5.3) 19	(3.0, 7.8)*#	(5.3) 19	(3.0, 7.8)*#	(5.3) 19	(3.0, 7.8)*#
Normal		(43.8) 158	(38.5, 49.3)*#	(43.8) 158	(38.5, 49.3)*#	(42.9) 155	(38.0, 48.2)*#	(42.9) 155	(38.0, 48.2)*#
Prediabetes		(16.9) 61	(13.0, 21.0)*#	(16.9) 61	(13.0, 21.0)*#	(17.5) 63	(13.6, 21.3)*#	(17.5) 63	(13.6, 21.3)*#
Above normal (hyperglycaemia)		(34.1) 123	(29.1, 38.8) ǂ	(34.1) 123	(29.1, 38.8) ǂ	(34.3) 124	(29.6, 39.3) ǂ	(34.3) 124	(29.6, 39.3) ǂ
Mean		6.28	(6.08, 6.49) ǂ	6.28	(6.08, 6.49) ǂ	6.35	(6.12, 6.57) ǂ	6.33	(6.10, 6.54) ǂ
Min		1.9	-	1.9	-	1.9	-	1.9	-
Max		13.4	-	13.4	-	14.6	-	14.0	-
Standard Deviation (SD)		2.031	(1.876, 2.181)	2.031	(1.876, 2.181)	2.156	(1.959, 2.339)	2.156	(1.953, 2.340)
Exposed Cohort									
Blood pressure	**361**	**Systolic (%) *n***	**95% CI**	**Systolic (%) *n***	**95% CI**	**Systolic (%) *n***	**95% CI**	**Systolic (%) *n***	**95% CI**
Below normal		(0.0) 0	(0.0, 0.0)	(0.0) 0	(0.0, 0.0)	(0.0) 0	(0.0, 0.0)	(0.3) 1	(0.0, 0.8)*#

Normal	(36.0) 130	(31.3, 41.0)ǂ	(36.0) 130	(31.3, 41.0)ǂ	(36.3) 131	(31.3, 41.3)ǂ	(35.2) 127	(30.5, 39.9)*#
Prehypertension	(46.0) 166	(40.7, 51.2)ǂ	(46.0) 166	(40.7, 51.2)ǂ	(45.4) 164	(40.4, 50.1)ǂ	(47.4) 171	(42.1, 52.4)*#
Above normal (Stage 1 hypertension)	(8.6) 31	(5.8, 11.6)ǂ	(8.6) 31	(5.8, 11.6)	(8.9) 32	(5.8, 11.9)	(8.3) 30	(5.5, 11.1)*#
Above normal (Stage 2 hypertension)	(9.4) 34	(6.4, 12.5)ǂ	(9.4) 34	(6.4, 12.5)	(9.4) 34	(6.6, 12.5)	(8.9) 32	(6.1, 11.9)
Mean	122.65	(121.46, 123.87)ǂ	122.65	(121.46, 123.87)ǂ	122.27	(120.9, 123.5)ǂ	122.54	(121.31, 123.73)ǂ
Min	94.0	-	94.0	-	93.0	-	89.0	-
Max	199.0	-	199.0	-	199.0	-	199.0	-
Standard Deviation (SD)	12.412	(10.763, 14.159)	12.412	(10.763, 14.159)	12.832	(11.213, 14.607)	12.498	(10.865, 14.236)
Unexposed Cohort								
Blood pressure 722	**Systolic (%) *n***	**95% CI**	**Systolic (%) *n***	**95% CI**	**Systolic (%) *n***	**95% CI**	**Systolic (%) *n***	**95% CI**
Below normal	(0.6) 2	(0.0, 1.4)	(0.6) 2	(0.0, 1.4)	(0.3) 1	(0.0, 0.8)	(0.6) 2	(0.0, 1.4)
Normal	(35.7) 129	(30.8, 40.4)ǂ	(35.7) 129	(30.8, 40.4)	(36.3) 131	(31.6, 41.3)	(35.7) 129	(30.5, 41.0)
Prehypertension	(33.0) 119	(28.5, 38.2)ǂ	(33.0) 119	(28.5, 38.2)	(31.6) 114	(26.9, 36.6)	(33.2) 120	(28.3, 38.5)
Above normal (Stage 1 hypertension)	(15.2) 55	(11.6, 19.1)ǂ	(15.2) 55	(11.6, 19.1)	(14.7) 53	(11.1, 18.3)	(14.1) 51	(10.5, 17.7)
Above normal (Stage 2 hypertension)	(15.5) 56	(11.9, 19.4) *#ǂ	(15.5) 56	(11.9, 19.4)	(17.2) 62	(13.6, 21.1)	(16.3) 59	(12.5, 20.2)
Mean	125.19	(123.52,126.88) ǂ	125.19	(123.52,126.88) ǂ	125.61	(124.08,127.26) ǂ	125.22	(123.70,126.89) ǂ
Min	77.0	-	77.0	-	81.0	-	81.0	-

Max	186.0	-	186.0	-	186.0	-	186.0	-
Standard Deviation (SD)	15.738	(14.143,17.261)	15.738	(14.143,17.261)	15.498	(13.979,16.875)	15.289	(13.766,16.762)
				Exposed Cohort				
Blood pressure 361	**Diastolic (%) *n***	**95% CI**	**Diastolic (%) *n***	**95% CI**	**Diastolic (%) *n***	**95% CI**	**Diastolic (%) *n***	**95% CI**
Below normal	(0.1) 1	(0.0, 0.0)	(0.1) 1	(0.0, 0.0)	(0.4) 3	(0.0, 1.4)*[#]	(0.4) 3	(0.0, 1.4)*[#]
Normal	(52.6) 380	(54.0, 64.8)*[#]	(52.6) 380	(54.0, 64.8)*[#]	(54.7) 395	(56.8, 66.8)*[#]	(53.9) 389	(54.0, 64.5)*[#]
Prehypertension	(31.7) 229	(23.0, 33.5)*[#]	(31.7) 229	(23.0, 33.5)*[#]	(29.8) 215	(20.8, 29.6)*[#]	(31.2) 225	(24.1, 33.8)*[#]
Above normal (Hypertension)	(15.5) 112	(9.1, 15.5)*[#]	(15.5) 112	(9.1, 15.5)*[#]	(15.1) 109	(9.1, 15.8)[o]	(14.5) 105	(8.0, 14.7)[o]
Mean	78.33	(77.46, 79.19)[o]	78.33	(77.46, 79.19)[o]	77.73	(76.80, 78.67)[o]	78.11	(77.28, 78.87)[o]
Min	60.0	-	60.0	-	52.0	-	59.0	-
Max	108.0	-	108.0	-	108.0	-	108.0	-
Standard Deviation (SD)	8.413	(7.802, 8.986)	8.413	(7.802, 8.986)	8.911	(8.212, 9.558)	8.359	(7.734, 8.980)
				Unexposed				
Blood pressure 361	**Diastolic (%) *n***		**Diastolic (%) *n***		**Diastolic (%) *n***		**Diastolic (%) *n***	
Below normal	(0.3) 1	(0.0, 0.8)*[#]	(0.3) 1	(0.0, 0.8)	(0.3) 1	(0.0, 0.8)	(0.3) 1	(0.0, 0.8)
Normal	(45.7) 165	(40.4, 51.0)*[#]	(45.7) 165	(40.4, 51.0)	(47.6) 172	(42.4, 52.9)	(48.5) 175	(43.2, 54.0)
Prehypertension	(35.5) 128	(30.5, 40.2)*[#]	(35.5) 128	(30.5, 40.2)	(34.3) 124	(29.6, 39.3)	(33.5) 121	(28.5, 38.5)
Above normal (Hypertension)	(18.6) 67	(14.4, 22.7)*[#]	(18.6) 67	(14.4, 22.7)	(17.7) 64	(13.9, 21.6)	(17.7) 64	(13.6, 21.9)
Mean	80.61	(79.57, 81.65)[o]	80.61	(79.57, 81.65)[o]	80.36	(79.25, 81.41)[o]	80.32[o]	(79.33, 81.34)
Min	52.0	-	52.0	-	59.0	-	54.0	-

Max	114.0	-	114.0	-	114.0	-	114.0	-
Standard Deviation (SD)	9.638	(8.928, 10.320)	9.638	(8.928, 10.320)	9.963	(9.193, 10.757)	9.642	(8.878, 10.335)

*# Significant difference present, ° Slight decrease but no significant difference, ǂ No significant difference observed

Slightly more than half of the participants in the exposed group had normal blood glucose levels and approximately a quarter had prediabetes. There were observed significant differences in the blood glucose categories indicated by confidence intervals that do not overlap. There was a decline in diabetes prevalence over the study period, although this decrease was not significant.

As in the exposed group, more than half of the participants in the unexposed group had normal blood pressure which was the case throughout the study period. There were also significant differences between the blood glucose categories. Unlike in the exposed group however, there was an increase in the prevalence of diabetes and prediabetes over the study period. The increase was however not significant.

Most of the participants in the exposed group had systolic prehypertension, the prevalence of which increased between 2015 and 2016 after decreasing slightly between 2014 and 2015. The prevalence for hypertension however decreased between 2014 and 2015. There were significant differences in prevalence between systolic blood pressure categories in 2016 but not in any of the other years during the study period. There were no significant differences in prevalence between participants with normal systolic blood pressure and prehypertension. There were however significant differences between these categories and the other blood pressure categories (below normal and hypertension groups). Systolic blood pressure decreased between 2015 and 2016 after increasing slightly between 2014 and 2015.

With regards to diastolic blood pressure in the exposed group, a majority of employees (over 52%) had normal diastolic blood pressure. There were significant differences in prevalence within the blood pressure categories. The prevalence of diastolic hypertension decreased in the exposed group over the study period.

As in the exposed group, most employees in the unexposed group had normal diastolic and systolic blood pressure with notable differences only between diastolic blood pressure categories. The confidence intervals in the categories for systolic blood pressure (between employees with normal blood pressure and prehypertension and within the two types of hypertension) were overlapping indicating that differences were not significant. The prevalence for prehypertension and hypertension in the unexposed group decreased slightly over the study period but was however not significant. The means for systolic and diastolic blood pressure were lower in the exposed versus the unexposed group.

Based on the above tables, employees who took part in wellness initiatives (exposed) had higher mean BMI values but lower blood glucose, systolic and diastolic pressure levels.

4.4.1 T-test analysis for BMI, blood glucose and blood pressure

This section presents the independent-samples t-test analysis for BMI, blood glucose and blood pressure. The analysis for sick leave is also presented further below as indicated. This test was used in the study to determine if differences existed between two independent groups on BMI, blood glucose and blood pressure (dependent variables). This test also determined whether the differences between these two groups were statistically significant.

t-test and BMI

Based on Table 4.9, there seems to be some differences between the mean BMI of participants who partook in the worksite physical activity and nutrition interventions (i.e. exposed) and those who did not (unexposed) collected during baseline, 2014, 2015 and 2016, respectively. However, the differences were not significant. It must be noted that the mean BMI of the exposed participants collected at baseline was markedly higher than that of their non-exposed counterparts. This suggests that the mean BMI differences were higher at baseline (i.e. 0.76kg/m^2), and the mean differences appeared to decrease gradually over the different time points when the measurements were taken and became the narrowest in 2016 (i.e. 0.41kg/m^2).

<u>Table 4.9:</u> Independent samples test BMI (Group statistics and test output)

Exposed			**Statistic**	**Bias**	**Std. Error**	**95% Confidence Interval**	
						Lower	Upper
Baseline BMI	Yes	N	361				
		Mean	30.742	-0.002	0.280	30.193	31.278
		Std. Deviation	5.1696	-0.0186	0.2072	4.7622	5.5550
		Std. Error Mean	0.2721				
	No	N	361				
		Mean	29.987	-0.010	0.318	29.367	30.603
		Std. Deviation	6.0332	-0.0318	0.3093	5.4083	6.6274
		Std. Error Mean	0.3175				
BMI 2014	Yes	N	361				
		Mean	30.483	-0.003	0.272	29.939	31.008
		Std. Deviation	5.0303	-0.0198	0.2104	4.6151	5.4199
		Std. Error Mean	0.2648				
	No	N	361				
		Mean	29.987	-0.010	0.318	29.367	30.603
		Std. Deviation	6.0332	-0.0318	0.3093	5.4083	6.6274
		Std. Error Mean	0.3175				
BMI 2015	Yes	N	361				

		Mean	30.330	-0.002	0.272	29.780	30.856
		Std. Deviation	4.9886	-0.0195	0.2078	4.5751	5.3825
		Std. Error Mean	0.2626				
	No	N	361				
		Mean	29.987	-0.010	0.318	29.367	30.603
		Std. Deviation	6.0332	-0.0318	0.3093	5.4083	6.6274
		Std. Error Mean	0.3175				
BMI 2016	Yes	N	361				
		Mean	30.269	-0.001	0.271	29.712	30.795
		Std. Deviation	4.9639	-0.0196	0.2085	4.5484	5.3627
		Std. Error Mean	0.2613				
	No	N	361				
		Mean	29.987	-0.010	0.318	29.367	30.603
		Std. Deviation	6.0332	-0.0318	0.3093	5.4083	6.6274
		Std. Error Mean	0.3175				

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Baseline BMI	Equal variances assumed	5.920	0.015	1.807	720	0.071	0.7555	0.4182	-0.0655	1.5764
	Equal variances not assumed			1.807	703.473	0.071	0.7555	0.4182	-0.0655	1.5765
BMI 2014	Equal variances assumed	9.430	0.002	1.200	720	0.230	0.4962	0.4134	-0.3155	1.3078
	Equal variances not assumed			1.200	697.445	0.230	0.4962	0.4134	-0.3155	1.3079
BMI 2015	Equal variances assumed	10.123	0.002	0.833	720	0.405	0.3433	0.4120	-0.4656	1.1522
	Equal variances not assumed			0.833	695.453	0.405	0.3433	0.4120	-0.4657	1.1523

BMI 2016	Equal variances assumed	10.892	0.001	0.686	720	0.493	0.2821	0.4112	-0.5252	1.0894
	Equal variances not assumed			0.686	694.232	0.493	0.2821	0.4112	-0.5253	1.0894

t-test and blood glucose

Table 4.10 shows the group statistics and output for the t-test analysis conducted in order to determine the differences in blood glucose between the two groups of employees (the exposed and unexposed group). There are significant differences in mean blood glucose between the exposed and the unexposed group as indicated by a significance value p of <0.001 in all the reporting periods of the study. The negative mean differences indicate that blood glucose was lower in the exposed group by 0.58mmol/L at baseline and in 2014, 0.66 mmol/L in 2015 and 0.64 mmol/L in 2016 than in the non-exposed group. It is also important to note that there was a slight increase in mean blood glucose in the unexposed group over the study, while there was a steady decline in blood glucose in the exposed group. The mean in the exposed group was below 6mmol/L while the mean in the unexposed group was above 6mmol/L as discussed previously.

Table 4.10: **Independent samples test blood glucose (Group statistics and test output)**

Exposed			Statistic	Bias	Std. Error	95% Confidence Interval	
						Lower	Upper
Baseline Blood Glucose	Yes	N	361				
		Mean	5.701	0.006	0.083	5.545	5.870
		Std. Deviation	1.5844	-0.0019	0.0944	1.4101	1.7682
		Std. Error Mean	0.0834				
	No	N	361				
		Mean	6.282	-0.003	0.107	6.072	6.497
		Std. Deviation	2.0310	-0.0066	0.0804	1.8716	2.1679
		Std. Error Mean	0.1069				
Blood Glucose 2014	Yes	N	361				
		Mean	5.701	0.006	0.083	5.545	5.870
		Std. Deviation	1.5844	-0.0019	0.0944	1.4101	1.7682
		Std. Error Mean	0.0834				
	No	N	361				
		Mean	6.282	-0.003	0.107	6.072	6.497
		Std. Deviation	2.0310	-0.0066	0.0804	1.8716	2.1679
		Std. Error Mean	0.1069				
Blood Glucose 2015	Yes	N	361				
		Mean	5.681	0.007	0.080	5.535	5.844
		Std. Deviation	1.5314	0.0019	0.0820	1.3730	1.7038
		Std. Error Mean	0.0806				
	No	N	361				
		Mean	6.348	-0.003	0.115	6.121	6.576
		Std. Deviation	2.1541	-0.0070	0.0979	1.9548	2.3305
		Std. Error Mean	0.1134				

Blood Glucose 2016	Yes	N	361				
		Mean	5.687	0.005	0.078	5.543	5.845
		Std. Deviation	1.4794	0.0012	0.0824	1.3179	1.6398
		Std. Error Mean	0.0779				
	No	N	361				
		Mean	6.327	-0.006	0.115	6.100	6.543
		Std. Deviation	2.1558	-0.0108	0.1002	1.9472	2.3337
		Std. Error Mean	0.1135				

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Baseline Blood Glucose	Equal variances assumed	38.355	0.000	-4.290	720	0.000	-0.5816	0.1356	-0.8477	-0.3154
	Equal variances not assumed			-4.290	679.748	0.000	-0.5816	0.1356	-0.8478	-0.3154
Blood Glucose 2014	Equal variances assumed	38.355	0.000	-4.290	720	0.000	-0.5816	0.1356	-0.8477	-0.3154
	Equal variances not assumed			-4.290	679.748	0.000	-0.5816	0.1356	-0.8478	-0.3154
Blood Glucose 2015	Equal variances assumed	45.412	0.000	-4.792	720	0.000	-0.6666	0.1391	-0.9397	-0.3935
	Equal variances not assumed			-4.792	649.861	0.000	-0.6666	0.1391	-0.9398	-0.3935
Blood Glucose 2016	Equal variances assumed	51.661	0.000	-4.649	720	0.000	-0.6398	0.1376	-0.9099	-0.3696
	Equal variances not assumed			-4.649	637.517	0.000	-0.6398	0.1376	-0.9100	-0.3695

***t*-test and blood pressure**

Based on Table 4.11, there were statistically significant differences (indicated by the significant value *p* of <0.001) in both systolic and diastolic blood pressure between employees who took part in workplace wellness initiatives and those who did not take part, with those employees who took part in these initiatives having lower systolic and diastolic blood pressure. These mean differences were 2.54mmHg, 2.54mmHg, 3.34mmHg and 2.68mmHg for systolic blood pressure, 2.29mmHg, 2.29mmHg, 2.6 mmHg and 2.21mmHg for diastolic blood pressure at baseline, 2014, 2015 and 2016 respectively.

Table 4.11: **Independent samples test BP (Group statistics and test output)**

Exposed			Statistic	Bias	Std. Error	95% Confidence Interval	
						Lower	Upper
Baseline Systolic Blood Pressure	Yes	N	361				
		Mean	122,65	0,01	0,66	121,33	123,95
		Std. Deviation	12,412	-0,044	0,921	10,688	14,176
		Std. Error Mean	0,653				
	No	N	361				
		Mean	125,19	-0,01	0,80	123,63	126,76
		Std. Deviation	15,738	-0,019	0,792	14,143	17,190
		Std. Error Mean	0,828				
Baseline Diastolic Blood Pressure	Yes	N	361				
		Mean	78,33	0,00	0,44	77,51	79,17
		Std. Deviation	8,413	-0,019	0,313	7,775	9,004
		Std. Error Mean	0,443				
	No	N	361				
		Mean	80,61	0,02	0,52	79,58	81,66
		Std. Deviation	9,638	-0,011	0,367	8,887	10,360
		Std. Error Mean	0,507				
Systolic Blood Pressure 2014	Yes	N	361				
		Mean	122,65	0,01	0,66	121,33	123,95
		Std. Deviation	12,412	-0,044	0,921	10,688	14,176
		Std. Error Mean	0,653				
	No	N	361				
		Mean	125,19	-0,01	0,80	123,63	126,76
		Std. Deviation	15,738	-0,019	0,792	14,143	17,190
		Std. Error Mean	0,828				

Diastolic Blood Pressure 2014	Yes	N	361				
		Mean	78,33	0,00	0,44	77,51	79,17
		Std. Deviation	8,413	-0,019	0,313	7,775	9,004
		Std. Error Mean	0,443				
	No	N	361				
		Mean	80,61	0,02	0,52	79,58	81,66
		Std. Deviation	9,638	-0,011	0,367	8,887	10,360
		Std. Error Mean	0,507				
Systolic Blood Pressure 2015	Yes	N	361				
		Mean	122,27	0,02	0,70	120,90	123,69
		Std. Deviation	12,832	-0,043	0,911	11,074	14,508
		Std. Error Mean	0,675				
	No	N	361				
		Mean	125,61	-0,02	0,80	124,04	127,12
		Std. Deviation	15,498	0,002	0,743	14,088	16,944
		Std. Error Mean	0,816				
Diastolic Blood Pressure 2015	Yes	N	361				
		Mean	77,73	0,02	0,47	76,82	78,68
		Std. Deviation	8,911	-0,012	0,320	8,244	9,515
		Std. Error Mean	0,469				
	No	N	361				
		Mean	80,36	0,03	0,54	79,36	81,43
		Std. Deviation	9,963	-0,008	0,409	9,171	10,752
		Std. Error Mean	0,524				
Systolic Blood Pressure 2016	Yes	N	361				
		Mean	122,54	0,01	0,69	121,18	123,93
		Std. Deviation	12,498	-0,046	0,920	10,766	14,399

		Std. Error Mean	0,658				
	No	N	361				
		Mean	125,22	-0,01	0,78	123,68	126,73
		Std. Deviation	15,289	0,004	0,750	13,835	16,816
		Std. Error Mean	0,805				
Diastolic Blood Pressure 2016	Yes	N	361				
		Mean	78,11	0,00	0,42	77,26	78,92
		Std. Deviation	8,359	-0,022	0,311	7,720	8,954
		Std. Error Mean	0,440				
	No	N	361				
		Mean	80,32	0,02	0,52	79,24	81,30
		Std. Deviation	9,642	-0,009	0,367	8,883	10,321
		Std. Error Mean	0,507				

		Levene's Test for Equality of Variances		**t-test for Equality of Means**						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Baseline Systolic BP	Equal variances assumed	19.548	0.000	-2.403	720	0.017	-2.535	1.055	-4.606	-0.464
	Equal variances not assumed			-2.403	682.897	0.017	-2.535	1.055	-4.606	-0.463
Baseline Diastolic BP	Equal variances assumed	5.319	0.021	-3.394	720	0.001	-2.285	0.673	-3.607	-0.963

	Equal variances not assumed			-3.394	707.108	0.001	-2.285	0.673	-3.607	-0.963
Systolic BP 2014	Equal variances assumed	19.548	0.000	-2.403	720	0.017	-2.535	1.055	-4.606	-0.464
	Equal variances not assumed			-2.403	682.897	0.017	-2.535	1.055	-4.606	-0.463
Diastolic BP 2014	Equal variances assumed	5.319	0.021	-3.394	720	0.001	-2.285	0.673	-3.607	-0.963
	Equal variances not assumed			-3.394	707.108	0.001	-2.285	0.673	-3.607	-0.963
Systolic BP 2015	Equal variances assumed	16.750	0.000	-3.155	720	0.002	-3.341	1.059	-5.420	-1.262
	Equal variances not assumed			-3.155	695.792	0.002	-3.341	1.059	-5.420	-1.262
Diastolic BP 2015	Equal variances assumed	2.222	0.136	-3.733	720	0.000	-2.626	0.704	-4.007	-1.245
	Equal variances not assumed			-3.733	711.213	0.000	-2.626	0.704	-4.007	-1.245
Systolic BP 2016	Equal variances assumed	17.518	0.000	-2.577	720	0.010	-2.679	1.039	-4.719	-0.638
	Equal variances not assumed			-2.577	692.602	0.010	-2.679	1.039	-4.719	-0.638
Diastolic BP 2016	Equal variances assumed	7.519	0.006	-3.291	720	0.001	-2.211	0.672	-3.529	-0.892
	Equal variances not assumed			-3.291	705.809	0.001	-2.211	0.672	-3.529	-0.892

4.5 Sick leave (absenteeism) trends

The following sick leave trends were observed in employees over the three-year study period between baseline and 2016. According to Table 4.12, of the overall Nestle population (3167 employees) 68.1%, 73.4% and 74.9% took leave in 2014, 2015 and 2016, respectively. The average sick leave days the employees took were 4.8 and 4.9 and 5.1 in 2014, 2015 and 2016 respectively.

<u>Table 4.12:</u> Sick leave trend analysis (overall for the Nestlé population)

	$\frac{Sample}{N}$	2014	2015	2016
Total Nestlé population	**3167**	**(%) n**	**(%) n**	**(%) n**
No. of employees who took sick leave		(68.1) 2158	(73.4) 2324	(74.9) 2372
Total sick leave days		10451.3	11498.6	12013.5
Ave. sick leave days per employee		4.8	4.9	5.1

It can be noted that the average number of sick leave days in the company increased between January 2014 and 2016. The difference in increase between 2014 and 2015 was 2.08% and between 2015 and 2016 it became 4.08%. Based on Table 4.13, all the 722 employees included in this analysis took sick leave. The average leave days that these employees took is also indicated in Table 4.13 below. The increase in the number of sick leave days over the study period for participants in the study was 8.19% between 2014 and 2015 and 16.12% between 2015 and 2016.

There seemed to be no significant differences on the number of leave days taken by employees with different body size statuses. However, the total mean sick leave days taken by employees significantly increased over the years. Moreover, the mean sick leave days taken by obese employees significantly increased over the years.

Table 4.13: Sick leave trends for sample

	Sample N	2014		2015		2016	
Total Study Sample (Current analysis)	**722**	**(%) n**		**(%) n**		**(%) n**	
No. of employees in the study who took sick leave (as a proportion of the total population in the organisation)		(22.8) 722		(22.8) 722		(22.8) 722	
Total sick leave days		(38.7) 4048		(38.2) 4389		(42.4) 5099	
Ave. sick leave days per employee		5.62		6.08		7.06	
Average sick leave days per employee by BMI	**722**	**n**	**95% CI**	**n**	**95% CI**	**n**	**95% CI**
Underweight		5.00	(4.00. 6.00)ǂ	5.50	(5.00. 6.00) ǂ	6.00	(4.00. 8.00) ǂ
Normal weight		5.65	(5.41, 5.91)ǂ	5.99	(5.70, 6.27)ǂ	6.76	(6.45, 7.09)ǂ
Overweight		5.91	(5.70, 6.13)ǂ	6.18	(5.95, 6.42)ǂ	7.28	(6.98, 7.60)ǂ
Obese		5.45	(5.24, 5.64)*ǂ	6.07	(5.84, 6.29)*ǂ	7.07	(6.82, 7.32)*ǂ
Mean		5.61	(5.48, 5.73)*	6.08	(5.94, 6.23)*	7.06	(6.91, 7.22)*
Min		0	-	0	-	2	-
Max		13	-	16	-	20	-
Standard Deviation		1.773	(1.678, 1.871)	1.956	(1.837, 2.077)	2.314	(2.171, 2.464)
Average sick leave days per employee by BG	722	**n**	**95% CI**	**n**	**95% CI**	**n**	**95% CI**
Below normal		5.62	(5.17, 6.07)ǂ	6.22	(5.67, 6.86)ǂ	7.30	(6.55, 8.05)ǂ
Normal		5.22	(5.05, 5.37)ǂ	5.64	(5.46, 5.80)ǂ	6.52	(6.32, 6.73)ǂ
Prediabetes		5.05	(4.79, 5.28)ǂ	5.54	(5.27, 5.82)ǂ	6.39	(6.09, 6.70)ǂ

Above normal (hyperglycaemia)		6.86	(6.58, 7.13)*ǂ	7.40	(7.09, 7.72)ǂ	8.75	(8.40, 9.12)*
Mean		5.61	(5.48, 5.73)*	6.08	(5.94, 6.23)*	7.06	(6.91, 7.22)*
Min		0	-	0	-	2	-
Max		13	-	16	-	20	-
Standard Deviation		1.773	(1.678, 1.871)	1.956	(1.837, 2.077)	1.918	(1.353, 2.434)

Average sick leave days per employee by BP	722	**Systolic**	**95% CI**	**Diastol.**	**95% CI**	**Systolic**	**95% CI**	**Diastol.**	**95% CI**	**Systolic**	**95% CI**	**Diastol.**	**95% CI**
Below normal		5.50	(5.00, 6.00)ǂ	7.00	(7.00, 7.00)*ǂ	8.00	(8.00, 8.00)*	6.0	(5.00, 7.00)ǂ	6.00	(4.00, 8.00)ǂ	5.33	(5.00, 6.00)*ǂ
Normal		5.66	(5.45, 5.87)*ǂ	5.36	(5.20, 5.52)ǂ	6.07	(5.85, 6.28)ǂ	5.92	(5.75, 6.12)ǂ	7.19	(6.94, 7.47)*	6.82	(6.06, 7.05)*
Prehypertension		5.04	(4.84, 5.21)*	5.63	(5.39, 5.86)*ǂ	5.60	(5.36, 5.84)*ǂ	6.04	(5.75, 6.32)ǂ	6.39	(6.15, 6.62)*	7.11	(6.82, 7.40)*ǂ
Above normal (Stage 1 hypertension)		5.87	(5.58, 6.18)*	6.38	(6.06, 6.75)*	6.16	(5.79, 6.57)ǂ	6.72	(6.36, 7.08)*ǂ	7.17	(6.76, 7.61)*ǂ	7.90	(7.47, 8.34)*
Above normal (Stage 2 hypertension)		7.01	(6.67, 7.38)*ǂ	-	-	7.41	(7.02, 7.80)*ǂ	-	-	8.78	(8.27, 9.29)*	-	-
Mean		5.61	(5.48, 5.73)*	5.61	(5.48, 5.73)*	6.08	(5.94, 6.23)*	6.08	(5.94, 6.23)*	7.06	(6.91, 7.22)*	7.06	(6.91, 7.22)*
Min		0	-	0	-	0	-	0	-	2	-	2	-
Max		13	-	13	-	16	-	16	-	20	-	20	-
Standard Deviation		1.773	(1.678, 1.871)	1.773	(1.678, 1.871)	1.956	(1.837, 2.077)	1.956	(1.837, 2.077)	2.314	(2.171, 2.464)	2.314	(2.171, 2.464)

*Significant differences present, ǂ No significant differences observed

Table 4.13 shows that sick leave absenteeism was highest in employees with diabetes and increased over the years between the 2014 and 2016, with the greatest significance observed in 2016. Mean sick leave taken by employees increased over the years, but this increase was the highest in participants with diabetes.

Sick leave absenteeism was highest in employees with Stage 2 systolic hypertension, except in 2015 where employees with below normal blood pressure had the highest sick leave absence. There were significant differences in sick leave days taken by employees with normal systolic blood pressure, prehypertension and those with Stage 1 and Stage 2 hypertension.

Employees with diastolic hypertension had the highest sick leave absenteeism in 2015 and 2016. In 2014 however, employees with below normal diastolic blood pressure had the highest sick leave absenteeism. Sick leave absence increased in employees with hypertension, but the difference was not significant except in 2016.

<u>Table 4.14:</u> Total sick leave days by site

Site	**Sample Size Per Site**	**2014 (%) n**	**2015 (%) n**	**2016 (%) n**
Nestle - Babelegi	67	(8.4) 339	(8.8) 387	(9.1) 464
Nestle - Bellville	15	(2.0) 79	(1.9) 82	(2.0) 103
Nestle - East London	210	(30.5) 1236	(31.6) 1389	(32.8) 1670
Nestle - Estcourt	71	(9.0) 363	(8.6) 378	(8.8) 449
Nestle - Harrismith	79	(10.8) 439	(11.2) 491	(11.4) 579
Nestle - Head Office	60	(8.0) 322	(8.0) 354	(8.1) 414
Nestle - Longmeadow	38	(5.5) 221	(4.9) 217	(5.1) 257
Nestle - Mossel Bay	63	(8.6) 348	(8.4) 368	(8.5) 433
Nestle - N'dabeni	27	(4.3) 173	(3.8) 168	(3.4) 175
Nestle - New Germany	24	(3.9) 156	(3.8) 167	(3.3) 167
Nestle - Potchefstroom	68	(9.2) 372	(8.8) 388	(7.6) 388
Total	722	(38.7) **4048**	(38.2) **4389**	(42.4) **5099**

Based on Table 4.14, employees in East London took more sick leave days than any other site in the sample. Employees in Bellville took the least amount of sick leave days in the study sample.

4.5.1 Participation in wellness initiatives by sick leave absenteeism

The data presented in the following tables indicate the differences in sick leave absenteeism outcomes of the participants who participated in the workplace wellness initiatives and the outcomes of those that did not. Table 4.15 shows that the mean sick leave days taken by employees who took part in the wellness programs were the lowest in the underweight group and these was significantly different from the other BMI categories (i.e. normal weight, overweight and obese participants). Sick leave days taken were the highest in the overweight group and there was a significant difference observed between this group and the obese group. Moreover, the mean sick leave days taken by overweight and obese employees steadily increased over the years and the significant differences were observed between the mean sick leave days taken in 2015 and 2016. Similarly, mean sick leave days taken increased at the different time points when the measurements were taken. The significant differences were only observed between 2015 and 2016. It also must be noted that the overall mean sick leave days taken by the non-exposed participants were higher than those taken by participants who were exposed to wellness programmes in all the time points when the measurements were taken.

Table 4.15 shows that according to those participants who were never exposed, the lowest mean leave days taken were in the underweight group and the highest in obese participants. In 2014 the significant differences were observed between the underweight and obese group, and in 2015 and 2016 the significant difference was observed between the underweight, overweight and obese groups. The mean sick leave days taken seemed to increase with time when the measurements were taken. The significant differences in this case were observed between 2015 and 2016.

<u>Table 4.15:</u> Effect of participation in workplace wellness programmes on sick leave absenteeism based on BMI, diabetes and HPT status by exposure to workplace wellness initiatives

	Sample / N	2014		2015		2016	
		Exposed					
BMI	361	**Sick leave days *n***	**95% CI**	**Sick leave days *n***	**95% CI**	**Sick leave days *n***	**95% CI**
Underweight		4.00	(4.0, 4.0)*	-		-	
Normal weight		5.20	(4.88, 5.50)*	5.55	(5.20, 5.93)	6.21	(5.74, 6.66)
Overweight		5.60	(5.21, 5.95)**	5.69	(5.30, 6.01)*	6.99	(6.51, 7.55)*
Obese		4.70	(4.47, 4.94)**	5.09	(4.86, 5.34)*	5.88	(5.62, 6.17)*
Mean		4.96	(4.78, 5.14)	5.29	(5.11, 5.47)*	6.16	(5.95, 6.41)*
Min		0	-	0	-	2	-
Max		12	-	16	-	20	-
Standard Deviation		1.698	(1.546, 1.830)	1.707	(1.504, 1.932)	2.183	(1.961, 2.455)
		Unexposed					
BMI							
Underweight		5.50	(5.00, 6.00)*	5.50	(5.00, 6.00)*	6.00	(4.00, 8.00)*
Normal weight		5.97	(5.67, 6.33)°	6.32	(5.96, 6.70)	7.19	(6.81, 7.60)°
Overweight		6.14	(5.88, 6.39)°	6.49	(6.21, 6.79)*	7.47	(7.08, 7.88)*°
Obese		6.47	(6.23, 6.75)*°	7.41	(7.09, 7.72)*°	8.69	(8.41, 9.03)*°
Mean		6.25	(6.07, 6.42)°	6.87	(6.66, 7.07)°	7.96	(7.74, 8.19)°
Min		2	-	3	-	3	-
Max		13	-	13	-	15	-
Standard Deviation		1.606	(1.463, 1.744)	1.872	(1.729, 2.019)	2.083	(1.930, 2.240)
		Exposed					

Blood Glucose	**361**						
Below normal		5.50	(5.10, 6.00)	5.38	(4.40, 6.33)	6.25	(4.89, 7.86)
Normal		4.65	(4.46, 4.86)#	5.04	(4.86, 5.24) #	5.69	(5.45, 5.94) #
Prediabetes		4.65	(4.36, 4.96) #	5.10	(4.76, 5.44) #	5.97	(5.59, 6.37) #
Above normal (hyperglycaemia)		6.43	(5.87, 6.98)*	6.47	(5.90, 7.08)*	8.37	(7.68, 9.15)*
Mean		4.96	(4.79, 5.14) #	5.29	(5.11, 5.47) #	6.16	(5.95, 6.41)*
Min		0	-	0	-	2	-
Max		12	-	16	-	20	-
Standard Deviation		1.698	(1.546, 1.830)	1.707	(1.504, 1.932)	2.183	(1.961, 2.455)
		Unexposed					
Blood Glucose	**361**						
Below normal		5.68	(5.00, 6.39) #	6.58	(5.93, 7.39)* #	7.74	(7.05, 8.48) #
Normal		5.92	(5.70, 6.53) #	6.41	(6.16, 6.68) #	7.58	(7.29, 7.90) #
Prediabetes		5.66	(5.34, 5.98) #	6.19	(5.80, 6.61) #	7.10	(6.66, 7.59) #
Above normal (hyperglycaemia)		7.06	(6.75, 7.37)*	7.82	(7.49, 8.15)*	8.91	(8.54, 9.26)*
Mean		6.25	(6.07, 6.42)*	6.87	(6.66, 7.07)*	7.96	(7.74, 8.19)*
Min		2	-	3	-	3	-
Max		13	-	13	-	15	-
Standard Deviation		1.705	(1.463 1.943)	1.872	(1.729, 2.019)	2.083	(1.930, 2.240)
		Exposed					

Blood Pressure	**361**	**Systolic**	**95% CI**	**Diastolic**	**95% CI**	**Systolic**	**95% CI**	**Diastolic**	**95% CI**	**Systolic**	**95% CI**	**Diastolic**	**95% CI**
Below normal		-		-		-		5.5	(5.0, 6.0)	-		5.00	(5.0, 5.0)*
Normal		5.04	(4.76, 5.34)*	4.73	(4.54, 4.94) #	5.38	(5.17, 5.63) #	5.17	(4.97, 5.37)* #	6.39	(6.01, 6.78)*#	6.06	(5.78, 6.35)* #

Prehypertension	4.44	(4.22, 4.66)*	5.07	(4.68, 5.44) #	4.88	(4.63, 5.12) #	5.35	(4.94, 5.82) #	5.64	(5.39, 5.92)* #	6.25	(5.79, 6.72) #
Above normal (Stage 1 hypertension)	5.77	(5.19, 6.38)*	5.80	(5.22, 6.37) #	5.50	(5.00, 6.10) #	5.76	(5.25, 6.27) #	6.57	(5.90, 7.35) #	6.54	(6.00, 7.07) #
Above normal (Stage 2 hypertension)	6.47	(5.87, 7.09) #			6.71	(6.02, 7.48) #			7.75	(6.83, 8.88) #		
Mean	4.96	(4.79, 5.14) #			5.29	(5.11, 5.47) #			6.16	(5.95, 6.41)*		
Min	0	-			0	-			2	-		
Max	16	-			16	-			20	-		
Standard Deviation	1.698	(1.546, 1.830)			1.707	(1.504, 1.932)			2.183	(1.961, 2.455)		
							Unexposed					
Hypertension **361**	**Systolic**	**95% CI**	**Diastolic**	**95% CI**	**Systolic**	**95% CI**	**Diastolic**	**95% CI**	**Systolic**	**95% CI**	**Diastolic**	**95% CI**
Below normal	5.50	(5.00, 6.00*)#	7.00	(7.00, 7.00*)	8.0	(8.00,8.00*)*	7.00	(7.00, 7.00) #	7.00	(6.00, 8.00*)#	6.00	(6.00, 6.00*)*
Normal	6.29	(6.02, 6.56) #	6.18	(5.94, 6.41) #	6.76	(6.48, 7.04) #	6.90	(6.63, 7.20) #	7.98	(7.66, 8.34) #	7.75	(7.43, 8.07) #
Prehypertension	5.87	(5.63, 6.12) #	6.07	(5.82, 6.34) #	6.62	(6.27, 7.02) #	6.54	(6.44, 6.85) #	7.46	(7.09, 7.84) #	7.85	(7.52, 8.20)
Above normal (Stage 1 hypertension)	5.93	(5.60, 6.29)*#	6.78	(6.40, 7.21)*	6.57	(6.09, 7.06) #	7.41	(6.96, 7.87) #	7.53	(7.02, 8.02) #	8.78	(8.27, 9.26)*
Above normal (Stage 2 hypertension)	7.34	(6.93, 7.78) #	-	-	7.79	(7.37, 8.22) #	-	-	9.34	(8.83, 9.90)*	-	-
Mean	6.25	(6.07, 6.42)	6.25	(6.07, 6.42)	6.87	(6.66, 7.07)	6.87	(6.66, 7.07)	7.96	(7.74, 8.19)	7.96	(7.74, 8.19)
Min	2	-	2	-	3	-	3	-	3	-	3	-
Max	13	-	13	-	13	-	13	-	15	-	15	-
Standard Deviation	1.606	(1.463, 1.744)	1.606	(1.463, 1.744)	1.872	(1.729, 2.019)	1.872	(1.729, 2.019)	2.083	(1.930, 2.240)	2.083	(1.930, 2.240)

***Boot strapping calculated based on a lower than 1000 sample** ** Significant differences existed ᵒAn increase in mean values and the significant differences present #No significant differences

In participants who took part in workplace wellness programmes, based on blood glucose measures, sick leave absenteeism was lowest in employees with normal blood glucose (and prediabetes in 2014) and was highest in employees with diabetes. These differences were statistically significant in employees with diabetes at all points when the measurements were taken. In the unexposed group, employees with diabetes also had the highest sick leave absence with significant differences between the other blood glucose categories. Employees with prediabetes had the lowest sick leave absenteeism, however this difference was not statistically significant from the other blood glucose categories except diabetes. In comparing the two groups, mean sick leave was lowest in the exposed group versus the unexposed group and differences were statistically significant.

The mean sick leave days taken by employees who took part in the wellness programs were the lowest in employees who had systolic hypertension and highest in employees with stage 2 hypertension. With regards to diastolic hypertension however, employees with normal blood pressure had the lowest sick leave absence in 2014 and 2015, while employees with below normal systolic blood pressure had the lowest sick leave absenteeism in 2016. Differences were statistically significant between the measurement periods 2014 and 2015 and statistically significant for below normal blood pressure within the category in 2016.

In the group of employees who did not take part in workplace wellness programmes, sick leave absenteeism was also highest in employees with stage 2 hypertension, however differences between the other blood pressure categories were significant only in 2016. Employees with below normal systolic blood pressure in the unexposed group had the lowest sick leave absenteeism in 2014 and 2016, while employees with systolic prehypertension had the lowest sick leave absence in 2015. Differences were however not significant. With regards to diastolic blood pressure in the unexposed group, employees with prehypertension had the lowest sick leave absence in 2014 and 2015, however differences were not significant. Employees with below normal diastolic blood pressure had the lowest sick leave absence in 2016 and this was statistically significant when compared to other diastolic blood pressure groups in the same measurement year (2016). Overall, mean sick leave absenteeism was significantly lower in employees who took part in workplace wellness initiatives versus those who did not take part in these initiatives.

Based on Table 4.16, there seems to be some significant differences (Mean difference = -1.29, -1.58, and -1.80) between the mean sick leave days taken by the participants who partook in the worksite physical activity and nutrition interventions and those who did not, collected during baseline, 2014, 2015 and 2016, respectively. It must be noted that the mean differences tended to increase over the years. This suggests that the mean sick leave days taken by the exposed participants increased at a slower rate than those for the non-exposed participants.

Table 4.16: **Independent samples test sick leave absenteeism (Group statistics and test output)**

Exposed			Statistic	Bias	Std. Error	95% Confidence Interval	
						Lower	Upper
Sick_Leave_2014	Yes	N	361				
		Mean	4.96	0.00	0.09	4.79	5.14
		Std. Deviation	1.698	-0.002	0.076	1.548	1.854
		Std. Error Mean	0.089				
	No	N	361				
		Mean	6.25	0.00	0.08	6.09	6.42
		Std. Deviation	1.606	-0.004	0.072	1.462	1.754
		Std. Error Mean	0.085				
Sick_Leave_2015	Yes	N	361				
		Mean	5.29	0.00	0.09	5.12	5.47
		Std. Deviation	1.707	-0.002	0.111	1.506	1.938
		Std. Error Mean	0.090				
	No	N	361				
		Mean	6.87	0.00	0.10	6.67	7.07
		Std. Deviation	1.872	-0.003	0.076	1.716	2.029
		Std. Error Mean	0.099				
Sick_Leave_2016	Yes	N	361				
		Mean	6.16	0.00	0.12	5.93	6.39
		Std. Deviation	2.183	-0.005	0.139	1.958	2.509
		Std. Error Mean	0.115				
	No	N	361				
		Mean	7.96	0.00	0.11	7.73	8.17
		Std. Deviation	2.083	-0.001	0.078	1.929	2.225
		Std. Error Mean	0.110				

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Sick Leave 2014	Equal variances assumed	0.018	0.892	-10.497	720	0.000	-1.291	0.123	-1.532	-1.049
	Equal variances not assumed			-10.497	717.776	0.000	-1.291	0.123	-1.532	-1.049
Sick Leave 2015	Equal variances assumed	4.521	0.034	-11.822	720	0.000	-1.576	0.133	-1.838	-1.314
	Equal variances not assumed			-11.822	713.921	0.000	-1.576	0.133	-1.838	-1.314
Sick Leave 2016	Equal variances assumed	0.196	0.658	-11.322	720	0.000	-1.798	0.159	-2.110	-1.486
	Equal variances not assumed			-11.322	718.415	0.000	-1.798	0.159	-2.110	-1.486

Table 4.17 shows the outcomes of group statistics and output for the paired t-test for the study sample. This test is used to determine the significance of the mean difference between paired observations. In the current analysis we paired the outcomes of the overall sample at two time points (i.e. between baseline and 2014 [Pair 1], between 2014 and 2015 [Pair 2] and between 2015 and 2016 [Pair 3]).

Significant mean BMI differences were observed within each pair (i.e. Mean BMI Differences = 0.1296kg/m², 0.0764kg/m² and 0.0764kg/m² for Pair 1, 2 and 3, respectively), with all the *p* values <0.001.

Table 4.17: Paired sample test (total sample)

Paired Samples Statistics					
		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	Baseline BMI	30.364	722	5.6268	0.2094
	BMI_2014	30.235	722	5.5561	0.2068
Pair 2	BMI_2014	30.235	722	5.5561	0.2068
	BMI_2015	30.158	722	5.5344	0.2060
Pair 3	BMI_2015	30.158	722	5.5344	0.2060
	BMI_2016	30.128	722	5.5224	0.2055
Pair 4	Baseline Blood Glucose	5.992[a]	722	1.8432	0.0686
	Blood Glucose 2014	5.992[a]	722	1.8432	0.0686
Pair 5	Blood Glucose 2014	5.992	722	1.8432	0.0686
	Blood Glucose 2015	6.014	722	1.8972	0.0706
Pair 6	Blood Glucose 2015	6.014	722	1.8972	0.0706
	Blood Glucose 2016	6.007	722	1.8750	0.0698
Pair 7	Baseline Systolic Blood Pressure	123.92[a]	722	14.220	0.529
	Systolic Blood Pressure 2014	123.92[a]	722	14.220	0.529
Pair 8	Systolic Blood Pressure 2014	123.92	722	14.220	0.529
	Systolic Blood Pressure 2015	123.94	722	14.316	0.533
Pair 9	Systolic Blood Pressure 2015	123.94	722	14.316	0.533
	Systolic Blood Pressure 2016	123.88	722	14.018	0.522
Pair 10	Baseline Diastolic Blood Pressure	79.47[a]	722	9.112	0.339
	Diastolic Blood Pressure 2014	79.47[a]	722	9.112	0.339
Pair 11	Diastolic Blood Pressure 2014	79.47	722	9.112	0.339
	Diastolic Blood Pressure 2015	79.04	722	9.536	0.355
Pair 12	Diastolic Blood Pressure 2015	79.04	722	9.536	0.355
	Diastolic Blood Pressure 2016	79.21	722	9.084	0.338

Pair 13	Sick_Leave_2014	5.61	722	1.773	0.066
	Sick_Leave_2015	6.08	722	1.956	0.073
Pair 14	Sick_Leave_2015	6.08	722	1.956	0.073
	Sick_Leave_2016	7.06	722	2.314	0.086

a. The correlation and t cannot be computed because the standard error of the difference is 0.

		Paired Differences					**t**	**df**	**Sig. (2-tailed)**
		Mean Difference	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
					Lower	Upper			
Pair 1	Baseline_BMI - BMI_2014	0.1296	0.6698	0.0249	0.0807	0.1786	5.201	721	0.000
Pair 2	BMI_2014 - BMI_2015	0.0764	0.3381	0.0126	0.0517	0.1011	6.075	721	0.000
Pair 3	BMI_2015 - BMI_2016	0.0306	0.1968	0.0073	0.0162	0.0450	4.179	721	0.000
Pair 5	Blood Glucose 2014 - Blood Glucose 2015	-0.0229	0.8842	0.0329	-0.0875	0.0418	-0.694	721	0.488
Pair 6	Blood Glucose 2015 - Blood Glucose 2016	0.0076	0.8586	0.0320	-0.0551	0.0704	0.238	721	0.812
Pair 8	Systolic Blood Pressure 2014 - Systolic Blood Pressure 2015	-0.018	7.982	0.297	-0.601	0.565	-0.061	721	0.952
Pair 9	Systolic Blood Pressure 2015 - Systolic Blood Pressure 2016	0.057	7.109	0.265	-0.463	0.576	0.215	721	0.830
Pair 11	Diastolic Blood Pressure 2014 - Diastolic Blood Pressure 2015	0.428	7.528	0.280	-0.122	0.978	1.528	721	0.127
Pair 12	Diastolic Blood Pressure 2015 - Diastolic Blood Pressure 2016	-0.166	6.913	0.257	-0.671	0.339	-0.646	721	0.518
Pair 13	Sick_Leave_2014 - Sick_Leave_2015	-0.472	1.885	0.070	-0.610	-0.335	-6.732	721	0.000
Pair 14	Sick_Leave_2015 - Sick_Leave_2016	-0.983	2.152	0.080	-1.141	-0.826	-12.277	721	0.000

Similarly, there were significant mean differences in the participants' sick leave taken across all reporting periods. However, there were no significant mean differences in participants' blood pressure and blood glucose outcomes over the years in the study period.

4.6 Summary and conclusion

This chapter presented the findings of the study based on the primary research data. The data was presented based on the objectives of the study and focused on BMI, blood glucose, blood pressure and sick leave outcomes as dependent variables of participating in workplace wellness initiatives. The statistical analyses that were conducted are prevalence and descriptive analysis and t-test analyses for BMI, blood glucose and blood pressure between the two groups, employees who took part in workplace wellness programmes (exposed) and employees who did not take part in these wellness programmes (unexposed). These analyses were done for each of the variable outcome measures to answer the research objectives.

Overall, in the current study, there were more obese females than males. On the other hand, there were more males and middle-aged employees that had abnormal blood glucose and high blood pressure levels. The Eastern Cape had the highest prevalence of obesity and abnormal blood glucose levels, while the abnormal blood pressure levels were more prevalent in KZN and Free State.

There were more obese and employees with abnormal diastolic pressure in the exposed group than the non-exposed group. There were more hyperglycaemic and employees with abnormal systolic blood pressure in the non-exposed group. While the mean BMI and mean diastolic blood pressure were higher in the exposed than the non-exposed group; hyperglycaemia and mean systolic blood pressure were higher in the non-exposed than the exposed group.

The following chapter discusses the results of the study as presented in this chapter using the different statistical methods indicated above.

CHAPTER 5

DISCUSSION

5.1 Introduction

Employees spend a large proportion of their lives in the workplace. This makes workplace a key setting for addressing NCDs and related risk factors in the working population.

The purpose of the study was to determine the effect of participating in workplace wellness initiatives targeted at employees, particularly those that are overweight, hypertensive and diabetic at Nestlé, and the number of working days lost due to sick leave from NCDs and NCD risk factors.

The previous chapter presented the results of the study and outlined the effect of workplace wellness programmes on overweight and obesity, hypertension and diabetes management. This chapter discusses the study's key findings and corroborate or contrast them using relevant related literature.

5.2 Key Study Findings

Based on the descriptive analyses, there was an overall slight decrease in the number of the employees with NCD risk factors in December 2016 compared to the baseline (January 2014). Participation in the workplace wellness initiatives seemed to have modest effects on the NCD risk profile of the employees at Nestlé. This effect was shown by the steady significant decreases in NCD risk factor outcome measurements taken over time, from baseline to December 2016. However, based on the paired sample t-test outcomes, these reductions were significant for significant obesity prevalence and mean BMI only.

5.2.1 Socio-biographical information

Gender

Employees at Nestlé are mostly males, and this is related to the production nature of the work conducted which can be labour intensive and involves the operation of heavy machinery. The study sample reflects this in that there were more male participants in the sample than female participants, with approximately 70% males and 30% females. Apart from the head office, each location, therefore had more male than female employees. The head office is the only site where the nature of work is not operational and is thus more suited to accommodate both male and female employees. The Estcourt factory in the KZN region, has the highest proportion of male employees with males making up over 90% of the study sample. This may be attributable to the rural KZN culture, which subordinates women and defines their role as mainly in the household, while men go out and work (Sathiparsad, Taylor and Dlamini, 2008). Females had a significantly higher prevalence of overweight and obesity and significantly higher mean BMI values when compared to males. This reflects the prevalence of overweight and obesity in South Africa, in which females have a higher prevalence of overweight and obesity than males (i.e. 40% in males and 64% in females as indicated by the WHO (2017). Males in the sample had a higher prevalence for prediabetes and diabetes than did females. Males also had higher mean blood pressure with systolic and diastolic than females. Although not conducted in the South African environment, this is consistent with a study by Nordström, Hadrévi, Olsson, Franks and Nordström (2016) which states that the prevalence of diabetes in males is higher than in females (at 14.6% in males and 9.1% in females). Wandai and Day (2015) indicate the prevalence of hypertension in males as 27.4%, which is higher than the prevalence of hypertension in females which is 26.1%. Based on these findings therefore, female participants had a higher prevalence of overweight and obesity, while males had a higher prevalence of hypertension and diabetes than females.

Age

The average age of the sample was approximately 46 years (45.95 years) and the largest proportion of the sample is in the 45 – 54-year age group. The average age of the population was higher than the average age of the total workforce in the company which was 39 years (with the largest proportion of employees aged between 30 and 39 years old). This can be expected given that age is a non-modifiable risk factor for chronic NCDs and therefore the sample, which was employees with at least one chronic disease. An employee in the sample is therefore on average older than the average employee in the company who does not have a chronic non-communicable disease.

Participants aged 35 – 44 years had the highest mean BMI, with participants age <24 years having the lowest mean BMI. Participants in the age group 55 – 64 years and participants >64 years had the highest mean blood glucose, with participants aged <24 years having the lowest mean blood glucose. Employees older than 64 years had the highest mean systolic blood pressure consistently over the study period, while employees younger than 24 years had the lowest mean systolic and diastolic blood pressure consistently over the study period.

Based on the above, it can be stated (except for BMI which was not highest in the oldest age group) that NCD risk factors increased with increasing age (with younger employees having lower mean blood glucose and blood pressure measurements and older employees having higher mean reading of blood glucose and blood pressure). This is consistent with a study by Manning, Senekal and Harbron

(2016) who identify age as a non-modifiable risk factor for NCDs, resulting in increasing NCD prevalence with increasing age.

Population and location

The East London factory had the greatest number of employees and therefore had the greatest number of study participants, making up 29% of the study sample. The East London factory is the confectionery factory and represents the largest market for Nestlé's products, so it is expected that Nestlé would invest in workforce in this area. Given the nature of the products however, which staff could freely access, this had a significant impact on the health profile of the employees at this location. Based on the results of the study, participants based in the East London factory had the highest mean BMI and blood glucose measurements of any group in the sample. Furthermore, participants in the East London factory had the highest mean age in the sample (which was 50 years compared to 46 years in the total sample). This further increased NCD risk factors in this population in particular as supported by the above study by Manning, Senekal and Harbron (2016).

5.2.2 Description of workplace wellness programmes aimed at addressing chronic non-communicable diseases at Nestlé

Based on what Mattke et al. (2013) posit as constituting a successful comprehensive workplace wellness programme, Nestlé offers all the recommended programmes which cover screening services, physical wellbeing, nutrition interventions and mental health support, thereby constituting a comprehensive workplace wellness programme. Additionally, Nestlé's programmes are supported by leadership and management buy-in (from a financial perspective), a wellness strategy and operational plans which are monitored and evaluated regularly, availability of data, and marketing and communication.

5.2.3 Effect of workplace wellness programmes on NCDs and NCD risk factors

This section is an outline of the NCD and NCD risk factor profile of the study sample and the effect of workplace wellness programmes on BMI, blood glucose and BP outcomes.

Body weight

Based on the independent sample t-test analyses outcomes, the mean BMI and the mean systolic BP of the exposed group decreased over time, while the mean BMI of the non-exposed group remained constant. This resulted in positive mean BMI differences between exposed and non-exposed that decreased slightly overtime. However, these mean differences were not significant.

Based on the paired samples t-test analyses outcomes, the mean BMI of exposed participants significantly decreased between two time point intervals. In this case, there was a big decrease between baseline and 2014, the decrease narrowed between 2014 and 2015, and the decrease became the smallest between 2015 and 2016.

In the current analyses, there were more obese employees in the exposed group than in the non-exposed group at all points where measurements were taken. The possible explanation to this could be that there might have been a heightened uptake of obese employees who were keener to lose weight than individuals with lower BMIs. In fact, in the months closer to our baseline, Nestlé had launched and heightened the promotion of physical activity and nutrition interventions to obese employees and those that suffered or were at risk of NCDs. This therefore may have increased uptake of programmes by obese employees and resulted in the higher mean BMI in employees taking part in workplace wellness initiatives versus those not taking part in the programmes. This assumption is consistent with a study undertaken by Fink, Smith, Singh, Ihrke and Cisler (2015), which investigated the patterns of participation in wellness initiatives by obese employees. The authors found that over 30% of employees who took part in the workplace wellness initiatives were obese and 49% of those employees specifically participated in weight management programmes.

According to the results of the current study, it was also observed that there was a modest decrease in the mean BMI of the exposed group over time, while the mean BMI of the non-exposed group remained constant. This therefore resulted in positive mean BMI differences between the exposed and non-exposed. However, these differences were not significant and became narrower over time. A possible explanation to the weight loss observed in the exposed group versus the non-exposed group is supported by a myriad of studies. For example, a study by Anthony et al. (2015) which indicated improvements in risk factors associated with NCDs in the intervention group versus the control group, suggest that engaging in dietary and physical activity workplace wellness initiatives is beneficial in that these do more to prevent, curb, and even reverse the NCD risk factors, including obesity. The Institute of Medicine (2004), further argues that although physical activity is an effective strategy for weight loss and maintenance, it can significantly improve health outcomes and reduce the risk for NCD and other health ailments even without weight loss.

Another study by Stubbs and Lee (2004) highlights the importance of physical activity and dietary interventions in weight loss and maintenance and as tools to prevent and manage overweight and obesity. Koolhaas et al (2017) state that being physical activity had the effect of countering the risk of being overweight or obese, in that physically active overweight or obese individuals had a similar NCD risk as normal weight individuals who were not active.

Moreover, the modest mean BMI differences observed in the current study could be explained by the fact that the data used was not initially collected with this current study in mind. As such, data collection was therefore not meant for the study purpose and may have thus not been treated with the necessary protocol to provide the desired outcome. In fact, Lowrance (2003) identifies this as one major challenge in using secondary data to conduct research. He argues that, the use of data that is not collected for the study can produce inconclusive or modest outcomes.

Moreover, the Nestlé wellness initiative accommodates many participants. This therefore results in difficulty in following up everyone appropriately to ensure compliance to the exercise and diet prescriptions. This can lead to participants not strictly following the regimen as outlined in the intervention, hence could also be the result of the modest outcome observed in the sample. According to a study by Schaefer (2018), exercise engagement without appropriate dietary changes does not lead to significant weight loss. Lee et al. (2017) on the other hand state that diet interventions without the requisite amount of physical activity also do not lead to significant changes in health outcomes. These may therefore be the reason for the lack of significant improvements in BMI in participants who took part in our study's workplace wellness initiatives, in that they may have focused on the one aspect of workplace wellness initiatives and not on the other.

The aforementioned confounders to weight loss may partly explain our paired samples t-test outcomes that showed that the mean BMI decrease observed within the first year of engaging in the wellness initiatives tended to decrease over time. It is possible that during the first year, employees engaged in both the dietary and physical activity interventions, hence the big mean BMI decrease between baseline and 2014. The results show that overtime, compliance in one or both interventions decreased, hence the BMI decrease narrowed between 2014 and 2015, and the decrease became the smallest between 2015 and 2016. Montesi et al. (2016) have shown that longer interventions tend to have decreased compliance by participants, hence their success needs individual commitment, continuous team coordination (from a multidisciplinary team approach) and closely maintained supervision in the form of group support from peers. The authors also found that high levels of physical activity, eating a low fat, low calorie diet and maintaining a consistent eating pattern on weekdays and weekends were some of the key aspects of maintaining weight loss in the longer term. Given that BMI in the study sample decreased at a decreasing rate over time, it may have been the case at Nestlé, that compliance was negatively influenced by the duration of the programme. Employees in the sample did however receive supervision and support, albeit not from a group of peers, from the clinic nursing practitioner and the dietician, which according to Montesi et al. (2016), may positively influence compliance but perhaps not to the same extent as support from peers.

Blood Glucose and blood pressure

In the current study it is observed that, while the mean blood glucose and blood pressure levels of the exposed employees decreased slightly overtime, the mean blood glucose and BP levels of the non-exposed employees increased steadily. This therefore resulted in negative mean blood glucose and mean diastolic BP differences that were significant and that also increased over time. Based on the paired samples t-test analyses outcomes, there were no significant differences observed between the mean blood glucose and mean BP of the employees between two time point intervals.

The above findings are consistent with a study by Russell et al. (2016) which state that participation in exercise and diet initiatives and weight management had the most positive effect on blood glucose control. This was the case in the exposed group despite BMI being higher in this group versus in the non-exposed group (as weight was decreasing steadily over the study period). This indicates that exercise and diet interventions positively influence blood glucose irrespective of BMI status, and according to the American Diabetes Association (2019) increases insulin sensitivity and results in lower blood glucose. Lee et al. (2017) and Marandi et al (2013) indicate that participants in diet and exercise programmes exhibit better blood sugar and BP control due to improvements in body fat and body composition (increased muscle/fat-free mass and decreased fat mass), body weight and BMI over time. Marandi et al (2013) also indicate that exercise interventions (particularly aerobic exercise) positively influenced cholesterol in the body, by decreasing "bad" cholesterol and increasing the amount of "good" cholesterol, thus improving BP and cardiovascular disease risk. As such, engaging in wellness initiatives results in better lipid profile and lower the risk of CVDs.

Although differences were not significant, there was also a decrease in the mean diastolic BP in non-exposed participants over the study period. It is not clear what this decrease in diastolic BP was attributable to, given that systolic BP increased over the study period. Increasing systolic BP is associated with increasing age, resulting in older individuals having a higher prevalence of systolic high BP (which according to Strandberg and Pitkala (2003), is the most common type of hypertension in older adults). This is consistent with the current study's findings given that the sample population had a higher average age than the rest of the population at Nestlé.

The rise in systolic BP which are observed with decreases in diastolic BP is a cause for concern given the outcomes of the study by Benetos et al. (2010) that suggest that a decline in diastolic BP while systolic BP increases results in an increase in CVD risks and mortality from cardiovascular diseases. This risk was stated to be independent of other risk factors. In fact, Strandberg and Pitkala (2003) argue that, systolic BP is a more important predictor of CVD risk and that the above spread, called the pulse pressure (the difference between systolic and diastolic BP), has become a key independent risk factor for CVDs.

Based on the paired samples t-test analyses outcomes, no significant differences were observed between the mean blood glucose and mean BP of the employees between two time point intervals. According to a review by Song and Baicker (2019), which evaluated workplace wellness programmes in middle- and low-income populations, they also found no significant improvements in clinical health outcomes among the participants in these programmes. These authors do however indicate that workplace wellness programmes had positive and significant impact on health and lifestyle behaviours (such as increasing physical activity and improving dietary choices) of the participants. Based on the above, these authors suggested that if these behaviours continue into the future, there are likely to be significant health outcomes in the longer term.

There is however a trend of note from the current study. For both the exposed and non-exposed groups, systolic BP decreased between 2014 and 2015 and increased in 2016. In fact, in 2016, there were organisational issues that emanated from the Nestlé's organisation restructuring and change of leadership. This might have been the cause of constant stress to the employees. This likely might have led to the continuous increase in the BP of some of the employees. Spruill et al. (2019) have recently stated that psychological distress is associated with raised BP and if persistent over time, may lead to hypertension.

5.2.4 Description of sick leave absenteeism of study participants over the study period

The results also show the effect of wellness initiatives on sick leave absenteeism. For instance, those employees who took part in wellness initiatives tended to take less sick leave days than employees who did not participate in these initiatives. In fact, overweight and obese employees living with NCD risk factors such as abnormal blood glucose and abnormal blood pressure significantly took the most sick leave days than their counterparts who had less abnormal NCD risk factors.

In terms of sick leave taken, while the exposed employees took less sick leave days than their non-exposed counterparts; both the exposed and non-exposed sick leave days taken increased over time, with the increase being higher in the non-exposed than the exposed employees. This resulted in negative mean sick leave days differences that significantly increased over time.

Employees in the current sample took significantly higher leave (approximately 40% of the total leave) considering that they made up only approximately 23% of the total Nestlé population. However, this was to be expected given that employees in the sample were chosen based on chronic diseases status and the presence of NCD risk factors. Similarly, according to a study by Virtanen et al. (2018), employees living with risk factors associated with NCDs exhibit higher sick leave absenteeism due to a myriad of diseases. High BMI and low physical activity were specifically identified in the study, along with other risk factors such as smoking and alcohol consumption.

Moreover, based on the current study's descriptive statistics, as can be expected and as indicated above, employees who were exposed to workplace programmes took fewer sick leave days than did their non-exposed counterparts. In addition, based on the independent sample t-test, while sick leave increased over time in both exposed and non-exposed groups, the increase was significantly lower in the exposed group than in the non-exposed group. This resulted in negative mean sick leave differences between the exposed and non-exposed groups which increased over time. Differences were highly significant between the two groups. These results are consistent with a study by Chenoweth (2011), which states that employees who did not participate in wellness initiatives tended to be more absent from work and a study on workplace wellness by the Department of Health (2011) which states that absenteeism can be greatly reduced by addressing diet and physical activity needs in the workplace.

In fact, in the current study, employees with diabetes took more sick leave days than employees in the other blood glucose measurement categories. These outcomes are consistent with the outcomes of the study by Pheiffer et al. (2018) which stated that diabetes in particular, mainly affects individuals aged 40 to 60 years who are in the working population and thus has a significant impact on absenteeism in the workplace. Kengne, Mchiza, Amoah and Mbanya (2013) further state that diabetes is responsible for approximately 1% to 1.2% of sick leave absenteeism in South Africa.

In the total sample, there were no significant differences overall in sick leave absenteeism between employees with normal BP and employees with prehypertension. There were however significant differences within the BP categories between participants exposed to wellness programmes and those not exposed to these programmes. Similarities can be noted however in the two groups, in that employees with normal BP exhibited higher sick leave absence than employees with prehypertension. This relationship could however not be explained except through the protective effect of slightly elevated BP on the arteries. This phenomenon is termed the j-curve concept and states that when BP drops significantly, the risk for coronary artery disease is increased (Messerli and Panjrath (2009), which may lead to higher sick leave absenteeism in participants with lower BP. This is however not founded on information obtained in the current research.

Participants with systolic stage 2 hypertension and participants with diastolic hypertension took more sick leave than employees in the other blood pressure categories. Sick leave absenteeism was highest overall (across all outcomes measures; BMI, blood glucose and BP) in participants with stage 2 hypertension not exposed to workplace wellness initiatives. A study by Unmuessig et al. (2015) shows that employees with hypertension were more likely to report lost productive time due to absenteeism than employees with normal BP.

As indicated above and by the study results, sick leave increased in the organisation overall over time. There are several reasons that would cause sick leave to rise over time. There would be higher sick leave utilisation if the employee population in the organisation was getting sicker over the years. This may be the case with the employees in the non-exposed group. An ageing workforce would also cause sick leave utilisation to increase over time. This may be the case in the East London factory, where the average age is higher than in the organisation. There may also be a general culture of sick leave abuse, where employees feel sick leave is an entitlement and utilise it even when there is no legitimate illness. This will be the case when sick leave is not actively managed, as Griessel (2018) states, absenteeism, together with poor performance, are the most unmanaged areas in the workplace. This is not the case at Nestlé however, as sick leave was actively managed and would thus not be applicable to the organisation.

A study by Hultin, Lindholm, Malfert and Möller (2012) state that short term sick leave is a predictor of long-term sick leave in later periods. Helgesson, Johansson, Wernroth and Vingård (2016) further mention in another study that there was a steep increase in sick leave in subsequent periods in employees who had absences of between one and seven days versus employees who had no sick leave absence the preceding year. They do mention however that although sick leave still increases, this increase lowers and becomes steady over time.

5.3 Summary and conclusion of findings

Comprehensive workplace wellness programmes are key to the management of NCDs in the working population. The current study indicated this by showing improvements in the health outcomes of participants who took part in these programmes versus those who did not. Participants in the study showed improvements in BMI status, blood glucose and BP measurements. This is supported by literature which indicates that participation in workplace wellness initiatives decreased the prevalence of NCDs in the working population by improving weight status, blood glucose and BP control.

The results of the current study show that employees who were exposed to wellness programmes in the work setting not only had better health outcomes with regards to a steady decline in BMI, better blood glucose and BP control, but also took fewer sick leave days when compared to employees who did not take part in these initiatives. This is consistent with literature, which indicates that employees who took part in workplace wellness programmes took less sick leave days than did employees who did not take part in these programmes. Furthermore, literature indicates that companies can benefit significantly from reductions sick leave absenteeism which costs corporations tremendous amounts from lost productivity by offering workplace wellness programmes.

5.4 Study limitations

The study had several limitations. Data on waist circumference and cholesterol was not available for all employees in the sample. This data was available for some participants in the study but was not available for others and seemed not to be standard measurements across the entire population at Nestlé. This data would have presented key supporting evidence to some of the outcomes presented in the study (i.e. BMI and waist circumference could have been used together to support the findings of the study e.g. improvements in waist circumference while BMI remained constant can help determine NCD risk). Other data which was available was however used to obtain the required information to conduct the study.

Due to the nature of the study (a retrospective cohort study), it was not possible to obtain additional information directly from participants to validate some of the findings such as physical activity outside work (which may have been omitted from the health records). These additional activities may have led to additional improvements in health outcomes (and which cannot then be directly attributed to the success of workplace wellness programmes). Below is an outline of some other disadvantages of the chosen study design;

- Less control over variables
- Available data may be of poor quality
- Confounding factors may not be accounted for if data was collected in the past
- Differential loss to follow-up may bias the study

Lowrance (2003) has identified some limitations specific to secondary research and include:

- Information may be outdated and therefore no longer relevant
- Data may be inaccurate
- The data may have been collected for a purpose different from that of the current research

Another limitation of the study is that some employees may have failed to log sick leave on the leave management system and may have underreported sick leave absences which would have not been considered in the study. This may have led to incorrect conclusions about the study findings if indeed this was the case and underreported absences were significant. Although not impossible, this was however unlikely, particularly in the production environment where presence is clocked as employees enter the production plant. It may have been the case with office-based workers who do not report in the production facilities of the company and may even have agile working arrangements which allow them to work remotely (although not a common practice at Nestlé).

This chapter provided an interpretation and analysis of the study findings. The following chapter draws conclusions from the study and provides recommendations to the organisation which was the subject of the study, using both the information found in the literature and the current study.

CHAPTER 6

CONCLUSION AND RECOMMENDATIONS

6.1 Introduction

This chapter presents the conclusions drawn from the study and provides key recommendations with regards to workplace wellness programmes. The recommendations provided in this chapter are based on current industry practice as reviewed in the literature and on the study findings.

The purpose of the study was to determine the effect of workplace wellness programmes on NCD and NCD risk factor outcomes and on sick leave absenteeism. The significance of the study was identified as the reduction in the working population of NCD prevalence and NCD risk factors, helping corporations manage and decrease sick leave absenteeism.

The results of the study as discussed indicate that the workplace wellness programmes at Nestlé, which included dietary and physical activity initiatives, can have a positive influence on the management of NCDs and NCD risk factors such as overweight and obesity, prediabetes, prehypertension, diabetes and hypertension in employees who took part in these programmes. The influence of these programmes on the management of overweight and obesity, although clearly positive, were however shown to be insignificant, indicating a need for a more targeted approach to the management of overweight and obesity in these programmes. This is particularly important given that obesity has been identified at the single most important risk factor for NCDs.

Workplace wellness programmes were shown to also have a significant positive effect on sick leave absenteeism in the organisation in that employees who took part in these programmes spent more days at work and thus had fewer sick leave absence days than employees who were not exposed to these programmes.

In conclusion, Nestlé and corporations with similar workplace wellness programmes can improve participation in workplace wellness programmes and improve the positive effect of these programmes by following a few key recommendations. These recommendations are suggested based on the study findings, industry best practice and the latest research. These recommendations are presented below.

6.2 Recommendations

6.2.1 Workplace wellness programmes

Health risk assessment

Cholesterol and waist circumference measures should be considered as part of the annual medical surveillance for the measurement of the effect of workplace wellness programmes on the management of NCD risk factors. The absence of this data, and sporadic presence of it in some instances, presented a limitation in the study in that the above data could not be use as measurements outcomes in the study.

In order to expand the scope of measuring the effect of workplace wellness programmes on the management of NCD and NCD risk factors, these should be considered as standard measurements in annual medical surveillance for measuring NCDs and related risk factors going forward.

Leadership support

Leadership has been identified as a key success factor for workplace wellness programmes and although Nestlé's programme is comprehensive and appears to have many of the elements required to ensure programme success, it was not clear what examples leaders were setting (other than by generously funding the programme) to encourage employees to take part in wellness programmes. Employees are more likely to take part in wellness programmes when leaders themselves are actively involved in these programmes. This is emphasised by Zula (2014), who claims that leadership participation in these programmes is one of the leading factors for the success of workplace wellness programmes.

Addressing overweight and obesity

This recommendation relates to targeting excess weight and obesity in addition to addressing the other NCDs. Sheik, Evans, Morden and Coetzee (2016) recommend the following interventions specifically targeted at addressing overweight and obesity in the workplace setting.

- Nutrition and physical activity advice and group sessions
- Physical activity programmes
- Changes in the food service canteens and
- The use of printed and multi-media materials to promote health messages

Although many of the above initiatives are already part of the wellness programme at Nestlé, more can be done within each of these areas to significantly improve BMI status in participants. The discussion of the results highlighted that there may have been challenges with participants adhering to the prescriptions of the programmes hence the low significance in some improvements. A more structured approach to follow-up may therefore be appropriate to ensure the participants adhere to the programmes. Incentivising these programmes may assist greatly in this regard.

Incentivising participation in wellness programmes

In addition to the above listed interventions by Sheik, Evans, Morden and Coetzee (2016), Chenoweth (2011) recommends providing incentives which are targeted at addressing the primary risk factors for NCDs including overweight and obesity to increase programme uptake and have the greatest impact on programme success. This is the element that seemed to be missing from Nestlé's wellness programme, incentives. These incentives need not be excessive and as identified by Chenoweth (2011) may include: setting realistic targets and rewarding their achievement by employees; making incentivised programmes easy to access; giving regular feedback on the progress towards achieving targets; and communicating effectively to other programme participants once targets have been achieved (to encourage other participants to continue to pursue the targets for rewards).

Nestlé could benefit from an incentives programme which will likely not only see more employees taking part in workplace wellness programmes but will also help to achieve an observable and significant difference in BMI in programme participants. This may not only improve BMI outcomes, but may help reduce the overall burden of NCDs in the working population at Nestlé.

Sick leave Management

Given that sick leave increased not only in the study sample, but across the organisation, it is worth looking at a leave management system that will help reduce sick leave absence. Demou, Brown, Sanati, Kennedy, Murray and Macdonald (2016) recommend a proactive call back service to employees reporting sick to provide them a several services based on the reason for illness which they voluntarily take up. These services include occupational health, physiotherapy, counselling services, and general health and wellbeing advice to assist with speedy recovery. Given that Nestlé already has a majority of these services, it is a relatively easy process to implement which can make use of external contractor services such as the EAP provider to initiate.

Research in the following areas may offer additional improvement opportunities and benefit the field of public health by leading to a reduction in the prevalence of NCDs in the working population, whom research indicates have the highest prevalence of NCDs.

6.3 Recommendations for further research

Further similar studies at Nestlé

Secondary data was used to conduct the study and as such, the data may not have yielded the desired results and outcome. Given this, it will benefit the organisation to conduct a similar but prospective study. This will ensure that the data collected is specifically for the intended purpose and will provide a better perspective of the performance of workplace wellness programmes.

The organisation may also benefit from studies which measure the type of programmes and extent of participation in different programmes by employees. This will assist the organisation in determining the impact of participating in different programmes on chronic disease status and sick leave absenteeism.

Improvement in matrices aimed at measuring the performance of workplace wellness programmes

Tyron et al. (2014) show that there are still gaps in the measurement of the performance of workplace wellness initiatives, indicating that the overuse of the return on investment model for measuring the impact of corporate wellness initiatives masks the true positive impact of wellness initiatives (which cannot always be determined using by financial measures). Tyron et al. (2014) further mention that unlike typical financial outcomes which are calculated annually for positive returns, successful wellness programmes generally produce positive outcomes in the longer term and can usually be up to five years, but typically between three and five years. This leads many sponsors of wellness programmes (who are usually finance people) to not invest adequately in the programmes, further compromising programme success.

The above calls for better measures of the success of workplace wellness programmes and therefore further research into possible matrices to measure programme success. This will be particularly beneficial from the South Africa corporate perspective where adequate research on corporate wellness programmes is lacking.

Research quality and quantity of corporate wellness programmes in South Africa and in the South African and other low and middle-income countries' context

It is indicated in a study by Tyron et al. (2014) that the amount of research available on workplace wellness programmes in South Africa and other developing countries is lacking. These authors also suggest that the little research that is being done, lacks the necessary quality and financial backing required to produce superior findings and outcomes. It is thus recommended that further research (which is backed by adequate funding, particularly from private corporations that can benefit significantly from the findings) on corporate wellness programmes in South Africa and other low-and middle-income countries be conducted as it would contribute significantly to this area of the health field.

Driving participation

It was indicated previously that providing incentives is an effective way of encouraging employees to take part in wellness programmes. This is recommended by Conradie, van der Merwe Smit and Malan (2016) who state that incentives can be appealing to employees and encourage them to participate in workplace wellness programmes. Further to this, Chenoweth (2011) indicates that these incentives can vary between cash incentives (making up over a 3rd of incentive types usually given for programme participation) and non-cash incentives. It is worth researching the type of incentives (other than cash rewards) which would lead to increased uptake of workplace wellness programmes in the South African context.

Another component which was identified in literature as key to the success of workplace wellness programmes is marketing and communication. Companies in South Africa have varied labour forces, from highly skilled and sophisticated to low level unskilled manual labourers, who according to Laubscher (2018), make up the majority of the workforce in South Africa. This is particularly the case in industries such as the one in which Nestlé operates, specifically in the South African context where there is a mixture of highly skilled individuals and production workers who are often unskilled (i.e. those who manufacture the products).   Research on how best to communicate and market wellness initiatives to these individuals (who make up a large proportion of working in South Africa and other developing nations) such that they want to take part in these programmes, will provide valuable insight to promote the success of these programmes and consequently contribute to the public health field.

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Appendix I: Ethics approval

OFFICE OF THE DIRECTOR: RESEARCH
RESEARCH AND INNOVATION DIVISION

UNIVERSITY of the WESTERN CAPE

Private Bag X17, Bellville 7535
South Africa
T: +27 21 959 4111/2948
F: +27 21 959 3170
E: research-ethics@uwc.ac.za
www.uwc.ac.za

28 June 2019

Ms M Maseko
School of Public Health
Faculty of Community and Health Sciences

Ethics Reference Number: BM19/3/20

Project Title: Chronic non-communicable diseases (NCDs), absenteeism and workplace wellness initiatives at a consumer goods company in South Africa.

Approval Period: 28 June 2019 – 28 June 2020

I hereby certify that the Biomedical Science Research Ethics Committee of the University of the Western Cape approved the scientific methodology and ethics of the above mentioned research project.

Any amendments, extension or other modifications to the protocol must be submitted to the Ethics Committee for approval.

Please remember to submit a progress report in good time for annual renewal.

The Committee must be informed of any serious adverse event and/or termination of the study.

Ms Patricia Josias
Research Ethics Committee Officer
University of the Western Cape

BMREC REGISTRATION NUMBER -130416-050

FROM HOPE TO ACTION THROUGH KNOWLEDGE.

<u>**Appendix II: Information letter**</u>

UNIVERSITY OF THE WESTERN CAPE
Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-9592809, Fax: 27 21-9592872
E-mail: soph-comm@uwc.ac.za

<u>**Information Letter**</u>

Kindly take a few minutes of your time to read through this participant information sheet before deciding whether Nestlé can grant permission for me to access employee records. No employee will be directly involved in the study as use will only be made of records and not actual persons. This is a research project being conducted by Mbali Maseko, a Masters' in Public Health student at the University of the Western Cape. We are inviting the organisation to participate in this research and are requesting you, Victoria Jowitt, as the Wellness Manager at Nestlé, the organisation which will be studied as part of the research study and as the custodian of the health data to be accessed for the study to kindly familiarise yourself with the contents of this information sheet.

Project Title: Chronic non-communicable diseases (NCDs), Absenteeism and Workplace Wellness Initiatives at a Consumer Goods Company in South Africa

What is this study about?

The purpose of this research project is to investigate the effect that participating in workplace wellness initiatives targeted at employees, particularly those that are overweight, hypertensive and diabetic at Nestlé has on the number of working lost days due to sick leave from NCDs.

What is the expectation from the organisation by the researcher?

You will be asked to grant your permission for the researcher to access de-identified employee records in order to conduct the study, which will commence as soon as the study has received ethical clearance from UWC. Data collection will take place approximately over 2 months. Employee records will be accessed and reviewed at the company's facilities and will not be removed from the facilities.

Will the organisation's participation in this study and any data collected therein be kept confidential?

The researcher undertakes to protect the identity of the organisation and the nature of the organisation's contribution. To ensure subject anonymity, all the collected data will be de-identified using a coding system.

To ensure confidentiality, all the collected data will be electronic in nature and stored (for no more than five years) in a password protected electronic file in the computer of the researcher. If we write a report or article about this research project, the identity of the organisation and research data will be protected.

Regardless of the study making use of staff records only, in accordance with legal requirements and/or professional standards, we will disclose to the appropriate individuals and/or authorities information that comes to our attention concerning child abuse or neglect or potential harm to the organisation or others. In this event, we will inform the organisation that we have to break confidentiality to fulfil our legal responsibility to report to the designated authorities.

What are the risks of this research?

There will be no direct contact with employees as the research will make use only of de-identified case records and therefore if there are any risks these would be minimal. We will nevertheless act promptly to assist if there are any risks experienced during the process of this study. Where necessary, an appropriate referral will be made to a suitable professional for further assistance or intervention via the wellness.

What are the benefits of this research?

The benefits to Nestlé include an opportunity to establish whether the wellness programmes that are currently in place in the company are impactful for the main purpose of improving the health and wellbeing of employees, particularly those who have non-communicable diseases. The study will also allow the organisation to see what other organisations are doing in the area of wellness and this will present an opportunity for the organisation to strengthen workplace wellness programmes.

This research is not designed to any individual personally, but the results may help the researcher learn more about the organisation and about its workplace wellness programmes in particular and how these can be used as instruments to address non-communicable diseases. We hope that, in the future, other organisations might benefit from this study through an improved understanding of workplace wellness programmes and non-communicable diseases.

Can the organisation opt out of participating in the study at any time?

Nestlé's participation in this research is completely voluntary. The organisation may therefore choose to not take part at all. If Nestlé does decide to initially participate in this research, there will always be an option to stop participating at any stage thereafter. There will be no penalty, loss of benefit or repercussions should Nestlé decide not to participate in this study or decide to stop participating at any time after the study has commenced.

What if the organisation has additional questions?

This research is being conducted by Mbali Maseko who is a student in the Masters' of Public Health programme at the University of the Western Cape. If there are any questions about the research study itself, please contact Mbali Maseko at: 153 Nottinghill Estate, Bottlebrush Street, Ferndale, Randburg, 2190, Cell: +27 79 731 5150, masekom@live.com

Should there be any questions regarding this study and the rights of the organisation as a research participant or if you as the representative of the organisation wish to report any problems you or any other party has experienced related to the study, please contact:

Prof Uta Lehmann

Director: School of Public Health

University of the Western Cape

Private Bag X17

Bellville 7535

Tel: +27 21-959 2809 Fax: 27 21-959 2872

E-mail: soph-comm@uwc.ac.za

Prof Anthea Rhoda

Dean of the Faculty of Community and Health Sciences

University of the Western Cape

Private Bag X17

Bellville 7535

chs-deansoffice@uwc.ac.za

This research has been approved by the University of the Western Cape's Biomedical Research Ethics Committee

BIOMEDICAL RESEARCH ETHICS ADMINISTRATION

Research Office

New Arts Building,

C-Block, Top Floor, Room 28

University of the Western Cape

Private Bag X17

Bellville

7535

Appendix III: Permission letter to conduct the research

UNIVERSITY OF THE WESTERN CAPE
Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2809, Fax: 27 21-959 2872
E-mail: soph-comm@uwc.ac.za

Permission Letter

153 Nottinghill Estate
Bottlebrush Street
Ferndale, Randburg
2190
10 August 2018

To: Nestlé South Africa
8 Anslow Crescent
Anslow office Park, Bryanston
2021
Attention: Wellness Manager (Nestlé Representative)

RE: Conducting a research project on the "Chronic non-communicable diseases (NCDs), Absenteeism and Workplace Wellness Initiatives at a Consumer Goods Company in South Africa"

I am Mbali Maseko, a Master of Public Health student at the University of the Western Cape (UWC). I am in the research phase of my master's degree and have chosen Nestlé South Africa as the organisation on which to conduct the above-mentioned research study. Please see the attached information sheet for a detailed description of the study.

I would like the organisation's permission to access employee records in order to conduct the study, which will be from the 20th of August to the 31th of October 2018. Employee records will be accessed at the company's facilities and will not be removed from the facilities.

Please kindly sign below as an approval of the above request.

Kind regards	Name and Signature:
………………………	………………………………..

Mbali Maseko (+27 79 731 5150) Wellness Manager (Nestlé Representative)

Appendix IV: Consent form

UNIVERSITY OF THE WESTERN CAPE
Private Bag X 17, Bellville 7535, South Africa
Tel: +27 21-959 2809, Fax: 27 21-959 2872
E-mail: soph-comm@uwc.ac.za

Consent Form

Title of the research project:

Chronic non-communicable diseases (NCDs), Absenteeism and Workplace Wellness Initiatives at a Consumer Goods Company in South Africa

Principal investigator: Mbali Maseko

Contact number: +27 79 731 5150

Consent of Organisation

I, as a representative of Nestlé South Africa (*name of the undersigned*)................................agree that Nestlé South Africa can take part in the above-mentioned study. In addition, I declare that:

- I, as a representative of Nestlé, have read the information contained in the information sheet and consent form which is written in a language I understand.
- I understand that the Company's involvement in this study is voluntary and in no way was Nestlé or any representative thereof coerced into taking part in the study.
- I have had the opportunity to ask questions about the study and these questions have been answered to my satisfaction
- I understand that no identities will be disclosed to anyone.
- I may choose to withdraw the Company from the study at any time and understand that there will be no repercussions as a result of this action.

Signed at (*place*)..on (*date*)..

Signature of Nestlé representative **Name of witness**

....

Signature of researcher **Signature of witness**

-- --

Appendix V: Data Collection Tools

Medical Assessment Data

Nestlé Site:...

Study Title: Chronic non-communicable diseases (NCDs), Absenteeism and Workplace Wellness Initiatives at a Consumer Goods Company in South Africa

Below are the snapshots of the tools that were used to collect the baseline and follow-up data for all employees for both the exposed and unexposed cohorts. The information on the first tool was used to analyse data in SPSS.

Data collection tool

													Baseline (Jan 2014)		2014		2015		2016		Sick Leave Absence Days		
Unique ID	Site	Age	Gender	Exposure to workplace wellness initiatives	Baseline BMI	2014 BMI	2015 BMI	2016 BMI	Baseline BG	2014 BG	2015 BG	2016 BG	Systolic	Diasotlic	Systolic	Diastolic	Systolic	Diastolic	Systolic	Diastolic	2014	2015	2016
1	Nestle - Babelegi	56	F	0	34	34	34	34	4.3	4.3	6.8	6.1	122	82	122	82	135	94	128	90	8	11	12
2	Nestle - Babelegi	42	F	1	31	30	30	30	4.1	4.1	4.3	7.7	128	79	128	79	117	91	120	69	3	7	9
3	Nestle - Babelegi	56	F	1	40	40	40	39	4.0	4.0	4.1	5.6	124	78	124	78	120	77	122	72	6	5	10
4	Nestle - Babelegi	42	M	1	32	32	32	31	5.3	5.3	5.5	6.0	118	79	118	79	121	78	116	76	7	7	9
5	Nestle - Babelegi	34	M	1	23	23	23	23	5.8	5.8	6.0	6.2	124	76	124	76	122	80	123	78	5	4	6
6	Nestle - Babelegi	42	F	0	48	48	48	48	5.3	5.3	5.0	4.6	98	71	98	71	117	79	110	74	11	10	13
7	Nestle - Babelegi	54	M	1	31	31	31	30	5.0	5.0	4.9	5.8	143	92	143	92	122	75	123	76	7	6	4
8	Nestle - Babelegi	48	M	1	34	34	33	33	10.8	10.8	8.0	7.9	116	76	116	76	118	72	111	81	5	6	3
9	Nestle - Babelegi	44	M	1	36	35	35	35	5.6	5.6	5.2	6.1	108	73	108	73	100	75	99	72	4	7	8
10	Nestle - Babelegi	45	M	0	24	24	24	24	7.0	7.0	6.8	7.5	147	92	147	92	149	89	150	88	8	6	9
11	Nestle - Babelegi	39	M	1	38	36	36	36	4.3	4.3	4.6	4.5	122	80	122	80	115	79	110	80	3	5	7
12	Nestle - Babelegi	37	M	0	24	24	24	24	6.9	6.9	7.0	7.8	125	78	125	78	127	81	127	81	5	7	5
13	Nestle - Babelegi	40	M	1	36	36	35	35	4.5	4.5	4.5	4.5	138	89	138	89	138	89	138	89	4	6	6
14	Nestle - Babelegi	31	M	1	32	31	30	30	6.5	6.5	4.4	4.1	130	79	130	79	130	80	124	74	2	5	3
15	Nestle - Babelegi	30	M	1	30	30	30	30	6.1	6.1	5.8	4.6	121	76	121	76	122	78	124	80	4	3	6
16	Nestle - Babelegi	54	F	1	31	31	31	31	4.1	4.1	4.1	4.1	118	72	118	72	118	72	118	72	5	7	8
17	Nestle - Babelegi	34	M	1	32	32	32	31	7.9	7.9	6.3	4.4	125	75	125	75	127	72	120	77	5	3	6
18	Nestle - Babelegi	28	F	1	30	30	30	30	4.1	4.1	5.2	7.4	125	78	125	78	126	75	127	79	3	5	4
19	Nestle - Babelegi	40	F	1	38	27	26	26	4.9	4.9	4.9	4.9	127	80	127	80	127	80	127	80	4	6	6
20	Nestle - Babelegi	35	M	1	32	32	32	32	4.3	4.3	6.1	5.1	118	77	118	77	125	74	126	67	2	1	4

Absenteeism Data

Nestlé Site:..

Study Title: Chronic non-communicable diseases (NCDs), Absenteeism and Workplace Wellness Initiatives at a Consumer Goods Company in South Africa

This data recorded as the number of sick leave days taken per month and was presented in the study on an annual basis (monthly data was collated to arrive at annual figures for each of the three periods).

	2014												2015												2016											
Employee Unique ID	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**	**Jan**	**Feb**	**Mar**	**Apr**	**May**	**Jun**	**July**	**Aug**	**Sept**	**Oct**	**Nov**	**Dec**

Appendix VI: Annual Medical Surveillance Data

The annual medical surveillance assessment measures the following data;

- Height
- Weight
- Body mass index (BMI)
- Waist circumference (in some instances)
- Blood glucose
- Blood pressure
- Urine tests
- Stress questionnaire
- Musculoskeletal assessment
- General eye, ear, nose and throat examinations and
- Depending on the production that takes place at each site, hearing function and lung function (particularly at powdered products factories) tests

Appendix VII: Non-Disclosure Agreement

Life Occupational Health

Oxford Manor
21 Chaplin Road
Illovo
2196
+27 11 219 9000

To: Whom it may concern

I, Mbali Maseko, agree not to share any medical information shared with me for the purposes of the study. I also agree to immediately advise the designated custodian of these health records, Life Occupational Health should there be any accidental breach of this agreement for immediate remedy.

Mbali Maseko

13 August 2018