Longitudinal Analysis of the Relationship between Religion and Infectious and Non-Infectious Diseases: Evidence from the South African National Income Dynamics Study

This research report was submitted to the Faculty of Humanities, School of Social Sciences, in partial fulfilment of the requirements for the Degree of Master of Arts in Health Demography at the University of the Witwatersrand

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Declaration

I, Nqabanomqhele Mthimkhulu, hereby declare that this research report titled '***Longitudinal Analysis of the Relationship between Religion and Infectious and Non-Infectious Diseases: Evidence from the South African National Income Dynamics Study'*** is my original work. It is being submitted in partial fulfilment of the requirements for the Master of Arts Degree in Health Demography at the University of the Witwatersrand, Johannesburg. The work has not been submitted before for any other degree or examination in any other university.

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Acronyms and Abbreviations

AIDS	Acquired immune deficiency syndrome
CHD	Congenital heart disease
DM	Diabetes Mellitus
HIV	Human immunodeficiency virus
NIDS	National Income Dynamics Study
PRO	Patient-reported outcomes
SDHs	Social Determinants of Health
SSA	sub-Saharan Africa
Stats SA	Statistics South Africa
TB	Tuberculosis
UNAIDS	Joint United Nations Programme on HIV and AIDS

Abstract

Background: South Africa has been experiencing a complex health transition that is defined by a double burden of disease in a weak health system. Infectious and non-infectious diseases accounted for 31.1% and 57.4% of deaths in 2016, respectively. Tuberculosis and Diabetes Mellitus are two of the leading causes of death among South Africans. In South Africa, TB is the leading cause of death among individuals aged 15-44 years accounting for 11.2% of the deaths. Deaths attributable to non-infectious diseases have increased in South Africa from 53.3% in 1997 to 57.4% in 2016. South Africa has the highest prevalence of age-adjusted DM in adults aged 20-79 years (12.7%) and over 4 million people are living with diabetes. Disease rates in South Africa are largely shaped by behavioural risk factors such as smoking, unhealthy diet, physical inactivity, alcohol use and religion. This study therefore focuses on religion as a substantial influencer of behavioural risk factor to disease outcomes among the economically active (15-64 years) in South Africa.

Objectives: The objective of this study therefore was firstly to identify the prevalence of Tuberculosis and Diabetes Mellitus by religious affiliations in South Africa. Secondly, to describe disease outcomes of the economically active by religious affiliations and selected socio-economic and demographic factors. And lastly, to examine the relationship between religious affiliations and disease outcomes.

Methodology: The study used a retrospective longitudinal study design. The study used secondary data from the National Income Dynamic Study (NIDS) that has had five waves, from 2008 to 2017. The study population were economically active, aged 15-64 years, both males and females who have a religious affiliation. Total sample was 7895. Descriptive statistics measured the prevalence of infectious disease and

non-infectious diseases among the economically active that have a religious affiliation. A binary logistic regression model was used, after describing data, to assess the relationship between religion and infectious and non-infectious diseases in South Africa.

Results: The results show that Tuberculosis and Diabetes Mellitus prevalence was high amongst individuals affiliating with African Traditional Beliefs. Furthermore, smoking status [**OR:** 1.56 **CI**: 1.5470– 1.5785], and alcohol habits [**OR:** 1.41 **CI:** 1.3933– 1.4175] were associated with Tuberculosis. Whereas, Diabetes Mellitus was associated with race (coloured) [OR: 3.08 CI:3.0371 - 3.1191]**,** having secondary education [**OR:** 1.34 **CI:** 1.3237 - 1.3623] and residing in rural areas [**OR**: 1.42 **CI:** 1.4046 - 1.4318].

Conclusion: The study found that there is a relationship between religious affiliation and disease outcomes in South Africa. The results also showed that South Africans engage in risky behaviours and are left susceptible to disease acquisition. The results show that regardless of your religious affiliations and beliefs, your engagement in risky behaviour leaves you susceptible to the acquisition of disease.

Keywords: *Religious affiliation, tuberculosis, diabetes mellitus, economically active, longitudinal study*

Chapter One

Introduction

1.1 Background

Globally there has been a growing interest to understand the role that religion, religiosity, and spirituality has on the health of individuals of all ages in the world (Zimmer, Jagger, Chiu, Ofstedal, Rojo & Saito, 2016). Religion has been described as an entity that involves a series of beliefs and practices guided by a set of rules, regulations, and responsibilities which are held and practiced by followers of the said religion (Koenig, 2009). Religion has been associated with a set of foundational principles arranged around distinct systems of practices, rituals, and beliefs held by individuals in a community (Zimmer *et al*, 2016). The belief systems held are relative to the sacred, the Divine, God and they are held to acknowledge, worship, or communicate with the "*powerful being*" (Koenig, 2008).

Spirituality has been about creating an intimate connection with a sacred being and this usually occurs first before an individual identifies with a religious group or affiliation (Koenig 2012; Nahardani, Ahmadi, Bigdeli & Arabshahi, 2019). It is about the active search of a sacred being to surrender and worship the being (Koenig, 2012). When something is spiritual it is understood to be transcending of ordinary physical limits to time, space, matter, and energy (Miller and Thoresen, 2003). Religiosity refers to active engagement to religious activities such as prayer or listening to chants, sermons or songs, ritualistic practice and attendance at a place of worship (Zinnbauer, Pargament, Cole, Rye, Butfer, Belavich, & Kadar, 2015; Zimmer *et al* 2016).

Religion, amongst other factors in society, influences how individuals engage with each other and on how they define their roles and moral values in society, and their conceptualisation of the relationship between humans and the environment (Hope & Jones, 2014). For example, how the status of men and women is defined in society (Brown *et al, 2009)*. Young women are taught to be nurturers and to be concerned about social relationships and social evaluations, whereas young men are taught to be assertive, independent, and competitive (Brown *et al*, 2009). The role and status of women and men in society is based on how religious texts and scriptures have been interpreted, alongside existing institutional and cultural communities (Klingorova & Havilicek, 2015). Societies with higher levels of religiosity have amplified gender inequality and promoted patriarchy (Klingorova & Havilicek, 2015).

Religious doctrines play a crucial role in formulating rules and regulations that inform everyday behaviours and daily livings of their believers and followers. For instance, in Islam, the values, beliefs, and identities of female followers have been found to negatively impact breast cancer screening behaviours among women residing in Chicago based on feelings of discrimination (Padela, Murrar, Adviento, Liao, Hosseinian, Peek & Curlin, 2015). The Islamic religion also has very strict dietary restrictions which include prohibiting alcohol consumption, the use of non-Halal animal fats and any animal that has not been slaughtered according to the correct customs and rituals (Attum, Waheed Shamoon, 2019). These restrictions have been found to influence even the type of medication that can be taken. These restrictions extend to medication that contains alcohol, gelatine, or pork-based medications (Attum, Waheed Shamoon, 2019).

In sub-Saharan Africa (SSA), religious affiliation is diverse. Individuals who affiliate with Christianity are densely located in the Southern Region of sub-Saharan Africa. Likewise, religion in South Africa is diverse and is predominantly made-up of individuals who affiliate with Christianity (85.6%), followed by individuals with no religious affiliations (5.6%), individuals that practice African traditional beliefs (5%), and Islam Religion accounting for less than 5% of the population (Statistics South Africa, 2014).

1.2 Problem Statement

South Africa has one of the worst Human Immunodeficiency Virus (HIV), Acquired Immune Deficiency Syndrome (AIDS) and Tuberculosis (TB) epidemics in the world. Despite the improvements in treatment outcomes directed towards new smear-positive cases, TB cases continue to rise and are driven by the rise in HIV-infections. (Mayosi & Benatar, 2014; Kyu, Maddison, Henry, Mumford, Barber, Shields, *et al*, 2018). Globally TB is one of the leading causes of death that result from a single infectious agent; this is above deaths caused by HIV and AIDS (World Health Organisation (WHO, 2018). Worldwide, over 10 million new cases of TB were reported in 2017 and this was equivalent to 133 new TB cases per 100 000 population (WHO, 2018). In the same year (2017), 58% (5.8 million) of the newly reported TB cases were men, 32% (3.2 million) were women and majority of these are in the working age group (WHO, 2018). Internationally, TB affected more than 90% of adults aged 15 years and above in 2017 (WHO, 2018).

Developing countries form part of the high burden TB countries, accounting for more than 87% of newly reported TB cases in 2017 (WHO, 2018). In South Africa, TB

remains a major health problem, although there has been a decline in deaths due to TB from 8.3% in 2014 to 6.5% in 2016 (Statistics South Africa, 2017, Massyn, Peer, English, Padarath, Barron & Day, 2016). In 2017, South Africa had an estimated 322,000 incident cases of TB and 60% of the reported cases were HIV positive (WHO, 2018). TB is the number one leading cause of death among males (7.6% of deaths), individuals aged 15-44 years (11.2% of deaths), and 45-64years (8.0% of deaths) in South Africa in 2016 (Statistics South Africa, 2017).

In South Africa, non-infectious diseases have been increasingly affecting the health profile of South Africans and are amongst the leading causes of death (Massyn *et al,* 2016). In both rural and urban areas, there is an increasing burden of non-infectious diseases which mainly affect individuals living in poverty in South Africa (Mayosi & Benatar, 2014). Deaths attributed to non-infectious diseases in South Africa have increased from 53.3% deaths in 1997 to 57.4% in 2016 (Statistics South Africa, 2017). Diabetes Mellitus has been the leading cause of death amongst females accounting for 7.2% of deaths an increase from 6.5% deaths in 2014 (Statistics South Africa, 2017). Diabetes Mellitus was the second leading cause of deaths amongst South Africans after TB, particularly amongst individuals aged 45-64 years accounting for s1% of deaths and 8.9% of deaths among individuals aged 65 years and older in 2016 (Statistics South Africa, 2017).

South Africa is part of the three-high burden country list for the highest incident of TB among individuals with HIV, the highest numbers of TB cases and the highest estimated numbers of incident multi-drug resistant tuberculosis (MDRTB) and HIV for the period of 2016-2020 (WHO, 2019). In 2018, there was an estimated 10.0 million

individuals who were diagnosed with TB and South Africa accounted for 3% (520 incident cases per 100 000) of the incident cases (WHO, 2019). In Africa, 11.6 million of individuals aged 20-79 years are undiagnosed with diabetes, representing a regional prevalence of 59.7% (International Diabetes Federation (IDF), 2019). In Africa, it is estimated that individuals aged 20-79 years have been diagnosed with diabetes (IDF, 2019). In the African region, South Africa has the highest age-adjusted comparative prevalence (12.7%) in adults aged 20-79 years and over 4 million people living with diabetes (IDF, 2019).

As stated above there has been a noteworthy increase in deaths caused by non-infectious diseases over the years in South Africa. There has been an increase in deaths caused by infectious diseases from 29.7% in 1997 to 31.6% in 2016 (Statistics South Africa, 2017, 2017). In South Africa, TB and Diabetes mellitus are the top two leading causes of death accounting for 29 513 (6.5%) and 25 255 (5.5 %) deaths in 2016, respectively (Statistics South Africa, 2017). Infectious and non-infectious disease deaths are preventable but are worsened by the limited resources and inadequate resources and facilities in the health sector in South Africa (Ndind *et al*, 2018). TB and Diabetes Mellitus have been chosen as the two main disease outcomes for the study given that they are the two most leading causes of death in South Africa across population groups of all ages.

1.3 Justification

A healthy working population is crucial for spearheading a sustainable economic growth in any country (Qadri & Waheed, 2014). Thus, it is crucial to provide adequate education that is accompanied by good health systems as these factors provide a step closer to producing a more productive labour force that will ultimately stimulate national economic growth (Bloom *et al,* 2004; Ogundari & Awokuse, 2018). Poor

health in the working population results in loss of working hours and corresponds to a decline in the mental and physical capabilities, productivity, and overall wages (Ogundari & Awokuse, 2018).

The well-being and health of the economically active is essential for the economic development and sustainability of South Africa. The poor health status of an economically active population affects their productivity and their ability to contribute to the economic growth of the country. Previously, South Africans have been described as partakers in behavioural risk factors such as alcohol abuse, physical inactivity, smoking, unhealthy diets, and personal violence (Norman, Matzopoulos, Groenwald & Bradshaw, 2007; Mukong, van Walbeek & Ross, 2017). This has ultimately led to the continuous increase of disease and preventable deaths from preventable diseases in South Africa (Norman *et al*, 2007).

Religious institutions and faith communities are fundamentally instrumental in regulating and influencing the lives and attitudes of members (Eriksson, Lindmark, Haddad, & Axemo, 2014). Findings from this study will be crucial in informing policy interventions aimed at preserving and creating health systems that promote the health and well-being of South Africans. This could mean a modification of the existing National Development Plan which is aimed at ensuring that all South Africans have a long and healthy life through treatment and prevention of disease (NDP, 2012). Specifically, the findings from this study could inform increasing efficient integration of dynamics of religion and economically working population into the National Health Promotion Policy and Strategy 2015-2019 that provides a framework that is aimed at integrating health promotion into all health programmes in South Africa. This is aimed at allowing and promoting individuals to have increased control over their health and

make informed healthy choices. The policy recognises that the health outcomes of an individual are not solely based on individual behavioural outcomes but that health outcomes are a product of social networks, cultural and religious norms, and attitudes (South African National Department of Health, 2015). Moreover, the results will inform interventions aimed at improving the health and wellbeing of South Africans towards achieving Sustainable Development Goal 3 (SDG 3), which is to ensure healthy lives and to promote well-being for all at all ages. In achieving SDG-3, South Africans would need to understand and account for the role of religion in designing interventions directed towards reducing health outcomes and behavioural risk factors of disease.

The relevance of understanding the relationship between disease and religious affiliations in South Africa amongst the economically active is in two folds. Firstly, religion plays a crucial role in influencing the activities of individuals with regards to behaviour and dietary requirements. For example, religious doctrines inform the number of allowable sexual partners (polygamy) and even the acceptability of family planning measures such as contraceptives and condoms that contribute to the prevalence of HIV/AIDs and STIs (Garner, 2000; Gyimah, Adjei, & Takyi, 2012). Secondly, it will provide a better understanding of the relationship between religion and disease, through the behavioural risk factors that the economically active engage in. This study assessed the role that religion plays in the health of the economically active in South Africa, through assessing the prevalence of diseases and the associated risk factors of Tuberculosis and Diabetes Mellitus.

1.4 Research Question

Main Question: What is the relationship between religious affiliation and infectious and non-infectious diseases among the economically active (15-64 years) in South Africa?

Sub Questions

1. What is the prevalence of infectious and non-infectious diseases in South Africa among the economically active (15-64 years) by religious affiliation in South Africa?
2. What is the association between religious affiliation and disease outcomes among the economically active (15-64 years) in South Africa?

1.5 Research Objectives

Research Objective: The purpose of the study is to identify religious affiliation as a determinant of infectious and non-infectious diseases in South Africa.

Sub-objectives

1. To determine the prevalence of infectious and non-infectious disease amongst the economically active groups (15-64 years) in South Africa, by religious affiliation.
2. To examine the relationship between religious affiliation and disease outcomes amongst the economically active in South Africa.

Chapter Two
Literature Review and Theoretical Framework

2.1 Prevalence and Incidence of Tuberculosis

Globally, Tuberculosis (TB) has been a major public health problem affecting the functionality and wellbeing of individuals. It was described as the single most leading cause of death by infectious disease surpassing HIV-infection deaths (SADHS, 2016). TB mainly affects developing countries and individuals who experience poverty. Previous studies have examined alcohol use, alcohol dosage, and alcohol-related problems in relation to the risk of developing TB. These were factors previously identified as important risk factors for TB incidence, morbidity, and mortality (Imtiaz, Shield, Roerecke, Samokhvalov, Lönnroth & Rehm, 2017). The study also estimated alcohol-attributable TB incidence and mortality rates for over 190 member states of the WHO (Imtiaz *et al,*2017).

The high prevalence of TB has been attributed to individuals not following through or adhering to treatment after diagnosis (Harries, Rusen, Chiang, Hinderaker & Enarson, 2009). A study conducted in South Africa found that there were various reasons as to why patients who were diagnosed with TB did not attend treatment. These reasons included not feeling ill, wanting to maintain a certain lifestyle, an issue with accessibility and problems at the primary health care facilities (Skinner & Claassens, 2016). Another study conducted in South Africa found that poverty, the lack of food and issues of accessibility to a healthcare facility remained a challenge to treatment adherence (Bond, Chileshe, Magazi & Sullivan, 2008).

A study conducted in peri-urban Khayelitsha, Cape Town in South Africa reported that there was an overall high prevalence of multi-morbidity among individuals who received treatment and care in public clinics (Oni, Youngblood, Boulle, McGrath, Wilkson & Levitt, 2015). The findings of the study revealed that TB patients had a high prevalence of HIV-infection, also a high prevalence of Hypertension and Diabetes (Oni *et al*, 2015). The findings suggest that in a peri-urban township in South Africa that there is a high prevalence of infectious and chronic infectious diseases (Oni *et al*, 2015). The results of the study must be interpreted in moderation given that they cannot be generalised to the country as the study was only based on one small public clinic in South Africa. Furthermore, the study failed to assess other factors related to the development of disease such as behavioural risk factors, lifestyle choices and cultural or religious beliefs and attitudes held by individuals.

Recently there has been an interest in the presence of TB and Diabetes Mellitus (DM) comorbidity. A global systematic review found that DM among TB patients ranged from 1.9% to 45%, with a global median DM at 16% (IQR 9.0% - 25.3%) (Workneh, Bjune & Yimmer, 2017). Furthermore, the prevalence of TB among DM patients ranged from 0.38% to 14%, with a global median prevalence of 4.1% (IQR 1.8% - 6.2%) (Workneh, Bjune & Yimmer, 2017). The review identified several associated risk factors of the TBDM comorbidity. These factors include age, sex, urban areas, higher education, illicit drug use, and sedentary lifestyles and clinical factors amongst other factors (Workneh, Bjune & Yimmer, 2017).

Imtiaz *et al* (2017), in their meta-analysis revealed alcohol consumption was a major contributor to TB and alcohol users were at a higher risk of TB compared to non-alcohol users in all the member states. Furthermore, the findings from the study

revealed that TB incidence and alcohol-attributable risks were most prominent in the African countries, namely in Namibia, Lesotho, Gabon, and South Africa (Imtiaz *et al*, 2017). Similarly, a study in Kampala, Uganda, found that alcohol use was a risk factor for TB amongst adult TB patients (Kirenga, Ssengooba, Muwonge, Nakiyingi, *et al*, 2015). Despite the insightful findings from these results, both studies were susceptible to issues of social desirability and recall bias because of the measurements and definitions of alcohol consumption. Furthermore, both studies failed to assess the role that socioeconomic status (i.e. type of employment, income, type of residence) played in influencing a patient's susceptibility to TB.

Among other suspected factors is the exposure to certain work environments which leaves individuals vulnerable to contracting TB infection. Work environments such as working in mines, health workers are amongst the many environments that leave individuals exposed and susceptible to diseases and infections (Ehrlich. Montogomery, Akugizibwe & Gonslaves, 2017). In low-middle income countries such as South Africa, TB has become a major/significant occupational risk particularly amongst health workers (i.e. nurses, doctors, pharmacists, general stuff, and admin) (o'Hara, Yassi, Zungu, Maletle, Bryce, Barker, Darwin and Fitzgerald, 2017). A decade long cohort study in the Free State, South Africa estimated the rate of TB among health workers from 2002-2012 and compared the socio-demographic and clinical characteristics to the general population with TB. The study found that the incidence rate of TB among health workers (1496.32 per 100 000) was higher than that of the general population (719.37 per 100 000) from 2002-2017 (o'Hara *et al*, 2017). Furthermore, the study discovered that TB was higher amongst Black health

workers, males, individuals born in 1960-1969 and those who worked for more than 10-15 years (o'Hara*, et al,* 2017).

Similarly, a systematic review of the epidemiology of TB among health workers in South Africa found that health workers are consistently exposed to the occupational risk factors of tuberculosis (Grobler, *et al*, 2016). The review found that there is a high burden of latent and active TB among health workers in South Africa (Grobler, *et al*, 2016). The limitation of these two studies is the failure to assess the health workers behavioural risk factors. Certain behavioural risk factors that individuals may engage in exert serious health consequences. Understanding behavioural risk factors is important to health studies because previously they have been found to leave populations susceptible to disease.

A case control study conducted in the Gambia identified the risk factors for pulmonary TB amongst general outpatients at the Medical Research Council outpatients' clinic (Hill, Jackson-Sillah, Donkor,Out, Adegbola & Lienhardt, 2006). The study found that households with at least four persons, Jola ethnic group (OR: 3.83 CI: 1.35-10.86) and history of TB in another household member (OR: 10.17 CI: 4.08-25.63) where significant predictors of pulmonary TB among outpatients in Gambia (Hill, *et al*, 2006). The limitation of this study was that cases not randomly sampled study and the study suffers from selection bias because convenience sampling was used. Similarly, a case control study conducted in Moscow, Russia assessed the risk factors of pulmonary TB. The study found that living in crowded conditions, having a relative with TB, diabetes, and a history of being in a prison were risk factors of pulmonary TB (Coker et, al, 2006).

2.2 Prevalence and incidence of Diabetes Mellitus

A study conducted in Zambia and the Western Cape, in South Africa, assessed the prevalence, associated risk factors, and diagnosis and management of diabetes in select communities. The study found that there was a high prevalence of diabetes in the Western Cape communities as compared to communities in Zambia (Bailey, Ayles, Beyers, Godfrey-Fauscett, *et al*, 2016). Furthermore, the study found that age, sex, education, economic position, HIV-status, and BMI were associated risk factors of DM in both communities. The study also found that older participants aged 35 years and older in the study had a higher prevalence of diabetes in both communities as compared to other age-groups residing in Zambia and Western Cape (Bailey *et al*, 2017). Similarly, a study conducted in South Africa found that diabetes was most prevalent amongst older participants and that they also experienced multi-morbidity (Weimann, Dai & Oni, 2016). The results of the study conducted in Zambia and Western Cape should be interpreted in moderation given the fact that the communities were not selected randomly.

A study conducted in both rural and urban Malawi assessed the prevalence of diabetes, overweight, obesity, hypertension, and multi-morbidity. The results of the study revealed that in urban areas there was a higher prevalence of diabetes (Price, Crampin, Amberbir, Kayuni-Chihana, *et al*, 2018). Similarly, a study conducted in South Africa that assessed the prevalence and unmet need of diabetes found that the prevalence of diabetes was higher amongst individuals who resided in urban formal areas (Stokes, Berry, Mchiza, Parker, Labadarios, Chola, *et al*, 2017). Furthermore, the study revealed that there was an increased risk of diabetes and hypertension among individuals of all ages with low to normal body mass index (BMI) (Price *et al*,

2018). The study was subject to social desirability given that diabetes and hypertension were measured on self-reported measures.

A study conducted in Gondor Ethiopia assessed the prevalence and associated risk factors of undiagnosed DM among rural and urban dwellers (Abebe, Berhane, Worku & Assefa, 2014). The study found that there was a high prevalence of previously undiagnosed DM with more than 65% of unidentified cases (Abebe *et al*, 2014). In rural Gondar, 82.6% of the residents were undiagnosed, this was 19.6% higher compared to individuals who reside in urban areas (Abebe *et al*, 2014). However, a study conducted in East Gojjam found that the prevalence of undiagnosed DM was high amongst urban dwellers at 13.4% as compared to rural dwellers with a prevalence of 10.3% (Wondemagegn, Bizuayehu, Abie, Ayalneh, Tiruye & Tessema, 2017). In both studies, the prevalence of undiagnosed DM increased by age in both rural and urban areas (Abebe *et al,* 2014 & Wondemagegn *et al,* 2017).

2.3 Associate risk factors

Assessing risk factors of health among workers is important given the detrimental effects of disease on work productivity, family life and the overall economic development of a country. A study assessed the prevalence of undiagnosed and diagnosed diabetes and impaired fasting glucose (IFG) and their associations with occupational categories among the working population in Spain (Maty, Everson-Rose, Raghunathan & Kaplan, 2005). The study found that there was a 1.3% prevalence of undiagnosed diabetes mellitus, 10.3% impaired fasting glucose and 1.1% and 0.3% of diagnosed type 1 and type 2 diabetes (Maty *et al*, 2005). An unhealthy diet and lack of physical activity are the two driving factors influencing the

development of diseases such as cardiovascular disease, diabetes, and obesity (Maty, *et al,* 2005).

Furthermore, the study found that the prevalence of undiagnosed diabetes was highest among blue-collar workers (1.5%) as compared to white-collar (0.8%) and diagnosed diabetes was high amongst blue-collar workers as compared to white-collar workers (1.3% vs 0.8%) (Maty *et al*, 2005). With a sample size of 371 997 study participants and using logistic regression model, the study found that being overweight/obese, hypertension and dyslipidaemia, increasing age and being male was associated with undiagnosed diabetes, Type 2 diabetes and impaired fasting glucose (Maty *et al*, 2005). A shortfall of the study is that most study participants were men, and this could have biased the results towards away from the null. The study failed to assess other factors such as behavioural risk factors, dietary habits, and family history of diabetes or cardiovascular disease

2.4 Religion and Health Outcome

Religion is a social determinant that influences health outcomes such as lower mortality (Chida, Steptoe, & Powell, 2009). Religion has also been described as a protective factor of behavioural risk factors such as smoking, alcohol consumption and physical activity amongst other factors of disease outcomes (Idler, Blevins, Kiser, & Hogue, 2017 & Park, Aldwin, Choun, Suresh, & Bliss 2016). A study in India examining the relationship between socio-economic status and health found that Christians were more likely to report heart disease, hypertension, and diabetes as compared to Brahmins, which is a Hindu caste (Childers & Chiou, 2016). Findings suggested that health outcome differences are influenced by lifestyle and dietary

limitations as a result of religious beliefs and restrictions on certain behaviours (Childers & Chiou, 2016).

A cross-sectional study applied multivariable General Linear Models (GLMM) to predict whether religious/spiritual and the importance of religion/spirituality in one's life would predict patient-reported outcomes (PRO) amongst individuals with congenital heart disease (CHD). The study reported that, after adjusting for patients' characteristics and unmeasured country differences, individuals who described themselves as religious predicted better health, health behaviours and higher satisfaction of life amongst individuals with CHD (Moons *et al*, 2018). Similarly, a study conducted in the middle east region found that there was a relationship between increasing religiousness/spirituality dimensions (religious belief, commitment, and emotions) and scores, and the decreasing likelihood of CHD amongst Muslims in Iran (Hemmati *et al*, 2018). The study used hospital-based sampling methods which affect the generalizability of the results in the study (Hemmati *et al*, 2018). The authors further argued that religious involvement may be instrumental in helping individuals to maintain cardiovascular health (Hemmati *et al*, 2018).

In the United States, a study assessed the relationship between the sacred view of the body and health behaviour. The results showed that greater involvement by individuals in religious activities was associated with health behaviours such as strenuous and normal exercise, better sleep quality and eating of fruits and vegetables (Krause, Hill, Emmons, Pargament, & Ironson, 2017). Similarly, another study found that individuals who identified as religious/spiritual depicted better health behaviours such as a healthier diet, fewer risk-taking behaviours and increased physical activity (Cheadle and Dunkel Schetter, 2017).

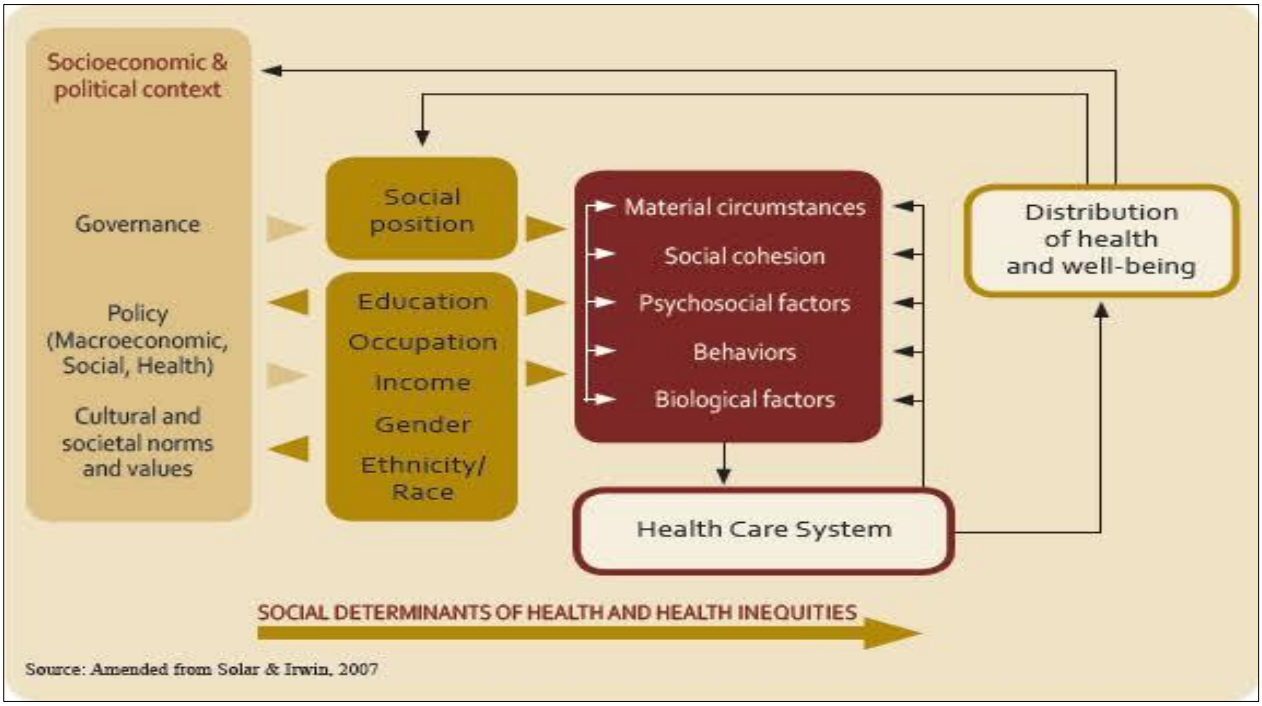
In South Africa, the relationship between religion and health has been assessed extensively in HIV-prevention and coping mechanisms amongst individuals who know their status. A study by Eriksson and colleagues found that individuals residing in faith-based communities had received teachings about premarital sexual abstinence but messages on HIV-testing and condom use were less frequent and perceived themselves as being at risk of HIV-infection (Eriksson, Lindmark, Axemo, Haddad, & Ahlberg, 2013; Francis *et al, 2019*). A study in the Western Cape examined the relationship between religious activities and lifestyle risk factors of HIV amongst youth (Francis *et al*, 2019). The study discovered that youth who described themselves as being religious were less likely to engage in risky sexual behaviour, or the consumption of alcohol or drugs in the last 30 days (Francis *et al*, 2019). The study was a cross-sectional study and was limited to youth in the Western Cape this affected the generalizability of the results and inferring causality.

2.4 Theoretical Framework

Globally there has been an acknowledgement and the understanding that health outcomes are not merely affected by health care or access to healthcare but rather that there is a complex relationship between societal conditions and health outcomes of populations (Ataguba, Day, McIntyre, 2015). The societal conditions and factors are described as Social Determinants of Health (SDHs). SDHs are a range of political, social, economic, environmental, gender equality, human rights and cultural factors (WHO, 2009; Halfron, Larsson & Russ, 2010).

Social determinants of health are the social conditions and factors in which individuals' function and interact. Health starts at schools, neighbourhoods, homes, and communities. SDHs illustrate how health outcomes are not merely the presence

or absence of healthcare facilities but that the social conditions and environments that individuals interact in have an influential factor on the health outcomes of societies worldwide. The social and economic conditions that populations experience, known as the SDH, can ultimately influence differences in the health status of individuals and this varies by country (Braveman & Gattileb, 2014). Social determinants of health are understood to be the circumstances where populations engage in alongside systems (structures) that are put in place to address the burden of illness in the population (WHO, 2009).



***Source**: Solar & Irwin, 2007*

***Figure 2.1**: Social Determinants of Health Framework*

2.5 Conceptual Framework

The conceptual framework was adapted from the Social Determinants of Health framework by Solar and Irwin (2007). The framework illustrates how health/disease outcomes are the result of interactions between socio-economic and political contexts and intermediate factors (Solar & Irwin, 2007). Figure 2 illustrates the adopted SDH and depicts the pathways and interaction of social and behavioural factors. Figure 2

illustrates that social factors such as the demographic and socio-economic factors i.e. education or age, work through behavioural factors that an individual may engage in in-order to influence disease outcomes.

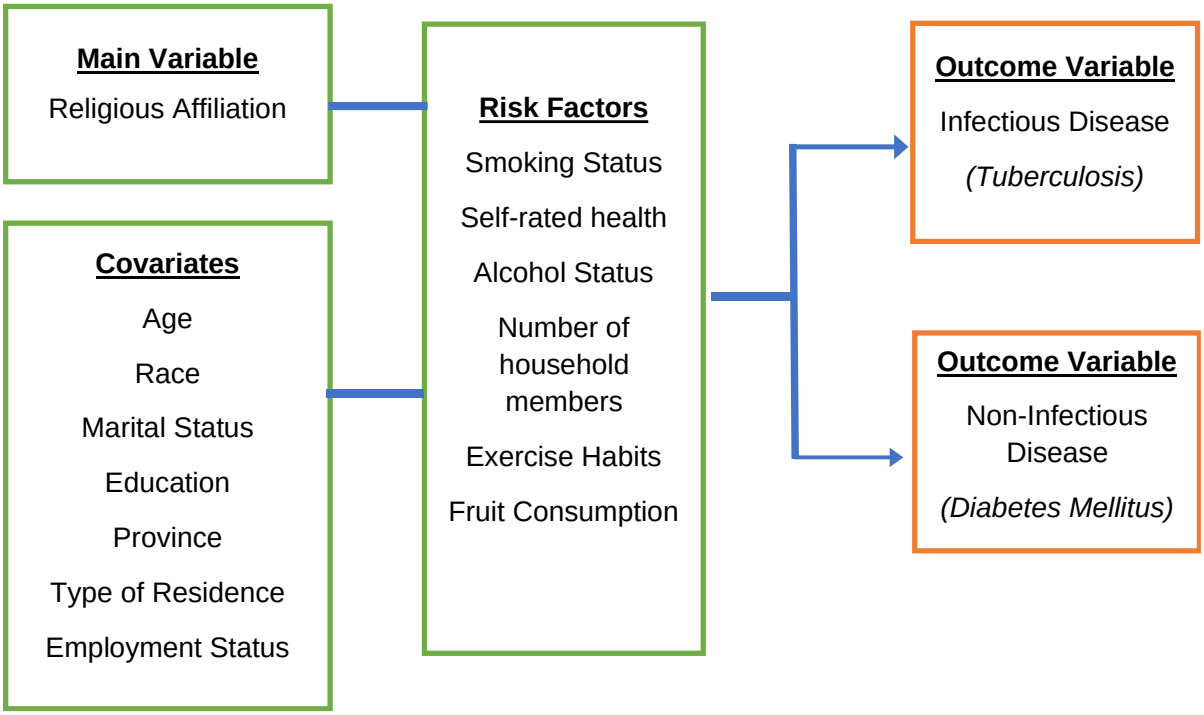


Figure 2.2: *Conceptual Framework for the study adapted from the Social Determinants of Health Framework*

Chapter Three

Methodology

3.1 Study Area

South Africa is one of the Sub-Saharan African countries and is located at the Southern tip of the African continent. The country surrounded by the following countries namely Namibia, Zimbabwe, Mozambique, and Botswana. South Africa is made up of a total of nine provinces namely: Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North West, and Western Cape. In 2019 the South African mid-year population was estimated at 58.78 million, this was less than 1% of the total world population (Statistics South Africa, 2019). In 2019 approximately 51.2% of the population was female, 81% was black African population and 67.6% of the population was aged 15-65 years (Statistics South Africa, 2019).

Figure 3.3: *Map of South Africa and the Neighboring Countries*

3.2 Study design

This study adopts a quantitative approach to answer the research question. Quantitative research focuses on gathering numerical data and utilising the information to explain a phenomenon or generalising the information across the population of interest (Crause, 2020). The defining characteristic of this approach is its focus on confirmation of a theory or hypothesis testing, standardised data collection and statistical analysis (Crause, 2020). Quantitative research aim is to quantify and analysis variables of interest to get a result through using and analysing numerical data (Apuke, 2017). This study employed this approach because it tested hypotheses and assessed interactions between variables.

Longitudinal study design is used to evaluate the relationship between risk factors and the subsequent development of disease over long periods of time (Caruana, Roman, Hernandez-Sanchez & Solli (2015). This study is a retrospective (cohort) study, a form of longitudinal study design. A cohort describes a group of individuals who are included in a study because of an event they experienced, based on a definition provided by a researcher (Sertia, 2016). Cohort studies are a type of observational or experimental study design. The main defining characteristic of a cohort study is that participants do not have the outcome of interest at the beginning of the study (Sertia, 2016). There are two types of cohort studies, namely prospective and retrospective. A retrospective study assesses data from existing records to examine recorded exposures and their relationship to the development of disease at the end of the study (Klebanoof & Snowden, 2018 and Sertia, 2016). The defining characteristics of a retrospective study are that, (i) participants recruited are disease-free, (ii) exposures are recorded at the beginning of the study, (iii) the study is

conducted after the outcome of interest has developed in some people (Klebanoof & Snowden, 2018).

In a retrospective study, researchers work backwards to identify a group of individuals who do not present the disease of interest and their exposures status is recorded at the beginning (Klebanoof & Snowden, 2018). Afterward, researchers determine whether the individuals have developed the outcomes of interest (Klebanoof & Snowden, 2018 and Sertia, 2016). This present study is a retrospective study because i) I worked backward to identify individuals who were disease-free at wave one (2008), ii) who had the main exposure (religious status) and other exposures and lastly determined whether some individuals had developed the outcome of interest at wave five (2017).

3.3 Data source

This study utilizes data from the South African National Income Dynamic Study (NIDS). NIDS is a panel study that collects information and assesses changes in the dynamics of household members in South Africa, changes in their income, expenditure, assets, and access to services, education, health and other dimensions of well-being (Leibbrandt, Woolard, & De Villiers, 2010). NIDS is the first national household study in South Africa with a baseline of 28 255 residents in 7305 households (Brophy, Branson, Daniels, Leibbrandt, Mlatsheni, & Woolard, 2018; Leibbrandt *et al*, 2010). NIDS has a total of five waves to date, the first wave initiated in 2008 and the most recent wave (wave 5) was conducted in 2017. The study is conducted every two-years and follows national citizens (Brophy *et al*, 2018).

NIDS was based on the initiative by the Department of Planning, Monitoring and Evaluation (DPME) and the efforts of the South African government to monitor and understanding the shifts in poverty among South Africans (Brophy *et al*, 2018). It was

implemented by the Southern Africa Labour and Development Research Unit based in the University of Cape Town (Brophy *et al*, 2018). NIDs provides information about the same group of households over time to provide a better understanding of social change, income mobility, poverty dynamics, and labour participation changes, amongst other factors (Amina, & Kezia (2019). The survey follows individuals of all ages, it follows children aged 0-14years and adults 15 years and above (Leibbrandt *et al*, 2010). NIDS has a total of three questionnaires namely the Household Questionnaire, Adult Questionnaire, and Child Questionnaire.

3.4 Research Instrument

Topics in the questionnaire contain information on income, educational attainment, assets, the health status of household members, and expenditures of the household gathered at the baseline (Leibbrandt *et al,* 2010). Information is from members of the household including non-residents at the time of the interview, residents became the base sample to be followed by NIDS over time (Leibbrandt *et al,* 2010). In each wave, there are four types of questionnaires administered namely the Household Questionnaire, Adult Questionnaire, Proxy Questionnaire, and the Child Questionnaire (Brophy *et al*, 2018).

The household questionnaire covers information on household characteristics, living standards, agriculture, expenditure, household roster, negative and positive events in the household, consumption, and mortality history. The adult questionnaire gathers information on demographics, labour market participation, education, income, health, and wellbeing of people in the household, numeracy, and anthropometric measurements. This questionnaire is administered to individuals in the sampled households who were 15-years or older on the day the interview was conducted

(Brophy *et al,* 2018). The child questionnaire is administered to household members who were younger than 14 years and it covers information on their education, family support, grant status, numeracy, and anthropometric data and their health. The proxy question is completed for individuals who were not present or unable to answer their adult questionnaire on the day of the interview. In this study, the adult questionnaire was used because it contains information on the population of interest.

3.5 Study population

The study population is respondents who are aged 15-64 who are of employable age (economically active) and were residents in the first wave (2008) and the most recent wave (2017). The study has an approximate sample of 7,895 (unweighted sample) in Wave 5.

3.6 Study variables

3.6.1 Dependent variable

Table 1 displays information on how the selected variables were defined and coded for the study.

Table 1: Categorisation of the outcome variable

Variable Name	Definition	Coding
Non-infectious Disease		
Diabetes	Whether the individual had diabetes at the last wave	Yes (1) No (0)
Infectious Disease		
Tuberculosis (TB)	Whether the individual had TB at the last wave	Yes (1) No (0)

The response variables of interest (TB and Diabetes Mellitus) were measured in binary codes of either “Yes” or “No” referring to whether the respondent reported the diagnosis of disease or not. Individuals who had responded “*Yes*” were coded as “*Present*” and “*1”* was allocated, whereas individuals who had responded *“No”* were coded as *“Not Present”* and *“0”* was allocated. Individuals who stated that they do not know were dropped. Missing values were dropped too.

3.6.2 Main variable

The main variable, religious affiliation is summarised in **Table 3.2**. **Table 3.2** contains information on how the variable was defined and coded for the study.

Table 2: Definition and categorisation of the independent variable for this study

Variable Name	Definition	Coding
Religious Affiliation	Whether an individual affiliated with one of the following religions namely: No Religion, Christianity, Other Religions and Traditional Religion.	No Religion **(1)**, Christianity **(2)**, Traditional African Religion **(3)**, Other Religion **(4)**

The main variable of interest was religious affiliation. Respondents were asked which religious group they belonged to with seven response categories to choose from. The response categories for this variable were measured by seven categories namely No Religion, Christianity, Jewish, Muslim, Hindu, African Traditional Beliefs and Other.

For this study, these were re-grouped into four categories namely *No Religion, Christianity, African Traditional Beliefs and Other Religion*. Jewish, Muslim, Hindu and others were grouped to create Other Religions; this was grouped due to the small sample size. Christianity refers to a religion based on the life and teachings of Jesus Christ. Traditional African beliefs is religion that is largely shaped by oral traditions

that have been passed from generation to generation. The categories were coded as follows: No Religion **(1)**, Christianity **(2)**, *Traditional African Religion* **(3)** *Other Religion* **(4)**.

Table 3: Definition and categorisation of control variables

Variable Name	Definition	Coding
Demographic Characteristics		
Age	*The respondents age*	15-24 **(1)** 25-34 **(2)** 35-44 **(3)** 45-54 **(4)** 55-64 **(5)**
Gender	*The respondents' gender*	Male **(1)** Female **(2)**
Race	*The respondents' group which the respondent belongs to*	Black African **(1),** Coloured **(2),** White **(3),** Asian/Indian **(4)**
Type of Residence	*Where the respondent resides*	Urban **(1)** Rural **(2)**
Socio-economic Status		
Educational attainment	*Respondents educational attainment*	No Education **(1)** Primary Education **(2)** Secondary Education **(3)** Higher Education **(4)**
Marital Status	*Respondents current marital status*	Never Married **(1)**, Married/Living Together **(2)** Widowed **(3)** Divorced/ Separated **(4)**
Employment Status	*Respondents current employment status*	No **(1)** Yes **(2)**
Risk Factors		
Smoking Status	*Number of times respondent smokes a day*	No **(1)** Yes **(2)**
Exercise Habits	*How often the respondent exercises a week*	Never/less than once a week **(1)** Once/twice a week **(2)** Three or more times a week **(3)**
Fruit Consumption	*Respondents ate fruits and nuts in the last 30 days*	Yes **(1)** No **(2)**

Alcohol Habits	*How often the respondent consumes alcohol a week*	Yes **(1)** No **(2)**
Perception of Health	*Respondents perception of their health*	Poor **(1)** Average **(2)** Good **(3)** Excellent **(4)**

3.7 Ethical issues

The study used secondary data and the data were fully anonymised. This means that participants' identity could not be identified with information collected. Information collected on the participants' socioeconomic, demographic, emotional and well-being and their behavioural factors cannot be connected to the participants identity and unknown to the researcher conducting the study. As a result, the respondent's identity is protected.

Ethics was granted to NIDS by the Commerce Faculty Ethics Committee of where? Before approval for the commencement of NIDS, there were a few steps that needed to be followed to be granted ethics approval (Leibbrandt *et al*, 2010). Firstly, the Committee assessed the informed consent forms and procedures, pre-test questionnaire, proposed fieldwork procedures and confidentiality plans (Leibbrandt *et al*, 2010). Upon approval, the pre-test was run (Leibbrandt *et al*, 2010). Secondly, after the completion of the pre-test, a completed faculty application *(i.e. a cover letter, final questionnaires, and other essential NIDS documents)* were submitted to the Committee for ethics approval for Wave 1 (Leibbrandt *et al*, 2010). Lastly, the application was accepted, and ethics was granted for the commencement of Wave 1 (Leibbrandt *et al*, 2010).

To access NIDS data there are two steps to be followed. Firstly, you are required to register as a user on the *DataFirst* website, the details created will be used to access

the data. Secondly, you are required to complete an online application for access to a Public Use Dataset for the NIDS datasets. On the application form, you are requested to state why and how you intend to use the data and you are also requested to agree with the Terms and Conditions, related to the utilization of the data, after reading them.

Access to the data and registration is available on this link:

http://www.datafirst.uct.ac.za/dataportal/index.php/catalog/central/about

This study was granted ethics approval by the Faculty of Humanities after the researcher has followed the ethics approval process. An ethics waiver form describing the study and disclosing any information that could potentially cause harm, was submitted to the Faculty of Humanities at the University of Witwatersrand. The ethics waiver form was firstly accessed and downloaded from an online platform called 'Sakai'. The form was downloaded under the 'resource tab' under the master's 2019 site. This form was filled in electronically and printed out and signed by my supervisor, Associate Professor Nicole De Wet-Billings. The signed document was uploaded unto Sakai alongside my 10-page research report proposal and submitted to the Faculty of Humanities. Upon approval, the faculty issued a School Ethics Protocol Number. The ethics protocol approved number is: ***WDEMG2019/07/16*.**

3.8 Data Analysis procedure

Objective 1: To determine the prevalence of infectious and non-infectious diseases amongst religious groups in South Africa. This objective was evaluated across *wave 1 to wave 5*. Firstly, frequency and percentage distributions of disease outcomes (TB and Diabetes Mellitus) were compared between wave 1 and wave 5. The two waves were used to compare how disease distribution has changed over time. Secondly to

examine the prevalence rate of disease outcomes by religious affiliations in South Africa. The results were presented in a bar graph. Lastly, differences in socio-economic and behavioural risk factors were evaluated by religious affiliation among the economically active.

Prevalence rate calculation:

Prevalence Rate= total cases/mid-year population * 1000

$$Prevalence\ Rate = \frac{All\ new\ and\ pre-existing\ cases\ during\ a\ given\ time\ period}{population\ during\ the\ same\ time\ period} \times 1000$$

Objective 2: To examine if there is a relationship between religious affiliation and health outcomes (disease) among the economically active in South Africa.

Firstly, the disease outcomes were cross-tabulated with religious affiliations and the control variables, namely the socio-demographic and behavioural characteristics. Pearson Chi-squared was utilized to detect significant differences in proportions in DM and TB and the selected characteristics of the respondents.

Secondly, to assess the relationship between religious affiliation and disease outcomes the logistic regression model was used. Binary Logistic Model is a model that is an extension of a simple linear regression model but with this model, the outcome is binary or dichotomous (0 or 1). The logistic regression model is utilized to describe and test hypotheses relating to the relationship between two variables, where the outcome is binary, and the predictor variable is either continuous or categorical or both. The goal of this model is to predict the probability of an outcome variable by fitting the data to a logistic curve (Bhattacherjee, 2012). The logit model predicts the logit of Y from X, where X is used to predict whether Y has the probability of happening.

The formula is as follows:

$$\text{logit}\,(Y) = \text{In}\,(\frac{1}{1-\pi}\pi) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \ldots + \text{B}_\text{n}\text{X}_\text{n} + \text{e}_0$$

***Where**:*

π = probability

α = Y-intercept

β = coefficients

χ = predictor

The models considered for this study are described below. The selected demographic and socio-economic factors are factors from the baseline wave (Wave1) and the outcome of interest from Wave 5.

Models

Tuberculosis Model

Model 1: religious affiliation and the outcome variable **Wave 1** (baseline) where *TB* is not present and against **Wave 5** (outcome) where *TB* is present.

Model 2: considers model 2 and demographic socio-economic characteristics (Wave 1, baseline) where TB is not present against Wave 5 (outcome) where the TB is present.

Model 3 ***(full model)**:* considers model 2 and behavioural factors: smoking, exercise habits, alcohol consumption, number of household members, self-rated health and fruit or nut consumption (Wave 1, baseline) where *TB* is not present against Wave 5 (outcome) where the *TB* is present.

Model 4: Model 4 considers the full model (model 3) but using variables from Wave 5, where the outcome is present.

Diabetes Mellitus Model

Model 1: religious affiliation and the outcome variable **Wave 1** (baseline) where *DM* is not present and against **Wave 5** (outcome) where *DM* is present.

Model 2: considers model 2 and demographic socio-economic characteristics (Wave 1, baseline) where *DM* is not present against Wave 5 (outcome) where the *DM* is present.

Model 3 *(full model)*: considers model 2 and behavioural factors: smoking, exercise habits, alcohol consumption, self-rated health, and fruit or nut consumption (Wave 1, baseline) where *DM* is not present against Wave 5 (outcome) where the *DM* is present.

Model 4: Model 4 considers full model (model 3) but using variables from Wave 5, where the outcome is present.

Interpretations of the results were made using Odds Ratios (OR), where OR>1 indicates that there is a higher risk and OR<1 indicates a lower risk and OR=1 indicates that there is no risk difference. The level of significance for the study was set at 0.05 and a confidence interval of 95% was utilized. The data and variables in this study were weighted utilizing “iweights” this was to correct for possible survey design sampling errors and to ensure that the sample reflects truly the population from which it was drawn.

3.9 Data Management

The data was managed and analysed using Stata statistical software package version 14 and 15. Stata was used to clean data and manage the data. The full dataset was created by appending and merging data from within and between the five waves. The following steps were followed for each wave. Firstly, the Child and Proxy Questionnaire were appended to the Adult Questionnaire. This was followed by merging the Household Questionnaire, *hhderived and indderived*. The household and hhderived were merged “many to one” using the *hhid* (household identifier). The indderived was merged “one to one” using *pid* (person identifier). Thereafter the newly merged data was sorted by *pid* and saved. This was done for all the five waves. Thirdly, all the waves were merged to the master dataset (Wave 1) by the *pid,* the dataset was saved. Lastly, the newly merged and saved full dataset was merged to the *Linkfile (*It lists the individual identifiers and the household identifier for each wave in which the individuals are residents).

Chapter Four

Results

4.1 Descriptive profile of the economically active population in South Africa

Table 4 describes the percentage distributions of the economically active at *Wave 1* in South Africa. The population was largely made up of individuals aged 15-24 years (36.45%), more than half of the population is female (63.05%) and black African (82.79%). The majority of the economically active reside in rural areas (53.95%) as compared to urban areas (46.05%), have never been married (59.57%), have secondary education (67.38%) and 61.29% are unemployed. Furthermore, the majority of the economically active have never exercised or exercise at least once a week at 74.88%, followed by those who exercised at least three or more times a week at 12.97%, while 12.15% exercised at least once or twice a week.

Majority of the population do not drink alcohol (71.44%) and are non-smokers (82.39%). The mean number of household members was about 5.4. While 59.77% did not consume fruits and nuts in the last 30 days compared to 40.23% who consumed fruits or nuts in the last and 85.73% reported that their health was good and 4.5% reported that their health was poor.

Table 4: Descriptive profile of the economically active in South Africa at Wave 1 *(unweighted)*

Characteristics	Frequency	Percentage (%)
	N=7 895 (100)	
Age		
15-24	2 878	36.45
25-34	1 704	21.58
35-44	1 444	18.29
45-54	1 133	14.35
55-64	736	9.32
Sex		
Male	2 917	36.95
Female	4978	63.05

Race		
Black African	6 536	82.79
White	88	1.11
Coloured	1 088	13.78
Asian/Indian	183	2.32
Type of Residence		
Urban	3 636	46.05
Rural	4 259	53.95
Marital Status		
Never Married	4 703	59.57
Married or Living Together	2 680	33.95
Divorced or Separated	170	2.15
Widow or Widower	342	4.33
Education		
No Schooling	656	8.31
Primary Education	1 787	22.63
Secondary Education	5 320	67.38
Tertiary Education	132	1.67
Employment status		
Not Employed	4 793	61.29
Employed	3 027	38.71
Missing	75	0.95
Exercise Habits		
Never &/or Less than a Week	5 912	74.88
Once or Twice a Week	959	12.15
Three or times a Week	1 024	12.97
Alcohol Habits		
No	5 640	71.44
Yes	2 255	28.56
Smoking Status		
No	6 505	82.39
Yes	1 390	17.61
Number of Household Member		
Min-Max (1-25)	**Mean =** 5.4	**S. D=** 3.128463
Fruit and Nut Consumption		
Yes	3 176	40.23
No	4 719	59.77
Self-Rated Health		
Poor	355	4.5
Average	772	9.78
Good	6 768	85.73

4.2 Religious Affiliation of South Africans at Wave One

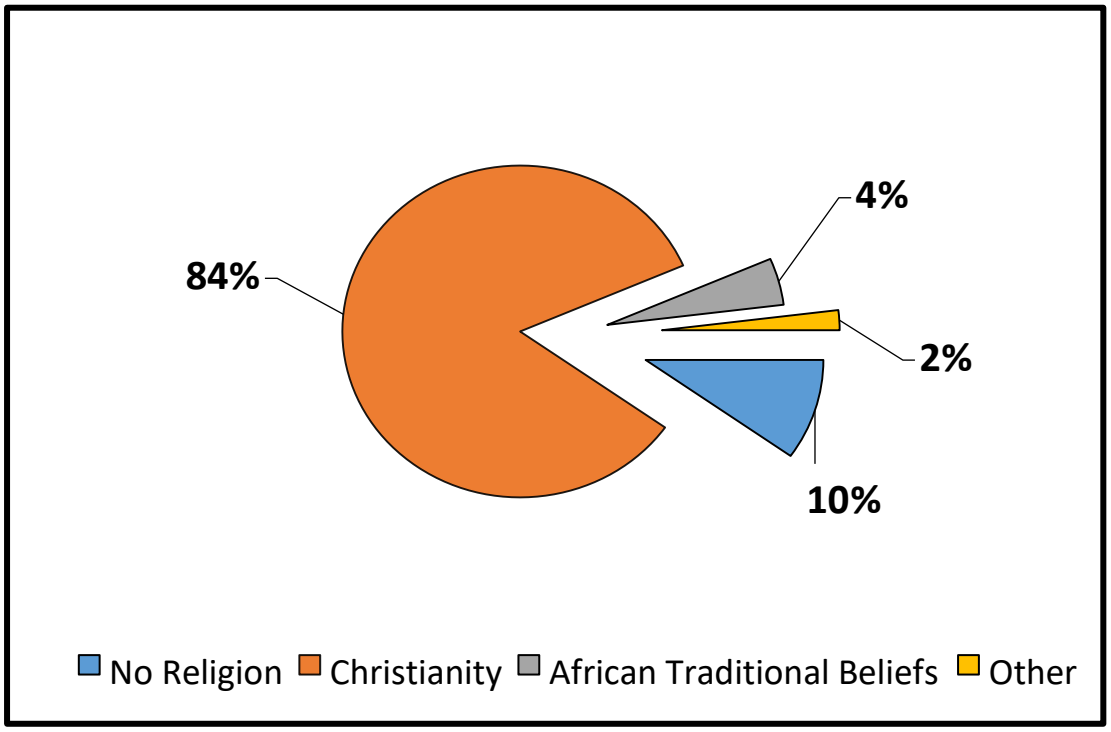


Figure 4.4: *Religious Affiliation of the economically active at Wave 1 (Unweighted), NIDS*

The above figure describes the religious affiliations of the population at *Wave 1*. The figure revealed that the majority of the population in South Africa, affiliated with Christianity at 83.33% followed by individuals with no religious affiliation at 10.63%, with individuals with African Traditional Beliefs and Other Religions accounting for less than 7% of the population, combined.

Table 5 describes the frequency and percentage distributions of the economically active by religious affiliation at *Wave 1*. The table reveals that most of the population affiliated with Christianity at 83.33% followed by individuals with no religious affiliation at 10.63%, with individuals with African Traditional Beliefs at 3.79% and Other Religions accounting for less than 2% of the population. Majority of the population aged 45-54 (86.05%) affiliate with Christianity whereas most the individuals aged 15-24 (13.24%) have no religious affiliation. Majority of the female population affiliated with Christianity (87.44%) whereas the male population had no religious affiliation

(17.24%) and affiliated with African Traditional beliefs (4.94%). Majority of the white population in South Africa were affiliated with Other Religious groups (72.73%) followed by Christianity (26.14) and African Traditional Beliefs (1.14%).

The majority of Christians reside in urban areas (78.38%), are widowed (89.18%), have a tertiary education (91.67) and are employed (83.94%). Whereas, majority of individuals who identified with African Traditional beliefs resided in rural areas (5.64%) and have no tertiary education (0.00%) and have never attended school (8.84%). However, 12.55% of individuals with no religious affiliation have never been married and 14.77% reside in rural areas. In South Africa, 83.94% of Christians are employed, followed 9.71% of individuals with no affiliation, followed by 4.49% of individuals affiliating with African traditional beliefs and 1.85% of individuals affiliating with other religions.

About 85% of Christians in South Africa exercise at least once or twice, 83.79% do not consume alcohol, 78.71% are smokers and 87% consumed fruits and nuts in the last month. However, 12.51% and 13.96% of individuals with no religious affiliation consumed alcohol and are smokers, respectively. Furthermore, 0.89% of individuals with Other Religious affiliation did not consume fruits and nuts in the last month and 1.46% rated their health as good.

Table 5: Descriptive profile of the economically active by religious affiliation in South Africa at Wave 1, unweighted (row percentages)

Selected Characteristics	**No Religion**		**Christianity**		**African Traditional Beliefs**		**Other Religions**	
Age	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
15-24	381	13.24	2 346	81.51	109	3.79	42	1.46
25-34	189	11.09	1 408	82.63	80	4.69	27	1.58
35-44	126	8.73	1 231	85.25	64	4.43	23	1.59
45-54	84	7.41	975	86.05	59	5.21	15	1.32
55-64	59	8.02	619	84.1	44	5.98	14	1.9
Sex								

Male	503	17.24	2226	76.31	144	4.94	44	1.51
Female	336	6.75	4353	87.44	212	4.26	77	1.55
Race								
Black African	824	12.61	5322	81.43	355	5.43	35	0.54
White	0.00	0.00	23	26.14	1	1.14	64	72.73
Coloured	13	1.19	1 055	96.97	0.00	0.00	20	1.84
Asian/Indian	2	1.09	179	97.81	0.00	0.00	2	1.09
Type of Residence								
Urban	210	5.78	3241	89.14	116	3.19	69	1.9
Rural	629	14.77	3338	78.38	240	5.64	52	1.22
Marital Status								
Never Married	590	12.55	3839	81.63	218	4.64	56	1.19
Married or Living Together	219	8.17	2288	85.37	115	4.29	58	2.16
Widow or Widower	20	5.85	305	89.18	15	4.39	2	0.58
Divorced or Separated	10	5.88	147	86.47	8	4.71	5	2.94
Education								
No Schooling	106	16.16	487	74.24	58	8.84	5	0.76
Primary Education	215	12.03	1461	81.76	87	4.87	24	1.34
Secondary Education	513	9.64	4510	84.77	211	3.97	86	1.62
Tertiary Education	5	3.79	121	91.67	0.00	0.00	6	4.55
Employment status								
Not Employed	537	11.2	3978	83	215	4.49	63	1.31
Employed	294	9.71	2541	83.94	136	4.49	56	1.85
Missing	8	10.67	60	80	5	6.67	2	2.67
Exercise Habits								
Never &/or Less than a Week	638	10.79	4904	82.95	279	4.72	91	1.54
Once or Twice a Week	86	8.97	821	85.61	40	4.17	12	1.25
Three or times a Week	115	11.23	854	83.4	37	3.61	18	1.76
Alcohol Habits								
No	557	9.88	4726	83.79	271	4.8	86	1.52
Yes	282	12.51	1853	82.17	85	3.77	35	1.55
Smoking Status								
No	645	9.92	5485	84.32	285	4.38	90	1.38
Yes	194	13.96	1094	78.71	71	5.11	31	2.23
Fruit and Nut Consumption								
Yes	214	6.74	2772	87.28	111	3.49	79	2.49
No	625	13.24	3807	80.67	245	5.19	42	0.89
Self-Rated Health								
Poor	31	8.73	286	80.56	26	7.32	12	3.38

Average	74	9.59	634	82.12	54	6.99	10	1.3
Good	734	10.85	5659	83.61	276	4.08	99	1.46

4.3 Distribution of TB and Diabetes Mellitus in South Africa

The table below depicts the change in disease outcomes from Wave 1 to Wave 5 among the economically active in South Africa. The table reveals that from Wave 1 to Wave 5 there has been a decline from 3.83% to 3.47% of individuals who reportedly had been diagnosed with TB. However, there has been a 0.76% increase among individuals who have reported a DM diagnosis by a health practitioner, from 2.42 in Wave 1 to 3.18% in Wave 5.

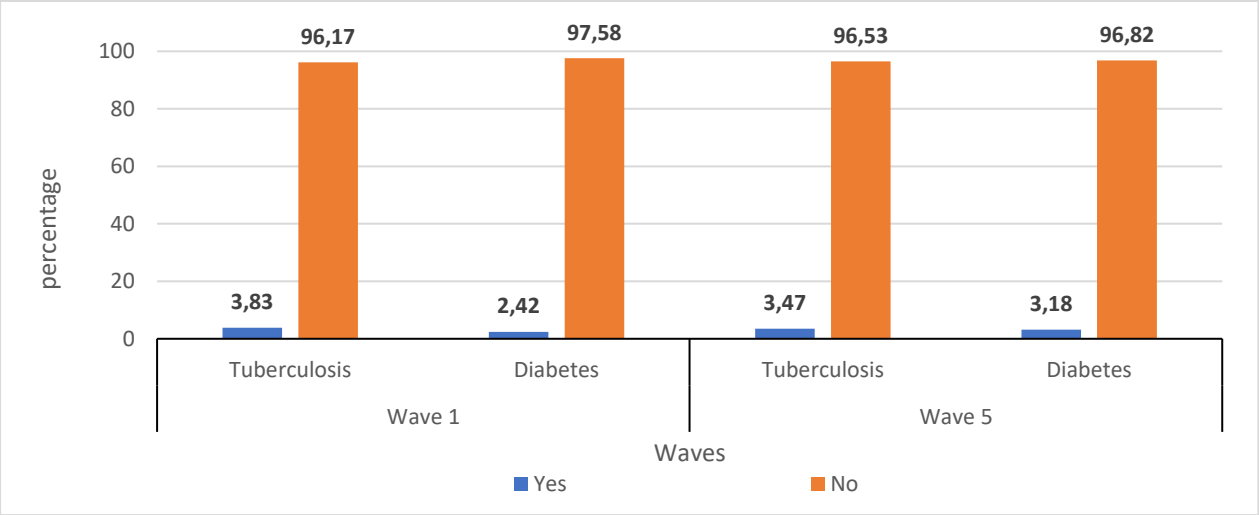


Figure 4.5: *Frequency Distribution of TB and Diabetes Mellitus at Wave 1 & Wave 5, NIDS*

4.4 Prevalence of Tuberculosis and Diabetes Mellitus by Religious Affiliation at Wave 5

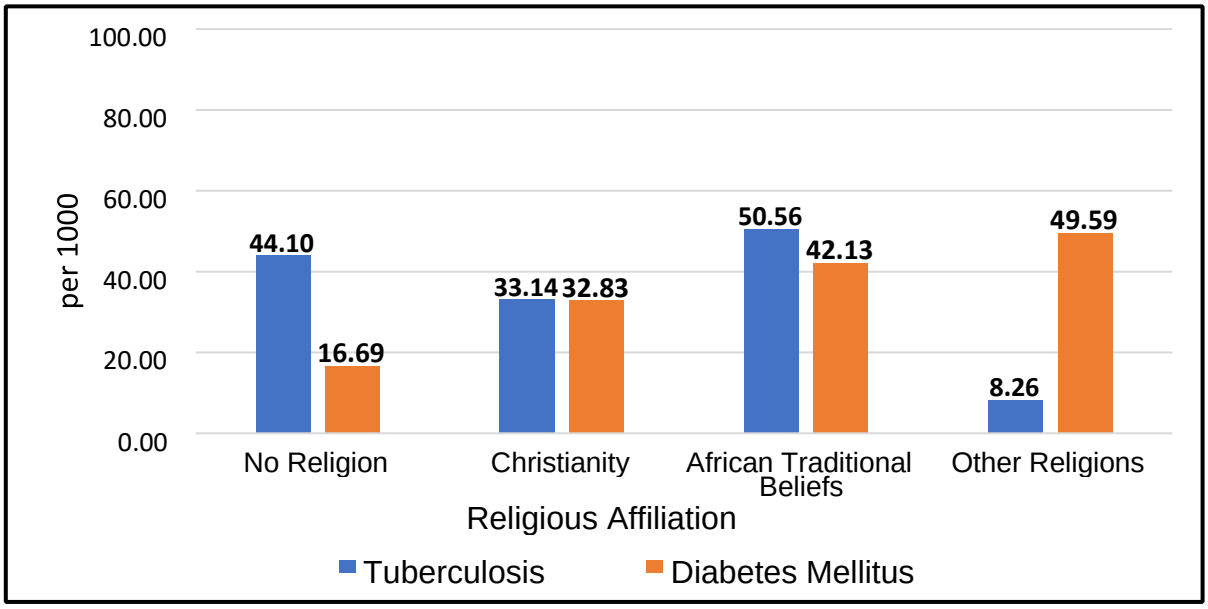


Figure 4.6: *Prevalence of Tuberculosis and Diabetes Mellitus by Religious Affiliation in South Africa*

The figure above shows that individuals with African Traditional Beliefs had the highest prevalence of TB as compared to other religious groups at 50.56 per 1000 population. This was followed by individuals with no religious affiliation at 44.10 per 1000 population, Christianity at 33.14 per 1000 population and Other Religions at 8.26 per 1000 population. However, individuals who affiliate with Other Religions (49.59 per 1000 population) and African Traditional Beliefs (42.13 per 1000 population) had the highest prevalence of Diabetes Mellitus. However, Christians and individuals with no religious affiliation had a prevalence of 32.83 per 1000 population and 16.69 per 1000 population, respectively.

4.5 Tuberculosis and Diabetes Mellitus by select characteristics

4.5.1 Tuberculosis and select characteristics

Table 6 Individuals aged 55-64 years and 25-34 years had the highest proportion of individuals who reported being diagnosed with TB as compared to other age groups at 4.62% and 4.28%, respectively. More males (4.29%) than females (2.99%) were

diagnosed with TB, this was significant at a p= 0.002. Coloured population group had the highest proportion (4.23%) of individuals diagnosed with TB as compared to Black African (3.47%), White racial group (0%) and Asian or Indian (0.55%) this was significant at p= 0.021. 5.88% of divorced or separated individuals reported being diagnosed with TB. Individuals who had no schooling had the highest proportion of people who reported being diagnosed with TB at 4.73% as compared to those with primary, secondary, and tertiary education. Employed (3.60%) and unemployed (3.38%) were diagnosed with TB and this was not significant at p= 0.603.

Individuals who have never exercised or exercised less than once a week had the highest proportion of individuals who were diagnosed with TB at 3.79%; this was significant at a p=0.025. Individuals who consumed alcohol had the highest proportion of individuals diagnosed with TB at 5.37% as compared to those who do not drink alcohol (2.71%); this was significant at a p=0.000. There was a marginal difference between those who consume fruits and nuts (3.49%) and those who do not (3.45%), among those who were diagnosed with TB, this was not significant. Individuals who rated their health as being poor had the highest proportion of individuals diagnosed with TB as compared at 5.92% as compared to those who rated their health as average (4.53%) and good (3.22%). Furthermore, the table revealed that about 5.31% of individuals who consume alcohol were diagnosed with TB.

Table 6: Pearson Chi-squared of Tuberculosis of the economically active in South Africa (Wave5, unweighted), NIDS

Tuberculosis			
Socio-Demographic Characteristics	**Tuberculosis Present**	**Tuberculosis Not Present**	
	(%)	**(%)**	
Religious Affiliation			
No Religion	4.41	95.59	P-Value= 0.048
Christianity	3.31	96.69	
African Traditional Beliefs	5.06	94.94	
Other	0.83	99.17	

Age*			
15-24	2.54	97.46	
25-34	4.28	95.72	
35-44	3.88	96.12	P-Value= 0.006
45-54	3.35	96.65	
55-64	4.62	95.38	
Sex*			
Male	4.29	95.71	
Female	2.99	97.01	P-Value= 0.002
Race*			
African	3.47	96.53	
White	0	100	P-Value= 0.021
Coloured	4.23	95.77	
Asian/Indian	0.55	99.45	
Marital Status			
Never Married	3.32	96.68	
Married/Living Together	3.66	96.34	P-value= 0.276
Divorced/Separated	5.88	94.12	
Widow/Widower	2.92	97.08	
Type of Residence			
Urban	3.82	96.18	P-Value= 0.114
Rural	3.17	96.83	
Education*			
No Schooling	4.73	95.27	
Primary Education	4.59	95.41	
Secondary Education	3.01	96.99	P-Value= 0.001
Tertiary Education	0.76	99.24	
Employment status			
Employed	3.6	96.4	P-Value= 0.603
Not Employed	3.38	96.62	
Exercise Habits*			
Never &/or Less than a Week	3.79	96.21	P-Value= 0.025
Once or Twice a Week	2.29	97.71	
Three or times a Week	2.73	97.27	
Alcohol Habits*			
Yes	5.37	94.63	P-Value= 0.00
No	2.71	97.29	
Fruit and Nut Consumption			

Yes	3.49	96.51	P-Value= 0.923
No	3.45	96.55	
Self-Rated Health*			
Poor	5.92	94.08	P-Value= 0.006
Average	4.53	95.47	
Good	3.22	96.78	

4.5.2 Diabetes Mellitus and select characteristics

Table 7 reveals that 4.96% of individuals who affiliate with Other Religions were diagnosed with Diabetes Mellitus, this is statistically significant ($p<0.05$). More than 9.92% of individuals aged 55-64 were diagnosed with DM followed by individuals aged 45-54 at 7.06% and lastly by individuals aged 15-24 (0.38%), this was statistically significant at a p-value lower than 0.05 Across sex, females (3.80%) were more likely to be diagnosed with DM as compared to males (2.13%) this was statistically significant ($p<0.05$). More than 3% of individuals residing in urban areas were diagnosed with DM as compared to those who live in rural areas, this was not significant at $p=0.085$. Individuals who were employed reported being diagnosed with DM as compared to those who were not employed at 3% and 2.61%, respectively. Individuals who have never exercised or exercised at least once a week reported being diagnosed with DDM(3.48%) as compared to those who exercised three or more times a week (2.45%) and those who exercised once or twice a week (1.98%) and this was significant at $p=0.022$. Furthermore, the table reveals that about 7.32% of individuals who self-reported their health as poor were diagnosed with DM.

Table 7: Diabetes Mellitus of the economically active in South Africa (Wave 5, unweighted), *NIDS*

Diabetes Mellitus			
Socio-Demographic Characteristics	**Diabetes Mellitus Present**	**Diabetes Mellitus Not Present**	
	(%)	**(%)**	
Religious Affiliation*			
No Religion	1.67	98.33	P-Value= 0.030
Christianity	3.28	96.72	
African Traditional Beliefs	4.21	95.79	
Other	4.96	95.04	
Age*			
15-24	0.38	99.62	P-Value= 0.000
25-34	1.53	98.47	
35-44	4.22	95.78	
45-54	7.06	92.94	
55-64	9.92	90.08	
Sex*			
Male	2.13	97.87	P-Value= 0.000
Female	3.8	96.2	
Race*			
African	2.69	97.31	P-Value= 0.000
White	7.95	92.05	
Coloured	5.42	94.58	
Asian/Indian	4.92	95.08	
Marital Status*			
Never Married	1.57	98.43	P-Value= 0.000
Married/Living Together	5.26	94.74	
Divorced/Separated	5.88	94.12	
Widow/Widower	7.6	92.4	
Type of Residence			
Urban	3.55	96.45	P-Value= 0.085
Rural	2.86	97.14	
Education*			
No Schooling	6.86	93.14	P-Value= 0.000
Primary Education	3.97	96.03	
Secondary Education	2.41	97.59	
Tertiary Education	5.3	94.7	
Employment status*			
Employed	4.00	96.00	P-Value= 0.001
Not Employed	2.61	97.39	
Exercise Habits*			
Never &/or Less than a Week	3.48	96.52	P-Value= 0.022
Once or Twice a Week	1.98	98.02	
Three or times a Week	2.54	97.46	
Alcohol Habits			
Yes	3.50	96.50	P-Value= 0.299
No	3.05	96.95	

Fruit and Nut Consumption*			
Yes	3.90	96.10	P-Value= 0.003
No	2.69	97.31	
Self-Rated Health*			
Poor	7.32	92.68	P-Value= 0.000
Average	6.48	93.52	
Good	2.59	97.41	

* *Significance level: α = 0.05*

4.6 Relationship between Tuberculosis and Religious Affiliation among the economically active aged 15-64

Model 1 (Religious Affiliation and Tuberculosis)

Model 1 which only included the main predictor variable and dependent variable revealed that Christianity [**OR**: 0.67 **CI**: 0.6678 – 0.6818] and Other religions [**OR**: 0.06 **CI**: 0.0539 – 0.0638] were less likely to report a TB diagnosis as compared to individuals who had no religious affiliation. Whereas, the odds of a reported TB diagnosis among individuals with African Traditional Beliefs was 1.20 times the odds of individuals with no religious affiliation. The relationships were statistically significant at a p-value of less than 0.05.

Model 2 (Socio-demographic factors and ever experienced Tuberculosis)

After controlling for socio-demographic and economic factors the model reveals that the odds of a reported TB diagnosis among individuals who affiliated with African Traditional Beliefs are 1.2 times that of individuals with no religious affiliation. The model also revealed that the odds of reporting a TB diagnosis were lower amongst Christianity [**OR**: 0.76 **CI**: 0.7514 – 0.07677] and Other religions [**OR**: 0.14 **CI**: 0.1259 – 0.1491] as compared to individuals who had no religious affiliation. This relationship was statistically significant. There was a significant relationship between TB and individuals aged 25-34 [**OR**: 2.22 **CI**: 2.1940 - 2.2399], 35-44 [**OR**: 2.16 **CI**: 2.1324 - 2.1864] and 55-64 [**OR**: 1.51 **CI**: 1.4868 -1.5379]. The odds of TB among individuals

aged 45-54 years were 1.32 times higher as compared to individuals aged 15-19 years, this was statistically significant at a p-value less than 0.05.

There was a 0.64 times lower likelihood of females reporting a TB diagnosis as compared to their counterparts, this relationship was statistically significant at a p-value lower than 0.05 [**CI**: 0.6388 - 0.6486]. The odds of a reported TB diagnosis among Coloured population group were 0.02 times the odds of reporting a TB diagnosis among the Black African population group. The odds of having TB were 0.68 times lower among Asian or Indian population groups as compared to the Black African population group. There was a 0.68 times lower probability for individuals residing in rural areas to report a TB diagnosis as compared to individuals who reside in urban areas, this relationship was significant at a $p< 0.05$.

The odds of a reported TB diagnosis among individuals who were divorced or separated were 1.23 times the odds of reported TB diagnosis among individuals who have never been married. The odds of reporting a diagnosis were 0.80 times lower among individuals who are married, as compared to those who have never been married. The odds of reporting a TB diagnosis among individuals with a primary- (0.78), secondary- (0.50) and tertiary education (0.02) were lower as compared to individuals with no schooling, this relationship was significant. There was a 0.83 times lower likelihood of TB being reported among individuals who are employed as compared to individuals who are not employed.

Model 3 *(Risk Factors- Full Model)*

Model 3 is the full model that assessed the relationship between religious affiliation and TB while controlling for socio-demographic and economic factors and behavioural risk factors. The results revealed that the odds of TB among individuals who affiliate

with Christianity [**OR**: 0.87 **CI**: 0.8527 – 0.8766] and Other Religions [**OR**: 0.13 **CI**: 0.1230 – 0.1457] were lower as compared to individuals with no religious affiliation. There was a statistical relationship between individuals aged 25-64 and reporting of TB as compared to individuals aged 15-19. The odds of reporting a diagnosis of TB among women were 0.74 times the odds of reporting a TB diagnosis among men, this was statistically significant. The odds of TB among Coloured population group were 0.54 times the odds of TB among the Black African population group.

The results show that individuals who reside in rural areas were less likely to report a TB diagnosis as compared to individuals who reside in urban areas [**OR**: 0.67, **CI**: 0.6603 – 0.6709]. The odds of a reported TB diagnosis were 1.64 times higher among divorced or separated individuals as compared to individuals who have never been married. The odds of TB among individuals who were married or living together [**OR**: 0.92 **CI**: 0.6713 – 1.2730] and those who were widowed [**OR**: 0.92 **CI**: 0.6713 – 1.2730] were lower as compared to individuals who have never been married.

There was a 0.83 lower probability for the presence of TB amongst individuals who are employed as compared to individuals who are not employed in the economically active in South Africa. The odds of TB diagnosis being reported among individuals who exercised once or twice a week [**OR**: 0.63 **CI**: 0.6258 – 0.6421] and individuals who exercised three or more times a week [**OR**: 0.86 **CI**: 0.8486– 0.8685] were less likely as compared to individuals who have never exercised or exercise less than once a week, this was statistically significant at a p-value less than 0.05.

Individuals who consumed alcohol were significantly more likely to report a TB diagnosis as compared to individuals who do not consume alcohol [**OR**: 1.41 95%**CI**: 1.3933– 1.4175]. Furthermore, those who smoked cigarettes were statistically

significantly more likely to report a diagnosis of TB as compared to individuals who do not smoke cigarettes [**OR**: 1.56 95%**CI**: 1.5470– 1.5785]. There was a relationship between individuals who did not consume fruits, individuals who rated their health as average or good, and TB.

Model 4 (Second Full Model: Wave 5 Variables)

Model 4 is the second full model that assessed the relationship between religious affiliation and TB while controlling for socio-demographic, economic and behavioural factors from wave 5. The results reveal that the odds of TB being reported among individuals who affiliate with Christianity and Other Religions were 1.79 and 1.00 the odds of TB among individuals with no religious affiliation, respectively. There was a statistical relationship between individuals aged 25-64 and the reporting of TB as compared to individuals aged 15-19.

The odds of reporting a diagnosis of TB among women were 1.43 times the odds of reporting a TB diagnosis among men, this was statistically significant at a p-value less than 0.05. There is 0.20 times lower likelihood of TB being reported among the Coloured population group as compared to the Black African population group, an observable decline from the previous model.

The results show that individuals who reside in rural areas were less likely to report a TB diagnosis as compared to individuals who reside in urban areas [**OR**: 0.86, 95%**CI**: 0.8463– 0.8830]. The odds of a reported TB diagnosis were 0.81 times lower among individuals who were married or living together as compared to individuals who have never married. The odds of TB among individuals who were divorced or separated and those who were widowed had lower odds as compared to individuals who have

never been married [**OR**: 2.32, 95% **CI**: 2.2451 – 2.4020] and [**OR**: 0.88 , 95% **CI**: 0.8334 – 0.9271], respectively.

There was a 1.06 times higher probability for the presence of TB amongst individuals who are employed as compared to individuals who are not employed in among the economically active in South Africa. The odds of TB diagnosis being reported among individuals who exercise once or twice a week [**OR**: 0.13, 95% **CI**: 0.1227 – 0.1411] and individuals who exercise three or more times a week [**OR**: 0.27 , 95% **CI**: 0.2620 – 0.2850] were less likely as compared to individuals who have never exercised or exercise less than once a week, this was statistically significant at a p-value less than 0.05. For every one-unit increase in the number of members in the household, the odds of reporting a TB diagnosis increased by a factor of 1.09. Furthermore, those who smoked cigarettes [**OR**: 4.30, 95% **CI**: 4.1799 – 4.4331] were more likely to report a diagnosis of TB as compared to individuals who do not smoke cigarettes this was statistically significant at a p-value less than 0.05. There was a relationship between individuals who did not consume fruits, individuals who rated their health as average or good, and TB.

Table 8: Binary Logistic Regression on relationship between Religious Affiliation and Tuberculosis among the economically active (Aged 15-64)

Logistic Regression Model: Tuberculosis				
Characteristics	**Model 1: Main Independent variable**	**Model 2: Socio-demographic**	**Model 3: Risk Factors**	**Model 4 and Wave 5**
	OR [95% CI]	*OR 95% CI]]*	*OR [95% CI]]*	
Religious Affiliation				
No Religion	**RC**	**RC**	**RC**	**RC**
Christianity	0.67 [0.6678 - 0.6818] *	0.76 [0.7514 - 0.7677] *	0.87 [0.8577 – 0.8766] *	1.79 [1.7213 - 1.8610] *
African Traditional Beliefs	1.20 [1.1804 - 1.2189] *	1.12 [1.1008 - 1.1371] *	1.18 [1.1597 - 1.1985] *	*
Other Religion	0.06 [0.0539 - 0.0638] *	0.14 [0.1259 - 0.1491] *	0.13 [0.1230 - 0.1457] *	1.00
Age				
15-24	**RC**	**RC**	**RC**	**RC**
25-34		2.22 [2.1940 - 2.2399] *	1.96 [1.9410 - 1.9824] *	2.33 [2.2622 - 2.3966] *
35-44		2.16 [2.1324 - 2.1864] *	1.88 [1.8515 - 1.8992] *	1.79 [1.7306 - 1.8462] *
45-54		1.32 [1.2979 - 1.3373] *	1.09 [1.0704 - 1.1041] *	0.53 [0.5033 - 0.5502] *
55-64		1.51 [1.4868 - 1.5379] *	1.29 [1.2656 - 1.3105] *	1.08 [1.0230 - 1.1359] *
Sex				
Male	**RC**	**RC**	**RC**	**RC**
Female		0.64 [0.6388 - 0.6486] *	0.74 [0.7329 - 0.7460] *	1.43 [1.3942 - 1.4715] *
Race				
Black African	**RC**	**RC**	**RC**	**RC**
White		0.70 [0.6854 - 0.7063] *	1.00	1.00
Coloured		0.02 [0.0201 - 0.0270] *	0.54 [0.5295 - 0.5464] *	0.28 [0.2573 - 0.2976] *
Asian/Indian		0.68 [0.6700 - 0.6802] *	0.02 [0.0189 - 0.0254] *	1.00
Type of Residence				
Urban	**RC**	**RC**	**RC**	**RC**
Rural		0.68 [0.6700 - 0.6802] *	0.67 [0.6603 - 0.6709] *	0.86 [0.8463 - 0.8830] *
Marital Status				
Never Married	**RC**	**RC**	**RC**	**RC**
Married or Living Together		0.80 [0.7956 - 0.8105] *	0.86 [0.8488 - 0.8650] *	0.81 [0.7880 - 0.8292] *

Divorced or Separated		1.23 [1.2062 - 1.2491] *	1.34 [1.3171 - 1.3649] *	2.32 [2.2451 - 2.4020] *
Widow or Widower		2.03 [1.9908 - 2.0692] *	2.07 [2.0343 - 2.1154] *	0.88 [0.8334 - 0.9271] *
Education				
No Schooling	**RC**	**RC**	**RC**	**RC**
Primary Education		0.78 [0.7675 - 0.7895] *	0.82 [0.8117 - 0.8352] *	1.35 [1.2905 - 1.4203] *
Secondary Education		0.50 [0.4933 - 0.5078] *	0.59 [0.5799 - 0.5973] *	1.42 [1.3504 - 1.4853] *
Tertiary Education		0.02 [0.0203 - 0.0262] *	0.03 [0.0274 - 0.0353] *	1.00
Employment status				
Not Employed	**RC**	**RC**	**RC**	**RC**
Employed		0.83 [0.8198 - 0.8330] *	0.83 [0.8263 - 0.8397] *	1.06 [1.0389 - 1.0828] *
Exercise Habits				
Never &/or Less than a Week	**RC**	**RC**	**RC**	**RC**
Once or Twice a Week			0.63 [0.6258 - 0.6421] *****	0.13 [0.1227 - 0.1411] *
Three or times a Week			0.86 [08486 - 0.8685] *	0.27 [0.2620 - 0.2850] *
Alcohol Habits				
No	**RC**	**RC**	**RC**	**RC**
Yes			1.41 [1.3933 - 1.4175] *	**-**
Smoking Status				
No	**RC**	**RC**	**RC**	**RC**
Yes			1.56 [1.5470 - 1.5785] *	4.30 [4.1799 - 4.4331] *
Number of Household Member				
Number of members in Household			1.04 [1.0357 - 1.0380] *	1.09 [1.0899 - 1.0965] *
Fruit and Nut Consumption				
Yes	**RC**	**RC**	**RC**	**RC**
No			1.16 [1.1508 - 1.1686] *	1.33 [1.3035 - 1.3585] *
Self-Rated Health				
Poor	**RC**	**RC**	**RC**	**RC**
Average			0.51 [0.4979 - 0.5148] *	0.73 [0.6979 - 0.7542] *
Good			0.55 [0.5439 - 0.5590] *	0.35 [0.3376 - 0.3599] *

****Significance level**: α = 0.05; **RC**: Reference Category*

4.7 Relationship between Diabetes Mellitus and Religious Affiliation among the economically active aged 15-64

Model 1 *(Religious Affiliation and Diabetes Mellitus)*

Model 1 in table 9 assessed the relationship between the main predictor and dependent variables and the results revealed that individuals who affiliated with Christianity [**OR**: 2.05, 95% **CI**: 2.0171 – 2.0926], African Traditional Beliefs [**OR**: 3.00, 95% **CI**: 2.9252– 3.0670] and Other Religion [**OR:** 3.98, 95% **CI**: 3.8778 – 4.0950] were more likely to report a Tuberculosis diagnosis as compared to individuals with no religious affiliation, this was statistically significant at a p-value less than 0.05.

Model 2 *(Socio-demographic factors and ever experienced Diabetes Mellitus)*

Model 2 which considered the relationship between religious affiliation while controlling socio-demographic and economic factors revealed that individuals who affiliate with Christianity [**OR**: 1.31, 95% **CI**: 1.1046 – 1.1477] and African Traditional Beliefs [**OR**: 1.77, 95% **CI**: 1.7239 – 1.8102] were more likely to report a DM diagnosis as compared to individuals with no religious affiliation, this was statistically significant. There is a statistically significant relationship between age groups (25-64 years) and coloured population group and DM diagnosis. There is a 2.21 times higher likelihood of a reported DM diagnosis among females as compared to males, this was statistically significant at a p-value less than 0.05.

There is a 1.39 times higher likelihood of DM being reported among individuals who reside in rural areas as compared to individuals in urban areas among the economically active. In relation to marital status, individuals who were married or living together [**OR**: 1.36, 95% **CI**: 1.3492 – 1.3791], divorced or separated [**OR**: 0.62 , 95% **CI**: 0.6104 – 0.6350] and widowed [**OR**: 0.79, 95% **CI**: 0.7677 – 0.8034] were less

likely to report a DM diagnosis as compared to individuals who have never been married. In relation to educational attainment, individuals with primary education were less likely to report a DM diagnosis. Whereas, individuals with a secondary education [**OR**: 1.25 , 95% **CI**: 1.2277 – 1.2627] and tertiary education [**OR**: 3.25, 95% **CI**: 3.1817 – 3.3278] were more likely to report a DM diagnosis, the relationships were statistically significant. There is a 0.93 lower probability of a reported DM presence among individuals who are employed as compared to those who are not employed in South Africa.

Model 3 *(Risk Factors and Diabetes Mellitus)*

Model 3 is the full model that assessed the relationship between religious affiliation and DM while controlling for socio-demographic and economic factors and behavioural risk factors. The model revealed that individuals who affiliate with Christianity [**OR**: 1.12, 95% **CI**: 1.0955 – 1.1385] and African traditional beliefs [**OR**: 1.72, 95% **CI**: 1.6734– 1.7578] were more likely to report a Diabetes Mellitus as compared to individuals with no affiliation. Whereas those who affiliated with Other Religions [**OR**: 0.44, 95% **CI**: 0.4234 – 0.4618] were less likely to report a DM diagnosis as compared to individuals with no religious affiliation in South Africa. There was a relationship between individuals aged 25-64 and White and Coloured population groups and the reported presence of Diabetes Mellitus. The odds of a reported DM diagnosis were 1.97 times higher among females as compared to males, this was statistically significant.

The odds of a reported DM diagnosis among individuals who reside in rural areas was 1.42 times the odds of DM among individuals who reside in urban areas this was statistically significant. In relation to marital status the odds of a DM diagnosis were

lower among individuals who were divorced or separated [**OR**: 0.60 , 95% **CI**: 0.5926 – 0.6166], married or living together [**OR**:1.35, 95% **CI**: 1.3319 – 1.3616] and those who were widowed [**OR**: 0.79, 95% **CI**: 0.7761 - 0.8123] as compared to individuals who have never been married.

There is a 0.91 times lower probability of a reported DM diagnosis among individuals with primary education as compared to individuals with no schooling. However, there was a higher likelihood for DM diagnosis to be reported amongst individuals with secondary [**OR**: 1.34, 95% **CI**: 0.8990 – 0.9249] and tertiary education [**OR**: 3.60, 95% **CI**: 3.5135 – 3.678] as compared to individuals with no schooling. The odds of DM among individuals who were employed is 0.95 times the odds of DM among individuals with unemployed in South Africa.

In relation to exercise habits of individuals, individuals who exercised once or twice a week [**OR**: 0.73, 95% **CI**: 0.7187 – 0.7407] or exercised three or more times a week [**OR**: 0.77, 95% **CI**: 0.7582 – 0.7819] were less likely to report a DM diagnosis as compared to individuals who have never exercised in South Africa. There is 1.01 times higher likelihood for DM diagnosis to be reported amongst individuals who consume alcohol as compared to those who do not. There is a 0.80 times lower likelihood of DM diagnosis to be reported amongst individuals who smoke cigarettes.

Model 4 *(Second Full Model: Wave 5 Variables)*

Model 4 is the second full model that assessed the relationship between religious affiliation and DM while controlling for socio-demographic, economic and behavioural factors from wave 5. The model revealed that individuals who affiliate with Christianity [**OR**: 17.86, 95% **CI**: 14.8239 – 21.5229], Other Religions [**OR**: 27.27, 95% **CI**: 22.2401

– 33.4391] and African Traditional Beliefs [**OR**: 6.80, 95% **CI**: 5.5383– 8.3491] were more likely to report a Diabetes Mellitus, as compared to individuals with no religious affiliation in South Africa. There was a relationship between individuals aged 35-54 and Coloured population group and the reported presence of Diabetes Mellitus. The odds of a reported DM diagnosis 2.86 times higher among individuals residing in rural areas as compared to those in urban areas, this was statistically significant at a p-value less than 0.05.

The odds of a DM diagnosis were higher among individuals who were married or living together [**OR**: 1.87, 95% **CI**: 1.7980 – 1.9369], divorced or separated [**OR**: 1.68 , 95% **CI**: 1.5925 –1.7664] and those who were widowed [**OR**: 0.79 , 95% **CI**: 0.7179 – 0.8671] as compared to individuals who have never been married, a noticeable increase from model 4. There is a 0.77 times lower probability of reporting DM diagnosis among individuals with a primary education as compared to individuals with no schooling. However, there is 1.71 times higher likelihood for DM diagnosis to be reported amongst individuals with secondary education as compared to individuals with no schooling. There is a 2.07 higher likelihood for DM diagnosis to be reported among individuals who were employed compared to those who are not employed in South Africa.

Individuals who exercised once or twice a week [**OR**: 0.50, 95% **CI**: 0.4687 – 05341] were less likely to report a DM diagnosis, whereas individuals who exercised three or more times a week [**OR**: 5.13, 95% **CI**: 4.9855 – 5.2883] were more likely to report a DM diagnosis as compared to individuals who have never exercised in South Africa. There is a 1.89 times higher likelihood for DM diagnosis to be reported amongst individuals who consumed fruits and nuts as compared to those who do not, an

increase from model 3. There is a 1.29 higher likelihood for DM diagnosis to be reported amongst individuals who smoke cigarettes.

Table 9: Binary Logistic Regression on relationship between Religious Affiliation and Diabetes Mellitus among the economically active (Aged 15-64)

Logistic Regression Model: Diabetes Mellitus				
Characteristics	**Model 1: Main Independent variable**	**Model 2: Sociodemographic**	**Model 3: Risk Factors**	**Model 4: Wave 5 Variables**
	OR [CI: 95%]	*OR [CI: 95%]*	*OR [CI: 95%]*	*OR [CI: 95%]*
Religious Affiliation				
No Religion	**RC**	**RC**	**RC**	**RC**
Christianity	2.05 [2.0171 - 2.0926] *****	1.13 [1.1046 - 1.1477] *****	1.12 [1.0955 - 1.1385] *****	17.86 [14.8239 - 21.5229] *****
African Traditional Beliefs	3.00 [2.9252 - 3.0670] *****	1.77 [1.7239 - 1.8102] *****	1.72 [1.6734 - 1.7578] *****	6.80 [5.5383 - 8.3491] *****
Other Religion	3.98 [3.8778 - 4.0950] *****	0.49 [0.4686 - 0.5102] *****	0.44 [0.4234 - 0.4618] *****	27.27 [22.2401 - 33.4391] *****
Age				
15-24	**RC**	**RC**	**RC**	**RC**
25-34		3.56 [3.4747 - 3.6406] *****	3.47 [3.3877 - 3.5501] *****	0.47 [0.4393 - 0.4957] *****
35-44		8.67 [8.4745 - 8.8684] *****	8.37 [8.1821 - 8.5641] *****	4.41 [4.2269 - 4.6085] *****
45-54		17.37 [16.9732 - 17.7681] *****	16.32 [15.9447 - 16.6978] *****	3.00 [2.5811 - 3.1561] *****
55-64		30.40 [29.6874 - 31.1197] *****	28.12 [27.4621 - 28.7998] *****	1.06 [0.9737 - 1.521]
Sex				
Male	**RC**	**RC**	**RC**	**RC**
Female		2.21 [2.1851 - 2.2325] *****	1.97 [1.9463 - 1.9932] *****	3.08 [2.9591 - 3.2017] *****
Race				
Black African	**RC**	**RC**	**RC**	**RC**
White		7.83 [7.5470 - 8.1246] *****	8.20 [7.8996 - 8.5195] *****	1.00
Coloured		2.80 [2.7641 - 2.8329] *****	3.08 [3.0371 - 3.1191] *****	6.02 [5.7232 - 6.3223] *****
Asian/Indian		1.54 [1.5055 - 1.5655] *****	1.80 [1.7629 - 1.8379] *****	1.00
Type of Residence				
Urban	**RC**	**RC**	**RC**	**RC**
Rural		1.39 [1.3492 - 1.3791]	1.42 [1.4046 - 1.4318]	2.86 [2.7765 - 2.9539] *****
Marital Status				
Never Married	**RC**	**RC**	**RC**	**RC**
Married or Living Together		1.36 [1.3492 - 1.3791] *****	1.35 [1.3319 - 1.3616] *	1.87 [1.7980 - 1.9369] *

Divorced or Separated		0.62 [0.6104 - 0.6350] *****	0.60 [0.5926 - 0.6166] *	1.68 [1.5925 - 1.7664] *
Widow or Widower		0.79 [0.7677 - 0.8034] *****	0.79 [0.7761 - 0.8123] *	0.79 [0.7179 - 0.8671] *
Education				
No Schooling	**RC**	**RC**	**RC**	**RC**
Primary Education		0.89 [0.8728 - 0.8978] *****	0.91 [0.8990 - 0.9249] *	0.77 [0.7241 - 0.8208] *
Secondary Education		1.25 [1.2277 - 1.2627] *****	1.34 [1.3237 - 1.3623] *****	1.71 [1.6113 - 1.8104] *
Tertiary Education		3.25 [3.1817 - 3.3278] *****	3.60 [3.5135 - 3.6785] *****	1.00
Employment status				
Not Employed	**RC**	**RC**	**RC**	**RC**
Employed		0.93 [0.9221 - 0.9389] *****	0.95 [0.9447 - 0.9621] *****	2.07 [2.0098 - 2.1225] *
Exercise Habits				
Never &/or Less than a Week	**RC**	**RC**	**RC**	**RC**
Once or Twice a Week			0.73 [0.7187 - 0.7407] *	0.50 [0.4687 - 0.5341] *
Three or times a Week			0.77 [0.7582 - 0.7819] *	5.13 [4.9855 - 5.2883] *
Alcohol Habits				
No	**RC**	**RC**	**RC**	**RC**
Yes			1.01 [1.0039 - 1.0259] *	-
Smoking Status				
No	**RC**	**RC**	**RC**	**RC**
Yes			0.80 [0.7860 - 0.8079] *	1.29 [1.2177 - 1.3753] *
Fruit and Nut Consumption				
Yes	**RC**	**RC**	**RC**	**RC**
No			0.90 [0.8879 - 0.9043] *	1.89 [1.8344 - 1.9409] *
Self-Rated Health				
Poor	**RC**	**RC**	**RC**	**RC**
Average			0.77 [0.7597 - 0.7851] *	2.21 [2.0725 - 2.3585] *
Good			0.66 [0.6480 - 0.6673] *	1.23 [1.1597 - 1.2994] *

****Significance level**: α = 0.05; **RC**: Reference Category*

4.8 Testing of Hypothesis

The hypothesis test for this study was used utilizing the full model (model 3) for the analysis:

H0: Religious affiliation is not associated with disease outcomes among the economically active in South Africa

H1: Religious affiliation is associated with disease outcomes among the economically active in South Africa

i. Testing of hypothesis: Tuberculosis

H0: Religious affiliation is not associated with disease outcomes among the economically active in South Africa

H1: Religious affiliation is associated with disease outcomes among the economically active in South Africa

Assumption: Significance level: $\alpha = 0.05$

Given that the p-value was less than 0.05 the study accepts the alternative hypothesis and rejects the null hypothesis and concludes that there is a significant relationship between religion and TB.

ii. Testing of hypothesis: Diabetes Mellitus

H0: Religious affiliation is not associated with disease outcomes among the economically active in South Africa

H1: Religious affiliation is associated with disease outcomes among the economically active in South Africa

Assumption: Significance level: $\alpha = 0.05$

Given that the p-value was greater than 0.05 the study accepts the alternative hypothesis and rejects the null hypothesis and concludes that there is a significant relationship between religion and Diabetes Mellitus.

Chapter Five

Discussion

5.1 Introduction

Over the years South Africa has been experiencing a crippling triple burden of disease that not only affects the population at large but the distribution of already strained resources. DM and TB are the top two leading causes of death among South Africans of all ages. The main objective of the study was to assess the relationship between religious affiliation and disease outcomes among the economically active in South Africa. This study sought to fill the gap of understanding the role that religion plays in influencing disease outcomes among South Africans and how disease varies by the various religious groups in South Africa.

5.2 Religious Affiliation as a determinant of Tuberculosis

Religion is one of the most influential determinants of health outcomes globally, this is based on the influence religion has on the behavioral risk factors of disease. The study found that most of the population affiliated with Christianity, this is not surprising given that in Sub-Saharan Africa 57% of individuals are Christians (Pew, 2010).

Furthermore, the study found that there was a significant relationship between religious affiliation and disease outcomes in South Africa. Several factors can explain this phenomenon observed in this study and these factors relate to the type of lifestyle that an individual may engage in. These factors include exposure to smoking, low physical activity, alcohol consumption and body mass index (BMI). Individual beliefs have been found to supersede religious teachings and texts, a study found that at an individual level that beliefs held by individuals regarding abstinence norms were as

important irrespective of how consistently abstinence norms were reported with a religious group (Luczak, Prescott, Dalais, Raine *et al*, 2014).

This means that the decisions individuals make about the types of activities they engage in could go beyond their religious teachings but could be a result of social teachings or moral beliefs held by society or personal beliefs. The results of the study bring to light how other factors such as education and individual beliefs may have in influencing certain risky behavior apart from religious teachings or identifying with a certain religion.

Education improves cognitive and critical thinking of individuals and it can be assumed that the higher the level of education one has the less likely they are to believe in superstitions and in turn lowering their religiosity (Mocan & Pogorelova 2017). A study by Mocan and Pogorelova (2017) found a negative impact of education on aspects of religiosity such as low frequency of prayer, lower propensity to participate in social and private religious activities (Mocan & Pogorelova 2017). A possible reason for this is that education reduces the susceptibility to believe in things such as lucky charms and superstitions (Mocan & Pogorelova 2017). Similar results were found in Canada where higher levels of education lead to lower levels of religiosity later in life (Hungerman, 2014).

This brings to light the fact that there are other factors other than religious teachings and beliefs that can foster positive or negative behaviors relating to an individual's health or well-being. The findings highlight that over the life-course of any individual that there are various factors can influence an individual and these factors can also interact with each other, thus affecting impacting on their behaviors and beliefs. However, other studies have found that religious affiliation can be a protective factor

against the engagement of risky behaviors. A study conducted in South Africa found that religious affiliation provided a protective effect on tobacco and alcohol use among university students (Amoaten, Setlalentaa & Vdomboso, 2017). Religiosity and the importance of God in one's life play a substantial role in influencing behaviours. Another study found that individuals who viewed their religion as promoting abstinence from alcohol were less likely to be drinkers however among drinkers, religious commitment and abstinence norms lead to a lower likelihood of alcohol disorders among Catholics and Hindus in Mauritius (Luczak, Prescott, Dalais, Raine *et al*, 2014).

5.3 Determinants of Disease: *Tuberculosis*

Age

Previous studies have described age as an important influential determinant of TB globally, particularly in Sub-Saharan Africa. This study found that individuals aged 25-44 years had higher odds of reporting a TB diagnosis as compared to other age groups. A similar study in Addis Ababa, Ethiopia found that 45.8% of individuals aged 28-45 years had TB (Shimeles, Enquselassie, Aseffa, Tilahul *et al*, 2019). Another study conducted in the Free State, South Africa found that there was an increased risk of death among individuals aged 18-49 years who had TB (Henius, Kigozi, Chikobvu, Botha & Dingie van Rensburg, 2017). The same study further found that individuals in the same age group had higher proportions of deaths due to TB as compared to other age groups (Henius *et al*, 2017).

TB age distribution in South Africa is skewed by the HIV epidemic. There is a growing prevalence of HIV and TB comorbidity whereby more than 10% of individuals enrolled for HIV care were living with active TB in 2015 and more than 52% in the same program were on the TB prevention program (UNAIDS, 2019). Furthermore, in South

Africa more than 7 million individuals aged 15 years and older are living with HIV (Avert, 2019). South Africans have a high incidence of TB and HIV co-infection estimated at 520 per 100 000 population (WHO, 2014). Furthermore, TB is the leading cause of death among HIV-infected populations and this issue is further exacerbated by the emergence of drug-resistant TB, and are compounded by Multi-drug-resistant TB (MDR-TB) and the emergence of Extensively drug-resistant TB (XDR TB) (Karim, Churchyard, Karim & Lawn, 2009). Furthermore, in South Africa individuals aged 25-44 engage in behaviours that leave them exposed and susceptible to the development of TB. Thus, reflecting the likelihood of TB among younger age groups in South Africa. The outcome may be attributed to the comprising behavioral risk factors that younger age groups may engage in.

Alcohol Habits

Consumption of alcohol has been described as a risk factor for the development of TB. Alcohol exposure, particularly heavy alcohol consumption, has been described as a risk factor because it has been found to impair immune responses (Soh, Chee, Wang et al, 2017; Pasala, Barr & Messaoudi, 2015). While chronic alcohol exposure has been found to impair immune responses and the control of mycobacterial infection in many experimental and clinical studies. This study found that there was a higher probability of reported TB diagnosis among individuals who drank alcohol as compared to individuals who did not consume alcohol among the economically active in South Africa. Such a finding is not surprising as alcohol consumption in the African region has been described as a major contributor to the TB disease burden over the years (Imtiaz, Shield, Roerecke, Samokhvalor, Lonnroth and Rehm, 2017). The evidence of this study is further substantiated by a meta-analysis study that found

that there was a 35% higher risk of TB among individuals who consumed alcohol versus those who did not consume alcohol (Imitaz *et al*, 2017).

Another meta-analysis study found that there was a very strong association between alcohol disorders such as heavy and prolonged drinking, and the development of the disease, and that TB was a major cause of death among individuals with alcohol use disorder (AUD) (Rehm, Samokhvalov, Neuman, Room *et al*, 2009). Increased risk of alcohol consumption on TB is a result of the influence that alcohol has on the body. Alcohol is a major risk factor for TB because of its detrimental effects on the immune system which makes the immune system weak to fend off any infections or the development of disease (Rehm *et al*, 2009; Happel & Nelson, 2005).

Alcohol dependence does not only foster TB development but also the development of other lung infections such as pneumonia (Happel & Nelson, 2006). In South Africa, as in other countries alcoholism remains an issue for the development of TB and its effects on the functionality of individuals and it also leads to treatment default (Kendall, Theran, Laserson, Wells, Thorpe & Weyer, 2006). The current results of the study are linked to the previous findings as they reveal that being exposed to alcohol consumption or alcoholism results in detrimental effects on the health of individuals.

Smoking Status

Smoking has been identified as a major risk factor for disease and it is also one of the most frequent causes of death globally (Brunet, Davids, Ling, Paradis *et al*, 2010). This study identified a significant relationship between being a smoker and the reported presence of TB among the economically active in South Africa. Similarly, a study conducted in Cape Town, South Africa; found that there was an increased risk of *Mycobacterium* TB infection among smokers (Boon, van Lill, Borgdoff, Verver,

Bateman *et al*, 2005). A study in Hong Kong found that the effects of smoking led to increased TB infections, relapses and default treatments among current smokers, ex-smokers and passive smokers (Leung, Yew, Chan, Chang, Law *et al*, 2015).This is because smoking affects the pulmonary host defenses, and has adverse effects on disease severity, treatment outcome, bacteriological response and relapse in TB (Boon *et al*, 2005; Leung *et al*, 2015).

5.4 Determinants of Disease: Diabetes Mellitus

Age

Previous studies have previously identified individuals who are aged 54-79 years have a higher prevalence of Diabetes as compared to other age groups (Ogurtsova, Fernandes, Huang, Linnekamp *et al*, 2017). Over the years this phenomenon has been changing with a notable increase of Diabetes among the younger population. This means that notions previously held about DM and age have changed and that populations of all ages are at risk of having Diabetes Mellitus. This study discovered that there was a significant relationship between all the age groups and the reported presence of Diabetes Mellitus. A study by Whiting and colleagues (2011) found that at least 35% of adults aged 20-79 years were diagnosed with diabetes in 2011 (Whiting, Guanguata, Weil & Shaw, 2011).

Furthermore, it has been estimated that there will be an estimated 1.6% increase in the prevalence of Diabetes from 8.8% in 2013 to 9.9 in 2035 (Guariguata, Whiting, Hambleton, Beagley, Linnenkamp & Shaw, 2014). Because of the emerging phenomenon in low-income countries, DM has accounted for more than 70% of deaths among populations younger than the age of 60 years, and in high-income countries, DM has accounted for more than 25% of deaths (Ogurtsova *et al*, 2017). Lifestyle

factors have been instrumental in fostering the early development of DM among the economically active in South Africa. South Africans have been reportedly more likely to engage in detrimental behavioral risk factors that expose individuals to be susceptible to diseases such as cardiovascular disease, overweight/obesity, hypertension (van Heerdan, Barnabas, Norris, Micklesfield, van Rooyen & Celum, 2017)).

Smoking Status

The study found that smokers were less likely to report a DM diagnosis. This is a surprising result given that previous studies have found a strong association between DM and smoking. However, different studies have reported conflicting results about the association between smoking and DM (Hou, Qui,Chen, Lu *et al,* 2019). A prospective study conducted in Turkey assessed sex-specific influence of cigarette smoking on the risk of DM and metabolic syndrome (MS) (Onat, Ozhan, Esen, Albayrak *et al,* 2007). The study found that heavy cigarette smoking resulted in a risk reduction for both DM (RR:0.54) and MS (RR: O.69) in all adults (Onat *et al,* 2007). However, this protective effect was mediated by abdominal obesity and independent of obesity and insulin resistance (IR) (Onat *et al*, 2007). Similarly, a study conducted in China among middle aged men found that being a light and heavy smoker was negatively lowered the risk of developing pre-diabetes and type 2 diabetes compared to non-smokers (Wang, Chen, Wang *et al,* 2019). This observation of smoking as a protective effect may be underlined by rise in metabolic rate and diminished appetite in smokers (Onat *et al*, 2007).

A study conducted in Sweden found that smoking was the strongest predictor of death among individuals with Type 2 Diabetes (Rawshan, Rawshan, Franzen, Satttar,

Elliasson *et al*, 2018). Chiolero and colleagues found that not only does smoking lead to Type 2 Diabetes but that heavy smokers have an increased risk of being diagnosed with cardiovascular disease as compared to non-smokers (Chiolero, Faeh, Paccad & Cornuz, 2008; Hou *et al*, 2019). Although there is no association between being a smoker and DM, there could be other factors in South Africa that foster the presence of disease. However, the failure to find a likelihood association with DM does not imply that smoking is not a risk factor for other conditions such as cardiovascular disease, TB, and other lung infections.

Race

The study found that Coloured and White population groups in South Africa had higher odds of reporting a DM diagnosis as compared to other population groups. The result is not a surprise as previous studies have noted that there has been a substantial increase in the prevalence of DM in the Coloured population in Cape Town, South Africa (Eramus, Soita, Hassan, Blanco, Blanco,Vergotine, Kengne & Matsha, 2012 & Restrepo, Kleynhans, Salinas, Abdelbary *et al*, 2018). Furthermore, another study found that White population groups and Coloured populations in South Africa engaged in risky behaviors such as smoking, consumption of alcohol, illicit drugs and unhealthy diets as compared to other racial groups (Vellios & van Walbeek, 2018). A study conducted in South Africa found that there was a high prevalence of Type 2 DM at 17.4% among Coloureds, with an estimated 43.9% of new diagnoses (Restrepo *et al*, 2018). This is due to their high smoking prevalence, alcohol consumption and engagements in illicit drug-use (Reddy, Zuma, Shisana, Kim & Sewpaul, 2018; Peltzer & Pengpid, 2018).

Other significant results of the study are exercise habits and type of residence. The study found that there was a lower likelihood of DM among individuals who exercised once or twice a week, and three or more times a week. The results suggest that exercise habits are a protective factor for the development of Diabetes Mellitus. This result is surprising given that previous studies have found that low levels of exercise foster the development of diseases such as obesity, cardiovascular disease, diabetes and many more (Htet, Bjertness, Sherpa, Kjøllesdal, Oo, Meyer, & Bjertness, 2016). This study also found that the economically active in South Africa had low levels of exercise habits, consumed alcohol and were smokers.

Furthermore, South Africa has been described as one of the unhealthiest countries in the world with obesity on the rise (Kruger, Puoane, Senekal & van der Merwe, 2005). In South Africa, the overweight prevalence has significantly increased from 49.4% in 1980 to 57.8% in 2015 (Chooi, Ding & Magkos, 2018). Furthermore, South Africa has one of the highest prevalence of insufficient physical activity among adults aged 18 years and older, at 38.2% as compared to neighboring countries such as Zimbabwe (28.8%), Mozambique (5.6%) and Botswana (21.7%) (WHO, 2016). This means that the economically active populations are vulnerable to the development of disease.

The study found that individuals residing in rural areas had a higher probability of DM as compared to individuals residing in urban areas. These findings reflect recent literature that describes how individuals residing in rural areas are exposed to unhealthy lifestyle behaviors. For example, a study conducted in rural and urban Uganda and Tanzania, assessed the prevalence and associated risk factors of diabetes. The study found that rural Ugandans had the highest prevalence of diabetes at 16% and pre-diabetes at 26.5% as compared to Tanzania and peri-urban Uganda

(Chiwanga, Njelekela, Diamond, Bajunirwe, Guwatudde[5], Nankya-Mutyoba & Kalyesubula[5] *et al*, 2016). Furthermore, smoking, abdominal obesity and family history of diabetes were significant factors of diabetes in peri-urban and rural Uganda, whereas age as the only risk factor in Tanzania (Chiwanga *et al*, 2016).

From the discussion above, the research confirms that religious affiliations, amongst other factors, have an influence on the likelihood of disease outcomes. Furthermore, the above discussion shows that the proposed theoretical framework and conceptual framework are applicable. The socio-economic factors lead to risk factors that lead to disease outcomes. This reflects that there is no sole factor in the development of disease but that the development of disease is through the interaction of various factors.

Chapter Six

Conclusion and Recommendations

6.1 Conclusions

The study examined the relationship between religious affiliations and disease outcomes (TB and Diabetes Mellitus) among the economically active in South Africa. Other socio-demographic characteristics were also considered in the study. The study found that majority of the economically active in South Africa are Christians. The study further found that there was a significant relationship between religious affiliation and disease outcomes (Tuberculosis and Diabetes Mellitus). Furthermore, the study found that there was a significant association between age, Coloured and smoking status, and Diabetes Mellitus. The study also found there was a significant association between age, alcohol consumption and smoking status, and TB among the economically active in South Africa. The study found that there is a relationship between religious affiliation and disease outcomes in South Africa.

These results show that the health of South Africans is threatened by the types of behaviours that individuals engage in and that these behaviours foster other diseases such as lung cancer, pneumonia, and cardiovascular disease, apart from DM and TB. These results show that regardless of your religious affiliations and beliefs, that your engagement in risky behaviour leaves you susceptible to the acquisition of disease. The study assessed the relationship between religious affiliation and disease outcomes, however, there is no clear indication of the exact influence religion has on health outcomes. It is important to note that the mere measure of religion is not sufficient to assess how religion impacts health outcomes among individuals.

It is then important for government to ensure that efforts of agencies and national sectors are strengthened, such as the National Development Plan (NDP) and consider the implementation of bills such as the Control of Tobacco Products and Electronic Delivery Systems Draft Bill. Government should invest in innovate ways to continue raising public awareness about the effects of smoking and alcohol on health outcomes. These programs should be inclusive of religious agents and leaders, faith-operators of based primary health clinics and the real-life experiences of individuals who have used religion or spirituality to overcome addiction.

6.2 Recommendations

6.2.1 Future Research recommendations

Future research in this study area can assess and compare the type of roles and support that religious leaders provide in terms of raising awareness on the prevention of diseases currently burdening South Africans in rural and urban areas. A retrospective cohort study would bring to light the various roles played by religious leaders and on how they are changing the narrative of disease burden in South Africa. Findings from such a study would be beneficial in understanding the role that religious leaders have played over the years in influencing behaviour change and the promotion of a healthy life.

Future research can also assess the role that rural churches and religious groups play in promoting certain risky behaviours that individuals may engage in. This can be a qualitative study that seeks to understand the perceptions of both followers and religious leaders (various affiliations) and the role that is played in influencing and promoting behavioural risk factors. The appropriate qualitative methods for this study will be in-depth interviews and focus groups. In-depth interviews are appropriate

because participants can share their opinions, personal experiences and understandings without interference or bias from other participants, and new information can emerge that was not highlighted at the start of the study. In-depth interviews will allow for the researchers to understand the role religious leaders believe they play in influencing behavioural risk factors, and the follower's perception of the information they receive.

Furthermore, future quantitative research can assess the differences in behavioural risk factors among Christian denominations in South Africa. The data utilized in this study did not contain other religious variables such as frequency of prayer, attendance of service, involvement in church activities amongst other variables. Therefore, future research can assess the relationship between these variables and an individual's likelihood to engage in certain risky behaviours. In a country where religion plays a substantial role in influencing individuals' involvement in '*unconventional behaviour*' it would be interesting to assess how an individual's involvement in religion or spirituality modifies or influences their involvement in certain risky behaviours.

6.2.2 Programmes and policy recommendations

The findings of this study will also inform the National Health Promotion Policy and Strategy 2015-2019 that provides a framework that is aimed at integrating health promotion into all health programmes in South Africa. This is aimed at allowing and promoting individuals to have increased control over their health and make informed healthy choices. The policy recognises that the health outcomes of an individual are not solely based on individual behavioural outcomes but that health outcomes are a product of social networks, cultural and religious norms, and attitudes (South African National Department of Health, 2015).

In relation to policies and programmes, more effort should be directed towards investing in policies that aim to provide health promotion strategies, and this should be extended to religious institutes. The national strategic plan (NSP) is a guide that defines out plans and objectives pointed towards a future where three diseases (HIV, TB and STIs) are never again a health issue. The NSP is a plan to respond to these infections and to reduce new infections by 63% from 270 000 in 2016 to less than 100 000 by 2020 (NSP, 2017). To accomplish this the NSP for HIV, TB and STIs has made 8 objectives to achieve this, each with clear goals and sub-goals and activities to accomplish them (NSP, 2017). This study adds to Goal 4 that aims to address the social and social structural drivers of HIV, TB and STIs. National Development Plan 2030 aims to eradicate poverty, reduce inequality promote healthy lifestyle and wellbeing and the prevention of diseases among South Africans (NDP, 2012).

Furthermore, policies and programs efforts can be directed towards inclusion of programs for positive behaviour. Previous studies have documented the role that religion, religious activities and religiosity plays in promoting positive behaviours among followers. Religiosity and social support have been found to positively impact health outcomes and social support has been described as a mediator between religion and health (Kahn *et al,* 2002*;* Nieminen *et al*, 2013). Evidence has shown that supportive relationships with activity leaders may explain associations in overall activity involvement and lower engagement in risky behaviour such as substance abuse (Viau, Denault, & Poulin, 2015).

The Sustainable Development Goal 3 (SDGs) aims to ensure that South Africans live a healthy lifestyle and promote well-being for everyone at all ages. This study has

revealed other unnoticeable social structures that could aid promotion of healthy lifestyle behaviours by continuous enlightenment among the working class, leaders in both religion and secular sectors.

6.3 Limitations

6.3.1 Social Desirability

Disclosing your health status is a delicate issue, therefore participants may be reluctant to disclose their disease status, due to fear of stigmatization. Furthermore, participants could be reluctant to fully disclose the types of risky behaviours they engage in. Therefore, respondents may give socially desirable responses that do not necessarily reflect the truth.

6.3.2 Attrition Bias

Longitudinal studies are susceptible to an issue of attrition bias therefore resulting in loss to follow-up as a result of various reasons. These reasons include death, moving away and cannot be located or not wanting to take part in the study anymore.

References

Amina, E., & Kezia, L. (2019). *Gender and the South African labour market: Policy relevant research possibilities using South African tax data* (No. wp-2019-31). World Institute for Development Economic Research (UNU-WIDER)

Attum B, Waheed A, Shamoon Z. Cultural Competence in the Care of Muslim Patients and Their Families. [Updated 2019 Dec 6]. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2019 Jan-. Available from: https://www.ncbi.nlm.nih.gov/books/NBK499933/

Apuke, Oberiri. (2017). Quantitative Research Methods: A Synopsis Approach. Arabian Journal of Business and Management Review (kuwait Chapter). 6. 40-47. 10.12816/0040336.

Bailey, S. L., Ayles, H., Beyers, N., Godfrey-Faussett, P., Muyoyeta, M., du Toit, E., & Floyd, S. (2016). Diabetes mellitus in Zambia and the Western Cape province of South Africa: Prevalence, risk factors, diagnosis, and management. *Diabetes research and clinical practice*, *118*, 1-11.

Bloom, D. E., Canning, D., & Sevilla, J. (2004). The effect of health on economic growth: a production function approach. *World development*, *32*(1), 1-13.

Braveman, P. and Gottlieb, L., 2014. The social determinants of health: it is time to consider the causes of the causes. Public health reports, 129(1_suppl2), pp.19-31.

Brophy, T., Branson, N., Daniels, R.C., Leibbrandt, M., Mlatsheni, C., & Woolard, I., 2018. *National Income Dynamics Study panel user manual*. Release 2018. Version 1. Cape Town: Southern Africa Labour and Development Research Unit.

Caruana, E.J., Roman, M., Hernandez-Sanchez, J & Solli, P. (2015). Longitudinal Studies. Journal of thoracic disease, 7(11), E537 – E540. https://doi.org/10.3978/jssn.2072-1439.2015.1063

Cheadle, A. C., & Dunkel Schetter, C. (2017). Untangling the mechanisms underlying the links between religiousness, spirituality, and better health. *Social and Personality Psychology Compass*, *11*(2), e12299.

Chida, Y., Steptoe, A. & Powell, L. H. (2009). Religiosity/spirituality and mortality. *Psychotherapy and psychosomatics*, *78*(2), 81-90.

Childers, T. B. & Chiou, K. (2016). Socioeconomic Status, Religion and Health in India: An Examination of Chronic and Communicable Diseases. *The Review of Black Political Economy*, *43*(2), 149-164.

Chiwanga, F. S., Njelekela, M. A., Diamond, M. B., Bajunirwe, F., Guwatudde, D., NankyaMutyoba, J., & Volmink, J. (2016). Urban and rural prevalence of diabetes and pre-diabetes and risk factors associated with diabetes in Tanzania and Uganda. *Globalhealth action*, *9*(1), 31440.

Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism*. 2019; 92:6-10. doi: 10.1016/j.metabol.2018.09.005

Eriksson, E., Lindmark, G., Axemo, P., Haddad, B., & Ahlberg, B. M. (2013). Faith, premarital sex and relationships: are church messages in accordance with the perceived realities of the youth? A qualitative study in Kwazulu–Natal, South Africa. *Journal of religion and health*, *52*(2), 454-466.

Eriksson, E., Lindmark, G., Haddad, B., & Axemo, P. (2014). Young people, sexuality, and HIV prevention within Christian faith communities in South Africa: A cross-sectional survey. *Journal of religion and health*, *53*(6), 1662-1675.

Francis, J. M., Myers, B., Nkosi, S., Williams, P. P., Carney, T., Lombard, C., ... & Morojele, N. (2019). The prevalence of religiosity and association between religiosity and alcohol use, other drug use, and risky sexual behaviours among grade 8-10 learners in Western Cape, South Africa. *PloS one*, *14*(2), e0211322.

Garner, R. C. (2000). Safe sects? Dynamic religion and AIDS in South Africa. *The Journal of Modern African Studies*, *38*(1), 41-69.

Gyimah, S. O., Adjei, J. K., & Takyi, B. K. (2012). Religion, contraception, and method choice of married women in Ghana. *Journal of religion and health*, *51*(4), 1359-1374.

Harries, A. D., Rusen, I. D., Chiang, C. Y., Hinderaker, S. G., & Enarson, D. A. (2009). Registering initial defaulters and reporting on their treatment outcomes [Unresolved issues]. *The international journal of tuberculosis and lung disease*, *13*(7), 801-803.

Hemmati, R., Bidel, Z., Nazarzadeh, M., Valadi, M., Berenji, S., Erami, E., ... & Sabour, S. (2018). Religion, Spirituality and Risk of Coronary Heart Disease: A Matched Case–Control Study and Meta-Analysis. *Journal of religion and health*, 1-14.

Htet, A. S., Bjertness, M. B., Sherpa, L. Y., Kjøllesdal, M. K., Oo, W. M., Meyer, H. E., & Bjertness, E. (2016). Urban-rural differences in the prevalence of non-communicable diseases risk factors among 25-74 years old citizens in Yangon Region, Myanmar: a cross sectional study.

Hou, X., Qiu, J., Chen, P., Lu, J., Ma, X., Lu, J., ... & Tian, H. (2016). Cigarette smoking is associated with a lower prevalence of newly diagnosed diabetes screened by OGTT than non-smoking in Chinese men with normal weight. PLoS One, 11(3), e0149234.

Idler, E., Blevins, J., Kiser, M., & Hogue, C. (2017). Religion, a social determinant of mortality? A 10-year follow-up of the Health and Retirement Study. *PloS one*, *12*(12), e0189134.

Imtiaz, S., Shield, K. D., Roerecke, M., Samokhvalov, A. V., Lönnroth, K., & Rehm, J. (2017). Alcohol consumption as a risk factor for tuberculosis: meta-analyses and burden of disease. *European Respiratory Journal*, *50*(1), 1700216.

Karim, S. S. A., Churchyard, G. J., Karim, Q. A., & Lawn, S. D. (2009). HIV infection and tuberculosis in South Africa: an urgent need to escalate the public health response. *the Lancet*, *374*(9693), 921-933.

Kirenga, B. J., Ssengooba, W., Muwonge, C., Nakiyingi, L., Kyaligonza, S., Kasozi, S., ... & Okwera, A. (2015). Tuberculosis risk factors among tuberculosis patients in Kampala, Uganda: implications for tuberculosis control. *BMC public health*, *15*(1), 13.

Klebanoff, M. A., & Snowden, J. M. (2018). Historical (retrospective) cohort studies and other epidemiologic study designs in perinatal research. *American journal of obstetrics and gynecology*, *219*(5), 447-450.

Klingorova, K., & Havlíček, T. (2015). Religion and gender inequality: The status of women in the societies of world religions. *Moravian Geographical Reports*, *23*(2), 2-11.

Koenig, H. G. (2008). Religion and mental health: what should psychiatrists do? *Psychiatric Bulletin*, *32*(6), 201-203.

Koenig, H. G. (2012). Religion, spirituality, and health: The research and clinical implications. *ISRN psychiatry*, *2012*.

Koenig, H.G. (2009). Research on religion, spirituality, and mental health: A review. The Canadian Journal of Psychiatry, 54(5), 283–291

Krause, N., Hill, P. C., Emmons, R., Pargament, K. I., & Ironson, G. (2017). Assessing the relationship between religious involvement and health behaviors. *Health Education & Behavior*, *44*(2), 278-284.

Kruger, H. S., Puoane, T., Senekal, M., & Van Der Merwe, M. T. (2005). Obesity in South Africa: challenges for government and health professionals. *Public health nutrition*, *8*(5), 491500.

Kyu, H. H., Maddison, E. R., Henry, N. J., Mumford, J. E., Barber, R., Shields, C., ... & Wang, H. (2018). The global burden of tuberculosis: results from the Global Burden of Disease Study 2015. *The Lancet Infectious Diseases*, *18*(3), 261-284.

Leibbrandt, M., Woolard, I., & De Villiers, L. (2010). The South African national income dynamics study: design and methodological issues. *Studies in Economics and Econometrics*, *34*(3), 7-24.

Luczak, S. E., Prescott, C. A., Dalais, C., Raine, A., Venables, P. H., & Mednick, S. A. (2014). Religious factors associated with alcohol involvement: Results from the Mauritian Joint Child Health Project. *Drug and alcohol dependence*, *135*, 37-44.

Massyn, N., Peer, N., English, R., Padarath, A., Barron, P., & Day, C. E. (2016). District health barometer 2015/16. Durban: Health systems trust.

Maty, S. C., Everson-Rose, S. A., Haan, M. N., Raghunathan, T. E., & Kaplan, G. A. (2005). Education, income, occupation, and the 34-year incidence (1965–99) of type 2 diabetes in the Alameda County Study. *International journal of epidemiology*, *34*(6), 1274-1281.

Mayosi, B. M., & Benatar, S. R. (2014). Health and health care in South Africa—20 years after Mandela. *New England Journal of Medicine*, *371*(14), 1344-1353.

Mortality and causes of death in South Africa, 2016: Findings from death notification

National Development Plan, 2012, 'National Development Plan 2030. Our Future-make it work

Norman, R., Matzopoulos, R., Groenewald, P., & Bradshaw, D. (2007). The high burden of injuries in South Africa. *Bulletin of the World Health Organization*, *85*, 695-702.

Ogundari, K., & Awokuse, T. (2018). Human capital contribution to economic growth in SubSaharan Africa: Does health status matter more than education? *Economic Analysis and Policy*, *58*, 131-140.

Onat, A., Özhan, H., Esen, A. M., Albayrak, S., Karabulut, A., Can, G., & Hergenç, G. (2007). Prospective epidemiologic evidence of a "protective" effect of smoking on metabolic syndrome and diabetes among Turkish women—without associated overall health benefit. *Atherosclerosis*, *193*(2), 380-388.

Oni, T., Youngblood, E., Boulle, A., McGrath, N., Wilkinson, R. J., & Levitt, N. S. (2015). Patterns of HIV, TB, and non-communicable disease multi-morbidity in peri-urban South Africa-a cross sectional study. *BMC infectious diseases*, *15*(1), 20.

Padela, A. I., Murrar, S., Adviento, B., Liao, C., Hosseinian, Z., Peek, M., & Curlin, F. (2015). Associations between religion-related factors and breast cancer screening among American Muslims. *Journal of immigrant and minority health*, *17*(3), 660-669.

Panel User Manual - Release 2018, **V1:** Brophy, T., Branson, N., Daniels, R.C., Leibbrandt, M., Mlatsheni, C., & Woolard, I., 2018. National Income Dynamics Study Panel User Manual. Release 2018. Version 1. Cape Town: Southern Africa Labour and Development Research Unit.

Park, C. L., Aldwin, C. M., Choun, S., Suresh, D. P., & Bliss, D. (2016). Spiritual peace predicts 5-year mortality in congestive heart failure patients. *Health Psychology*, *35*(3), 203.

Pasala, S., Barr, T., & Messaoudi, I. (2015). Impact of Alcohol Abuse on the Adaptive Immune System. *Alcohol research : current reviews*, *37*(2), 185–197.

Price, A. J., Crampin, A. C., Amberbir, A., Kayuni-Chihana, N., Musicha, C., Tafatatha, T., & Smeeth, L. (2018). Prevalence of obesity, hypertension, and diabetes, and cascade of care in sub-Saharan Africa: a cross-sectional, population-based study in rural and urban Malawi. *The lancet Diabetes & endocrinology*, *6*(3), 208-222.

Qadri, F. S., & Waheed, A. (2014). Human capital and economic growth: A macroeconomic model for Pakistan. *Economic Modelling*, *42*, 66-76.

Rasouli, B., Grill, V., Midthjell, K., Ahlbom, A., Andersson, T., & Carlsson, S. (2013). Smoking Is Associated With Reduced Risk of Autoimmune Diabetes in Adults Contrasting With Increased Risk in Overweight Men With Type 2 Diabetes. *Diabetes Care*, *36*, 604-610.

Rehm, J., Samokhvalov, A. V., Neuman, M. G., Room, R., Parry, C., Lönnroth, K., ... & Popova, S. (2009). The association between alcohol use, alcohol use disorders and tuberculosis (TB). A systematic review. *BMC public health*, *9*(1), 450.

Setia M. S. (2016). Methodology Series Module 1: Cohort Studies. *Indian journal of dermatology*, *61*(1), 21–25. https://doi.org/10.4103/0019-5154.174011

Shamu, S., Kuwanda, L., Farirai, T., Guloba, G., Slabbert, J., & Nkhwashu, N. (2019). Study on knowledge about associated factors of Tuberculosis (TB) and TB/HIV co-infection among young adults in two districts of South Africa. *PloS one*, *14*(6), e0217836.

Skinner, D., & Claassens, M. (2016). It's complicated: why do tuberculosis patients not initiate or stay adherent to treatment? A qualitative study from South Africa. *BMC infectious diseases*, *16*(1), 712.

Solar, O., & Irwin, A. (2007). Towards a conceptual framework for analysis and action on the social determinants of health. *Geneva: WHO Commission on Social Determinants of Health*.

Soh, A. Z., Chee, C. B. E., Wang, Y. T., Yuan, J. M., & Koh, W. P. (2017). Alcohol drinking and cigarette smoking in relation to risk of active tuberculosis: prospective cohort study. *BMJ open respiratory research*, *4*(1), e000247.

South Africa. Department of Health. National health promotion policy and strategy, 2015-2019. Pretoria: Department of Health, 2015.

Southern Africa Labour and Development Research Unit. National Income Dynamics Study (NIDS) Wave 1, 2008 [dataset]. Version 6.1. Cape Town: Southern Africa Labour and Development Research Unit [producer], 2016. Cape Town: DataFirst [distributor], 2016.

Stats SA (Statistics South Africa), 2014. Mortality and causes of death in South Africa, 2011: findings from death notification form. Pretoria: Statistics South Africa.

Stokes A, Berry KM, Mchiza Z, Parker W-a, Labadarios D, Chola L, *et al*. (2017) Prevalence and unmet need for diabetes care across the care continuum in a national sample of South African adults: Evidence from the SANHANES-1, 2011-2012. PLoS ONE 12(10): e0184264. https://doi.org/10.1371/journal.pone.0184264

Viau, A., Denault, A. S., & Poulin, F. (2015). Organized activities during high school and adjustment one year post high school: Identifying social mediators. Journal of Youth and Adolescence, 44, 1638e1651. Viner, R. M., Ozer, E. M., Denny, S., Marmot, M., Resnick

Vellios, N. G., & Van Walbeek, C. P. (2018). Self-reported alcohol use and binge drinking in South Africa: Evidence from the National Income Dynamics Study, 2014-2015. *South African Medical Journal*, *108*(1), 33-39.

Wang, S., Chen, J., Wang, Y., Yang, Y., Zhang, D., Liu, C., & Wang, K. (2019). Cigarette Smoking Is Negatively Associated with the Prevalence of Type 2 Diabetes in Middle-Aged Men with Normal Weight but Positively Associated with Stroke in Men. *Journal of diabetes research*, *2019*.

Wave 1: Southern Africa Labour and Development Research Unit. National Income Dynamics

Study (NIDS) Wave 1, 2008 [dataset]. Version 7.0.0. Pretoria: SA Presidency [funding agency]. Cape Town: Southern Africa Labour and Development Research Unit [implementer], 2018. Cape Town: DataFirst [distributor], 2018. https://doi.org/10.25828/e7w9-m033

Wave 2: Southern Africa Labour and Development Research Unit. National Income Dynamics Study Wave 2, 2010-2011 [dataset]. Version 4.0.0. Pretoria: SA Presidency [funding agency]. Cape Town: Southern Africa Labour and Development Research Unit [implementer], 2018. Cape Town: DataFirst [distributor], 2018. https://doi.org/10.25828/j1h1-5m16

Wave 3: Southern Africa Labour and Development Research Unit. National Income Dynamics Study Wave 3, 2012 [dataset]. Version 3.0.0. Pretoria: SA Presidency [funding agency]. Cape

Town: Southern Africa Labour and Development Research Unit [implementer], 2018. Cape Town: DataFirst [distributor], 2018. https://doi.org/10.25828/7pgq-q106

Wave 4: Southern Africa Labour and Development Research Unit. National Income Dynamics Study 2014-2015, Wave 4 [dataset]. Version 2.0.0. Pretoria: Department of Planning, Monitoring, and Evaluation [funding agency]. Cape Town: Southern Africa Labour and Development Research Unit [implementer], 2018. Cape Town: DataFirst [distributor], 2018. https://doi.org/10.25828/f4ws-8a78

Wave 5: Southern Africa Labour and Development Research Unit. National Income Dynamics Study 2017, Wave 5 [dataset]. Version 1.0.0 Pretoria: Department of Planning, Monitoring, and Evaluation [funding agency]. Cape Town: Southern Africa Labour and Development Research Unit [implementer], 2018. Cape Town: DataFirst [distributor], 2018. https://doi.org/10.25828/fw3h-v708

Weimann, A., Dai, D., & Oni, T. (2016). A cross-sectional and spatial analysis of the prevalence of multimorbidity and its association with socioeconomic disadvantage in South Africa: A comparison between 2008 and 2012. *Social Science & Medicine*, *163*, 144-156.

Wondemagegn, A. T., Bizuayehu, H. M., Abie, D. D., Ayalneh, G. M., Tiruye, T. Y., & Tessema, M. T. (2017). Undiagnosed Diabetes Mellitus and Related Factors in East Gojjam (NW Ethiopia) in 2016: A Community-Based Study. *Journal of public health research*, *6*(1), 834. https://doi.org/10.4081/jphr.2017.834

Workneh, M. H., Bjune, G. A., & Yimer, S. A. (2017). Prevalence and associated factors of tuberculosis and diabetes mellitus comorbidity: a systematic review. *PloS one*, *12*(4), e0175925.

Zimmer, Z., Jagger, C., Chiu, C. T., Ofstedal, M. B., Rojo, F., & Saito, Y. (2016). Spirituality, religiosity, aging and health in global perspective: A review. *SSM-population health*, *2*, 373381.

Zinnbauer, B. J., Pargament, K. I., Cole, B., Rye, M. S., Butfer, E. M., Belavich, T. G., ... & Kadar, J. L. (2015). Religion and spirituality: Unfuzzying the fuzzy. In *Sociology of religion* (pp. 29-34). Routledge.