THE EFFECTS OF DIFFERENT HOUSING AND BASIC SERVICES ON DISEASE

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ABSTRACT

The prevalence and increase of non-communicable diseases (NCDs), including cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases, are a major threat to human health and development globally.

In 2016, 456 612 citizens have died due to different types of causes of deaths and deaths due to NCDs in South Africa are very high for adults from the ages of 45 and above 90 years while deaths due to communicable diseases are high (77,1%) for neonates between the ages 0-1 year. It was reported that deaths due to NCDs peaked from ages 45-49 years at 44.5% to 84.2% for people between the ages 80-84 years and dropped to 80.6% for adults aged 90 years and above. The environment plays a critical role in the development of communicable diseases. General sanitation, temperature, air pollution and water quality are among the factors that influence all stages in the chain of infection.

The purpose of the study is to analyse the effects of housing and basic services on communicable and non-communicable diseases. This study will then identify risk factors such as the environment, which means the materials used to build the house and other basic services, such as sanitation, which have an effect on the spread of communicable and non-communicable diseases.

Secondary data from the Living Conditions Survey 2014-2015, that was conducted by Statistics South Africa (Stats SA), will be used for analysis. Research subjects will be respondents in all nine provinces of South Africa in 2014/15 who were sampled and agreed to participate in the survey. This includes all respondents who are suffering from chronic illnesses and children below the age of 5 years who have suffered from communicable diseases. The significant difference between the expected and observed frequencies in one or more categories will be determined by using chi-square. A positive significant relationship was observed between fever and refuse collection were the chi-square 50.300 and the p-value is 0.000. Findings of logistic regression indicate that there is positive significant relationship with substandard housing material as compared with the standard housing material.

Keywords and phrases: Housing, basic services, disease, chi-square and binary logistics regression

OPSOMMING

Die voorkoms van en toename in nie-oordraagbare siektes (VDS'e), insluitende kardiovaskulêre siektes, diabetes, kanker en chroniese respiratoriese siektes is 'n groot bedreiging vir menslike gesondheid en ontwikkeling wêreldwyd.

Gedurende 2016 is 456 612 mense dood. VDS verwante sterftes in Suid-Afrika was baie hoog vir volwassenese vanaf die ouderdom van 45 sowel as vir mense bo 90 jaar. Gedurende dieselfde tydperk was sterftes as gevolg van oordraagbare siektese hoog (77.1%) onder pasgeborenes tussen die ouderomme van 0 en 1 jaar. Daar is gerapporteer dat sterftes as gevolg van VDS'e vir mense tussen 45 en 49 jaar 'n piek bereik by 44.5%, en dit styg tot 84.2% vir mense tussen die ouderdomme 80-84 jaar, en daal tot 80,6% onder volwassenes 90 jaar en ouer . Die omgewing speel 'n kritieke rol in die voorkoms van oordraagbare siektes. Algemene sanitasie, temperatuur, lugbesoedeling en watergehalte is sommige van die faktore wat alle stadiums in die infeksieketting beïnvloed.

Die doel van die studie is om die effek van behuisings- en basiese dienste op oordraagbare en nie-oordraagbare siektes te analiseer. Die studie sal dan risikofaktore identifiseer byvoorbeeld omgewings faktore soos die gebruik van materiale om huise te bou of basiese dienste soos sanitasie wat 'n uitwerking kan hê op verspeiding van oordraagbare en nie-oordraagbare siektes.

 Sekondêre data van die *Living Condition Survey 2014-2015*, wat deur Statistieke Suid-Afrika uitgevoer is, sal vir analise gebruik word. Die proefpersone vir hierdie navorsing is respondente van al die nege provinsies van Suid-Afrika watin 2014/15 vir die steekproef gekies is en wat ingestem het om aan die opname deel te neem. Dit het ingesluit alle respondente wat aan chroniese siektes ly en kinders onder die ouderdom van 5 jaar wat aan oordraagbare siektes ly. Die betekenisvolle verskil tussen die verwagte en waargenome frekwensies in een of meer kategorieë sal bepaal word deur die gebruik van chi-kwadraat. 'n Positiewe verhouding is waargeneem tussen koors en vullisversameling, waar die chi-kwadraant 50.300 was en die p-waarde is 0.000. Bevindinge van logistieke regressie dui daarop dat daar 'n beduidende positiewe verwantskap bestaan vir substandaard behuisingsmateriaal in vergelyking met standaard behuisingsmateriaal.

TREFWOORDE EN FRASES: BEHUISING, BASIESE DIENSTE, SIEKTES, CHI-KWADRAAT EN BINÊRE LOGISTIEKE REGRESSIE**ACKNOWLEDGEMENTS**

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CHAPTER 1: INTRODUCTION

1.1. BACKGROUND

Epidemiologists often investigate the health status of a population by starting with information that is routinely collected. Vital events such as births, marriages, divorces and deaths are information that is routinely collected in most of the countries (World Health Organisation, 2006). In many high-income countries the fact and cause of death are recorded on a standard death certificate, which also carries information on age, sex, and place of residence. The International Statistical Classification of Diseases and Related Health Problems (ICD) provides guidelines on classifying deaths (World Health Organisation, 2006). Assessment of death rates by cause has been an essential component of tracking progress in global health (GBD Colloborators, 2017). Epidemiologists rely heavily on death statistics for assessing the burden of disease, as well as for tracking changes in diseases over time. Death rates are particularly useful for investigating diseases with a high case-fatality (World Health Organisation, 2006) .

Globally in 2016, the prevalence of communicable diseases was 4 943 086 000, diarrhoea and lower respiratory disease was 434 596 000 (GDB Colloborators, 2017). The prevalence of and increase in non-communicable diseases (NCDs), including cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases, are a major threat to human health and development globally (Rath et al., 2015; Sishana et al., 2013). Currently non-communicable disease (NCDs) represent 43% of the global burden of disease, which indicates that an emerging epidemic of deaths as a result of NCDs and that the number are predicted to rise to between 60% and 70% of all deaths in 2020 (Maimela et al., 2016) Although the perception is that NCDs primarily affect wealthy nations, nearly 80% of NCDs deaths occur in low- and middle-income countries (Boda, 2013) Some diseases are caused solely by genetic factors; most result from an interaction between genetic and environmental factors. Diabetes, for example, has both genetic and environmental components. The environmental disease burden is much higher in low-income countries than in high-income countries, although in the case of certain NCDs, such as cardiovascular diseases and cancers, the per-capita disease burden is larger in high-income countries (World Health Organisation, 2006)

Evidence shows that the burden of NCDs in South Africa has increased over the past 15 years

(Maimela et al., 2016). In 2016, 456 612 citizens have died due to different types of causes of and deaths due to NCDs in South Africa is very high for adults from the ages 45 and above 90 years, while deaths due to communicable diseases are high (77.1%) among infants between the ages 0-1 yr. It was reported that deaths due to NCDs peaked from ages 45-49 years at 44.5% to 84.2% for people between the ages 80-84 years and dropped to 80.6% for adults between the ages 90 years and above (Statistics South Africa, 2018). The infant death rate from environmental causes is 12 times higher in low-income when compared to high-income countries, reflecting the human health gain that could be achieved by supporting healthy environments(World Healh Organisation, 2006). Most regions of Europe have observed a seasonal pattern of mortality with peaks during the winter months described as excess winter mortality (Vasconcelos et al., 2011). South Africa has also observed a seasonal pattern of mortality with peaks during the winter months.

The environment thus plays a critical role in the development of communicable diseases and NCDs. Sanitation, temperature, air pollution and water quality are among the factors that influence all stages in the chain of infection (World Health Organisation, 2006; Sheuya, 2007; Govender, 2011). The urban environment in the developing world increasingly offers conditions that trigger water- and vector borne diseases (Saravanan et al., 2016). Vector borne diseases (VBDs) and waterborne diseases (WBDs) in this study comprises all types of short duration fevers, such as cough, influenza, fever and diarrhoea. Airborne diseases (ABDs) in this study includes influenza and coughs for children below the age of 5 years.

Housing and the built environment have a profound impact on human health (World Health Organisation, 2010; Jones, 2010; McCarthy et al.,1985). Substandard housing is a major public health issue (Kreiger & Higgins, 2002). Features of substandard or deficient housing include non-existence of safe drinking water, sanitation and safe food preparation and storage; lack of housing and overcrowding; worse quality of ambient air; exposure to harmful building materials; and lack of electricity which are all identified as contributing to the spread of infectious diseases and chronic disease. Nowadays, public health officials are beginning to notice that poor city design is a large contributing factor (Un Habitat, 2003; Bonnefoy, 2007; Sheuya et al., 2007; Yadav et al., 2016; Fink et al., 2012; Kreiger & Higgins, 2002; Department of Science and Technology et al,n.d).

The absence of these housing necessities is seen as the defining characteristic of slums: lack of basic services; illegal or poor building structures; overcrowding and high density; inadequate access to sanitation and other infrastructure; inadequate access to safe water; hazardous locations; insecure tenure; and poverty which lead to social exclusion (Un Habitat, 2003; Sheuyaet al., 2007; Govender

et al., 2011). Current evidence shows that the home, despite highly developed technologies, materials and construction styles, remains a major cause for ill health through exposure to many factors, including (but not limited to): home injuries, chemical substances, mould and damp, noise, radon, pests and infestations, poor access to water and sanitation, proximity to pollution sources, or flooding, and inadequate protection from extreme weather (World Health Organisation, 2010; Kreiger &Higgins, 2002). Lack of electricity exposes the resident to polluted air because residents use braziers to cook their food. Braziers expose the residents to excessive smoke that pollute the air around them. Air pollution is a major cause of morbidity and mortality in the developing world and can have both indoor and outdoor sources (Moore et al., 2003).

Adequate shelter has been defined as "having more than a roof over one's head, it means adequate privacy, adequate space, physical accessibility, adequate security of tenure, structural stability and durability, adequate lighting, heating and ventilation, adequate basic infrastructure such as water, sanitation, and waste management facilities, suitable environmental quality and health factors and adequate and accessible location with regard to work and basic facilities, all of which should be available at an affordable cost (Yadav et al., 2016; Bonnefoy, 2007; Un Habitant, 2003; Sheuya et al., 2007). Housing "is the physical structure used or intended to be used, for human habitation". According to World Health Organisation (WHO), housing encompasses four inter-related aspects, namely a house, a home, a neighbourhood and a community (World Health Organisation, 2010; Sheuya et al., 2007). The quality of housing conditions, the materials used to build it and the location where it is build, plays a key role in the well-being of the residents (Kreiger & Higgins, 2002).

A communicable (or infectious) disease is one "caused by transmission of a specific pathogenic agent to a susceptible host". Infectious agents may be transmitted to humans either directly, from other infected humans or animals, or indirectly, through vectors, airborne particles or vehicles,9World Health Organisation, 2006) , they include amongst others, diseases such as diarrhoea, tuberculosis (TB) and pneumonia (Statistics Sout Africa, 2018). TB is an infectious bacterial disease caused by Mycobacterium TB (World Health Organisation,2016). NCDs are medical conditions or diseases that are non-contagious chronic diseases that are generally slow in progression; usually lasting for a long period of time; or even persisting for an individual's entire life and include, amongst others, cancer, diabetes and heart diseases (Statistics South Africa, 2018) and sanitation refers to the principles and practices relating to the collection, removal or disposal of human excreta, household waste water and refuse as they impact upon people and the environment (Department of Sanitation and Water, 2016; Statistics South Africa, 2016; Inner City Fund, 2016; Statistics South Africa, 2017).

There is a growing recognition that the built environment may profoundly influence the physical and mental health of inhabitants (Gan et al., 2017; Naicker et al., 2017). Housing all over the world has remained an interdependent phenomenon that affects every facet of mankind, with its importance being so pronounced that it impacts on the social, physical and mental well-being of man, irrespective of his socio-economic status, colour or creed (Marutlulle, 2017). Environmental and public health issues led to the development of city planning, yet the present lack of interdisciplinary communication limits the attainment of shared goals (Jones, 2012). Although public health and urban planning emerged with the common goal of preventing urban outbreaks of infectious disease, there is little overlap between the fields today. The separation of the fields has contributed to uncoordinated efforts to address the health of urban populations and a general failure to recognise the links between, for example, the built environment and health disparities facing low-income populations and people of colour (Cornburn, 2004).

The National Development Plan (NDP) adopted by South Africa envisions a life expectancy of at least 70 years, a largely Human Immunodeficiency Virus (HIV)-free population below 20 years, 28% reduction in non-communicable diseases, infant mortality rate less than 20 per 1000 live births, an under-five mortality rate less than 30 per 1000 live births, maternal mortality rate less than 100 per 100 000 live births and combating the tuberculosis and human immunodeficiency virus/acquired immunodeficiency syndrome (HIV/AIDS) epidemics by 2030 (Statistics South Africa, 2018). The National Development Plan (NDP) 2030 recognises collaboration across government sectors and it encourages human settlements, urban planning and urban design to build or design houses that take into account their impact on health (National Planning Commission, 2011).

1.2. RESEARCH PROBLEM

The research questions for this study are:

- How do houses that were built with substandard building materials have an impact on the health of the occupants?
- Are there any measures that can be taken to prevent people to stay in houses that were built with substandard building materials?
- How can the government put in place strict measures for people who are staying in places/areas that do not have basic services such as sanitation and water?
- Does lack of basic services such as sanitation and water have an impact on the health of individuals?

1.3. AIMS AND OBJECTIVES

The aim of this study is to analyse the effects of different housing and basic services on communicable diseases and NCDs. This study identifies risk factors such as the environment, which means the materials used to build the house and other basic services, such as sanitation, that will have an effect on communicable diseases and NCDs. The basic household services and housing are associated with the prevalence of both communicable disease and NCDs.

The objectives of this study is to profile the health status of household members in the country, to highlight selected NCDs prevalent among the elderly and selected communicable diseases prevalent among infants. The study aims to establish if there is a relationship between housing, basic services and diseases. Furthermore it seeks to find out if there is any association between communicable diseases and NCDs and the type of housing and basic service in South Africa, and to identify who are the most vulnerable (if any) amongst the people living in the different housing types and receiving basic service offered.

Studies have linked housing-related factors and health (Naicker et al., 2017; Somrongthong et al., 2014) however, the existing published research is minimal (Govender, 2011). Most of the studies in the country are collected over a small area or municipal level in one province and they do not give a clear picture of the spread and severity of both communicable diseases and NCDs in the country. The results of the conducted studies cannot be generalised to the overall population because the total number of people who participated is not a replica of the total number people who stay in South Africa. The limitation of this study is that it only analyses information of citizens who were told by a health practitioner that they suffer from chronic illnesses, whereas we do have people in the country who do not go to clinics/hospitals when they are sick.

Secondary data will be used where both descriptive and inferential statistics will be used to analyse data. Living Condition Survey (LCS) 2014/15 data will be used for analyses and the SPSS software program will be used. The significant difference between the expected and observed frequencies in one or more categories will be determined by using chi-square. Binary logistic regression will be used to see the relationship between the dependent variables, which are diseases, and the independent variables, which are the types of houses and the materials used to build those types of houses; and the type of basic services available. Frequencies and proportions will be provided in the form of tables and graphs.

CHAPTER 2: LITERATURE REVIEW

2.1 INTRODUCTION

South Africa, just like any other country, is experiencing a population explosion and migration where we have people moving from rural to urban areas in search for better jobs. According to the Community Survey 2016, since October 2011 to March 2016, more than a million residents have moved from their place of initial residence to their current place for reasons ranging from the need for better municipal services, or starting a business, to looking for paid jobs or a new dwelling for the household since. A total of 424 141 people migrated between October 2011 to March 2016 in search of paid work and 215 317 of them migrated to metropolitan areas (Statistics South Africa , 2016). Urbanisation has led to citizens not being provided with proper housing and a backlog of houses in the country (Meyer, 2014). Citizens have resorted to building their own houses informally. They build small houses using substandard materials, and because there was no planning there are no basic services like water, electricity and sanitation. In some instances we find that people are staying in houses that are very old and needs renovations but they are not renovated. Most of the traditional houses are dilapidated and do not have electricity, running water and proper sanitation.

Urbanisation is not the only factor that has led to a backlog of houses in this country. The new government has inherited the inequality of owning houses from the Apartheid government (Govender, 2011). During the Apartheid era, the erstwhile government put in place different policies that discriminated against other races. The policies disallowed the black population to own land and regulated where black South Africans can live or occupy land for residential purposes. Black South Africans were restricted and it led to overcrowding and slum areas. The Group Areas Act 41 of 1950 and the Group Areas Act 36 of 1966 were put in place for the control of the acquisition of immovable property and the occupation of land (Kloppers, 2014). The Post-apartheid government came up with policies that addressed these injustices brought about by the racially based policies and came up with policies such as the Reconstruction and Development Plan (RDP) and the White Paper on Land Policy, 1997. The abolition of the Group Areas Act has led to citizens moving nearer to their place of work and building substandard houses, which in turn has led to overcrowding and slum areas where municipalities are unable to provide running water and proper sanitations to the citizens.

In developed countries, 80-90% of the day is spent in built environments and most of this is in the home (Meyer, 2014). Some housewives spend most of their time indoors cleaning their houses using toxic cleaning materials or inhaling dust that can have an impact on their health or using cooking fuels that can have adverse health consequences. Therefore, exposures and health risks in this private

setting are of crucial relevance (World Health Organisation, 2010). It is of utmost importance for countries to build houses that are healthy so as to protect the health of their citizens. A healthy society is a productive asset for any economy (Rath et al., 2015) where the government will rather use their fiscal or reserves to come up with health promotion strategies that are effective in preventing communicable diseases and NCDs than to buy medicines or pay for medical consultations (National Department of Health, 2014).

For many years, the housing environment has been acknowledged as one of the main settings that affect human health (Breysse et al., 2004, Naicker et al., 2017; Baker et al., 2016). Living and housing conditions are the basis of many factors influencing residential health (Bonnefoy, 2007; Kreiger & Higgings, 2002). Housing conditions may dictate exposure to smoke, chemicals or toxins and could also directly influence mental health or inhibit adequate social interaction (Baker et al., 2017). Chronic diseases, such as heart disease, cancer, and stroke, account for 70% of annual deaths in the United States (Jones, 2012).

Adequate housing is a basic human requirement, and how to improve housing conditions and prevent housing related health problems is an important public health issue (Gan et al., 2017). Although several government health plans are run to prevent and cure these diseases, there is still an urgent requirement to implement them (Yadav et al., 2016). Housing structure is one factor that affects indoor temperature and this has an impact on human health. A cold house may affect health by increasing blood pressure, reducing resistance to infections associated with colds, and increasing the risk of influenza, asthma, seasonal mortality and heart attacks(Boomsma et al., 2017; Evans et al., 2000). Globally, around three billion people use solid fuel like wood, animal dung, crop waste and coal for cooking and keeping their houses warm. These fuels have low combustion efficiency and high polluting emissions. Biomass smoke contains many harmful components, including suspended particulate matter, nitrogen oxides, carbon monoxide, etc. Regular exposure to these air pollutants can cause serious health problems (Signh et al., 2018).

The use of substandard building materials, such as poor building materials used for the walls, floors and roofs of the houses increases the risk of chronic diseases such as coughing, TB, acute respiratory infection (ARI), and asthma. Occupants of the house will be inhaling environment contaminants (Yadav et al., 2016; Sheuya etal., 2007) Overcrowding (O'Neil, 2000; Curtis et al., 2010) and lack of basic services such as sanitation, electricity and water increase the risk of NCDs (Gupta et al., 2004; Roushdy et al., 2012). Inadequate access to safe drinking water is also associated to acute infectious diarrhoea and non-diarrhoeal diseases such as cancer and foetal abnormalities (Hunter, 2010; Curtis

et al., 2010; Roushdy et al., 2012). Overcrowding, dampness and moulds are generally considered as a threat to mental health, and infectious diseases such as TB, asthma, and scabies are also associated with overcrowding (O'Neil, 2000; Kreiger & Higgins, 2002). Inadequate sanitation facilities and substandard housing condition increase the risk of water-borne diseases such as diarrhoea, cholera and hepatitis (Yadav et al., 2016)

Diarrhoea and acute respiratory infections (ARI), which both impair growth, remain the leading cause of death and often co-occur in children under the age of 5 years. The comorbidity of the two health conditions may be as a result of shared risk factors at child level, or as a result of shared extrinsic factors. For instance, diarrhoea and ARI may both share age as a child-dependent risk factor or poor sanitation and crowding as the environmental risk factors (Kinyoki et al., 2017).

The vast majority of studies of housing quality, mostly in the public health and environmental health literatures, have focused on links between specific housing characteristics and health conditions (Curtis et al., 2010). In children, the environment's contribution to infectious and parasitic diseases, neonatal and nutritional diseases and injuries is very prominent. In older adults, the fraction of NCDs caused by the environment becomes more important, and that for injuries remains constant but significant (World Health Organisation, 2016). According to Cogta, 2016, inadequate housing exposes the inhabitants to hazards and health threats, with one of the most serious threats being overcrowding, which enhances the transmission of diseases among the household members, especially children, older persons and people with disabilities and many informal settlements are found on dangerous sites (e.g. low land prone to flooding) and contain structures that do not meet building codes. This makes them vulnerable to the impacts of climate change, which go beyond exposure to extreme weather events (Cogta, 2016). This statement is confirmed by the Causes of Death 2016 report released by Statistics South Africa in 2018, where the results show that communicable diseases are the major causes of death, and the percentage of deaths due to communicable diseases is above 70% for children less than the age of one year in the country (Statistics South Africa, 2018). The study conducted by Yadav, et al. (2016) confirms that household factors such as quality of building materials, cooking fuel, overcrowding and insufficient ventilation leads occupants suffering from ARI, fever, diarrhoea, TB and pneumonia (Yadav et al., 2016). NCDs like cerebrovascular diseases and diabetes, are the major causes of death among elderly people. The percentage of adults above the age of 65 years who have died due to cerebrovascular disease (9%) and diabetes (8.9%) is higher than that of infants (Statistics South Africa, 2018).

2.2 SOUTH AFRICAN POLICY ON SANITATION, WATER AND HOUSING

Sanitation is a public good and while sanitation is an intensely private social sphere of the water value chain, it is also a public good with environmental and public health protection benefits accruing well beyond the household boundary (Department of Water and Sanitation, 2016). The health, social and environmental benefits of improved sanitation are maximised when sanitation is planned for and provided in an integrated manner with other municipal services (Department of Water Affairs and Forestry, 2003). Sanitation policies currently provides no guidance on the provision of sanitation services to backyard dwellings in the country or informal settlements beyond the confines of private property models for housing delivery whereas the vision of the Strategic Framework for Water Services (SFWS) is that all people living in South Africa must have access to adequate, safe, appropriate and affordable water and sanitation services, use water wisely and practise safe sanitation. The Strategic Framework Water Services (SFWS) is an approved framework that provides a comprehensive summary of policy with respect to the water services sector in South Africa, and it sets out a strategic framework for its implementation over the next ten years (Department of Water Affairs and Forestry, 2003). The policy and strategy do not currently address sanitation in privately owned institutions such as crèches and day-care centres, churches and old-age homes (Department of Water and Sanitation, 2016).

Providing Free Basic Sanitation (FB San) services to all South Africans places a significant burden on the state and on the Water Service Authority (WSA), especially where individuals are able to afford these services. A Water Service Authority (WSA) is any municipality that has the executive authority to provide water services within its area of jurisdiction in terms of the Municipal Structures Act 118 of 1998 or the ministerial authorisations made in terms of this Act. There can only be one WSA in any specific area. WSA area boundaries cannot overlap. Water services authorities are metropolitan municipalities, district municipalities and authorised local municipalities (Department of Water Affairs and Forestry, 2003; (Department of Water and Sanitation, 2016). WSAs have limited resources to provide free services to individuals in their jurisdiction and the practice of providing a free service to all households in the WSA jurisdiction is often not sustainable. Due to limited resources, citizens do not have access to adequate safe water and proper toilets. This at the end can lead to citizens suffering from communicable diseases such as diarrhoea and cholera.

In South Africa, the National Home Builders Registration Council (NHBRC) was mandated to provide housing consumers with warranty protection in new homes against major structural defects and roofing leaks and to assist housing consumers in the enforcement of agreements concluded with home builders. According to the National Home Builders Registration Council (NHBRC), homes need to be supported by services which, depending upon the location, type and income levels of its

inhabitants, may include systems conveying water, gas, electricity or waste; and mechanical or electrical systems which use energy to provide air conditioning (hot or cold air), mechanical ventilation, hot water supply, artificial lighting and vertical transport (National Home Builders Registration Council, 2016).

According to a study conducted by Govender et al. (2011) in Cape Town, they found that houses were in a state of disrepair; majority of houses had cracked walls and/or visibly leaking roofs; and the sanitary state of the yard outside the dwelling was classified as being poor. As many as 68% of cases had no waste bin inside the dwelling; all of the respondents in the survey complained of pests carrying potential health risks within their immediate home environment. Over two weeks preceding the survey, 38% of dwellings reported one or more persons suffering from diarrhoea (Govender et al., 2011). According to the General Household Survey (GHS) 2016, 1 439 000 households lived in informal dwellings or shacks not situated in a backyard and 873 000 households lived in informal dwellings or shacks in backyard. A total of 2 368 000 households used a pit latrine/toilet without ventilation pipe, 171 000 households used a bucket toilet collected by the municipality and 39 000 households used a bucket toilet emptied by the households themselves while 482 000 households had no sanitation facility (Statistics South Africa, 2017).

Running water, electricity and adequate ventilation is of utmost importance when local government intends to build new houses for its citizens. As a minimum, each home requires access to potable water and adequate sanitation. In rural areas, water may be provided from boreholes and sanitation facilities may be in the form of ventilated improved pit (VIP) toilets or disposal systems which include septic tanks. In towns and cities, local government is tasked to provide the following infrastructure in support of housing within their areas of jurisdiction (National Home Builders Registration Council, 2016). The new democratic South African government is unable to provide these services to its inhabitants/citizens because of the backlog of housing they are experiencing and the inequalities inherited from apartheid (Meyer, 2014). That is why we have people living in houses that do not have electricity, running water or adequate ventilation. Lack of these basic services is viewed as the major causes of human diseases.

2.3 STUDIES ON COMMUNICABLE DISEASES

The highest fraction of deaths and disease that could be tackled through environmental improvements is in low- and middle-income countries (World Health Organisation, 2016). According to a study conducted by Saravanan et al., (2016) on institutional analysis of water-borne diseases in Ahmedabad,

India, they found that vulnerable houses reported a 50% higher chance of being infected with WBDs. These vulnerable houses comprised young families who were non-natives, received poorer water quality and practised unhygienic means to wash their hands. Water stagnant around the house and they were subjected to poor housing and environmental conditions (Saravanan et al., 2016). This is also confirmed by a study that was conducted by Gan et al. (2017) where they found that participants living in mobile homes had substantially elevated prevalence in all these respiratory symptoms and diseases compared with those living in other types of housing (Gan et al., 2017). Curtis et al., (2010) investigated the effect of health shock on the family's housing situation three years later a health shock at birth increases the likelihood if the family experiences overcrowding and homelessness (Curtis et al., 2010)

Most of the studies have used descriptive statistics (Saravanan et al., 2016; Baker et al., 2017, Curtis et al, 2010; Govender, 2011) to obtain the mean age of the household head, his/her level of educational attainment and the income of the household. According to Govender, et al., (2011) Almost 49% of the main houses had a toilet inside the house and no shacks had toilet or taps inside. According to Govender et al., (2016), they found that 40.5% of participants living in the main houses reported that they suffered diarrhoea occurring in the preceding fourteen days before the study and 23.3% reported that they have suffered from diarrhoea (Govender, 2011). Shueya et al., (2007) concluded that the world has become increasingly urbanised and improving houses and neighbourhoods for those who live in poor-quality houses and neighbourhoods is an urgent community and policy problem (Sheuya et al., 2007; Govender et al., 2011).

Some studies used the primary data collection method and data was analysed qualitatively, e.g. Baker et al., (2017) where the postal and online survey was administered from low to moderate-income households in South Australia. The survey was specifically designed to test the relationship between health and housing (Baker et al., 2017). Saravanan et al., (2016) also used a self-administered questionnaire to collect data and for analysis, households reporting incidence of water-borne diseases (WBDs) during January to July 2012, and those not reporting diseases were considered. Using STATA, the Principal Component Analysis (PCA) was calculated and the role of potentially correlated variable was derived. Out of 36 variables, 22 variables correlated with each other, and 60% of the Eigen values were used Poisson regression. Poisson regression revealed that vulnerable households and good water quality had a significant association with WBDs (Saravanan et al., 2016) For analysis, Baker et al., (2017) also conducted Principal Component Analysis (PCA) as an exploratory analysis, in order to identify indicators that are not correlated and those that are correlated. Indicators varied between -0.08 to 0.79. The correlation between most items was low, e.g. for 'access

to services' and 'house condition' the correlation was 0.11. To measure mental and physical health, they used the standard linear regression model an Ordinary Least Squares (OLS) estimator. They found that people with poor health also had the highest exposure to housing problems. For general health, which was measured on a 5-point scale from excellent (1) to poor (5), a non-linear logit model was used (Baker et al., 2017).

Other studies used secondary data, e.g. Yadav et al., (2016) used data from the last three rounds of the National Sample Survey (NSS) on 'Morbidity and Health Care' in India. Three models of logistic regression have been analysed to see the relationship between the response variable (0 or 1) and the predictor variables. The first logistic regression model dealt with VBDs, the second dealt with WBDs and the third one dealt with ABDs. Odds ratio was used to determine whether a particular exposure is a risk factor for a particular outcome and to compare the magnitude of various risk factors for that outcome. In addition to this, the odds ratio was also to explain the constant effect of a predictor X on the likelihood that one outcome will occur. The prevalence of infectious diseases is higher in rural areas (above 50%) than in urban areas (below 40%) (Yadav et al., 2016). In this study, the risk of the onset of different infectious diseases cannot be analysed because respondents were not asked on the duration of their stay in that particular dwelling unit. Curtis et al., (2010) and Fink and Arku (2012) conducted a secondary study using data from two independent household surveys. Fink and Arku (2012) analysed data using linear regression and descriptive statistics.

A study conducted by Naicker et al. (2017) concluded that the Reconstruction and Development Programme (RDP) houses and informal dwellings were the most vulnerable structures in terms of indoor temperature stability and by inference, thermal comfort. These types of housing (RDP houses and informal dwellings) are common among the very poor and thus coping strategies in very hot and very cold environments will be limited, and the risk of temperature-related diseases may be elevated (Naicker et al., 2017).

2.4 STUDIES ON NON-COMMUNICABLE DISEASES

In South Africa, a problem arises when people without proper educational qualifications go to urban areas to look for employment. When they arrive in these urban areas they do not find work and they cannot pay for basic services. Consequently, they resort to building shacks that are made of materials that ultimately affect their health. In South Africa, studies have linked housing-related factors and health. Some of the causal links between housing and health are clear and there are similarities in kind, if not degree, between areas of low-income housing in the industrialised world and slums in the developing world. Sheuya et al. (2007) have argued that whereas the responsibility to improve health rests on each one of us, individual slum dwellers, civil associations, non-governmental organisations, municipal and national governments, the private sector, and the international community, do not all have equal power or leverage (Sheuya et al., 2007). Moore et al. (2003) concluded that the main area for attention and action to safeguard urban health is more effective partnering across sectors (Moore et al., 2003). Many health problems are either directly or indirectly related to the building itself, because of the construction materials that were used and the equipment installed, or the size or design of the individual dwellings (Bonnefoy, 2007).

Schootman et al. (2007) conducted a study on the effects of adverse housing and neighbourhood conditions on the development of diabetes mellitus. They used 644 subjects and housing conditions were rated as excellent, good, fair, or poor. Self-reported diabetes was obtained at baseline and 3 years later. Of the 644 subjects without self-reported diabetes, 10.3% reported having diabetes at the 3-year follow-up. Every housing condition rated as fair-poor was associated with an increased risk (Schootman et al., 2007). They used logistic regression for statistical analysis and they found that every housing condition was associated with an increased risk of diabetes in unadjusted analysis, with odds ratios ranging from 1.78 (cleanliness inside the building) to 2.53 (physical condition inside the building). Adverse housing conditions were independently associated with the development of self-reported diabetes (Schootman et al., 2007)

There are several potential mediating mechanisms through which adverse conditions of neighbourhoods and housing may promote the development of diabetes. First, they may increase the risk of diabetes through adoption and maintenance of behaviours such as lack of participation in physical activity, greater use of tobacco, alcohol consumption, and poor nutrition (Schootman et al., 2007). Informal settlements do not have enough space for the residents to exercise. Lack of exercise is one of the risk factors for diabetes. Lack of recreational facilities and activities in the area has led to residents indulging in a lot of alcohol consumption which is another risk factor of NCDs.

Women bear higher exposures to traditional environmental risks to health, such as exposure to smoke while cooking with solid fuels or carrying water from community sources (World Health Organisation, 2016). Cooking within a home without any separate room for a kitchen coupled with the use of polluting cooking fuel (i.e. biomass and charcoal) is a common contributing factor for ARI among children and women who reside inside the home most of the time. Women are at a higher risk of contractin an infection than men because of biological differences, social inequities, and cultural norms (Yadav et al., 2016). Poor hygiene and sanitation as well as crowding are still typical basic problems of growing settlements and megacities, most of which are located in developing countries (Bonnefoy, 2007).

2.5 CONCLUSION

In this chapter, we highlighted the studies that are related to our research and the challenges that arose from the policieson housing implemented by the South African government. We also highlighted the plight of communicable diseases and NCDs that is faced by many South Africans**.**

The government has a problem with providing housing and basic services such as sanitation, electricity and toilets to its citizens even though they are public goods. Studies that were conducted have shown that inadequacies of housing and basic services do have an impact on the health of the residents.

This study will be able provide information to urban planners and health expects/practitioners on the housing types that have an effect on either communicable diseases or NCDs. Furthermore, this study will highlight information on the type of basic services that have an effect on the health status of the residents.

Knowledge gained from this study will raise awareness that will contribute to the upgrading of the well-being of people in the country and improve their quality of life. Policy makers, urban planners and health practitioners will work together for the betterment of the citizens of the country where the citizens will be occupying houses that are well located, affordable and disease free. The study will provide appropriate information to policy makers, urban planners, housing material service providers, health experts/practitioners and home-owners about the dangers brought about by different house building materials.

The total number of people who have died in the country due to NCDs and communicable diseases is very high and that is why it is important that all the risk factors that lead to NCDS and

communicable diseases be identified. More research is needed to better describe and quantify relationships between environmental hazards and specific human health effects (Moore et al., 2003). The government will then have to come up with programmes to lessen morbidity and death triggered by communicable disease and NCDs. The current paper is going to identify the effects of housing and basic services on diseases.

CHAPTER 3: METHODOLOGY

Secondary data from LCS 2014/15 will be used for analysis in this study. Data was collected by Statistics South Africa during the LCS that was conducted by using a questionnaire. A total of 23 308 households across all nine provinces of South Africa participated in the survey that was conducted on from 13 October 2014 until 25 October 2015. The study is going to analyse all respondents who reported that they were told by a medical practitioner that they are suffering from chronic diseases and all children below the age of 5 years (through the help of a care-giver or parent) who reported that their children have suffered fromone or more of the communicable diseases which are influenza, cough, fever and diarrhoea. The socio economic and demographic factors of the target population will be explored and presented using tables and graphs. More analysis will be done on variables that needs interpretation by checking significant relationships using chi-square.

3.1 SAMPLING

The sample for this data is drawn from a master sample used by Stats SA to draw samples for surveys in South Africa. The target population for the study is all the residents within the borders of South Africa, with the exception of prisoners, elderly people who are staying at old-age homes and children who are staying at school hostels. The unit of analysis will be the individuals within the households that were sampled. The head household head was interviewed on behalf of the household members for some sections; however, for the health section, each and every individual in the household was personally interviewed on the issue of their health status. Data will be analysed using the demographic variables and information on their health status.

3.2 RESPONDENTS PROFILE

A total number of 88 906 respondents participated in the household survey and for children below the age of five, 9 504 children were residing in the sampled households. Unweighted data will be used for analysis.

3.3 DATA SOURCES

The study is quantitative and uses secondary data from the Living Conditions Survey (LCS 2014/15) data collected by Statistics South Africa. Data will be analysed using the Statistical Package for the Social Science (SPSS) version 25 software package. Statistics South Africa captured and stored data in SAS format. Data will be imported to SPSS for analysis. Data was captured and saved into two different data-sets namely household and individual data. The researcher is going to merge the two

data-sets using unique identifier for analysis. The analysis will use descriptive and inferential statistical tools.

3.4 MEASUREMENT

The type of dwelling units that are going to be analysed in this study are the main and other dwelling units. The main dwelling unit is the unit in which the members of the household spend most of the time and the other dwelling unit is the one that is used at certain periods like a unit that is used for sleeping only. The two dwelling units are further going to be categorised as formal, traditional, informal and other. Formal dwellings are houses, or a brick/concrete block structure on a separate stand or yard or on a farm (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016) and they include amongst others block of flats, townhouses, room or apartment on a property. Traditional dwellings are dwellings made of clay, mud, reeds or other locally available materials (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016). Categorisation is based on the type of material used to build that dwelling (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016). Materials used are further categorised into standard, substandard and other building materials.

For toilet facilities, standard means flushing toilets with either a septic tank or sewer (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016)chemical toilet, pit latrine with ventilation pipe and an ecological sanitation system (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016). Substandard services means a pit latrine without ventilation pipe, or a bucket toilet collected either by the municipality or emptied by the household (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016). None means there are no toilet facilities for the residents. They use the veld to relieve themselves. The household's main source of water (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016) was categorised into safe water, own supply of water, unsafe water and other source of drinking water. Safe water included piped water whether from the house, outside tap, neighbour's tap or communal tap; unsafe water means water from an unprotected well, springs, flowing water and stagnant water. Own supply of water means a borehole inside and outside the yard, and a rain tank in the yard. In this study, the WHO and UNICEF's (2008) drinking water ladder (Bradley & Putnick, 2012) could not be followed because the data that was collected did not classify the well and spring water as being protected or unprotected.

Floor material was also categorised into standard, substandard and other materials. When data was collected, the main material of the dwelling floor was recoded into the three existing superordinate

categories of natural (1), rudimentary (2), and finished flooring (3) (Bradley & Putnick, 2012; Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016). In this study, natural flooring was categorised as substandard while rudimentary and finished flooring was categorised as standard flooring. The other response in the questionnaire was the flooring categorised as other flooring material during analysis. The main source of energy for cooking and space heating was also categorised into standard, substandard and other source of energy. Standard cooking and space heating (Bonnefoy, 2007; Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa, 2016) means electricity, solar energy and gas, while substandard cooking and space heating include animal dung, paraffin, wood and coal.

The quality of houses in this study was collected through the observation of the fieldworker. The field workers were trained to observe the dwelling unit conditions, i.e. materials used for floors, roofs and walls of the house that was sampled and to record the correct observation on the questionnaire. The type of building material used for a sampled household will then be cross-tabulated with the type of illness/diseases that the respondents living in that sampled household are suffering from. Type of houses of those households who are not suffering any illness will not be included in this study

A cross-tabulation of respondents who are suffering from communicable dieases and NCDs and their type of housing material and basic services will be done using chi-square to determine the association between housing, basic services and diseases. The binary logistic regression model will be used to indicate the relationship between the response variable, which in this study is communicable or NCDs, and the predictor variables which are the types of houses, materials used and the basic services offered. Inferential statistics are used to highlight the statistical significance of data. In this study the dependent variables are the diseases and the responses on the diseases will be coded 0 (No) or 1 (Yes). Binary logistic regression is used to describe data and explain the relationship between one dependent binary variable with one or more continuous-level (interval or ratio scale) independent variable (Solutions, 2018). Categorical variables at 95% confidence interval will be used in this study. The referenced category is this study are all the adequate building material and formal houses.

3.5 ETHICAL ISSUES

The researcher applied for permission to conduct the study from the Stellenbosch University's Research Ethics Committee: Humanities on 29 August 2018 and permission was granted on 03 October 2018. The project number is ING-2018-8256.

3.6 LIMITATIONS

Data was collected at Provincial level as information at municipal level is not available. The question on how long have they been staying in the house that was sampled has not been included therefore the duration of exposure of an individual to the risk factor cannot be estimated.

Data that was collected did not take into consideration the various settlement typologies as developed by the Council for Scientific and Industrial Research (CSIR) (Cogta, 2016). Instead households were classified as formal, traditional, informal and other dwellings based on the responses of question 5.1 of the questionnaire.

This current study is carried out to investigate if different housing and insufficient/basic services are the causal factors of acute and chronic diseases in South Africa. Not all the diseases that are listed in the questionnaire are going to be analysed because very few cases or responses were recorded for some NCDs. Not all NCDs that are listed on the questionnaire are going to be analysed. NCDs that are going to be analysed in this study are hypertension, diabetes, asthma and arthritis.

Household expenditure surveys, such as the Living Conditions Survey and the Income and Expenditure Survey (IES), are amongst the most demanding type of survey run by statistical agencies both for those implementing the survey and the households that are sampled to participate. These surveys often suffer from a higher than average number of refusals relative to other household surveys in the survey programme. The LCS 2014/2015 had a notably lower response rate than previous household expenditure surveys. The challenge of non-response was especially problematic in Gauteng. Given that Gauteng accounts for well over a third of all household expenditure in the country, lower responses, especially amongst high-income households in this province, means that we could see larger underreporting in various expenditure areas, most notably food, beverages and tobacco (Statistics South Africa, 2017).

3.7 GENERAL REMARKS

The need to have available, accessible, relevant health data and to use such data to inform policy and target and evaluate interventions is of utmost importance. More research is needed to better describe and quantify relationships between environmental hazards and specific human health effects (Breysse et al, 2004). More sponsors are needed so that accurate data can be collected.

The linear regression model, Cox regression model and Spearman's rank correlation coefficient are the alternative methodologies that could be used for analysis. Linear regression analysis demands that

the dependent variable is continuous. However, many clinical or epidemiological variables are dichotomic in nature: for example, a patient may or may not be affected by a given disease, or he/she can die or survive during a given time period. Logistic regression analysis is a statistical technique that describes the relationship between an independent variable (either continuous or not) and a dichotomic dependent variable (Tripepi, Jager, Dekker, & Zocalli, 2008) The data that was used in this study is dichotomous that is why the linear regression model was not used in this study.

Cox regression is used to analyse time-to-event data, that is, the response is the time an individual takes to present the outcome of interest. Individuals that never get ill are assigned the total length of time of the follow-up, and are treated as *censored*, meaning that it is not known when they will get ill, but at least until the time of the end of the follow-up they are well. Individuals lost to follow-up are treated in a similar way. Cox regression estimates the hazard rate function that expresses how the hazard rate depends upon a set of covariates (Barros & Hirakata, 2003). Correlation coefficients are used to assess the strength and direction of the linear relationships between pairs of variables. Correlation coefficients do not communicate information about whether one variable moves in response to another (Mukaka,2012).

3.8 CONCLUSION

In this chapter, the researcher indicated the methodology employed in the study. The sampling methods and data set (including the variables) that were to be used were explored. Limitations of the study and the ethical aspects were discussed. In the next chapter, the researcher presents findings that emanated from the data analysis.

CHAPTER 4: ANALYSIS

NCDs that are going to be analysed in this study are hypertension, diabetes, asthma and arthritis. The communicable diseases that are going to be analysed for children below the age of 5 years are influenza, diarrhoea, fever and cough.

4.1 DESCRIPTIVE STATISTICS

Data on the sampled respondents was analysed using SPSS version 25. There are more females (46 751) than males (42 155) who participated in the survey. As regards children below the age of 5 years, there were 4 809 males and 4 695 females who participated in the survey.

4.1.1 Health status of household members

In Table 4.1 below, hypertension had the highest percentage (8.9%) of people who have reported that they were told by a doctor, nurse or health professional that they are suffering from a disease. Cancer had the lowest percentage (0.3%). In addition, the table shows that the percentage distribution of diseases increases with an increase in age, with the exception of HIV/AIDS. The percentage of HIV/AIDS is the highest (0.6%) among age group 35-44 years and it decreases with an increase in age. According to the results obtained, asthma is the only communicable disease that has the highest percentage for children below the age of 5 years. Percentages for high cholesterol, epilepsy, TB, heart disease, mental illness and cancer are below 1%. The percentages are very low, that is why they are not going to be discussed in this study.

AGE GROUP	DISEASE										
	Hypertension	Diabetes	Arthritis	HIV/AIDS	Asthma	High Cholesterol	Epilepsy	TB	Heart Disease	Mental Illness	Cancer
0-4	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
5-9	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
10-14	0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
15-24	0.1	0.0	0.0	0.1	0.1	0.0	0.1	0.1	0.0	0.1	0.0
25-34	0.3	0.1	0.1	0.5	0.1	0.0	0.1	0.1	0.0	0.1	0.0
35-44	0.9	0.3	0.1	0.6	0.2	0.1	0.1	0.1	0.1	0.2	0.0
45-54	1.9	0.7	0.4	0.4	0.2	0.2	0.1	0.2	0.1	0.1	0.0
55-64	2.6	1.0	0.7	0.2	0.3	0.2	0.1	0.1	0.2	0.2	0.1
65+	3.1	1.2	0.9	0.0	0.3	0.3	0.0	0.1	0.3	0.1	0.1
Mean	8.9	3.3	2.2	2.0	1.6	0.8	0.7	0.7	0.7	0.6	0.3

Table 4.1: Percentage distribution of the health status of the respondents who responded that they were told by health worker that they are suffering from a disease

In Figure 4.1 below, cough had the highest percentage distribution (53.3%) of children below the age of 5 years who suffered from such disease before the survey. Pneumonia had the lowest percentage (0.8%) distribution of children who suffered from the disease. This study will concentrate on the following illnesses: cough, influenza, fever and diarrhoea.
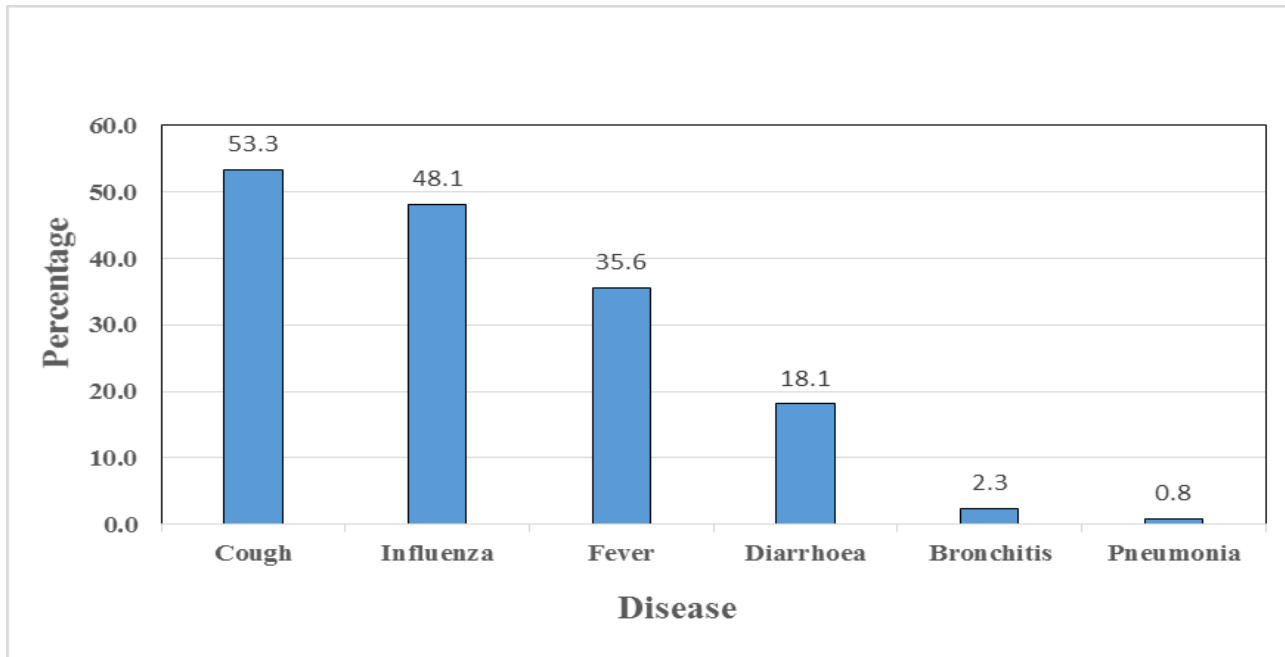
Figure 4.1: Percentage distribution of children below the age of 5 years who have reported that they were ill before the survey

4.1.2 Distribution of household members suffering from NCDs

Figure 4.2 shows that there are variations in the percentages of people who self-reported to have been suffering from chronic illness, by sex. Hypertension had the highest percentage for both males (2.7%) and females (6.2%). The percentage distribution of females suffering from chronic illnesses is higher than the percentage distribution of males.

	Hypertension	Diabetes	Asthma	Arthritis
■ Male	2.7	1.1	0.6	0.5
■ Female	6.2	2.2	0.9	1.8
■ Total	8.9	3.3	1.6	2.2
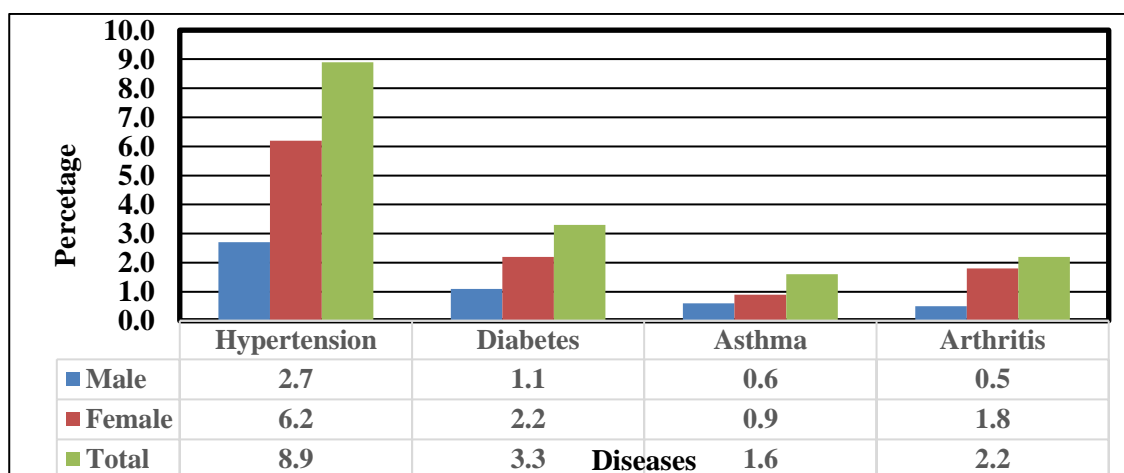
Figure 4.2: Percentage distribution of respondents who self-reported that they were diagnosed with an illness by a health worker

Figure 4.3 indicates that the percentage distribution of people who self-reported to be suffering from hypertension by population group is high for all population groups as compared to all other diseases. In most of the diseases, the black African population group has self-reported the highest percentages in all the chronic illnesses. The white and Indian/Asian population groups have reported the lowest percentages in all the diseases**.**

	Hypertension	Diabetes	Asthma	Arthritis
■ Total	8.9	3.3	1.6	2.2
■ White	0.7	0.3	0.1	0.2
■ Indian/Asian	0.2	0.2	0.1	0.1
■ Coloured	1.5	0.6	0.3	0.3
■ Black African	6.5	2.3	1.0	1.6
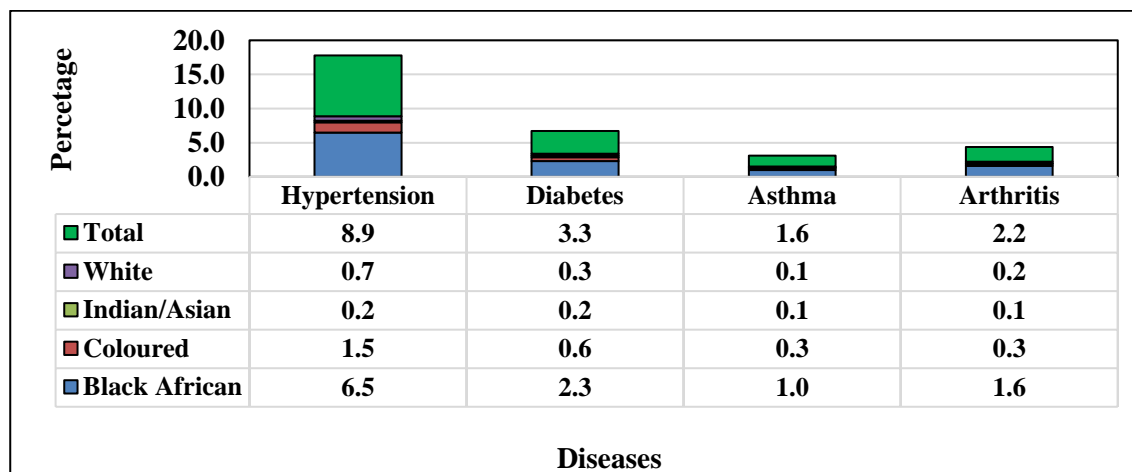
Figure 4.3: Percentage distribution of respondents who self-reported that they were diagnosed with an illness by a health worker

Table 4.2 shows that respondents below the age of 24 years have reported the lowest percentages of people suffering from chronic illness. The percentages of illnesses increased with an increasing age. Asthma had respondents who reported that they suffered from it. The percentages of all the diseases increase as the age of the respondents increased.

Age group	Disease			
	Hypertension	Diabetes	Asthma	Arthritis
0-4	0	0	0.1	0
5-9	0	0	0.1	0
10-14	0	0	0.1	0
15-24	0.1	0	0.1	0
25-34	0.3	0.1	0.1	0.1
35-44	0.9	0.3	0.2	0.1
45-54	1.9	0.7	0.2	0.4
55-64	2.6	1	0.3	0.7
65+	3.1	1.2	0.3	0.9
Mean	8.9	3.3	1.6	2.2

Table 4.2: Percentage distribution of respondent who self-reported that they were diagnosed with an illness by a health worker according to age-group

In Table 4.3 below, Western Cape and KwaZulu-Natal had the highest percentage (1.3%) of people suffering from hypertension, followed by Gauteng and Eastern Cape (both at 1.1%). KwaZulu-Natal reported the highest percentage of people suffering from diabetes (0.7%), and arthritis (0.5%). Western Cape reported the highest percentage (0.4%) of people suffering from asthma.

Age group	Disease			
	Hypertension	**Diabetes**	**Asthma**	**Arthritis**
Western Cape	1.3	0.5	0.4	0.4
Eastern Cape	1.1	0.5	0.2	0.4
Northern Cape	0.7	0.2	0.1	0.2
Free State	1	0.3	0.1	0.2
KwaZulu-Natal	1.3	0.7	0.3	0.5
North West	0.9	0.2	0.1	0.1
Gauteng	1.1	0.4	0.1	0.2
Mpumalanga	0.7	0.2	0.1	0.1
Limpopo	0.7	0.2	0.1	0.1
Mean	8.9	3.3	1.6	2.2

Table 4.3: Percentage distribution of respondents who self-reported that they were diagnosed with an illness by a health worker according to province

From the analysis that was given above, urban planners and health practitioners will be able to understand the percentage distribution of illnesses in the country and when they plan or come up with a health promotion programme, they will be able to know the relevant programmes that need to be planned for different diseases.

4.1.3 Distribution of household members suffering from communicable diseases

Figure 4.4 below is shows the percentage distribution of children below the age 5 years who self-reported that they were ill, by sex. Cough (53.3%) had the highest percentage while diarrhoea (18.1%) had the lowest percentage. Males below the age of 5 years have reported the highest percentages for all the diseases.

	Influenza	Fever	Cough	Diarrhoea
■ Male	24.6	18.2	27.3	9.4
■ Female	23.5	17.4	26	8.7
■ Average	48.1	35.6	53.3	18.1

Sex

Figure 4.4: Percentage distribution of children below the age of 5 years who self-reported that they have suffered an illness six months before the survey, by sex

The percentage distribution of children below the age of 5 years who self-reported that they suffered an illness before the survey was conducted is shown in Figure 4.5. The black African population had the highest percentage for all the diseases while the percentage distribution for the Indian/Asian population group is very low.

	Black African	Coloured	Indian/ Asian	White	Average
■ Influenza	42.8	4.1	0.4	0.9	48.1
■ Fever	29.4	4.7	0.4	1.1	35.6
■ Cough	46.3	5.4	0.5	1.2	53.3
■ Diarrhoea	15.6	2	0.2	0.3	18.1

Population group

Figure 4.5: Percentage distribution of children below the age of 5years who self-reported that they suffered an illness by population group

Figure 4.6 shows that KwaZulu-Natal had the highest percentage of children below the age of 5 years who have self-reported that they suffered illnesses. KwaZulu-Natal recorded the highest percentages for diarrhoea (2.9%) and Influenza (8.7%). KwaZulu-Natal and Eastern Cape had the highest percentages (6% each) of children below the age of 5 years who reported that they have suffered from fever before the survey. KwaZulu-Natal had the highest percentage of children below the age of 5 years who reported that they suffered from cough before the survey. Northern Cape had the lowest percentages of children below the age of 5 years who suffered diarrhoea (1%), cough (3.5%) and influenza (3.3%) whereas North West and Free State had the lowest percentage of children who reported that they suffered fever (2.5% and 2.1%, respectively).

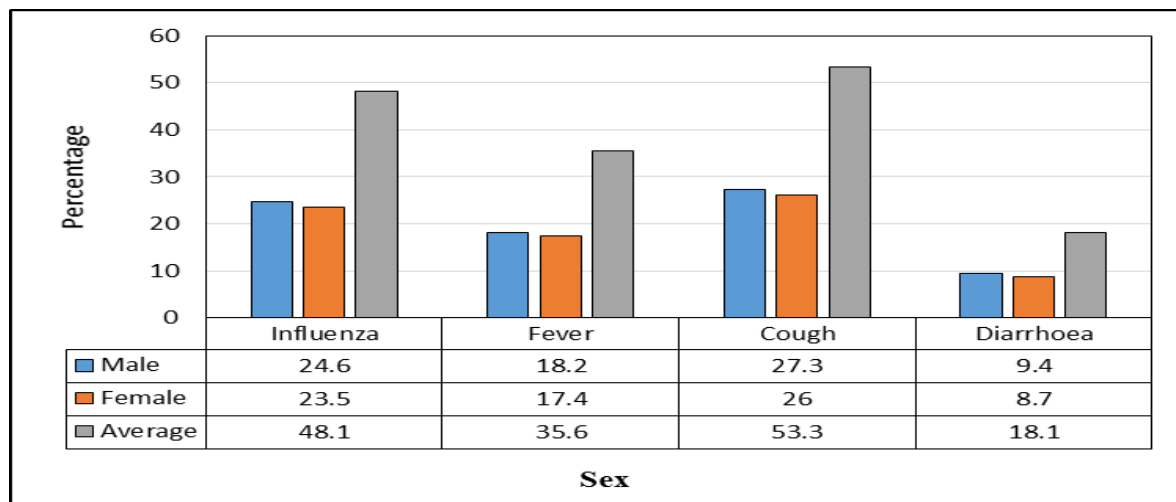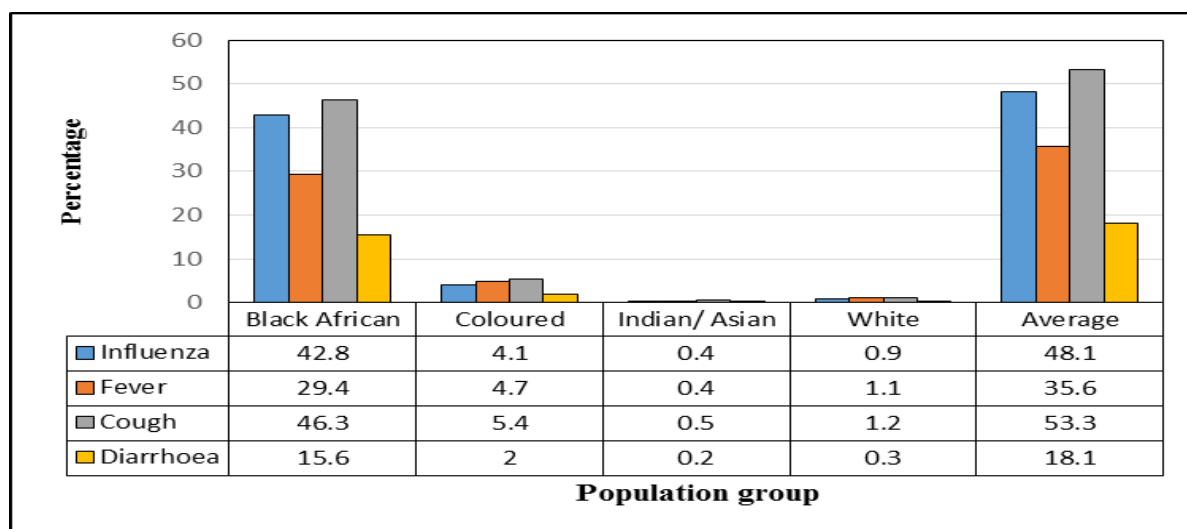|	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpumalanga	Limpopo	Average
Influenza	3.5	4.9	3.3	4.9	8.7	4.3	5.9	5.7	7	48.1
Fever	4.9	6	2.7	2.1	6	2.5	3.7	4	3.6	35.6
Cough	5.3	5.9	3.5	5	10	4.2	6.4	6.2	6.8	53.3
Diarrhoea	2.1	2.1	1	1.8	2.9	1.5	1.9	2.1	2.7	18.1
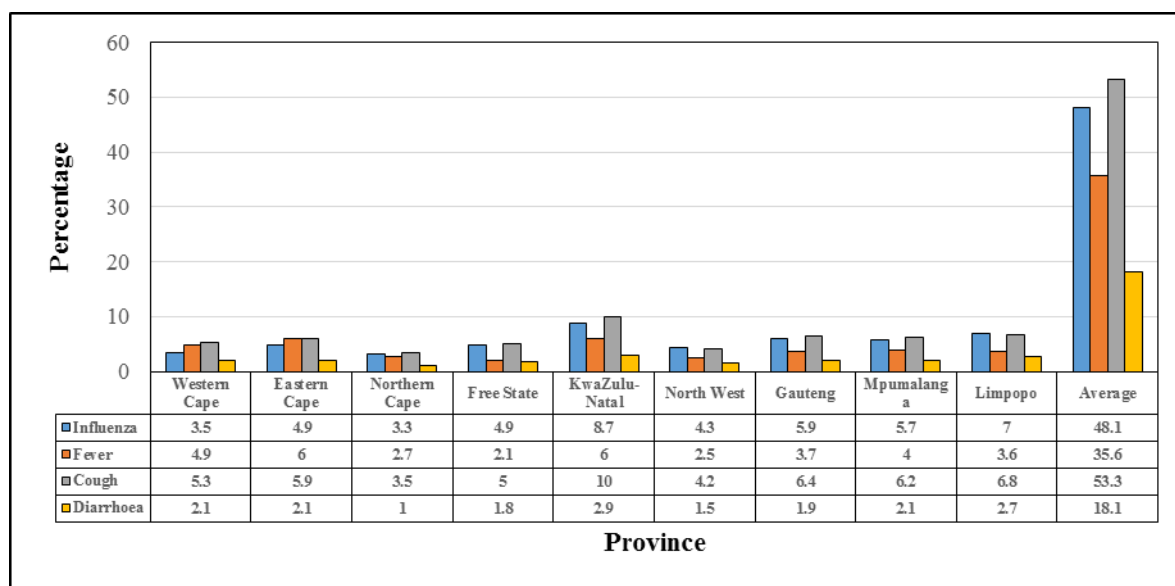
Figure 4.6: Percentage distribution of children below the age of 5 years who reported that they have suffered an illness six months before the survey

4.2 INFERENTIAL STATISTICS ANALYSIS

4.2.1 Self-reported cases on ncds (chi-square)

Pearson's chi-square analysis on the relationship between the disease and housing type are show in Table 4.4 below. There is an association/relationship between housing, housing material, source of energy and hypertension. The highest association is observed between the cooking energy source used (176.924[a]) and hypertension, and the lowest association was observed between space heating (35.143[a]) and hypertension. Roof material and diabetes have the highest chi-square value, while floor material and diabetes have the lowest chi-square and P-values below 0.05. All the variables are significant. For asthma, only two variables have the P-value below 0.05 which means roof material and cooking source of energy have an association with asthma. Main dwelling unit, roof material, cooking source of energy and space heating have an association with arthritis.

Variable	Hypertension			Diabetes			Asthma			Arthritis		
	Chi-square	P-Value	Association	Chi-square	P-Value	Association	Chi-square	P-Value	Association	Chi-square	P-Value	Association
Main dwelling units	115.741[a]	0.000	Yes	49.961[a]	0.000	Yes	.398[a]	0.941	No	37.848[a]	0.000	Yes
Other dwelling units	50.409[a]	0.000	Yes	11.397[a]	0.010	Yes	1.744[a]	0.627	No	3.947[a]	0.267	No
Wall material	118.846[a]	0.000	Yes	47.577[a]	0.000	Yes	.026[a]	0.987	No	.159[a]	0.924	No
Roof material	90.733[a]	0.000	Yes	166.307[a]	0.000	Yes	20.869[a]	0.000	Yes	6.794[a]	0.033	Yes
Floor material	72.922[a]	0.000	Yes	14.467[a]	0.001	Yes	1.053[a]	0.591	No	3.802[a]	0.149	No
Cooking energy source used	176.924[a]	0.000	Yes	105.202[a]	0.000	Yes	19.149[a]	0.000	Yes	31.079[a]	0.000	Yes
Space heating used	35.143[a]	0.000	Yes	40.488[a]	0.000	Yes	1.547[a]	0.461	No	16.928[a]	0.000	Yes

Table 4.4: Pearson chi-square values to show the relationship between housing, type of housing material, type of energy source and non-communicable diseases

4.2.2 Self-reported cases on communicable disease (chi-square)

Analysis of chi-square has indicated the relationship between the diseases and housing and basic services variables. For influenza, other dwellings had the highest chi-square value (43.811[a]) compared with any other variables, which means there is a strong relationship between other dwellings and influenza. Cooking source had the lowest chi-square value (.617[a]) compared with any other variable which means that there is no relationship between influenza and the cooking source. For diarrhoea, refuse collection has the highest chi-square value (17.510[a]) compared with any other variable and floor material has the lowest chi-square (1.946[a]). Refuse collection also has the highest chi-square value (50.300[a]) whereas other dwelling has the lowest chi-square value (1.228[a]) for fever. Refuse collection also has the highest chi-square value (44.795[a]) for cough as compared to other

variables and floor material has the lowest chi-square value (.269[a]). Not all the variables in the study have a positive relationship with the diseases in the study. Only five variables for influenza have a p-value less than 0,005 [a] and they are main and other dwelling units; floor material; toilet facility available and refuse collection available. All variables with a p-value less than 0.005[a] indicate that there is an association between a disease and the independent variable. It shows that there is interdependence between the two variables.

Variable	Influenza			Diarrhoea			Fever			Cough		
	Chi-square	P-Value	Association	Chi-square	P-Value	Association	Chi-square	P-Value	Association	Chi-square	P-Value	Association
Main dwelling units	13.365[a]	0.004	Yes	11.097[a]	0.011	Yes	8.642[a]	0.034	Yes	8.935[a]	0.030	Yes
Other dwelling units	43.811[a]	0.000	Yes	7.012[a]	0.072	No	1.228[a]	0.746	No	18.458[a]	0.000	Yes
Wall material	1.559[a]	0.459	No	2.605[a]	0.272	No	12.609[a]	0.002	Yes	3.485[a]	0.175	No
Roof material	3.584[a]	0.167	No	3.584[a]	0.167	No	11.628[a]	0.003	Yes	2.609[a]	0.271	No
Floor material	13.474[a]	0.000	Yes	1.946[a]	0.378	No	24.601[a]	0.000	Yes	.269[a]	0.874	No
Water supply	5.425[a]	0.143	No	4.909[a]	0.179	No	3.543[a]	0.315	No	3.628[a]	0.305	No
Toilet facility available	13.474[a]	0.004	Yes	5.891[a]	0.117	No	20.581[a]	0.000	Yes	8.486[a]	0.037	Yes
Refuse collection offered	16.039[a]	0.007	Yes	17.510[a]	0.004	Yes	50.300[a]	0.000	Yes	44.795[a]	0.000	Yes
Cooking energy source used	.617[a]	0.734	No	2.164[a]	0.339	No	27.656[a]	0.000	Yes	6.905[a]	0.032	Yes
Space heating used	2.631[a]	0.268	No	11.821[a]	0.003	Yes	4.677[a]	0.096	No	2.226[a]	0.329	No

Table 4.5: Pearson chi-square value to show the relationship between housing, type of housing material, basic services space heating and communicable diseases

4.2.3 Logistic regression

4.2.3.1 Logistic regression analysis for non-communicable disease

4.2.3.1.1 Hypertension

Table 4.6 below is shows odd ratios predicting hypertension by selected types of dwellings and the types of material used for the floor (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa,2016) ,walls and roof of the dwelling (Statistics South Africa, 2017; Inner City Fund, 2016; Statistics South Africa,2016) they are occupying. The model shows that the risk of hypertension is significantly higher for persons living in informal, traditional and other dwelling units, irrespectiveof whether they are living in the main dwelling and in other dwelling units. The odds of hypertension were higher (OR =1.865, CI =0,568-6.121) for those living in informal houses compared to those in the formal dwelling of reference. There is also a positive significant relationship between hypertension and the substandard wall condition; other wall condition; substandard roof and floor

conditions; and other floor material. Their odds ratio are above 1 for 95% CI. There is a negative significant relationship between hypertension and other roof condition. The odds ratio for the other roof condition is 0.993 which is below 1.People staying in these dwelling units that have "other roof condition" are at a lower risk of suffering from hypertension.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Formal Dwelling			14.511	3	0.002			
TraditionalDwelling	0.320	0.609	0.276	1	0.599	1.378	0.417	4.548
Informal Dwelling	0.623	0.606	1.057	1	0.304	1.865	0.568	6.121
Other Main Dwelling	0.195	0.617	0.100	1	0.752	1.216	0.362	4.078
Formal Other Dwelling			15.230	3	0.002			
Traditional other Dwelling	0.250	0.122	4.180	1	0.041	1.284	1.010	1.632
Informal Dwelling	0.066	0.130	0.256	1	0.613	1.068	0.827	1.379
Other other Dwelling	0.174	0.125	1.951	1	0.163	1.191	0.932	1.521
Standard Wall Condition			2.516	2	0.284			
Substandard Wall Condition	0.248	0.230	1.163	1	0.281	1.281	0.817	2.008
Other Wall Condition	0.103	0.221	0.215	1	0.643	1.108	0.718	1.710
Standard Roof Condition			0.086	2	0.958			
Substandard Roof Condition	0.010	0.124	0.006	1	0.936	1.010	0.793	1.287
Other Roof Condition	-0.007	0.114	0.004	1	0.952	0.993	0.794	1.243
Standard Floor Material			6.528	2	0.038			
Substandard Floor Material	0.296	0.196	2.280	1	0.131	1.345	0.916	1.975
Other Floor Material	0.152	0.205	0.545	1	0.460	1.164	0.778	1.740
Standard Space Heating			4.882	2	0.087			
SubstandardSpace Heating	0.028	0.051	0.305	1	0.581	1.028	0.931	1.136
Other Space Heating	0.111	0.051	4.644	1	0.031	1.117	1.010	1.236

Table 4.6: Logistic regression model showing odds ratio, level of significance between housing, types of housing material, types of energy source for cooking and hypertension

4.2.3.1.2. Diabetes

Most of the variables have a negative significant relationship with diabetes as shown in Table 4.7. For diabetes, traditional other dwelling, informal other dwelling and other (other) dwelling units have Exp (B) above 1, while all the dwelling units that are regarded as the main dwelling for the household have a negative significant relationship with diabetes. Substandard wall condition, substandard roof condition and other roof condition can be seen as risk factors for diabetes. Substandard floor material and other floor and wall material are regarded as insignificant predictors and their odd ratios are lower than 1. The odds ratio for other space heating were 1.25 (1.06-1.46) and was statistically significant with the level of significance of 0.006 which is below 0.05.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95%C.I.for EXP(B)	
							Lower	Upper
Formal Dwelling			13.592	3	0.004			
TraditionalDwelling	-1.262	0.514	6.024	1	0.014	0.283	0.103	0.775
Informal Dwelling	-0.780	0.502	2.411	1	0.120	0.459	0.171	1.227
Other Main Dwelling	-1.129	0.531	4.521	1	0.033	0.323	0.114	0.915
Formal Other Dwelling			2.232	3	0.526			
Traditional other Dwelling	0.142	0.177	0.639	1	0.424	1.152	0.814	1.630
Informal Dwelling	0.034	0.190	0.033	1	0.856	1.035	0.713	1.503
Other other Dwelling	0.139	0.182	0.589	1	0.443	1.150	0.805	1.641
Standard Wall Condition			4.673	2	0.097			
Substandard Wall Condition	0.076	0.310	0.060	1	0.806	1.079	0.588	1.981
Other Wall Condition	-0.252	0.291	0.747	1	0.387	0.778	0.439	1.376
Standard Roof Condition			17.072	2	0.000			
Substandard Roof Condition	0.371	0.192	3.714	1	0.054	1.448	0.994	2.111
Other Roof Condition	0.029	0.181	0.025	1	0.874	1.029	0.722	1.468
Standard Floor Material			0.889	2	0.641			
Substandard Floor Material	-0.162	0.254	0.407	1	0.523	0.850	0.516	1.400
Other Floor Material	-0.089	0.269	0.110	1	0.740	0.915	0.540	1.549
Standard Space Heating			8.175	2	0.017			
SubstandardSpace Heating	0.058	0.080	0.519	1	0.471	1.059	0.905	1.240
Other Space Heating	0.224	0.081	7.706	1	0.006	1.252	1.068	1.466

Table 4.7: Logistic regression model showing odds ratio, level of significance and coefficients between housing, type of house material, types of energy source for cooking and diabetes

4.2.3.1.3 Asthma

The logistic regression model showing odd ratios predicting asthma by selected conditions of type of housing, roof material, wall condition and floor material is shown in Table 4.8. The model shows that the risk of asthma is significantly lower for persons living in dwelling units with substandard and other walls conditions compared to those in standard wall (reference wall condition). All the types of dwelling units that the households occupy are significant predictors of asthma. The odds of asthma were higher (OR=1.505, CI= 0.874-2,592) for people who live in dwelling units with substandard roof conditions compared to those living in dwellings with standard roof material of reference. People living in dwellings with substandard wall and floor material; and dwellings with other wall and roof conditions had lower chances of asthma compared to those in other dwelling of reference.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Formal Dwelling			0.241	3	0.971			
TraditionalDwelling	0.352	1.056	0.111	1	0.739	1.422	0.179	11.260
Informal Dwelling	0.313	1.049	0.089	1	0.766	1.367	0.175	10.672
Other Main Dwelling	0.220	1.075	0.042	1	0.838	1.246	0.152	10.248
Formal Other Dwelling			2.137	3	0.544			
Traditional other Dwelling	0.195	0.266	0.536	1	0.464	1.215	0.721	2.048
Informal Dwelling	0.047	0.278	0.028	1	0.866	1.048	0.608	1.806
Other other Dwelling	0.169	0.276	0.376	1	0.540	1.184	0.690	2.032
Standard Wall Condition			1.204	2	0.548			
Substandard Wall Condition	-0.263	0.423	0.385	1	0.535	0.769	0.336	1.762
Other Wall Condition	-0.038	0.405	0.009	1	0.925	0.963	0.436	2.127
Standard Roof Condition			12.142	2	0.002			
Substandard Roof Condition	0.409	0.277	2.177	1	0.140	1.505	0.874	2.592
Other Roof Condition	-0.001	0.261	0.000	1	0.997	0.999	0.599	1.666
Standard Floor Material			1.177	2	0.555			
Substandard Floor Material	-0.086	0.369	0.055	1	0.815	0.917	0.445	1.889
Other Floor Material	0.059	0.385	0.024	1	0.878	1.061	0.499	2.257
Constant	-4.406	1.051	17.579	1	0.000	0.012		

Table 4.8: Logistic regression model showing odds ratio, level of significance, and coefficients between housing, type of housing material, types for energy source used for cooking and space heating and asthma

4.2.3.1.4 Arthritis

All variables of housing, type of roof, wall and floor material have a positive significant relationship with arthritis as shown on Table 8. Substandard floor material has the highest odd ratio as compared to other covariates (OR=2.370. CI=0.975-5.758) followed by informal dwelling (OR=2.320, CI 0.312-17.256). This shows that if people are staying in houses where the floor materials are made of earth and dung, they stand a greater chance of suffering from arthritis than those living in dwellings with standard floor materials such as carpets, ceramic tiles, wood planks, etc. Informal dwelling units also have a positive significant relationship with arthritis. The odds ratio is above 2. This also demonstrates that the type of materials that are used to build these informal houses has an impact on the health of the occupants.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Formal Dwelling			16.758	3	0.001			
TraditionalDwelling	0.246	1.030	0.057	1	0.811	1.279	0.170	9.634
Informal Dwelling	0.842	1.024	0.676	1	0.411	2.320	0.312	17.256
Other Main Dwelling	0.226	1.040	0.047	1	0.828	1.253	0.163	9.630
Formal Dwelling			4.479	3	0.214			
TraditionalDwelling	0.186	0.217	0.734	1	0.392	1.205	0.787	1.844
Informal Dwelling	0.037	0.230	0.026	1	0.873	1.037	0.662	1.627
Other other Dwelling	0.243	0.221	1.210	1	0.271	1.275	0.827	1.964
Standard Roof Condition			0.389	2	0.823			
Substandard Roof Condition	0.117	0.221	0.281	1	0.596	1.124	0.729	1.734
Other Roof Condition	0.064	0.204	0.100	1	0.752	1.066	0.716	1.589
Standard Floor Material			5.125	2	0.077			
Substandard Floor Material	0.863	0.453	3.627	1	0.057	2.370	0.975	5.758
Other Floor Material	0.724	0.463	2.444	1	0.118	2.062	0.832	5.107

Table 4.9: Logistic regression model showing odds ratio, level of significance and coefficients between housing, types of housing material and types of energy source for cooking and space heating and arthritis

4.2.3.2 Logistic regression analysis for communicable disease

4.2.3.2.1 Influenza

The analysis below shows a positive significant relationship between influenza and housing and basic services offered. Children that are exposed to substandard wall material (2.10, 95% CL: 0.29-15.03) are more likely to suffer from influenza than those living in houses with standard housing materials. The odds ratio for influenza among children living in other traditional dwelling was 1.61 (CL. 0.87-2.99), whereas all the types of the main dwelling are have a negative significant relationship with influenza. All the floor materials also have a negative significant relationship with influenza. All basic services have a negative significant relationship with influenza. Space heating has a positive significant relationship even though the coefficient is the lowest as compared to all the positive coefficients.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Formal Dwelling			2.752	3	0.431			
Traditional Dwelling	-1.440	1.328	1.176	1	0.278	0.237	0.018	3.197
Informal Dwelling	-1.197	1.302	0.846	1	0.358	0.302	0.024	3.872
Other Main Dwelling	-2.310	1.509	2.342	1	0.126	0.099	0.005	1.912
Formal Other Dwelling			12.586	3	0.006			
Traditional other Dwelling	0.480	0.314	2.326	1	0.127	1.615	0.872	2.992
Informal Dwelling	-0.069	0.347	0.040	1	0.841	0.933	0.473	1.841
Other other Dwelling	0.529	0.332	2.547	1	0.110	1.698	0.886	3.252
Standard Wall Condition			0.794	2	0.672			
Substandard Wall Condition	0.743	1.004	0.549	1	0.459	2.103	0.294	15.038
Other Wall Condition	0.546	1.006	0.295	1	0.587	1.727	0.240	12.406
Standard Roof Condition			0.502	2	0.778			
Substandard Roof Condition	0.161	0.227	0.500	1	0.480	1.174	0.752	1.833
Other Roof Condition	0.117	0.225	0.270	1	0.603	1.124	0.723	1.747
Standard Floor Material			0.353	2	0.838			
Substandard Floor Material	-0.314	0.558	0.317	1	0.574	0.730	0.245	2.181
Other Floor Material	-0.348	0.586	0.353	1	0.553	0.706	0.224	2.226
Standard Space Heating			1.215	2	0.545			
Substandard Space Heating	0.011	0.158	0.005	1	0.945	1.011	0.742	1.378
Other Space Heating	0.184	0.175	1.103	1	0.294	1.202	0.853	1.693
Municipal Refuse Removal			7.217	5	0.205			
Community Refuse Removal	-0.429	0.743	0.333	1	0.564	0.651	0.152	2.792
Communal Dump	-0.548	0.783	0.489	1	0.484	0.578	0.125	2.683
Own Dump	-0.881	0.931	0.894	1	0.344	0.414	0.067	2.572
No collection of Refuse	-0.912	0.735	1.538	1	0.215	0.402	0.095	1.697
Other Refuse Removal	-0.816	0.844	0.935	1	0.334	0.442	0.085	2.311

Table 4.10: Logistic regression model showing odds ratio, level of significance and coefficients between housing, type of housing material, types of energy source, basic services and influenza

4.2.3.2.2 Diarrhoea

The results confirm that children living in informal dwellings are the ones that are more prone to suffer from diarrhoea than children living in formal dwellings. None of the methods of water supply have an effect on diarrhoea and they have the highest coefficients as compared to the other covariates.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Formal Other Dwelling			5.412	3	0.144			
Traditional other Dwelling	0.328	0.475	0.477	1	0.490	1.388	0.547	3.521
Informal Dwelling	0.786	0.510	2.376	1	0.123	2.194	0.808	5.958
Other other Dwelling	0.551	0.486	1.283	1	0.257	1.735	0.669	4.500
Standard Wall Condition			8.393	2	0.015			
Substandard Wall Condition	0.638	1.222	0.273	1	0.601	1.893	0.173	20.764
Other Wall Condition	-0.545	1.234	0.195	1	0.659	0.580	0.052	6.518
Standard Roof Condition			3.420	2	0.181			
Substandard Roof Condition	-0.355	0.301	1.390	1	0.238	0.701	0.389	1.265
Other Roof Condition	0.010	0.292	0.001	1	0.973	1.010	0.569	1.791
Standard Floor Material			0.120	2	0.942			
Substandard Floor Material	0.262	0.784	0.112	1	0.738	1.300	0.279	6.043
Other Floor Material	0.284	0.825	0.119	1	0.731	1.329	0.263	6.700
Standard Water supply			5.363	3	0.147			
Substandard Water supply	-1.895	0.954	3.947	1	0.047	0.150	0.023	0.975
No Water supply	-2.245	1.008	4.958	1	0.026	0.106	0.015	0.764
Other Water supply	-2.077	0.982	4.470	1	0.034	0.125	0.018	0.859

Table 4.11: Logistic regression model showing odds ratio, level of significance and coefficients between housing, type of housing material, types of energy source, basic services and diarrhoea

4.2.3.2.3 Fever

Exposure to substandard basic services has an effect on fever. Different types of dwelling units do not have an effect on fever however materials used to build those dwellings have an effect on fever. Other space heating that includes a response of no space heating has an odds ratio of 1.46 (CL: 1.025-2.100) with significance level of 0,036 which is below 0.05. This shows that the relationship is significant.

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95% C.I.for EXP(B)	
							Lower	Upper
Formal Dwelling			5.124	3	0.163			
Traditional Dwelling	-1.749	1.435	1.484	1	0.223	0.174	0.010	2.900
Informal Dwelling	-1.440	1.415	1.036	1	0.309	0.237	0.015	3.791
Other Main Dwelling	-0.145	1.528	0.009	1	0.924	0.865	0.043	17.295
Formal Other Dwelling			0.795	3	0.851			
Traditional other Dwelling	-0.070	0.320	0.047	1	0.828	0.933	0.498	1.746
Informal Dwelling	-0.120	0.354	0.115	1	0.735	0.887	0.443	1.775
Other other Dwelling	0.080	0.337	0.057	1	0.812	1.084	0.560	2.098
Standard Wall Condition			3.460	2	0.177			
Substandard Wall Condition	1.398	1.033	1.830	1	0.176	4.046	0.534	30.655
Other Wall Condition	0.903	1.042	0.752	1	0.386	2.468	0.320	19.016
Standard Roof Condition			2.836	2	0.242			
Substandard Roof Condition	0.167	0.243	0.473	1	0.492	1.182	0.734	1.903
Other Roof Condition	0.359	0.239	2.252	1	0.133	1.432	0.896	2.290
Standard Floor Material			14.521	2	0.001			
Substandard Floor Material	-0.231	0.582	0.158	1	0.691	0.794	0.254	2.482
Other Floor Material	0.608	0.612	0.989	1	0.320	1.838	0.554	6.095
Standard Water supply			1.814	3	0.612			
Substandard Water supply	0.610	1.130	0.292	1	0.589	1.841	0.201	16.846
No Water supply	0.535	1.154	0.215	1	0.643	1.708	0.178	16.380
Other Water supply	0.378	1.144	0.109	1	0.741	1.460	0.155	13.745
Standard Space Heating			5.022	2	0.081			
Substandard Space Heating	0.009	0.168	0.003	1	0.958	1.009	0.726	1.401
Other Space Heating	0.383	0.183	4.386	1	0.036	1.467	1.025	2.100
Municipal Refuse Removal			4.082	5	0.538			
Community Refuse Removal	1.639	1.086	2.280	1	0.131	5.151	0.613	43.251
Communal Dump	1.815	1.115	2.648	1	0.104	6.141	0.690	54.657
Own Dump	1.120	1.246	0.807	1	0.369	3.064	0.266	35.235
No collection of Refuse	1.422	1.079	1.736	1	0.188	4.145	0.500	34.369
Other Refuse Removal	1.388	1.161	1.429	1	0.232	4.008	0.411	39.036

Table 4.12: Logistic regression model showing odds ratio, level of significance and coefficient between housing, types of housing materials, basic services and fever

4.2.3.2.4 Cough

Substandard wall condition have a positive significant relationship to cough. Other refuse removal method has the highest positive coefficient of 1.185, while substandard floor material has the lowest positive correlation of 0.029. Own dump that has the highest negative coefficient (-.409) has the lowest odds ratio of 0,666 (CI of 95%0.109-4.036).

Variable	B	S.E.	Wald	df	Sig.	Exp(B)	95%C.I.for EXP(B) Lower	Upper
Formal Other Dwelling			4.879	3	0.181			
Traditional other Dwelling	-0.096	0.308	0.097	1	0.755	0.909	0.497	1.660
Informal Dwelling	-0.354	0.338	1.095	1	0.295	0.702	0.362	1.362
Other other Dwelling	0.149	0.326	0.209	1	0.648	1.161	0.613	2.198
Standard Wall Condition			1.312	2	0.519			
Substandard Wall Condition	0.588	0.966	0.371	1	0.543	1.800	0.271	11.952
Other Wall Condition	0.257	0.983	0.068	1	0.794	1.293	0.188	8.875
Standard Roof Condition			1.061	2	0.588			
Substandard Roof Condition	0.048	0.223	0.047	1	0.829	1.049	0.678	1.623
Other Roof Condition	0.180	0.221	0.663	1	0.416	1.197	0.776	1.846
Standard Floor Material			1.423	2	0.491			
Substandard Floor Material	0.029	0.555	0.003	1	0.958	1.030	0.347	3.058
Other Floor Material	0.277	0.583	0.225	1	0.635	1.319	0.420	4.136
Standard Water supply			5.998	3	0.112			
Substandard Water supply	0.640	0.927	0.476	1	0.490	1.896	0.308	11.670
No Water supply	0.220	0.953	0.053	1	0.817	1.246	0.193	8.062
Other Water supply	0.314	0.943	0.111	1	0.739	1.369	0.216	8.687
Standard Space Heating			0.827	2	0.661			
SubstandardSpace Heating	-0.142	0.157	0.814	1	0.367	0.868	0.638	1.181
Other Space Heating	-0.038	0.173	0.048	1	0.827	0.963	0.685	1.353
Municipal Refuse Removal			5.823	5	0.324			
Community Refuse Removal	0.446	0.699	0.408	1	0.523	1.562	0.397	6.143
Communal Dump	0.512	0.742	0.477	1	0.490	1.669	0.390	7.141
Own Dump	-0.409	0.920	0.197	1	0.657	0.665	0.109	4.036
No collection of Refuse	0.359	0.690	0.271	1	0.603	1.432	0.370	5.534
Other Refuse Removal	1.185	0.815	2.116	1	0.146	3.271	0.663	16.146

Table 4.13: Logistic regression model showing odds ratio, level of significance and coefficients between housing, types of housing material and basic services and cough

CHAPTER 5: DISCUSSION

The purpose of this study was to examine the effects of housing and basic services on diseases. For children below the age of 5 years, the study concentrated on communicable disease and NCDs for all the respondents who participated in the study. At the end, the study had to identify the population at risk and identify housing materials that can be regarded as risk factors.

From the results obtained from the analysis on chi-square, it was found that there is an association between housing, type of housing material, basic services and both communicable and NCDs. The findings of this study are consistent with previous studies (Kinyoki, et al., 2017). Results obtained from logistic regression, found that deficient housing, housing material has a positive significant relationship with both communicable and NCDs. The null hypothesis which is, deficient housing, housing material and basic services does not have an effect on communicable diseaese and NCDs, is therefore rejected.

In this study some contradictory results have surfaced. Results on hypertension for chi-square have shown that there is a positive relationship between hypertension and all the covariates whereas results for logistic regression have shown that not all the covariates have a positive significance relationship with hypertension. One other thing is that most of the previous studies have shown that a cold room has an effect on hypertension and asthma. A cold room entails everything in the room including floors and now the findings of this study have shown that there is a negative significant relationship between substandard materials used for floors and asthma and hypertension. One most contradictory finding is when both logistic regression and chi-square results have shown that there is a negative significant relationship between diarrhoea and water supply.

Further research on this study needs to be done. During the period of data collection of LCS, the sampled household is trained on how to fill in the diary on a daily basis so as to record their daily acquisitions. For the purpose of further research, households must be given thermometers where the sampled family will have to record their indoor temperature in the diary provided on a daily basis. For those who cannot write, the fieldworker will give support. More health related questions need to be included in the questionnaire, such as how long they have been staying in that particular dwelling and a question on how often do they maintain the structure must be asked. A nurse must be appointed to do a test on the illnesses that are listed on the questionnaire instead of self-reported cases. Nurses must also be appointed to do anthropometric measurements because they know the importance of anthropometric measurements. The variable of overcrowding can be included in this study during data collection. The household must be asked if they perceive themselves or their household as being overcrowded. This must be analysed as a knowledge question.

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Children at risk are those staying in areas that do not have refuse removal services. Cough and fever are more prevalent in those areas. Children staying in informal settlements are more prone to suffer from diarrhoea. Substandard floor materials such as earth and dung have a positive relationship with influenza and children staying in those houses are at risk of suffering from influenza. For NCDs, exposure to substandard floor material and informal dwelling put occupants of those houses at risk of suffering from arthritis. Informal and traditional houses that are built with substandard wall, floor and roof materials are regarded as risk factors for hypertension.

The results of this study can be generalised to the whole population. Results can be analysed using a weighted data where one will find the results of the whole population. The worth of this study is that it has given the results at country level, where this information can be used by politicians during planning process.

 A healthy society is a productive asset for any economy (Rath et al., 20115). Urban planners and public health specialists must work together to create this kind of a society. In trying so hard to create this kind of a society, they need to bear in mind that citizen participation is of utmost importance.

Ths chapter presented the results of the data as was proposed in chapter three. That data was analysed and presented in meaningful graphs and tables. The results attempted to provide solutions to the questions raised in chapter two. It highlighted the contribution of the type of dwellings to communicable disease and NCDs. The next chapter makes recommendations from the findings of the study.

CHAPTER 6: FINDINGS AND RECOMMENDATIONS

The descriptive analysis results have shown that hypertension,was identified as the most common illness for respondents followed by diabetes for all the respondents. For children below the age of 5 years, the most common disease was influenza followed by cough. Health promotion at school level is the most basic practice that will raise awareness on communicable diseases and NCDs. This must be done at primary school level. Learners must be taught about the different kinds of ABDs,WBDs and VBDs.

According to the results obtained, there is a positive significant relationship between people living in informal and traditional houses when those living in formal houses were used as the reference group. People living informal and traditional houses may thus be viewed as the population that it is at risk. The country has different housing subsidies that can be given to its citizens, whether they stay in urban or rural areas. It looks as though our country is going back to the laissez faire growth and development era where there is lack of accountability from our urban planners. Roles and responsibilities of urban planners must be revised.

The country needs to come up with an analytical study that will concentrate on analysing the relationship between health status and other variables. Information on exposure to different risk factors of NCDs and communicable diseases must be collected. Case control studies must be encouraged in the country. Enough funds must be set aside for this study.

Substandard housing materials that include, amongst others, corrugated iron/zinc, cardboard, asbestos and plastic, may be regarded as risk factors for communicable diseases and NCDs. The country has policies that prescribe to the citizens the type of materials they must use to build their houses, but this is not taken into consideration. Strict measures must be taken against urban planners who fail to encourage residents to use materials that are prescribed in the housing policy.

It is important that urban planners and health practitioners must work as one unit. Their main objective is to create a liveable and sustainable cities.They must learn from other countries on how they managed to achieve those liveable and sustainable cities. They must bear in mind that situations are not the same and after learning about models that other cities have implemented, they must come back and choose models that will be most suitable for the country.

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APPENDICES

UNIVERSITEIT
STELLENBOSCH
UNIVERSITY

PROJECT EXEMPT FROM ETHICS CLEARANCE

3 October 2018

Project number: ING-2018-8256

Project title: The effects of housing and basic services on diseases

Dear Mrs Segametsi Letlape

Your application received on **05 September 2018** was reviewed by the REC: Humanities.

You have confirmed in the proposal submitted for review that your project does not involve the participation of human participants or the use of their data. You also confirmed that you will collect data that is freely accessible in the public domain only.

The project is, therefore, exempt from ethics review and clearance. You may commence with research as set out in the submission to the Research Ethics Committee: Humanities.

If the research deviates from the application submitted for REC clearance, especially if there is an intention to involve human participants and/or the collection of data not in the public domain, the researcher must notify the DESC/FESC and REC of these changes well before data collection commences. In certain circumstances, a new application may be required for the project.