Analysing income mobility and obesity in South Africa

R Maasz

orcid.org/0000-0002-0127-6506

Dissertation accepted in fulfilment of the requirements for the degree Master of Commerce in Economics at the North-West University

Supervisor: Prof WF Krugell

Co-Supervisor: Dr C Taljaard-Krugell

Graduation: June 2021

Student number: 26978296

Acknowledgements

I would like to acknowledge everyone who played a part in the completion of this academic paper.

My husband, thank you for your constant motivation, encouragement, support and unconditional love.
My loving family, thank you for supporting me in everything I do. Thank you for presenting me with so many opportunities throughout my life thus far.

I am extremely thankful to my supervisors, Prof. Waldo Krugell and Dr Christine Taljaard-Krugell.
Thank you for your patience and guidance in this wonderfully unique and strange year.

Dr Dieter von Fintel, I am grateful for your help in guiding the empirical analysis in the right direction.
Inarie Jacobs, my dear friend, thank you for your constant encouragement, advise and help.

Jesus Christ, my King.
May this glorify You.
Without You, none of this would have been possible.

There are numerous others not necessarily mentioned here by name.

You know who you are.

To you I am also sincerely thankful.

Abstract

Income mobility forms a part of growth in a society, especially when people move from lower income levels to higher income levels. It is often assumed that people who move to higher income levels are healthier than people who consistently find themselves in low-income groups. With this study, this assumption was tested by using obesity to measure health. Obesity, used as a health risk factor, is one of the results of the nutrition transition where people are moving away from traditional, nutritious foods to less nutritious foods. The prevalence of obesity was tested on a South African sample compiled by the National Income Dynamic Study (NIDS). The study was conducted over five years, or waves, from 2008 to 2017. The questionnaires that form part of the study provided enough data to calculate the Body Mass Index (BMI), as well as the income levels of adults. Respondents were divided into four BMI groups, as well as four income groups. By making use of this group classifications, the prevalence of obesity among the respondents participating in income mobility was tested. The findings of the study show that there is an observed positive relationship between respondents who moved from a lower social class to a higher social class and a BMI increase.

Opsomming

Inkomstemobiliteit vind plaas saam met ekonomiese groei in ‘n samelewing wanneer mense vanaf lae inkomstevlakke na hoër inkomstevlakke beweeg. Daar word gereeld ‘n aanname gemaak dat mense wat na hoër inkomstevlakke beweeg, gesonder is as mense wat hulself konstant in lae inkomstegroepe bevind. Met hierdie studie, is hierdie aanname getoets deur van vetsug (obesiteit) gebruik te maak om gesondheid te meet. Vetsug is gebruik as ‘n risiko-indikator vir gesondheid. Vetsug is een van die resultate van die voedingsoorgang waar mense wegbeweeg van tradisionele, voedsame kos na minder voedsame voedsel. Die voorkoms van vetsug word bepaal op ‘n Suid-Afrikaanse steekproef wat saamgestel is deur die Nasionale Inkomste Dinamiese Studie (NIDS). Die studie is uitgevoer oor vyf rondtes, vanaf 2008 tot en met 2017. Die vraelyste wat deel van die studie vorm het genoegsame data voorsien om die liggaamsmassa-indeks van volwassenes te bereken, sowel as hulle inkomstevlakke. Respondente is in vier liggaamsmassa-indeksgroepe verdeel, sowel as in vier inkomstegroepe. Deur gebruik te maak van hierdie groepsverdelings, is die voorkoms van vetsug onder die respondente wat deelgeneem het aan inkomstemobiliteit, bepaal. Die bevindinge van die studie toon dat daar 'n positiewe verband is tussen respondente wat beweeg het van 'n laer sosiale klas na 'n hoër sosiale klas en 'n liggaamsmassa-indekstoename.

Table of contents

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS & ACRONYMS

BMI	BODY MASS INDEX
CI	CONCENTRATION INDEX
CPI	CONSUMER PRICE INDEX
DHS	DEMOGRAPHIC AND HEALTH SURVEY
DPME	DEPARTMENT OF PLANNING, MONITORING AND EVALUATION
FDI	FOREIGN DIRECT INVESTMENT
GBD	GLOBAL BURDEN OF DISEASE
GDP	GROSS DOMESTIC PRODUCT
IMF	INTERNATIONAL MONETARY FUND
MDGs	MILLENNIUM DEVELOPMENT GOALS
NCD	NON-COMMUNICABLE DISEASE
NDoH	NATIONAL DEPARTMENT OF HEALTH
NIDS	NATIONAL INCOME DYNAMICS STUDY
PURE	PROSPECTIVE URBAN RURAL EPIDEMIOLOGY STUDY
SALDRU	SOUTHERN AFRICA LABOUR AND DEVELOPMENT RESEARCH UNIT
SAMRC	SOUTH AFRICAN MEDICAL RESEARCH COUNCIL
SANHANES	SOUTH AFRICAN NATIONAL HEALTH AND NUTRITION EXAMINATION SURVEY
SDGs	SUSTAINABLE DEVELOPMENT GOALS
STATS SA	STATISTICS SOUTH AFRICA
WHO	WORLD HEALTH ORGANISATION

1 CHAPTER 1

1.1 Introduction

"Health improvements stimulate economic development" is an argument presented by Bloom and Canning (2000:1209) based on their study of the relationship between health and wealth. These authors consider health-led development as a revolution in economic thinking that has the ability to transform slow-growing, disease burdened countries into healthy and developing economies with growing income levels (Bloom & Canning, 2000:1207-1209).

Poor health forms part of a potentially vicious cycle where the ability to work for an income is undermined by poor health. The potential lack in income, in turn, limits access to good (often private) healthcare (Ssebagala, 2019:519-536). South Africans face various diseases that have a negative influence on their health and that of the country as a whole. Among these diseases, one can distinguish between communicable diseases, such as HIV and Aids, and Tuberculosis and other non-communicable diseases (NCD's) that are not transmittable from one person to another, such as type 2 diabetes and hypertension. From 2000 and 2015, mortality rates due to NCD's increased with 14.1 per cent (GBD 2015 Mortality and Causes of Death Collaborators, 2016:1459-1544). One of the risk factors associated with non-communicable diseases that has been in a surge, is obesity (Henry & Kollamparambil, 2017; Mbanya *et al.*, 2014; Muluvhu *et al.*, 2019; Puaone *et al.*, 2002). Obesity is a medical condition where the body carries a high, unhealthy amount of fat tissue, which can lead to a number of other disorders, many of which are related to the heart, brain, cancer and high blood pressure (World Obesity Federation, 2018). Obesity therefore impact the health status of individuals, and consequently, the economic development of the country.

This study aimed to investigate the prevalence of obesity as a health risk factor in South Africa as well as its link to income mobility by making use of the panel dataset collected by the National Income Dynamics Study (NIDS). The NIDS dataset is based on a collection of questionnaires posed to the same +-28 000 respondents over five waves – from 2008 to 2017. Economic development and growth in income are often associated with the so-called A relevant, timeous analysis, where a shift occurs from traditional diets to increased intakes of processed snack foods, fast foods, carbonated beverages and various forms of sugar, oils, saturated fats and animal-proteins (Satia, 2010:219-223). The aim was to examine whether households that move to a higher social class (classified in terms of spending) over time are indeed healthier, or not. This has broader implications for further economic development.

The following section sketches a background about the main topics and key concepts of the study. The problem statement, motivation for the study, research question and aim, method, layout and ethical considerations follow. In Chapter 2, a review of the literature about the effect of better health on growth and development, as well as the links between growth and development and better health are provided. This is followed by a review of class and income mobility literature in Chapter 3, where after the method and results of the empirical analysis are presented in Chapter 4. The final chapter presents conclusions and recommendations based on the findings of the study.

1.2 Background to study

South Africa faces significant challenges such as a low economic growth rate, high levels of unemployment and poverty, and persistent inequality. Since 1994, some progress has been made in poverty alleviation and access to public services, but this does not directly translate into higher incomes and equal positive development outcomes. Inequality matters in that segments of the South African society are excluded from economic opportunities. It is correlated with different social problems such as crime, health problems and mortality. It limits individual capabilities and the performance of the economy.

Stats SA (Statistics South Africa) (2019), in partnership with the Southern African Labour and Development Research Unit (SALDRU), released a report in 2019 discussing inequality trends in South Africa. In the report, reference is made to the fact that income inequality Burger and McAravey (2014)is exceptionally high, despite multiple interventions aimed at lowering inequality levels (Stats SA (Statistics South Africa), 2019). Referring back to the notion of "health-led development" mentioned in the introduction, it is clear that the unequal distribution of income limits access to health services and makes it a challenge to live a healthy lifestyle. For example, low income compels poor households to spend less money on healthy, more expensive food and more money on cheaper, unhealthy food, such as high-energy, fatty, oily, salty convenience foods. These foods are, unfortunately, an inherent preference for mankind that is easily bought in place of healthy foods (Vorster *et al.*, 2011:429-441).

A close correlation exists between health and income. Health is a determinant of human capital and labour productivity (Weil, 2014:623-682). An improvement in health leads to a decrease in mortality, which motivates individuals to invest in their personal abilities, resulting in a more educated workforce that increases the level of human capital and enhances the potential of an increase in income levels (Bloom & Canning, 2000:1207-1209). An improvement of health in South Africa can therefore increase the level and quality of human capital in the country, as well as productivity and lead to economic growth.

In his discussion about health and economic growth, Weil (2014:623-682) focused extensively on the effect of health on economic growth. He used life expectancy as a measure of health, as good health is

associated with longer life expectancy. He further indicated, based on his analysis of other literature, that income has a bigger effect on health outcomes for people from the lower part of the income distribution than people from the high end of the income distribution.

Earlier work by Coovadia *et al.* (2009:817-834) shows that there are definite differences in health between people at different income levels. They show that higher-income areas have better access to health services and medical schemes and lower mortality rates. Those with higher incomes are healthier than those with lower incomes and they tend to have healthier lifestyles - eating healthier food and getting higher levels of physical exercise.

The focus of this study was on the link between income mobility and health across different socio-economic classes. A lot of literature exists that focuses on the poor and poverty dynamics, as well as income inequality, but there is also interest in income mobility and the middle class in South Africa. The growth of a middle class is considered as an important and powerful force that shapes a more dynamic, unbiased and unified society (Burger & McAravey, 2014; Burger *et al.*, 2015b:25-40). A growing middle class is considered to be the consequence of and driver of economic growth within a country. Recent studies of economic development in South Africa are evolving from being mainly poverty-focused to being more middle class focused (Burger *et al.*, 2015a:89-106; Burger *et al.*, 2015b; Schotte *et al.*, 2017). Visagie and Posel (2013:149-167) identified the South African middle class as being quite poor, given the fact that a household of four (in 2008) received between R1 520 ($190.24) and R4 560 ($570.713) income per month (BusinessTech, 2016; Visagie & Posel, 2013:149-167). More recent work by Zizzamia *et al.* (2019) distinguishes between five dynamic social classes: the chronically poor, the transient poor, the vulnerable, the middle class and the elite. Their paper highlights a number of important findings: The stable middle class (or elite) makes for approximately 25 per cent of the population. The transient poor and the vulnerable constitute almost 27 per cent of the population and they are different from the chronically poor and from the middle class – the analysis shows that their position is linked to their unstable and informal employment prospects. The remainder of the population remains trapped in persistent poverty (Zizzamia *et al.*, 2019:33-34).

There are various ways in which to distinguish between different social classes. Identification methods of the middle class include the use of the vulnerability approach, stability approach, income approach, self-identification, or occupation and skill level classification (Burger *et al.*, 2015b; Schotte *et al.*, 2017; Zizzamia *et al.*, 2019). Burger and McAravey (2014) included five criteria in their study in which adults (above 18 years of age) had to adhere to, to be categorised as middle class. The criteria stated that the adult had to have at least 7 years of education, access to key public services, had to be personally

employed or living in a household with a household member that was employed, had access to the media and lived in a household where there was both a refrigerator and a stove.

None of the criteria mentioned above draws specific attention to the health of the individual. The common perception of the middle class of a country is that they have access to medical and health services and are healthier with higher life expectancy. In their discussion paper of the health analysis of the first year (wave 1) of the NIDS dataset, Ardington and Case pointed out that an increase in health can lead to an increase in income and *vice versa* (Ardington & Case, 2009:1-34). It is therefore of interest to evaluate the link between socio-economic mobility and health status.

Coovadia *et al.* (2009:817-834) pointed out the inequalities of the health care system in South Africa and the challenges to achieve greater effectiveness. Within their findings, the following graph was used to illustrate the vast difference between public and private health-care expenditure per head in South Africa from 1996 to 2006.

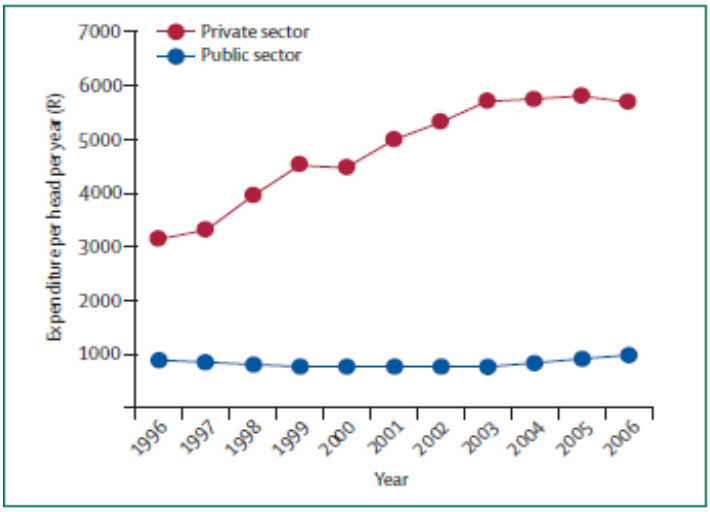


Figure 1 Relationship between public and private healthcare expenditure in South Africa from 1996 to 2006

Source: Coovadia *et al.* (2009:828)

In Figure 1, it is noteworthy that the amount spent on private sector healthcare greatly exceeds that of public sector care. Higher income individuals tend to make use of private sector healthcare as it is not government funded and requires out-of-pocket payments. The private sector has grown significantly faster than the public sector in terms of health-care spending per capita and therefore delivers better health-care (Coovadia *et al.*, 2009:817-834). Due to the out-of-pocket medical scheme payment system of private hospitals, low-income individuals are not able to make use of private healthcare. These individuals have no other choice but to make use of the neglected public sector healthcare, which further contributes to health inequality as a result of income inequality.

A more recent study by Mukong *et al.* (2017:1-19), made use of the health Concentration Index (CI) to determine the levels of health-related income inequality of South Africa over the first four waves of the NIDS. The findings include, amongst others, that individuals who form part of lower-income classes are faced with greater incidence of lifestyle-related diseases, such as diabetes and high blood pressure, especially those who engage in smoking and high levels of alcohol consumption.

Overweight and obesity are risk factors for lifestyle-related diseases and have an increasing incidence across the globe (The World Bank Group, 2020:71). Until recently, underweight as a form of malnutrition has been a great health-concern for Sub-Saharan African countries (Mbanya *et al.*, 2014:501). More recently, a different form of malnutrition is on the rise, namely obesity. When a household, individual or a population suffers from undernutrition along with the coexistence of overweight and obesity, it is referred to as a double burden of malnutrition (World Health Organisation, 2020a). Obesity is a disease where the body carries a high, unhealthy amount of fat tissue. The World Obesity Federation defines overweight as adults with a Body Mass Index (BMI) equal to or greater than 25 and as adults with a BMI equal to or greater than 30 (World Obesity Federation, 2018). The prevalence of obesity rises with an increase in foods containing high levels of saturated and trans fats, caloric sweeteners and processed animal source foods, along with a decrease in physical activity which is influenced by the availability of modern transport methods and industrialised working environments (Popkin & Gordon-Larsen, 2004). Obesity can be a consequence of the nutrition transition referred to above. The nutrition transition is often characterised by increased intakes of snack foods, carbonated beverages and various forms of sugar, oils, saturated fats and animal-proteins where there is a shift away from traditional diets (Satia, 2010:219-223). The findings of Vorster *et al.* (2011) indicate the presence of the nutrition transition in South Africa, with a significant increase of over-nutrition from 2005 to 2010 in specifically rural areas of the country (Vorster *et al.*, 2011:429-441). Several studies have examined obesity as a health risk factor in South Africa (Muluvhu *et al.*, 2019; Puaone *et al.*, 2002; Shisana *et al.*, 2015).

The South African Demographic and Health Survey was a national cross-sectional study performed in 1998 by Puaone *et al.* (2002:1038-1048). In this study, BMI and waist/hip ratio were used to identify adults above 15 years of age that could be classified as obese. Overnutrition in adults was identified, along with persisting high rates of undernutrition in children and infants. The results revealed low rates of underweight and high rates of overweight in respondents over the age of 15 years. In the results, 29,2 per cent of men and 56,6 per cent of women were classified as overweight or obese.

The 2013 report of the South African National Health and Nutrition Examination Survey (SANHANES-1) describes the health status of 25 532 individuals. Of these individuals, high blood pressure, known as

hypertension, was present in approximately 10 per cent of the respondents. Of these respondents, more than two-thirds were overweight or obese (Shisana *et al.*, 2013:1-401). Similar findings were reported more recently in a study conducted in the Limpopo province where it was found that obesity is in many cases the cause of multiple diseases and can lead to high blood pressure (Muluvhu *et al.*, 2019:361-368).

The NIDS questionnaire has an entire health-related section – section J (WAVE 5: page 40-45). The questions answered in this section enabled a study of BMI. Respondents were required to fill in their height and weight, which was then used to calculate their BMI. BMI is commonly used to classify overweight and obesity in adults and is the most useful population-level measure of overweight and obesity due to its consistency between different genders and adult ages. It is not, however, an indication of fatness in specific individuals (World Health Organisation, 2020b).

1.3 Problem statement

It is a common belief that being wealthier means being healthier. Yet, health outcomes in South Africa are influenced by various factors, including inequality and the ongoing nutrition transition. Due to the lack of conclusive research, it is unclear whether all South Africans who are moving to a higher social class with increased income levels are also experiencing better health.

This study set out to analyse the prevalence of obesity as a health risk factor across different social classes, to determine whether individuals who experience upward income mobility (moving from a lower to a higher social class) are healthier, based on their BMI status.

1.4 Motivation

This study aimed to contribute to the literature on the link between health risk factors (specifically obesity) and income mobility in South Africa, using data from the five waves of the National Income Dynamics Survey (NIDS). The health aspect of the study specifically focused on obesity, due to the increase in overweight and obesity across the globe and the multiple health problems that originate from it. Obesity causes approximately 4 million deaths globally each year (The World Bank Group, 2020).

The NIDS released five waves of data that were used in the analysis. Each wave had a health section from which this study drew. The wide span of data enabled a longitudinal study of adults to identify obesity prevalence in South Africa from 2008 to 2017. The data further included a range of socio-economic variables that enabled one to examine income mobility and the link to a specific health risk factor.

Previous studies about the health section of the NIDS data included, amongst others, a description of the health data of wave 1 and wave 2 of the survey, analysis of food expenditure patterns as well as analysis

of health seeking behaviour and health care (Ardington & Case, 2009; Ardington & Gasealahwe, 2012; Mhlongo & Daniels, 2013).

The description of the health data collected in wave 1 focused on mental health and anthropometric measurements of health (measurements of the human body) (Ardington & Case, 2009:1-34). The authors used these measurements to determine the prevalence of obesity using BMI dimensions for adults over 15 years in South Africa with specific differentiation between men and women. Their findings suggest that obesity in adults increased from 1998 to 2008 in all age groups, with the greatest increase in the age group between 15 and 24 years. Obesity in adult women (over 15 years of age) increased from 30 per cent to 33 per cent. In addition, the paper examined hypertension and the prevalence thereof and discussed the prevalence of hypertension amongst obese respondents. The researchers reported that hypertension was more prevalent amongst obese individuals and more common in women than in men. Their final key focus area was mental illnesses, such as depression.

Another study by Ardington and Gasealahwe (2012:1-36), made use of the NIDS wave 1 and wave 2 datasets to determine the relationship between health status and socio-economic status of South Africans, as well as to examine changes in nutritional status. Their study on health status focused on mortality trends and new births. The nutrition status aspect focused on obesity amongst adults and malnutrition amongst children. There were considerable transitions into and out of obesity, but nonetheless with an increase in obesity between the two waves, rising from 6,4 per cent to 8,7 per cent in men and 27,6 per cent to 32 per cent in women (Ardington & Gasealahwe, 2012:10). The study emphasised the potential of the NIDS panel data set for future studies.

Food expenditure patterns over the first three waves were studied by Mhlongo and Daniels (2013:1-24). Their findings indicated that at the time, households were spending proportionally less money on food in the face of increasing food prices. They also indicated the potential of future studies in this field.

These earlier studies using the health section of the NIDS data, indicate the exciting potential of the data. There is room for a diverse array of studies on this panel dataset, especially for investigating the links between economic development outcomes and health. No studies have examined the prevalence of obesity over all five waves and none of the studies have placed any focus on the link with income mobility over the period. This indicates a gap which this study aimed to fill.

1.5 Research question

What is the relationship between income mobility and obesity as a health risk factor, over time, in South Africa?

1.6 Research aim and objectives

1.6.1 Research aim

The aim of the research was to examine the link between income mobility and obesity in South Africa by comparing the prevalence of obesity for households that moved between different social classes.

1.6.2 Research objectives

Certain objectives needed to be achieved to reach the aim of the study. These objectives included:

- ✓ Describe obesity, as a health risk factor of South African households,
- ✓ Use BMI as an indicator to identify obesity,
- ✓ Identify households that experienced upward income mobility and moved between different social classes over the five waves of the National Income Dynamics Study (NIDS) data,
- ✓ Compare households from the different classes in terms of BMI categories.

1.7 Research method

The method of the study was a thorough review of relevant literature and empirical studies. Empirical analysis was required to achieve the above aims and included data preparation and model estimation.

The empirical analysis is explained in some detail in this section as the availability of data and use of established methods speak to the feasibility of the study.

The data used for this study was obtained from the National Income Dynamics Survey that was completed over five waves between 2008 and 2017. The survey had approximately 28 000 respondents who completed the same questionnaires over the five waves. Three different questionnaires were administered – one for adults (15 years and older), one for children (15 years and younger – completed by a parent or caregiver) and one for households (completed by the oldest women in the household). For the purpose of this study, only adults older than 19 years of age were considered. Each questionnaire had different sections of questions. This paper focused on the Health section. In their report on the health data in the first two waves of the NIDS, Ardington and Gasealahwe (2012:1-36) noted the presence of some measurement error in the health data. Despite these errors, they confirmed the feasibility of the use of the data in further studies. BMI was considered as one of the more consistent health indicators in the dataset (Ardington & Gasealahwe, 2012:8-9).

The key part of the empirical analysis was the identification of income mobility and movement between different social classes over time. That was linked to the obesity outcomes through simple cross

tabulations. Those characteristics of the households that are classified as “movers” were described in further detail. Finally, two simple regression models were included in the analysis to examine the relationship between BMI and income mobility while controlling for a number of confounding variables.

1.8 Chapter layout

1.8.1 Chapter 1

This chapter identified the purpose of the study by providing a brief background, stating the problem, explaining the motivation for the study, stipulating the various objectives and discussing the method to be followed.

1.8.2 Chapter 2 – Literature review: review of health research literature

Chapter 2 provides an overview of the health research literature. This includes the literature regarding health outcomes in South Africa’s, the nutrition transition, BMI and obesity.

1.8.3 Chapter 3 – Literature review: review of class and social mobility literature

Chapter 3 provides an overview of class and income or social mobility literature that forms the basis of the empirical analysis presented in Chapter 4.

1.8.4 Chapter 4 – Analysis and results

Chapter 4 reports on the method and results of the empirical analysis that was conducted with the software, Stata®. A discussion and interpretation of the results are included to clarify the findings.

1.8.5 Chapter 5 – Conclusion and recommendations

Chapter 5 concludes the study with a summary of the literature study, the analysis and findings. It draws conclusions and makes recommendations.

1.9 Contribution of the study

The study speaks to a clear gap in the literature, linking the analysis of social mobility to obesity, as a health risk factor, in South Africa. To the best of the author's knowledge, this has not yet been attempted in South Africa.

1.10 Ethical considerations

There is a very low risk of a harmful outcome and ethical clearance was given by the North-West University (NWU-00854-20-A4). The data is publicly available to download. The survey received ethics approval at the University of Cape Town (HREC REF: 697/2016) and consent of the participants can be reasonably assumed. There was no contact with human participants. The data was de-identified and there is no way that the analysis allows one to re-identify participants. Conventional methods were used to analyse the data and interpret the results.

2 CHAPTER 2: REVIEW OF HEALTH RESEARCH LITERATURE

2.1 Introduction

In an article written by Amartya Sen in 1999, he demonstrated the relationship between health and development in multiple ways. He argued that economic growth in itself cannot be the ultimate goal of development. He boldly claimed that "good health is an integral part of development". His argument is substantiated when one observes the effect of the ongoing Covid-19 global pandemic. The social and economic impact of the pandemic shows that the world is more dependent on the health of society than one is likely to admit. Economic growth must be accompanied by development - and various aspects thereof, including health (Sen, 1999:619-623). This concept that good health and economic prosperity support one another, specifically the effect of economic prosperity on health, formed part of the basis of this study.

Sen further stated that one of the most important freedoms that humans can have is the freedom from "avoidable ill-health" and "escapable mortality" (Sen, 1999:620). He elaborates on the notion that good health and economic prosperity tend to support each other. Healthy people can use their abilities to achieve higher levels of income and people with higher levels of income have more resources available to seek medical care, eat more nutritious food and, as a result, live healthier lives. Sen further argued that low-income countries are often sceptical of investing their limited resources into healthcare. However, he noted that healthcare is a labour-intensive resource, which makes it less expensive than other, mechanised resources and accordingly, an investment rather than a mere expense. Thus, by investing in healthcare (along with education) in a socially productive way, a country can boost its economic prosperity (Sen, 1999:619-623).

This chapter provides an overview of the literature that links health and economics and economics and health. The goal is to highlight the gap in this field for an empirical study that links income mobility to obesity in South Africa.

The first two sections of the literature review present firstly, the research that has examined the effect of better health on economic growth and development and secondly, the effect of economic growth and development on better health. The third section focuses on health, specifically zooming in on research that highlight aspects of nutrition and obesity and how the nutrition transition is linked to economic growth, development and health. Thereafter, the fourth section focuses specifically on recent South African literature and articles that have examined the health variables in the NIDS data. The chapter is concluded by summarising some of the key findings of the review.

2.2 Better health for growth and development

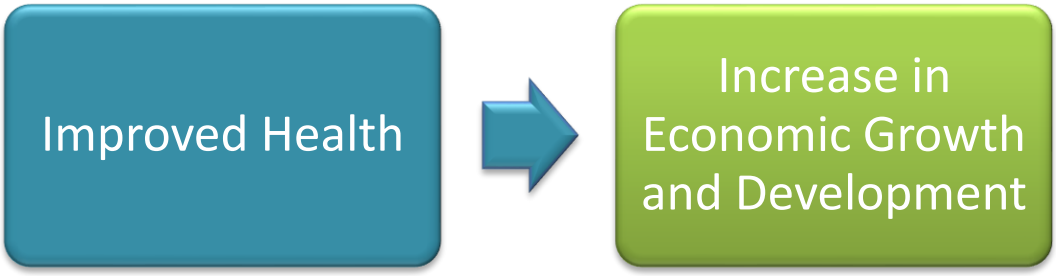


Figure 2 Better health for growth and development

"It is health that is real wealth and not pieces of gold and silver" – Gandhi (1922).

This section specifically looks at the influence of good health on economic prosperity. By way of introduction, the literature about the determinants of economic growth is discussed to indicate what determinants have been found to be key drivers of economic growth across countries. In this discussion, a lot of reference is made to the concept of human capital.

Health forms an important part of human capital and an investment in health can be considered as an investment in human capital (Temple, 1999:112-156). Temple addresses the importance of gaining an understanding of the drivers of economic growth, especially distinguishing between developed and developing countries. Temple mentions that a variety of variables have been shown to affect growth, such as human capital (including health and education), research and development, inequality and type of political system. The effect of health (as an investment in human capital) on economic growth is questioned due to a lack of well-developed theory, even though good health and high life expectancy are presumed to have a positive link to education and training, which in turn increases the quality of human capital and can potentially drive economic growth. To determine how health affects growth in different countries, health measures and interventions must be applied in similar, specified conditions within each of the countries. By measuring the effect of health in this way, the overall effect of health on growth between countries will be more clearly understood.

A few years before Temple, Rebelo (1991:500-521) indicated that the causes for economic growth and development differ across countries. The cause of growth in one country may not necessarily be the cause of growth in another. While looking at potential causes of heterogeneity in the determinants of growth in countries, Rebelo identified physical and human capital as an important reproducible factor of production.

The importance of including health as a critical part of human capital is also emphasised by Bloom *et al.* (2004:1-13). In a paper based on the Solow growth model, Mankiw *et al.* (1992:407-437) examined whether long-term economic growth is consistent with cross-country income variations by adding physical and human capital to the exogenous saving and population growth rates to better describe the data. Amongst their findings, they indicated that cross-country differences in income per capita are explained by saving, education and population growth. Sachs (2001:1-38) presents a different argument where he indicates that physical geography, specifically in tropical climates, has an influence on economic growth. He suggests that an increase in health and agricultural technologies in tropical regions will lead to economic development.

The variation in output per worker and essentially growth, is partially explained by physical and human capital, which are driven by social infrastructure, according to Hall and Jones (1999:83-116). Social infrastructure includes law and order, bureaucratic quality, corruption levels, risk of expropriation and openness to international trade. These authors indicate the importance of institutions and government policies to enhance long-term economic performance since differences in social infrastructure can lead to large differences in income. The theory posed by Mulligan and Sala-i-Martin (1993:739-773) on two-sector models of endogenous growth describes a general model of human capital and growth. Human capital is produced in the education sector, which is enhanced by health (see also Dimble and Menon (2017); Temple (1999); Bleakley (2010:283-310); and WHO Commission on Macroeconomics Health (2001)). More recently, Ogbuoji *et al.* (2020) examined the link between health and future economic wellbeing and found that health promotes the accumulation of, amongst others, human capital, providing favourable conditions for economic growth.

Sen (1999:619-623), in his book "Development as Freedom", exclaims that health is among the basic capabilities that give value to human life. He argued that health care is a fundamental component of development and economic progress. More than 20 years later, despite significant economic growth in countries across the world, health inequalities between different countries and different social classes within countries still exist. Health inequalities can lead to a poverty trap. The Commission Report of the WHO describes how the poor can fall prey to a poverty trap (WHO Commission on Macroeconomics Health, 2001:23). Lower-income or poor individuals are more prone to disease as they have a lack of access to clean water and sanitation and medical care and suffer inadequate nutrition. Due to low levels of income, they are less able to seek medical attention. However, in urgent situations where they have no other choice but to acquire debt to pay medical costs, they fall into a poverty trap. Their bad medical situation places them in a position where they are unable to work to pay off the debt, continuing the cycle

of the poverty trap mechanism. It is important to overcome this poverty trap, to create an environment where economic growth can benefit all social classes and improve development outcomes, such as health.

The WHO indicates that a positive correlation exists between education and health – with health indicated as life expectancy (World Health Organisation, 2002:21-41). Health contributes to development through the following pathways: higher labour productivity, higher rates of domestic and foreign investment, improved human capital, higher rates of national savings and demographic changes (Organisation for Economic Co-operation and Development (OECD) & World Health Organization (WHO), 2003). Healthier workers are physically and mentally robust and more energetic. A healthy workforce leads to an increase in productivity and workers earn higher wages (World Health Organisation, 2002:21-41). When looking at health as a determinant of human capital and life expectancy as a measurement of health, Barro (1997) found that life expectancy has a significant positive effect on human capital and a subsequent positive correlation with growth. The findings suggest an increase of 0.1 per cent in economic growth for a 10 per cent increase in life expectancy. Using the same indicators, Acemoglu and Johnson (2007:925-985) are amongst the few who, in their findings, indicate that there is no evidence that an increase in life expectancy (as an indicator for health) leads to an increase in income per capita. Bloom *et al.* (2004:1-13), however, found that an effective workforce is the result of healthier workers. Their findings state that health has a positive and statistically significant effect on economic growth as health improvements increase output. It is argued that mortality rates decrease when individuals with good health invest in their abilities (Bloom & Canning, 2000:1207-1209). This leads to an increase in human capital and creates an increase in an individual's potential to increase their income levels. In a report by the WHO Commission on Macroeconomics and Health, the importance of good population health is considered as a critical input of an overall development strategy that must be utilised with the aim to reduce poverty and enhance economic growth and long-term economic development (WHO Commission on Macroeconomics Health, 2001). In a recent study on population health, Sabina *et al.* (2020:585-597) examined a number of studies from 1990 to 2018 on the relationship between health care expenditure and health outcomes on economic growth. By studying various sources, they concluded that better health status improves economic growth (Sabina *et al.*, 2020:592).

Global goals have been set to attempt to improve global health and decrease inequalities, such as the Millennium Development Goals (MDG) and the Sustainable Development Goals (SDG) (Thomson, 2015; World Health Organisation, 2000). Of the SDG's, goal ten is specifically focused on reducing inequality and goal three is specifically focused on good health and wellbeing. These goals are aimed to be incorporated into global policy to ensure sustainable development and an increase in life expectancy as an indicator of health.

This section identified certain drivers of growth. It can be concluded that better health improves human capital and in that way, is an important driver of economic growth. In the following section, the effect of income (income mobility and income inequality) on health as described in the literature is considered.

2.3 Growth and development for better health

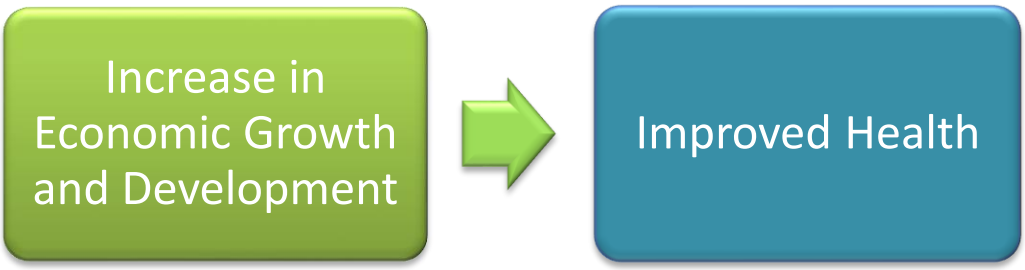


Figure 3 Increase in growth and development for better health

This section is the main focus of this chapter. It includes studies about the effect of economic growth (in this case mostly indicated with increases in income levels) and its effect on health. Health is frequently indicated as Body Mass Index (BMI), life expectancy, or others. This chapter focuses on the effect that economic growth and development have on obesity as a health risk factor (measured with BMI), but also makes reference to other indicators of health to determine the effect of economic growth and development on the overall health status of a country.

Figure 4 illustrates the relationship between income and health across the globe. The data used in this map, compiled by Gapminder, is combined by using data from the Institute for Health Metrics and Evaluation (using life expectancy as an indicator of health), the United Nations database and the World Bank's GDP per capita.

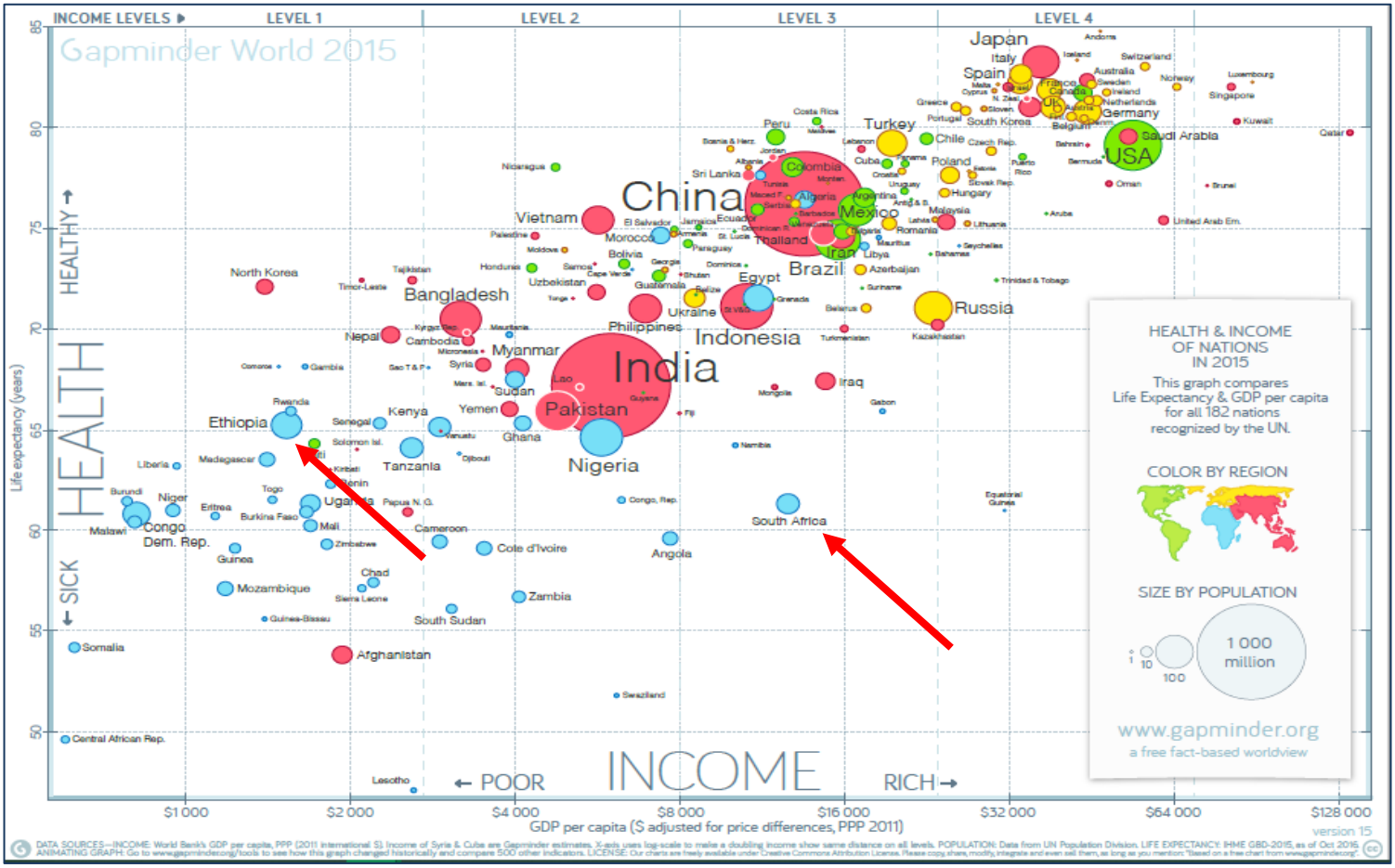


Figure 4 World Poster: Health and income

Source: Gapminder (2015)

In the map, it is notable that many African nations are marked by both low levels of income and low levels of health. South Africa stands out as a higher-income African country, but with low levels of health as measured by life expectancy. The low level of health in South Africa becomes evident when comparing South Africa with a country like Ethiopia. Income levels in Ethiopia are significantly lower than in South Africa, but they have higher life expectancy than in South Africa. This may be an indication of inequality in health provision or even a bad allocation of resources toward health.

North American and European countries experience higher levels of both income and health, with a few East-Asian countries also included.

In another comparison based on this author's own compilation of indicators from the World Economic Forum (WEF), the World Bank and the International Monetary Fund (IMF), the healthiest countries in the world (based on overall health and life expectancy) are compared with the countries with the highest GDP per capita. Within this comparison, some similarities exist. A country comparison of the top 5 healthiest

and wealthiest countries in the world are presented in Table 1. The first health indicator is reported by the WEF as a combination of life expectancy, obesity, tobacco use, air quality and access to clean water. The second health indicator is life expectancy reported by the World Bank. Wealth is classified by GDP per capita as reported by the IMF.

Table 1 Top five country comparison: health and GDP

HEALTHIEST COUNTRIES REPORTED BY THE WORLD ECONOMIC FORUM (Thornton, 2019).	**HIGHEST LIFE EXPECTANCY** REPORTED BY THE WORLD BANK (The World Bank, 2017)	**GDP PER CAPITA** REPORTED BY THE IMF (International Monetary Fund, 2019).
Spain	Hong Kong SAR, China	Luxembourg
Italy	Japan	Switzerland
Iceland	Macao SAR	Ireland
Japan	Switzerland	Macao SAR
Switzerland	Spain	Norway

Source: Author's own calculations adapted from the World Economic Forum (WEF), the World Bank and the International Monetary Fund (IMF).

When looking at correlations between good health and high-income countries, the top performers (especially when looking at the world poster (Figure 4)) can mostly be found in all three categories of the columns mentioned above. Switzerland is an example of this within the top five performing countries of each section. A number of studies have been performed on the high quality of health in Switzerland. Many of these studies state that Swiss citizens spend a lot of money on healthcare, but the high-income nature of the country enables them to do so. The small number of poorer citizens received healthcare subsidies from the government. Switzerland also has access to high-quality health technology, which improves the quality of its medical system (De Pietro *et al.*, 2015:1). Evidence from the table mentioned above shows that richer countries tend to be healthier than poor countries as not one low-income country is mentioned.

Previous studies about the relationship between income and health were conducted in many different contexts and countries. Weil (2014:623-682) noted that income and health are strongly associated, but the extent of the correlation depends on the specific country, how it is measured and the specific period

over which it is measured. Bloom and Canning (2000:1207-1209) argued that poor health is not only a consequence of low income, but that it is also one of the fundamental causes. They found that health improvements and economic growth can be mutually reinforcing. When looking at mothers and children, a rise in income benefits the health of both the mother and the child (Bloom & Canning, 2000:1209). In modern days, many health-related problems are caused by high caloric intakes, such as obesity and related diseases. This, in turn, has a negative influence on the health of individuals and populations. High caloric intake is no longer only associated with high-income social classes but is all the more present across all social classes. In the United States, adults with low income tend to be five times more likely to report poor health conditions than adults with higher levels of income, reporting especially high levels of chronic arthritis, diabetes and coronary heart disease (Woolf *et al.*, 2015:1-22).

When looking at the relationship between income and health expenditure (which leads to an increase in overall health) in developing countries, Bedir (2016:76-86) concluded a reciprocal relationship where he stated that economic growth causes an increase in healthcare expenditure and healthcare expenditure causes an increase in economic growth.

Michael Marmot, in his book "The Health Gap", emphasised the detrimental effect that inequality has on health where he mentioned that people who face relative social disadvantage suffer dramatic health disadvantages and that people in higher social classes live healthier and longer lives. He argued that the best way to reduce health inequalities is to empower people and create an environment for people to lead flourishing lives. The "health gap" that he spoke of, is when the prevalence of inequality limits the development of economic growth into better health (Marmot, 2015). The socioeconomic position of an individual often points to the level of health that the person is experiencing. An individual in a low socioeconomic position, which can be, amongst others, caused by an unequal distribution of income, is commonly faced with worse health than a person in a higher socioeconomic position (Marmot *et al.*, 2008:1661-1669). The authors of the latter acknowledged the importance of economic growth for health equity but emphasised the importance of appropriate social policies to ensure fairness in the way the economic resources are distributed to guarantee movement into a more equally healthy society.

When looking at the effect of income inequality on mortality on an international level, Rodgers (1979:343-351) found that the prevalence of income inequality leads to lower life expectancy. Wilkinson and Pickett (2006:1768-1784) evaluated the relationship between income inequality and population health by looking at existing literature and evidence. As many as 70 per cent of the 155 papers they studied indicated that health is worse in societies with high levels of income inequality. In another article, these same authors focused on the effect of income inequality on health, where health was measured by combining life

expectancy, mental illness, obesity, social mobility and more (Pickett & Wilkinson, 2015:316-326). They agreed with Lynch and Kaplan (1997:297-314) by presenting evidence that showed the negative effect of income inequality on health. They suggested that a reduction in income inequality will lead to an increase in population health.

In a paper focused on cross-national evidence of 155 countries over five decades for the relationship between income inequality and health, Beckfield (2004:231-248) expanded on other studies by accounting for unobserved between-country differences, using a larger sample and using more statistical controls. Similar to Deaton (2003:113-158), he found that overall inequalities have a bigger effect on population health than specifically income inequalities. When looking at different studies based on aggregate data, Gravelle *et al.* (2002:577-589) argued that the following absolute income hypothesis is not unlikely: "the health of individuals in a society also depends on the degree of income inequality in that society" (Gravelle *et al.*, 2002:587). Deaton (2003:113-158) did an in-depth study on the link between income inequality and health in both rich and poor countries. He argued that there is no direct link between income inequality and ill health, but rather that ill-health is the result of other factors, of which income inequality can be one of the factors. He further argued that income inequality is important to be considered, but that income inequality per se is not the only factor that influences health. He highlighted the need to investigate the role of income in promoting health so that adequate policies on income redistribution can be developed accordingly.

In a time-series analysis in the USA conducted by Bor *et al.* (2017:1475-1490) over four decades, they found that health is improving among the middle and upper classes and that health is worsening among the poor, supporting the idea that income levels affect health. The study further addressed obesity as a risk factor that has a negative impact on health outcomes. The authors emphasised the need to understand the cause of health inequalities so that equality can be improved to avoid the emergence of a health-poverty trap in the United States.

In the developing demography, Fichera and Savage (2015:500-515) focused on the relationship between income and health in Tanzania. Their findings suggested that income had a positive effect on health where a 10 per cent increase in income reduced the incidence of illnesses by 0,02 per cent in adults and a 10 per cent increase in income is associated with an increase in BMI of approximately 0,01 per cent.

Ssebagala (2019:519-536) illustrated how income and health interact with one another. His study was focused on the effect of poor health on consumer debt distress on South African adults by using the first three waves of the NIDS data. Amongst his findings, Ssebagala indicated that poor health increases the

probability of an individual to experience financial strain, enhanced by high healthcare costs and an inability to work. Good healthcare resulting from high health expenditure is key for improvements in health, as pointed out by Martin *et al.* (2008:826-842).

Case and Deaton (2009:319), in a study about the combined effect of wealth and health in South Africa and Udaipur (a city in India), reported that wellbeing is a result of good health, along with wealth. They supported the point that being wealthier means being healthier. Wealth in an economy is often the result of a productive labour force. A sick or vastly unhealthy labour force is doubtfully a productive labour force. The WHO views health as a productive asset that is essential to attract Foreign Direct Investment (FDI) (World Health Organisation, 2002:21-41). Their results indicate a link between health and nutrition with labour market outcomes. They used BMI as a health indicator where they found that poor nutrition in early childhood has long-term consequences as it can lead to bad health in adulthood, which can again undermine productivity. *Vice versa*, good nutrition starting from early childhood has a positive long-term effect on health and can positively influence future productivity. A positive effect on productivity has, in turn, a good effect on economic growth and development.

This section, in collaboration with Section 2.2, is evidence that income and health (measured in several different ways) are interrelated. However, some of the literature argues otherwise. Initially, it seems as if improvement in one leads to improvement in the other and as if a lack of growth in the one, commonly leads to a lack of development in the other. It is certain, however, that inequality has an influence on income inequality and can accordingly affect health.

Next, an overview of the literature regarding health in South Africa and the world is required. The following section identifies some specific health challenges that the world is faced with, specifically health challenges resulting from the nutrition transition currently taking place.

2.4 Health, nutrition and obesity

Overall, as seen in Section 2.3, higher income and higher social status are linked to better health. The greater the gap between the richest and poorest people of a country, the greater the differences in health (World Health Organisation, 2020b). This section focuses on obesity as a health risk factor and reviews South African research on nutrition and obesity.

Consumption patterns are changing for both rich and poor people across the globe. Understandably, people are not consuming the same foods that were consumed centuries ago. Eating habits and dietary patterns are changing due to an increase in food production and accessibility, as well as incorporating technological methods in food production. These changes have also been observed in South Africa as

Puaone *et al.* (2002:1038-1048) reported in the early 2000s. Puaone *et al.* (2002:1038-1048) observed a shift away from nutritional, traditional foods toward less nutritious foods. The less nutritious foods include an increase in intakes of carbonated beverages, more refined foods, snack foods, sugar, oils and saturated fats (Puaone *et al.*, 2002:1038-1048). This shift is known as the nutrition transition. The nutrition transition concept is described as the study of the dynamic shifts in dietary intake and physical activity patterns and trends in obesity and diet-related noncommunicable diseases (Popkin, 2017). The nutrition transition is characterised by lower nutritional diversity in the items that are consumed. Dietary diversity refers to the amount of different food groups consumed over a certain time. A study reporting on the dietary diversity of adult South Africans found that most South Africans have a diet that is very low in dietary diversity. Nutritional foods like fruit, vegetables, eggs, nuts and legumes are the least consumed foods, whereas starches, cereals, meat and dairy are the preferred foods to consume. Overall, rural, lower-income areas experience lower dietary diversity than higher-income urban areas (Labadarios *et al.*, 2011:33-43). Low dietary diversity has a negative effect on health due to the low nutritional value obtained from food.

As early as 1994, Popkin (1994:285-298) did a study on the changes in dietary trends in low-income countries. He indicated that the global change in consumption patterns are not limited to developed countries. His study included developing countries such as Thailand, China and Brazil. In another article, Popkin (2001:871S-873S) addresses the effect of the nutrition transition on the obesity epidemic. He links the changes in diet with increased levels of income. This is done by indicating that a link exists between income increases and negative diet and activity changes, such as consuming more fats, sugar and animal products and less fibre, while also having a less active lifestyle. These negative changes in consumption patterns lead to significant increases in BMI and greater risk of obesity.

Caballero and Popkin (2002:1-6), in the first chapter of their book, *The Nutrition Transition: Diet and Disease in the Developing World,* elaborated on the nutrition transition in the developing world and the possible effect on diseases that the changes in lifestyle (both eating habits and lack of physical activity) may have. Possible diseases that may occur as a result of the nutrition transition and lifestyle changes include obesity, diabetes and cardiovascular diseases.

In later years, Popkin (2015:64) built on his original work and identified five major direct drivers and four critical underlying drivers that influence the shift in the world's dietary and activity patterns which contributes to the nutrition transition. The major direct drivers are physical activity, diet, vegetable oils, a sweeter diet and animal-source food. The underlying drivers include technology, urbanisation, an increase in income per capita and expansion of global trade in services. The driver of most interest in line with this study is the shift in income per capita. Popkin pointed out that the overall cost of food has

decreased and that people are consuming more packaged and processed foods and beverages that require low levels of manual labour and contributes to a sedentary lifestyle. As mentioned above, one of the consequences of this nutrition transition and an overall change in food consumption habits is an increase in weight gain that can, ultimately, lead to obesity.

Obesity prevalence is rising across the globe. Obesity is related to many possible health risks that can potentially have a negative influence on the overall health of a population, which in turn has a negative influence on human capital. In Section 2.3, human capital was identified as one of the drivers that can potentially influence economic growth. Some of the health risk factors associated with obesity include high blood pressure (Muluvhu *et al.*, 2019:361-368), type II non-insulin-dependent diabetes, cardiovascular diseases, musculoskeletal disorders and some cancers (World Health Organisation, 2020b). In 2010, an estimated 3.4 million deaths were recorded globally as a result of overweight and obesity (Ng *et al.*, 2014).

The following two maps, shown in Figures 5 and 6, indicate the 2017 prevalence of obesity across the globe by looking at the adult BMI levels of men and women, respectively.

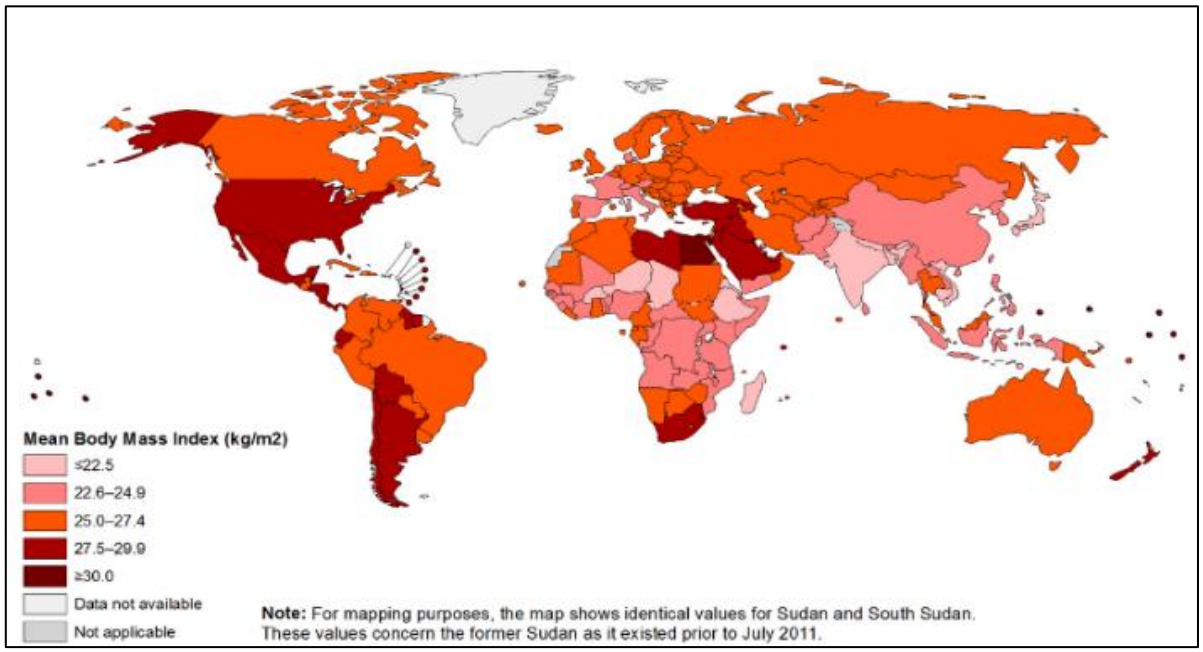


Figure 5 World: Mean Body Mass Index (BMI), ages 18+, age standardized: women, 2017

Source: The Global Health Observatory (2017)

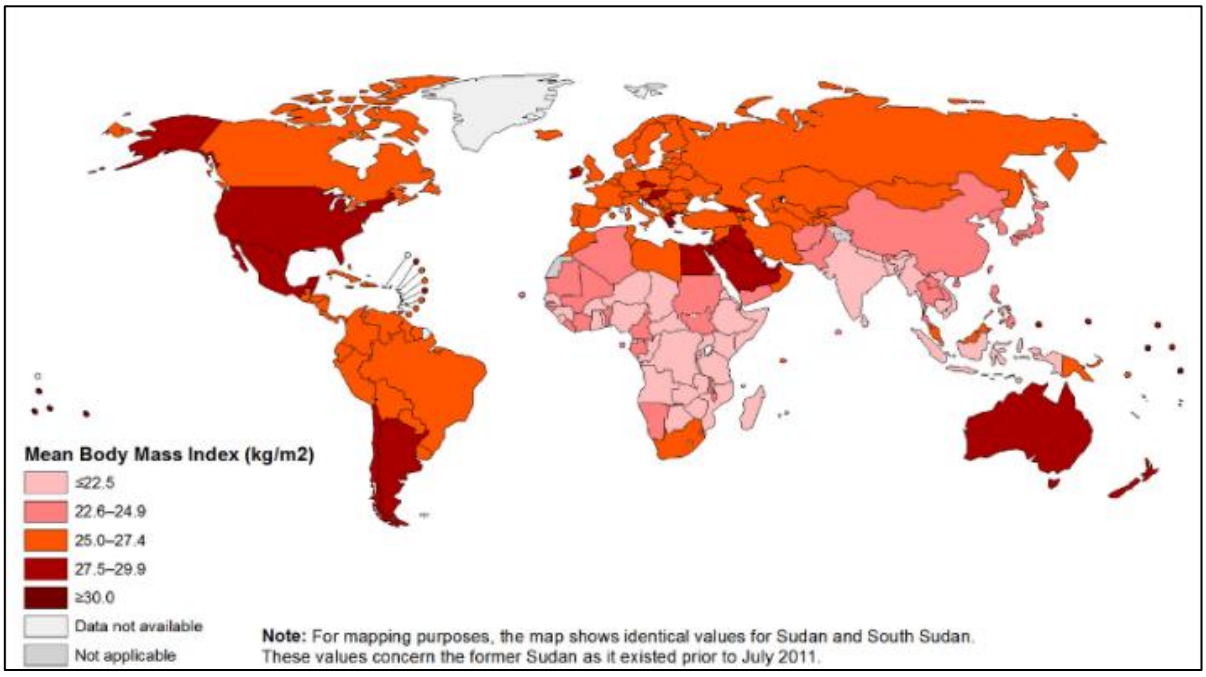


Figure 6 World: Mean Body Mass Index (BMI), ages 18+, age standardized: men, 2017

Source: The Global Health Observatory (2017)

In Figure 5 and Figure 6 mentioned above, it is notable that, overall, higher-income countries tend to have a higher occurrence of obesity than lower-income countries. Between 1980 and 2013, overweight and obesity increased globally with 8,1 per cent in adult men and 8,2 per cent in adult women (Ng *et al.*, 2014:766). The occurrence of overweight adults across the world is more prevalent than underweight adults, especially in women. This demonstrates the nutrition transition and substantiates Popkin's (2015:64) argument that there are underlying drivers that are influencing the consumption patterns across the globe that contribute to this major global health challenge (Ng *et al.*, 2014:766-781). According to the prevalence of obesity map, it can be noted that South Africa has the highest levels of obesity in women, with BMI levels between 30 and 40, when compared to the rest of Southern- and Sub-Saharan Africa (Ng *et al.*, 2014:776).

This section discussed the nutrition transition, while touching on dietary diversity and emphasised the rising occurrence of obesity across the globe and in South Africa. Obesity is a risk factor to many other diseases and poses a threat to the overall health of the population. There is a high prevalence of overweight and obesity in South Africa, especially in comparison with other Southern African countries. Specific South African related studies are discussed in the following section.

2.5 South African literature on income and health

South Africa has the highest prevalence of overweight and obese individuals in Southern Africa (see Figure 5 and Figure 6 in Section 2.4) in both men and women. In South Africa, ample research has been conducted on the nutrition transition. Vorster *et al.* (2011:429-441) indicated that income is increasing globally, which is leading to a more varied diet that in turn leads to an increase in caloric consumption and energy-dense foods. South Africans are moving away from more nutritious, traditional eating habits to more westernised diets (Puaone *et al.*, 2002:1038-1048). High dietary intake of fast food, high-energy, high-fat, high-fructose, low fibre and low dairy intake foods further contributes to obesity.

Overweight and obesity have many negative effects on the health of the South African population. As mentioned before, obesity prevalence is associated with other non-communicable diseases. One of these is type II diabetes. The prevalence of diabetes in South Africa is increasing and poses a threat to many. The biggest underlying cause of deaths amongst South African women specifically, is type II diabetes (Stats SA (Statistics South Africa), 2017:36).

The South African Demographic and Health Survey conducted in 1998 found that, by using BMI as an indicator of obesity, 29,2 per cent of men were overweight or obese and 56,6 per cent of women were overweight or obese. The findings indicate a significantly larger percentage of the adult respondents to be overweight than underweight. The explanatory variables for the occurrence of overweight or obesity in the study are age, level of education, population group and their area of residence (Puaone *et al.*, 2002:1038-1048). In 2016, the same study was repeated and, several years later, reported an increase in overweight and obesity of men and women (National Department of Health (NDoH) *et al.*, 2019:297). The percentage of overweight or obese men increased from 29,2 per cent in 1998 to 31 per cent in 2016. The percentage of overweight or obese women increased from 56,6 per cent in 1998 to 68 per cent in 2016.

In 2013, the South African National Health and Nutrition Survey (SANHANES) reported the prevalence of overweight and obesity amongst men and women. The prevalence of overweight in women (24,8%) was higher than the prevalence of overweight in men (20,1%). Likewise, the prevalence of obesity in women (39,2%) was higher than the prevalence of obesity in men (10,6%) (Shisana *et al.*, 2013:136).

The rest of this section focuses on South African related literature that has been conducted on the NIDS data, as well as some other studies relevant to the subject of this dissertation.

The following table summarises the literature discussed in this section.

Table 2 Summary of literature table

AUTHOR AND YEAR	ARTICLE TITLE	WHAT HAS BEEN DISCUSSED?
Puaone *et al.* (2002:1038-1048).	Obesity in South Africa: The South African demographic and health survey	Prevalence and determinants of obesity amongst South Africans in 1998.
Ardington and Case (2009:1-34)	Health: Analysis of the NIDS Wave 1 and 2 Datasets	Examine health (by measuring BMI) of wave 1 and wave 2 of the NIDS and explain potential for future health studies.
Ardington and Gasealahwe (2012:1-36)	Health: Analysis of the NIDS Wave 1 and 2 Datasets	Analyse obesity trend from wave 1 to wave 2.
Alaba and Chola (2013:63-72)	The social determinants of multimorbidity in South Africa	Relationship between income and multimorbidity.
Mhlongo and Daniels (2013:1-23)	Food expenditure patterns in South Africa: Evidence from the NIDS	Tracked food expenditure patterns in relation with fluctuating income levels over the first three waves of the NIDS. Indicate that food expenditure increased from the first wave to the third
Matsebula and Ranchhod (2016:1-13)	Socio-economic correlates with the prevalence and onset of diabetes in South Africa: Evidence from the first four waves of the National Income Dynamics Study	Studied the correlation between obesity and the prevalence of diabetes over the first four waves. Findings suggest that obese individuals are approximately twice as likely to be diagnosed with diabetes in comparison to adults in the healthy weight group.
Stoop *et al.* (2019:1-29)	Exploring psychological well-being and poverty dynamics in South-Africa: Evidence from NIDS waves 1-5	Looked at all five waves of the NIDS. They show a strong negative correlation between poor households with low levels of household income and psychological well-being.
Zizzamia *et al.* (2019:1-39)	Snakes and Ladders and Loaded Dice: Poverty dynamics and inequality in South Africa between 2008-2017	Look at social stratification. Indicate that more South Africans are transient poor and vulnerable to poverty than initially expected.

Morudu and Kollamparambil (2020:1-17)	Health shocks, medical insurance and household vulnerability: Evidence from South Africa	The study is aimed at analysing the relationship between health shocks and household vulnerability in the context of high levels of poverty and low rates of medical insurance. Analysing the data from wave three to wave five, higher-income individuals make more use of private healthcare and lower-income individuals of public healthcare.

In Section 2.4, Figure 4 and Figure 6 gave us an indication of where South Africa lies on a global perspective in terms of its obesity levels. When viewing South Africa on the map, it is the most overweight country in Sub-Saharan Africa, indicating that overweight is a problem and a health risk factor in the country.

Ardington and Case (2009:1-34) published a paper on the relationship between income and health where they studied the NIDS wave 1 data in terms of its health outcomes. Their study focused on all the health questions of the survey questionnaires to determine health status among different genders, population groups, locations, income groups, education levels and ages. They emphasised the threat that obesity holds for the health of South Africans and accordingly used BMI as a measure to identify obesity (weight-class classification by BMI is mentioned elsewhere). They further divided income per capita into five quintiles. The fourth quintile (fourth highest income category) has the highest number of female obese adults (37,3%) and the first quintile (lowest income category) has the least female obese adults (27,5%). When looking at the men, the highest prevalence of obesity is in the fifth income quintile (highest level of income) reported at 19,1 per cent obesity for this income group. They emphasised the importance of health and socioeconomic status for an individual's wellbeing.

The most closely related study to the NIDS is the Demographic and Health survey of 1998. Both studies measured BMI, but NIDS added the income aspect that was not present in the 1998 survey (Puaone *et al.*, 2002:1038-1048). NIDS is ideally positioned to empirically determine the relationship between income, income mobility and obesity over time.

Ardington and Gasealahwe (2012:1-36) conducted a similar study to the one by Ardington and Case (2009:1-34) mentioned above. They analysed self-reported health status and BMI, amongst others, of the adults of the first two waves of the study, however, they indicated that self-reported health status has evidence of errors. Potentially, self-reported health status is not such a good reflection of the actual health

status of the respondents, due to the lack of knowledge that the respondents may face when answering the questions. Nevertheless, in their analysis of BMI, they found that obesity levels have increased from the first wave to the second. They expected BMI to increase further in the upcoming waves, especially amongst women.

Alaba and Chola (2013:63-72) focused specifically on income in the NIDS. By dividing household income into five quintiles, they found that, amongst others, both income and obesity are strongly related to multimorbidity. Their findings suggest that 49 per cent of obese individuals suffer from multimorbidity. The 3rd income quintile has the largest presence of multimorbidity.

The Engel framework was used by Mhlongo and Daniels (2013:1-23) to track food expenditure patterns in relation to fluctuating income levels over the first three waves of the NIDS. They hypothesised that food expenditure levels will fall as income rises. They further claimed the importance of food expenditure in households as it receives the highest level of expense in the budget in most households (richer households excluded). The results of the paper indicate that food expenditure increased from the first wave to the third, which might have been a result of food-price inflation in South Africa. However, as indicated elsewhere, the increase in food expenditure could have been a result of an increase in consumption due to the nutrition transition.

Matsebula and Ranchhod (2016:1-13) studied the prevalence of obesity over the first four waves of the NIDS. Their findings confirm that obesity is strongly correlated with diabetes. They did not, however, find a correlation between income and diabetes when measuring income as household per capita income in quintiles. Their findings state that obese individuals are approximately twice as likely to be diagnosed with diabetes in comparison to adults in the healthy weight group (BMI between 18 and 25).

Another study on the NIDS shows a strong negative correlation between poor households with low levels of household income and psychological wellbeing (Stoop *et al.*, 2019).

When comparing health and household vulnerability, Morudu and Kollamparambil (2020:1-17) found that private healthcare is utilised by the upper-income quintile of wave three to wave five of the NIDS data and the lower quintile mainly rely on free public healthcare.

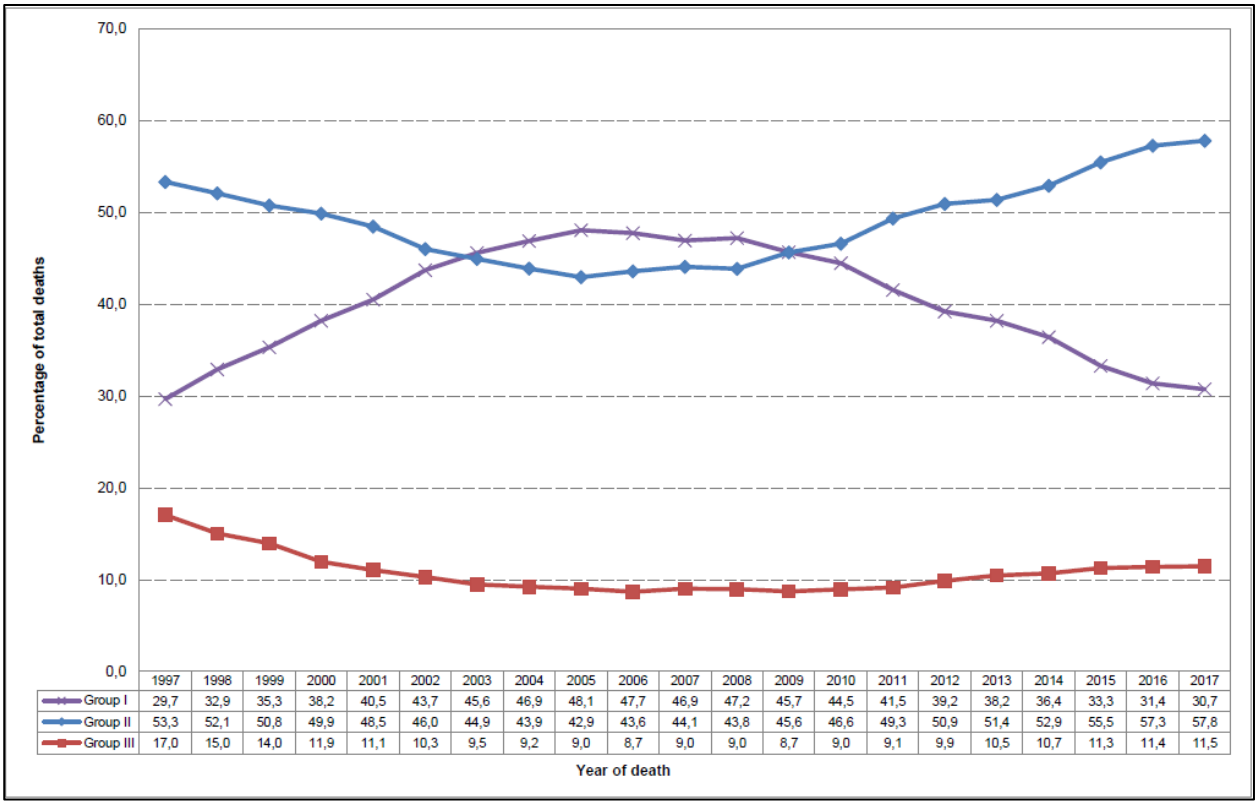
The following graph shows some of the major causes of death from 1997-2017 in South Africa. It distinguishes between communicable and non-communicable diseases, as well as injuries as causes of death.

Legend:

Group 1: Communicable Diseases

Group 2: Non-communicable Diseases

Group 3: Injuries



	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Group I	29,7	32,9	35,3	38,2	40,5	43,7	45,6	46,9	48,1	47,7	46,9	47,2	45,7	44,5	41,5	39,2	38,2	36,4	33,3	31,4	30,7
Group II	53,3	52,1	50,8	49,9	48,5	46,0	44,9	43,9	42,9	43,6	44,1	43,8	45,6	46,6	49,3	50,9	51,4	52,9	55,5	57,3	57,8
Group III	17,0	15,0	14,0	11,9	11,1	10,3	9,5	9,2	9,0	8,7	9,0	9,0	8,7	9,0	9,1	9,9	10,5	10,7	11,3	11,4	11,5

Figure 7 Percentage of deaths due to diseases and injuries in South Africa: 1997-2017

Source: Stats SA (Statistics South Africa) (2017)

In the graph mentioned above, it can be noted that death, as a result of non-communicable diseases from 2007 to 2017, is increasing and death, as a result of communicable diseases, is decreasing over the same period.

A great concern regarding obesity that Alaba and Chola (2013:63-72) touched on in their study on wave 1 of the NIDS data (2008), is multimorbidity, where two or more chronic illnesses were present in an individual at the same time. They found that both income and obesity are strongly associated with multimorbidity. Their findings further indicate that 76 per cent of the unemployed respondents were faced with multimorbidity, whereas 49 per cent of obese individuals were faced with multimorbidity. Both income and obesity are therefore associated with the presence of two or more chronic illnesses in individuals.

This section discussed many of the papers that have been conducted using the NIDS data. There is room for many more studies in this field. In South Africa, to the best of the author's knowledge, no study has identified the prevalence of obesity over the five waves of the NIDS data and no study has looked at the overall influence of income levels and socio-economic mobility on obesity as a health risk factor. This study is aimed at filling that gap.

2.6 Conclusion

This chapter presented a literature review on the relationship between income, health and growth-related studies.

The literature discussed in Section 2.1 emphasises the importance of a healthy society and discusses the basis of the study by stating that good health and economic prosperity support each other.

Section 2.2 focused on specific variables that can potentially lead to economic growth. Various growth models were discussed, indicating that human capital, physical capital, research and development, geography and social infrastructure are all variables that influence economic growth. Health is an important determinant of the quality of human capital and hence a big influence on economic growth. Health also contributes to development in the following ways: higher labour productivity, higher rates of domestic and foreign investment, improved human capital, higher rates of national savings and demographic changes.

Thereafter, Section 3.3 discussed literature regarding the effect of income mobility and income inequality on health, which formed the focus of this study. When looking at the relationship between health and income on a global scale, African countries are ranked in the lowest range of both income and health. North America, Europe and South-East Asia have significantly higher levels of both health and income. An increase in health, in many cases, leads to an increase in income. Conversely, an increase in income, in many cases, leads to an increase in health.

Income levels have been increasing across the globe, not excluding South Africa. South Africa has seen an increase in income; however, poverty levels remain high and inequality significant. The rise in income influences the nutrition transition where less nutritious, higher-calorie foods are being consumed. The world is faced with over-consumption of calories which can lead to obesity and, consequently many non-communicable diseases.

Studies show that obesity prevalence across the globe is increasing and accordingly, many related diseases and deaths. The question in this literature is, "Does an increase in income really lead to an improvement

in health?". Many articles based on the NIDS were discussed in Section 2.5, however, not one of these specifically address this question in the South African context with that specific dataset.

The following chapter is a review of the class and social mobility literature.

3 CHAPTER 3: REVIEW OF CLASS AND SOCIAL MOBILITY LITERATURE

3.1 Introduction

This study aimed to determine the link between income mobility and obesity as a health risk factor, specifically where an increase in income levels enabled people to move to a higher social class and their BMI also changed. Are individuals with higher levels of income also healthier? Chapter 2 argued that the more common approach is to examine the relationship from health to incomes. Health is a determinant of human capital and labour productivity and improvements in health are associated with growth in incomes. Yet, the focus here is on the health-related outcomes of growth in income. Income mobility has been associated with life-style related diseases such as type II diabetes and high blood pressure. Overweight and obesity are risk factors for these diseases. Obesity can be a consequence of the nutrition transition. The nutrition transition in a population is characterised by increased intakes of snack foods, carbonated beverages and various forms of sugar, oils, saturated fats and animal-proteins where there is a shift away from traditional diets (Popkin, 2017). There is evidence of the nutrition transition in South Africa, with a significant increase of over-nutrition from 2005 to 2010 in specifically rural areas of the country (Vorster *et al.*, 2011:429-441). Evidence from the first wave of the NIDS data suggests that obesity in adults increased from 1998 to 2008 in all age groups, with the highest increase in the age-group between 15 and 24 years (Ardington & Case, 2009:1-34). Obesity in adult women (over 15 years of age) increased from 30 per cent to 33 per cent which is more than the increase of obesity in men from 9 per cent to 11 per cent.

To examine the link between health risk factors and income mobility, Chapter 2 presented a review of the South African health literature, focusing on overweight and obesity and the nutrition transition. Chapter 3 presents a review of income mobility literature, also known as socio-economic stratification literature. The ambition was not to present an exhaustive review of a wide-ranging and complex literature, but to lay a foundation for the empirical analysis presented in Chapter 4.

Section 3.2 provides a brief introduction to the idea of social class. How one thinks about the shared interests, or shared life chances, that make for a specific social class, influences how class is measured and mobility between classes is quantified. The recent literature about class is about rising income inequality where globalisation and automation have squeezed the traditional middle class. Section 3.3 gives a broad overview of this tangential literature on increasing inequality, the decline of the middle class in advanced economies and polarisation of the labour market. Section 3.4 presents a review of South African studies of class and social mobility. This study's own classification of classes and mobility between

classes drew on recent work by Burger *et al.* (2015b:1-20) and Zizzamia *et al.* (2019:1-39). A summary and conclusion are presented in Section 3.5.

3.2 What is social class?

There are many approaches in the literature that are used to identify social classes. Many of these approaches made use of a certain characteristic or classification measure, such as income, expenditure, occupation, or risk of being poor, to identify the classes. When one sets out to measure class and social mobility, the concepts are those explained in the work of Karl Marx and Max Weber. Burger *et al.* (2015b:25-40) give an overview of their analysis of class.

Marx argued that shared interests and economic position form the basis of class. He focused on class conflict between the owners of capital, or the means of production, and the workers who can only sell their labour. The upper class (bourgeoisie) exploit the lower class (proletariat). In his view, the middle class of small business owners and managers is a transitory group that works alongside their staff and will eventually become part of the proletariat (Burger *et al.*, 2015b:3).

In Weber's view, class also depends on how income is earned in the market and that a specific class shares similar life chances. Weber distinguished between those who own land and property (capital) and those who must work for a salary or wage. He further differentiated between the property owners and the white-collar middle class who do not earn from property. For them, education, knowledge and skills determine their occupation and wages. Economic position determines lifestyle and social communities (Burger *et al.*, 2015b:4).

"Despite debates around the relevance of the concept of class in current times, the term "middle class" has continued to be popular amongst both researchers and the media. Recently, it has often been used to gauge the pace of social change and economic advancement in emerging and developing economies. In this literature the term "middle class" is frequently used as shorthand for increased agency and empowerment that allow individuals to competently navigate their own destinies and realise their own potential" (Burger *et al.*, 2015b:4)

Esteban and Ray (1994:819-851) on the measurement of polarisation, discussed how societies tend to be polarised into clusters with specific characteristics distinguishing them, such as income. They emphasised that large differences between social classes (because of differences in income) can often be the cause of social conflict. Inequality increases in groups with very high and very low-income levels and no middle-level income. Inequality decreases when income is more equally distributed, leaning less toward both upper-and lower extremes. An extended measure of polarisation was introduced by Gradín and Ray

(1999), making room for alternative group identification methods. They applied this method on five developed countries, comparing the standardised household income of the countries over time. The income polarisation approach discussed by Esteban and Ray (1994:819-851) was also applied by Schotte *et al.* (2017:1-45) where they identified five social classes: chronic poor, transient poor, vulnerable, middle class and elite. The authors include both a probability threshold and monetary threshold in this social stratification article. The probability threshold accounts for the average probability of either exiting or entering poverty. The monetary threshold is the method used to classify the pooled sample by expressing the monetary values in South African Rands.

Expanding on social stratification or polarisation methods, Burger *et al.* (2015b:1-20) compared four middle class approaches, namely occupational skill measure, a vulnerability indicator, an income polarisation approach and subjective social status. The occupational skill measure classifies individuals into social classes based on their occupation skill levels. The vulnerability approach distinguishes between stable middle class and non-poor households with a high risk of falling into poverty based on a selection of characteristics. The income polarisation approach is based on the method by Gradín and Ray (1999) mentioned above. The fourth approach, the subjective social status, is based purely on individual's perceptions. It is the self-identified position that respondents give themselves.

The modern discourse about class, specifically the middle class, is about rising income inequality where globalisation and automation have squeezed the traditional middle class. The following section gives a brief overview by expanding on the concept of social classes and polarisation and how it can influence a society.

3.3 Class, inequality and polarisation

In a society with different social classes, polarisation exists. A society can be polarised in terms of many different characteristics or category prescriptions. The focus of this section is polarisation by income groups that divides a society into classes and the results of inequality due to the different divisions. As mentioned in the previous section, inequality decreases when income is more equally distributed, leaning less toward both upper-and lower extremes. A large and stable middle class can therefore be an indication of a society with a more even distribution of income.

The secular trend of increasing inequality came into focus with the publication of Piketty (2014) *Capital in the Twenty-First Century*. He described the rising inequality in the United States after the 1970s. Inequality peaked before the 2008 recession when the top decile earned 50 per cent of the national income of the United States and it has remained in the high 40 per cent range. He explained it by the fact that the rate

of return on capital (r) exceeds the rate of economic growth (g). The inequality of r > g means that accumulated wealth grows at a faster rate than income and wages. van Biljon (2019:77-78) draws a parallel between the historical context in which Marx was writing in 1905 and that of Piketty in 2014. In the second half of the nineteenth century, industrialising economies were growing strongly, but it was a period of wage stagnation as population growth and increasing productivity in agriculture drove migration to urban slums and factory work in low-wage jobs. Since the 1970s, globalisation and automation have been displacing workers from well-paid factory jobs – squeezing the modern middle class.

Internationally, there are diverging trends in inequality between and within countries. The World Inequality Database (2018) strikingly shows this with the so-called elephant curve (attached in Appendix B). The graph resembles the outline of an elephant with its trunk pointed upwards. The vertical axis shows the percentage growth rate of real income per adult and the horizontal axis the distribution of income by percentile. The data is for the United States, the developed economies of Western Europe and the large emerging economies of China and India. The top of the elephant's head, between the 30^{th} and 50^{th} percentile shows the fast rate of growth of the incomes of the middle class in emerging economies. The trough between the 60^{th} and 90^{th} percentiles shows the much slower rate of growth of the incomes of the middle class in the developed economies. The upwardly pointed trunk shows the very fast rate of growth of the incomes of the global 1-percent elite.

van Biljon (2019:85) concluded that all this captures three major trends in social mobility:

- Millions of people escaping rural poverty in the developing world and finding an urban "middle class" life due to global trade.
- The growth of the incomes of the middle class in the developed world stagnating and them falling behind in their own countries.
- The very large share of income growth that has been captured by the elite.

The dynamics of social mobility and decline of the middle class in developed economies are also evident in the job market. Research by the Economic Policy Institute (a thinktank) shows that, in the U.S., growth in hourly wages and growth in productivity diverged in 1979. An increasing share of productivity growth has rewarded capital and not labour. At the same time, labour force participation has declined, particularly in the period since the recession in 2008. Many marginally employed workers only have part-time positions and there has been a decline in job quality (van Biljon, 2019:80).

There are many different definitions and measures of the so-called polarisation of the labour market. Goos and Manning (2007:118) described it as a rise in demand for low-paying 'lousy' jobs and high-paying

'lovely' jobs, but there is a fall in demand for middling jobs. One can think of any labour market outcome with observations forming twin peaks at both ends of the distribution: the number of jobs, or the number of people in jobs, can polarise along a distribution of wages or earnings, or along a distribution of skills, or job tasks. The elephant curve discussed above shows this polarisation of incomes between countries.

Autor *et al.* (2006:189-194) stated that polarisation occurs when middle-income jobs experience low growth compared to both low- and high-income jobs. Similarly, Nellas *et al.* (2009:2) identified polarisation by a two-part change in wage structures, namely: (1) an increase in wages in both the top and bottom part of the income distribution, compared to the middle and (2) a decrease in the proportion of middle-income jobs. Levy and Murnane (1992:1338-1339) simply stated that polarisation means the disappearance of middle-class jobs, whereas Wolfson (1994:353-354) wrote of a decline in the population with mid-level incomes.

The differences in descriptions of class, inequality and polarisation influence the measurement thereof. Autor *et al.* (2005:33) also took account of skill levels and described polarisation as strong demand for employees in the higher part of the skills distribution, weak market conditions for those with middle skills and a steady market for those at the base of the distribution. Card and Ashenfelter (cited by Acemoglu and Autor (2011:16)) framed polarisation as the coincidence of growth in both high-skill, high-wage jobs and low-skill, low-wage jobs.

Empirically, Goos and Manning (2007:118-133) examined the demand for 'lousy' and 'lovely' jobs in the UK. To examine the quality of jobs, they used the median wage in the job as a "single-index model of skill" (Goos & Manning, 2007:121) and plotted the proportional change in employment over time against the initial level of wages ordered by deciles. They found a large growth in the share of employment of high quality/high initial median wage jobs, a decline in middling jobs and some growth in the share of jobs in the bottom decile of quality/wage. The results show employment polarisation into low-paid and high-paid work.

Regression models showed that there is a U-shaped relationship between employment growth and the original wage level (Goos & Manning, 2007:122). The greatest employment growth was recorded at the extreme ends of the distribution. They also used total hours worked as a measure of employment (instead of median wages) and the results were quite similar. Both male and female jobs displayed similar patterns of change in employment (Goos & Manning, 2007:122).

Another key empirical paper that shows evidence of polarisation of the U.S. labour market is Autor *et al.* (2006) in the *American Economic Review*. They plotted the 90-50 and 50-10 log hourly wage differentials

to examine the evolution of the wage structure since the late 1970s. They found the 90-10 wage differential has expanded by 21 log points since 1980. Wage inequality in the bottom half of the distribution also displayed rapid growth between 1979 and 1987, but then stopped growing and declined from the end of that decade. They also examined employment growth by occupation by measuring an occupation's share of total hours worked and plotting it against the occupation's percentile in the 1980 education distribution. For the 1980s they found a decline in the share of hours worked at the bottom end of the education distribution. Moving up the education distribution, they found a sharp increase in the share of hours worked. In the 1990s, employment growth polarised into growth for low-education and high-education jobs and a decline in the middle.

The following section gives an overview of some more South African studies of class and social mobility.

3.4 South African studies of class and social mobility

Seekings (2009:865-881) reviewed South African studies of social class over the period 1950 to the early 1970s. The conclusion is that early work followed a Weberian approach linking class, skills, education and consumption. However, opposition to the Apartheid-era encouraged a more Marxist approach. Burger and McAravey (2014:5) mention several more recent studies of the concepts of class and social mobility. These, and more, are briefly reviewed in this section to serve as background to this study's own classification of classes and mobility between classes.

In a study by Schlemmer (2005:1-14), where he discussed the size of the rapidly growing African middle class, he emphasised the importance of using complex subdivisions to classify the South African middle class. By using three measures as strict subdivisions, making use of the 'middle-middle class' and the 'lower middle class', he compiled a group called the 'core' African middle class. He used three measures to define this 'core' middle class group: educational level, occupational measure and a combined index of income and standard of living. He found that the 'core' African middle class is much smaller than most would have anticipated it to be. In a similar study with a like-minded focus on South African demographics, Seekings (2007:3) commended the possibilities of an empirical class analysis. Seekings (2007) criticised Sclemmer's method by saying that it excluded too many people from the middle class. By focusing on Cape Town, Seekings (2007:14) reported that 25 per cent of Cape Town residents classified themselves as lower class, 41 per cent as working class, 33 per cent as middle class and 2 per cent as upper class. By defining class according to occupation, he found that Cape Town has a large upper class and intermediate class with a small core working class due to the weakness of the industrial sector in Cape Town (Seekings, 2007:6).

There are two ways of determining the middle class of a country, according to Visagie and Posel (2011). They made use of the first wave of the NIDS data. The first method to define the middle class was by looking at the middle share of the national income distribution and secondly, by looking at an absolute level of affluence and lifestyle. By using the first approach, the middle class comprised 31,6 per cent of the population, whereas the second approach defined the middle class as 20,4 per cent of the population (Visagie, 2013:7).

Expanding on social stratification methods, Burger *et al.* (2015b:1-20) compared four middle-class approaches, namely occupational skill measure, a vulnerability indicator, an income polarisation approach and subjective social status. The occupational skill measure classified individuals into social classes based on their occupation skill levels. The vulnerability approach distinguished between stable middle class and non-poor households with a high risk of falling into poverty based on a selection of characteristics. Focusing on expanding the definition of the middle class, Burger *et al.* (2015a:1-15) proposed a multi-dimensional approach by arguing that using only income as a measurement is not a sufficient way to determine the full size of the middle class. They suggested distinguishing between disempowered and empowered middle class, focusing on the ideas of empowerment and capability. They found that the middle class has expanded significantly from 1993 (27%) to 2012 (48%).

Visagie (2015:3-24) presented two perspectives of the middle class, namely an "affluence-based" and a "median-based" definition. He calculated the affluent middle class by setting two thresholds – an upper-bound an a lower-bound threshold. He then categorised the 2008 NIDS respondents into social classes based on these thresholds where the "affluence-based" middle class was the group of respondents who fell between the upper-bound and lower-bound thresholds. The "median-based" method of determining the middle class was done by identifying individuals who fell within an interval of 50 per cent to 150 per cent of the median per-capita household income (Visagie, 2015:5-6). His findings from the first perspective suggest that the affluent middle class grew at a slower rate than the population growth rate from 1998 to 2008. In his findings from the second perspective, he emphasized low growth in per capita household income and how the size of the middle class decreased from 1993 to 2008.

The income polarisation approach was also applied by Schotte *et al.* (2017:1-45) where they identified five social classes: chronic poor, transient poor, vulnerable, middle class and elite. The authors included both a probability threshold and monetary threshold in this social stratification article. The probability threshold accounted for the average probability of either exiting or entering poverty. The monetary threshold was the method used to classify the pooled sample by expressing the monetary values in South African Rands.

Zizzamia *et al.* (2019) drew from a whole body of research that they were involved in on social classes, including some of the methods mentioned in the previous section and highlighted three dimensions: poverty persistence, vulnerability and the stable middle class. Poverty persistence is the method used to identify which individuals are consistently in poverty. Vulnerability is the approach discussed by Burger *et al.* (2015b) used to identify individuals who have a risk of potentially falling into poverty. The results of their findings indicate that the stable middle class is considerably smaller than the presumed middle class of the country. The stable middle class is the non-poor middle class households where those with a high risk of falling into poverty are excluded. They studied the poverty trend over the five waves of the NIDS. Their findings suggest that the South African middle class is considerably smaller than anticipated (24,4%) and that more South Africans are transient poor and vulnerable to poverty (26,8%). They defined the stable middle class in South Africa by saying the middle class is a group of non-poor households that are also non-vulnerable (low risk of falling into poverty). This method is focused on clearly indicating the South African middle class over the first four waves, but also considerably narrows down the middle class. The advantage of this method is that individuals considered as middle class, but with the risk of falling back into poverty, are not included in the calculations focused on the middle class. They use expenditure rather than income as a measure of economic welfare. They made use of STATS SA's upper bound poverty line to distinguish between poor and non-poor households. In their conclusion, the authors amplified the need for studies to be conducted on determinants that differentiate between social classes.

Sections of the income polarisation method were applied in this study by identifying income distribution points and classifying the adults who took part in the National Income Dynamics Study (NIDS) into groups or classes according to the adult income/spending levels.

The following section concludes this chapter.

3.5 Conclusion

This chapter presented an introduction to social class, inequality and polarisation. The literature shows that there are various ways in which social classes can be determined, such as considering occupational skills, looking at different levels of income or expenditure, analysing the risk of people falling back into poverty or presenting people with a self-reporting option where they subjectively report the class that they fall in to.

People in lower income classes undeniably have less money at their disposal than people in higher income classes. Out of differences in monetary social classes, inequality exists. Globally, emerging economies are experiencing a decrease in inequality due to a rapidly growing middle class. One of the largest drivers of

growth in these emerging economies is an increase in global trade. On the other hand, developed countries are seeing lower growth rates of the middle class and high-income growths in the elite.

In South Africa, a variety of authors presented a variety of ways to determine the middle class. These methods vary from Schlemmer (2005:1-14) identifying a 'core' African middle class, to Seekings (2007) criticising Schlemmer's method and rather suggesting that the middle class is defined according to occupation. Visagie and Posel (2011:1-22) suggested looking at the middle share of income distribution or by investigating an absolute level of affluence and lifestyle. Burger *et al.* (2015b:1-20) compared four approaches to determine social class, namely occupational skill measure, a vulnerability indicator, an income polarisation approach and subjective social status. Similar to one of Burger's approaches, the vulnerability indicator, Schotte *et al.* (2017:1-45) identified five social classes: chronic poor, transient poor, vulnerable, middle class and elite. They used a probability threshold to determine the average probability of respondents to either enter or exit poverty. Similarly, Zizzamia *et al.* (2019:1-39) highlighted three dimensions in South Africa, namely poverty persistence, vulnerability and stable middle class.

This study aimed to use a similar method to the one described by Zizzamia *et al.* (2019:1-39) to distinguish between respondents who remain in poverty, respondents who had moved out of poverty but were still faced with a risk of falling back into poverty and respondents who were in the middle class.

This chapter laid the foundation for the fulfilment of the third objective which was to identify social classes with the NIDS dataset over the five waves from 2008 to 2017. The following chapter presents the analysis and the results.

4 CHAPTER 4: ANALYSIS AND RESULTS

4.1 Introduction

This study was aimed at examining the relationship between income mobility and obesity as a health risk factor over time. This link was examined by making use of the South African National Income Dynamics Study (NIDS) with specific focus on the changes in income class and obesity over time. Obesity was measured by categorising respondents using the Body Mass Index (BMI) to determine if they were underweight, normal weight, overweight or obese. Individuals were classified as obese when they had a Body Mass Index (BMI) of 30 and more. Income mobility between different social classes was determined by tracking the change in expenditure of adults between the age of 19 years and 70 years over the five waves of the NIDS data. Respondents were categorised as poor, vulnerable, stable middle class or elite. The NIDS dataset is a panel data set that tracked the same respondents over five waves, enabling one to track the movement of respondents over a time frame - from 2008 to 2017.

The results are reported in three main sections:

1. Changes in socio-economic status across the five waves (Section 4.2),
2. Changes in BMI across the five waves (Section 4.3 and 4.4) and
3. Cross-tabulation of coincident changes between income classes and BMI categories (Section 4.5).

Each one of these three sections is introduced with a brief description of the data. Thereafter, the results are discussed and compared with existing literature.

4.1.1 More about the analysis

This analysis aims to achieve the second, third and fourth objectives of the study: to identify households that experienced upward income mobility and moved between different social classes over the five waves of the NIDS data and to compare households from the different classes in terms of BMI categories. BMI is a measure of obesity which is a health risk factor. In this way, it was possible to examine corresponding changes in social class and BMI and describe the characteristics of the different households.

4.1.2 Research design

The data used for this study is secondary data. The National Income Dynamics Study is a household panel study conducted by the School of Economics of the University of Cape Town (UCT) in collaboration with the South African Labour and Development Research Union (SALDRU) and the Department of Planning, Monitoring and Evaluation (DPME). The study started in 2008 by interviewing 7300 households that

consist of approximately 28 000 individual respondents. The respondents were selected in a way that they are a representative sample of the population. The survey was conducted at regular intervals to present five waves of data. The same 28 000 respondents were interviewed roughly every two years. In the fifth wave, 2775 Continuing Sample Members were added to the survey, but were excluded from the panel of this study.

Within the NIDS questionnaire, there were sections specifically addressed to households, adults and children, respectively. The data was sufficient to calculate the BMI of adults. The use of the panel data means that one is observing the same people over time and this ameliorates the problem of unobserved heterogenous factors that may influence health risk factors.

The section of the NIDS specifically focused on income and expenditure of households makes it possible to divide the panel into social classes. In the empirical analysis of this study, total expenditure was used to classify the respondents into social classes following the work of Schotte *et al.* (2017:1-45). The four social classes are poor, vulnerable, stable middle class and elite.

4.1.3 Ethical considerations

The ethical considerations of the study were explained in Section 1.10 but are worth repeating here. This study had a very low risk of a harmful outcome and ethical clearance was given by the North-West University (NWU-00854-20-A4). The data is publicly available to download. The survey received ethics approval at the University of Cape Town (HREC REF: 697/2016) and consent of the participants can be reasonably assumed. There was no contact with human participants. The data was de-identified and there is no way that the analysis allows one to re-identify participants. Conventional methods were used to analyse the data and interpret the results.

4.2 Social stratification

The first part of the data analysis was to divide the respondents into social classes.

The social classes were divided by household expenditure, including both food and non-food items, with full imputations, following the method presented by Schotte *et al.* (2017:9-10). Similarly, Schotte *et al.* (2018:95-101) also used expenditure rather than income as a measure of economic welfare. Spending served as a proxy for the resources that people had access to and their overall living standard, though one should also acknowledge the limitation that expenditure was measured at the household level and the health analysis was at the individual level. Spending was adjusted for inflation using the Consumer Price

Index (CPI). The poverty line was Statistics South Africa's Upper Bound Poverty Line per person from March 2017. This was also adjusted for inflation using the CPI.

The classification of households to different classes occurred as follows:

- The poor are those with monthly spending below or equal to the poverty line. This was calculated as R2178 per month in 2017.
- The vulnerable are those with spending greater than the poverty line, but lower than the vulnerability threshold. This threshold is the 75th percentile of the distribution of spending, which was calculated as R7951 per month in 2017.
- The stable middle class are those with spending greater than the 75th percentile of the distribution of spending, but less than the level of spending at the elite threshold.
- The elite are the households with monthly spending greater than the elite threshold that was set as two standard deviations greater than the mean of spending and was calculated as R41802 per month in 2017.

Table 3 indicates the social class divisions of each wave, excluding pregnant women, as well as adults younger than 19 and older than 70 years of age:

Table 3 Distribution of social classes per wave

Social Classes	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Poor	13,18%	16,88%	20,76%	17,19%	18,12%
Vulnerable	61,81%	58,08%	54,20%	57,74%	56,92%
Middle Class	20,24%	20,22%	20,45%	20,68%	21,04%
Elite	4,77%	4,82%	4,59%	4,38%	3,93%

Source: Author's own calculations

As indicated in Table 3, there was an increase in the poor and a decrease in the vulnerable from wave 1 to wave 5. The percentage of respondents who remained in the stable middle class were relatively stable from wave 1 to wave 5 with a gradual increase from 20,24 per cent in wave 1 to 21,04 per cent in wave 5. The results of the analysis are quantitatively similar to those of Schotte *et al.* (2018:102) who indicated

that only approximately 24 per cent of South Africans can be considered stable middle class or elite. In aggregate, there was limited upward social mobility across the three waves. The majority of the moves between classes were of vulnerable households falling into and out of poverty. In the analysis that follows in Section 4.5, the households that did move across classes over time are linked to the changes that occurred across BMI categories. Sections 4.3 and 4.4 examine the prevalence of obesity and changes therein across the five waves.

4.3 Obesity prevalence over the five waves

This section looks at the BMI indicator used to examine obesity. For the purpose of this study, only adults older than 19 years of age were included in the analysis, based on the World Health Organisation (WHO) growth references (World Health Organisation, 2007) indicating that BMI was calculated differently for individuals younger than the age of 19. Only adults up to the age of 70 were included, following Ardington and Case (2009:6).

In the NIDS questionnaire, the Health section (section J) asked multiple questions, such as the weight, height and waist circumference of the respondents (SALDRU, 2018:40-45). Some of the questions included a self-reported health status, occurrence of certain health conditions (specifically asking about tuberculosis, high blood pressure, diabetes, stroke, asthma, heart problems, cancer, eyesight problems, hearing problems) and frequency of medical visits.

BMI was calculated by using the following formula:

$$\text{BMI} = \frac{(\text{weight in kilograms})}{(\text{height in meters})^2}$$

BMI can be interpreted as follow:

- BMI <18,5 = Underweight
- 18,5 ≥ BMI ≤ 24,9 = Normal weight or healthy weight
- 25,0 ≤ BMI < 30 = Overweight
- BMI ≥ 30 = Obese

Obesity can be subdivided into three categories, namely class 1 (BMI of 30 to <35), class 2 (BMI of 35 to <40) and class 3 (BMI of 40 and higher) (National Center for Chronic Disease Prevention and Health Promotion, 2020). This analysis focuses on the simple definition of obesity defined as a BMI of 30 and more. The goal of this paper was to use obesity as health risk factor, as a proxy for health status.

Using BMI as a health risk indicator has benefits. It is relatively easy to collect the data and calculate BMI of a large sample and it gives a good overall indication of the health of the population, as respondents with a high BMI are prone to many diseases (see Section 2.4). A potential weakness is the risk of incorrect measurements that lead to inaccurate results. However, the NIDS data collection process aimed to minimise this risk by measuring each adult twice and if large differences in the two measurements exist, the adult was measured a third time. To eliminate outliers, whether it was due to incorrect measurements or incorrect record keeping, respondents with a BMI of less than 10 and more than 65 were excluded from the analysis that follows.

The following two figures show the distribution of all successfully interviewed men and women respondents from wave 1 to wave 5 across BMI categories.

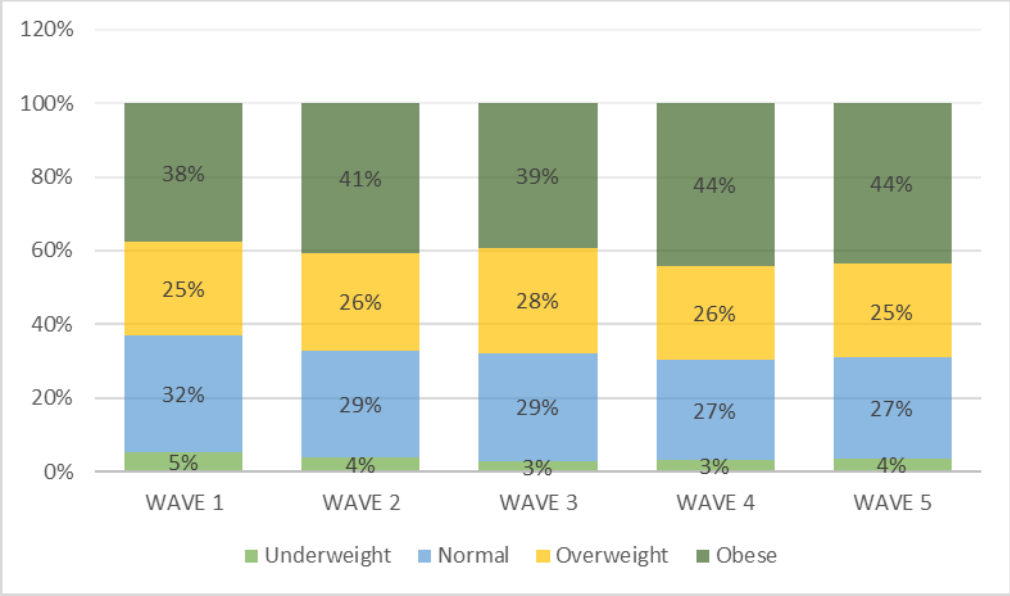


Figure 8 BMI category distribution of women over five waves

From Figure 8 above, it is evident that the highest percentage of women between the ages of 19 and 70 years old, were obese, increasing from 38 per cent in wave 1 to 44 per cent in wave 5. More than a third of the adult women respondents were obese.

In Figure 9 below, most men are categorised in the normal BMI category. Reflecting on Figure 8, it is notable that a greater proportion of women were overweight and obese than men. There was a greater proportion of underweight men (7% to 12%) compared to underweight women (3% to 5%).

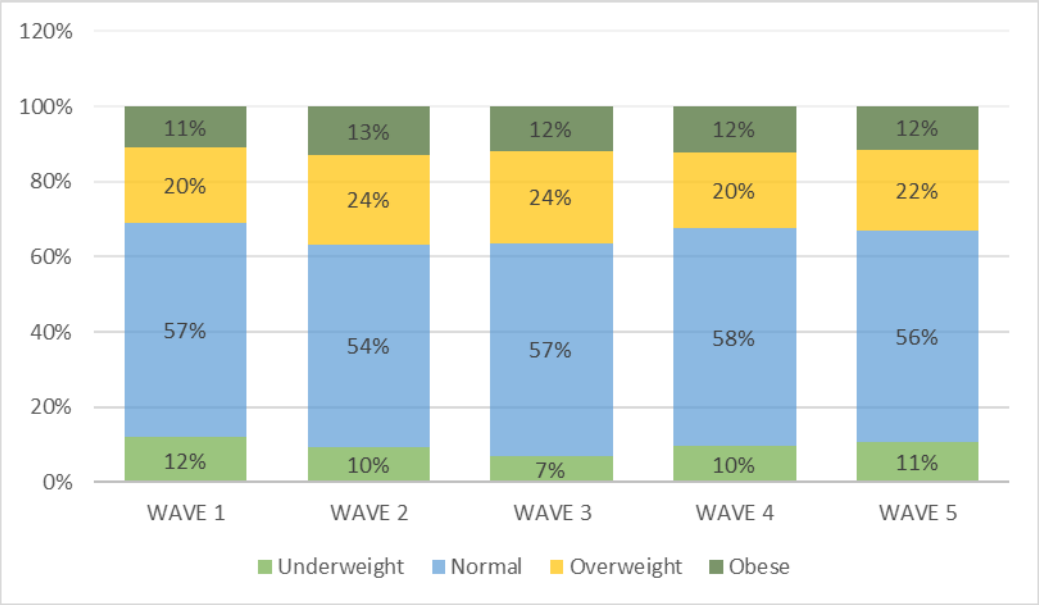


Figure 9 BMI category distribution of men over five waves

In wave 1, 63 per cent of the women fell in the overweight and obese BMI categories. This percentage increased to 69 per cent in wave 5. Thirty-one per cent of men were overweight and obese in wave 1 and this increased to 34 per cent in wave 5. These observed changes between BMI categories in both men and women indicated a worrisome increase in overweight and obesity from 2008 to 2017, with the increase in women being more marked.

4.4 BMI movements

This section reports the distribution of individuals across BMI categories in each wave with graphs, showing the difference between the BMI of men and women in each wave and then reports the cross tabulations of adult respondents moving between different weight groups over the five waves.

4.4.1 Descriptives

This section shows the BMI of adults for each wave. In each wave, the successfully interviewed respondents were determined by accurate BMI measurements (between 10 and 65kg/m^2) and an age indicator of >19 and <70 years.

Table 4 distinguishes between the successfully measured men and women, respectively, per wave.

Table 4 BMI data descriptive statistics

Health data descriptives	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5
Number of Pregnant Women	247	249	319	486	609
BMI observations of each wave, excluding pregnant, within correct Age parameters	10 736	11642	14111	17473	18408
Successful BMI: Men	4222	4726	5661	7321	7646
Successful BMI: Women	6514	6919	8450	10152	10762

BMI (BODY MASS INDEX)

In this analysis, a total of 1910 pregnant women were excluded in the BMI categorisation across the five waves. Across the panel, there were 42797 successful BMI measurements for women and 29576 for of men.

The flow chart in Figure 10 illustrates and describes the successful measurements of BMI in each wave, while also indicating the exclusions. BMI measurements that were excluded were of pregnant women and observations that fell outside of the parameters of 10 and 65kg/m^2.

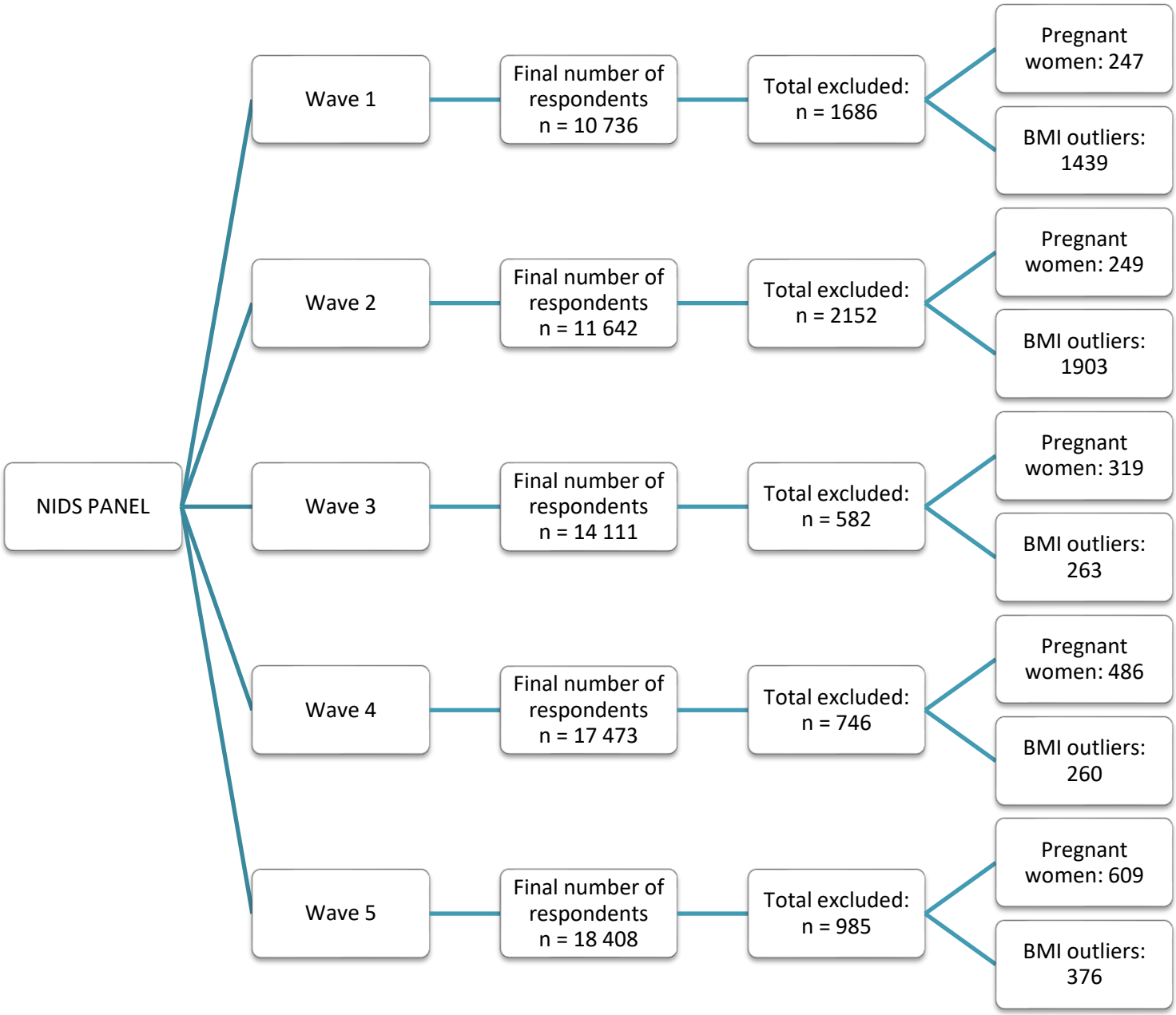


Figure 10 Flow diagram of the number of BMI measurements of each wave

4.4.2 Graphs of BMI distribution of each wave, men and women

The graphs on the following page illustrate the percentages of women and men within each BMI category. In all five waves it is evident there were more underweight and normal weight men than women. In all five waves, more women were overweight and obese than men. From wave 1 to wave 5 there was an increase in the percentage of obese women from 38 per cent in wave 1 to 44 per cent in wave 5. Obesity in men increased slightly from 11 per cent in 2008 to 12 per cent in 2017.

These findings are concurrent with research publications of South African obesity trends. According to wave 1 of the NIDS, one-third of women over the age of 15 were classified as obese in 2008 in contrast to 11 per cent of men (Ardington & Case, 2009). The SANHANES report of 2012 confirms the results presented by the NIDS study by indicating that 39,2 per cent of women were classified as obese and just 10 per cent of men. The SANHANES further reports that the highest prevalence of obesity was seen among urban women at 42 per cent (Shisana *et al.*, 2013). Recent Demographic and Health Survey (DHS) data found that approximately 41 per cent of women were obese and 11 per cent of men were obese (National Department of Health (NDoH) *et al.*, 2019:297).

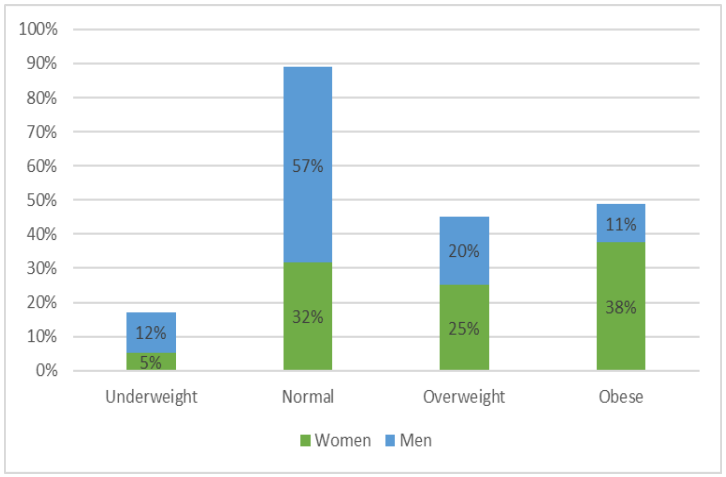


Figure 11 Wave 1: Men & women BMI categories

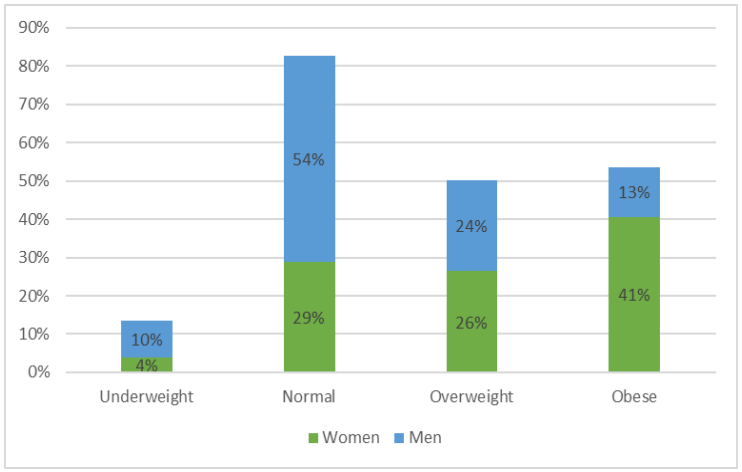


Figure 12 Wave 2: Men & women BMI categories

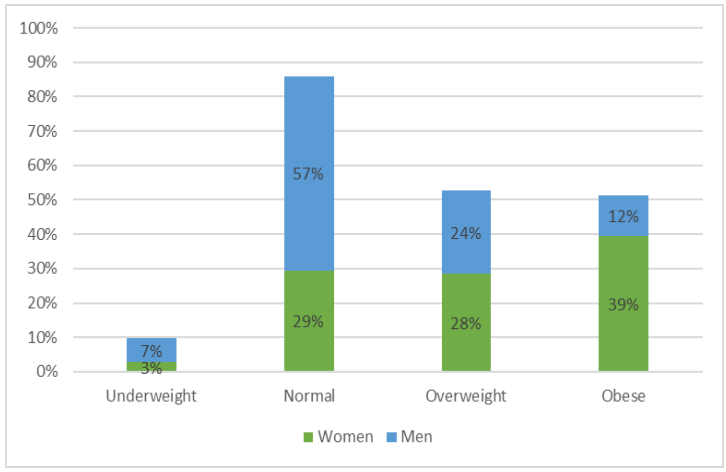


Figure 13 Wave 3: Men & women BMI Categories

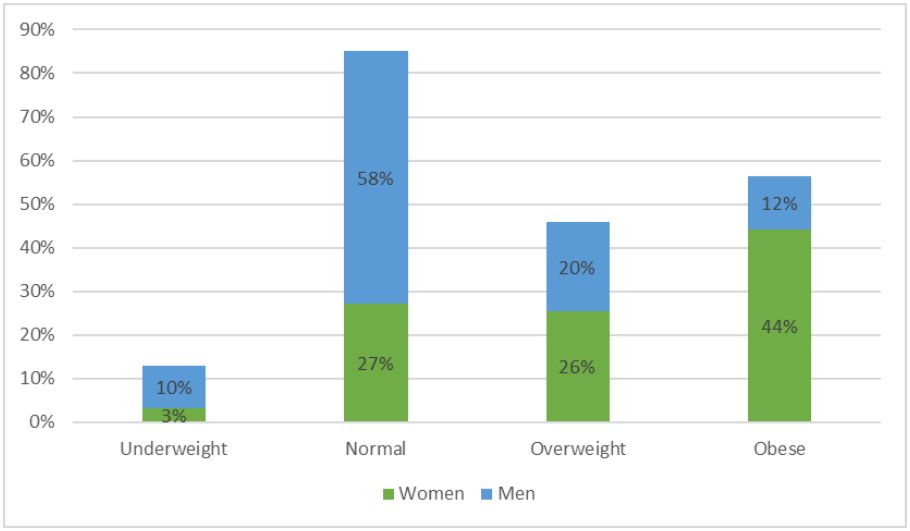


Figure 14 Wave 4: Men & women BMI Categories

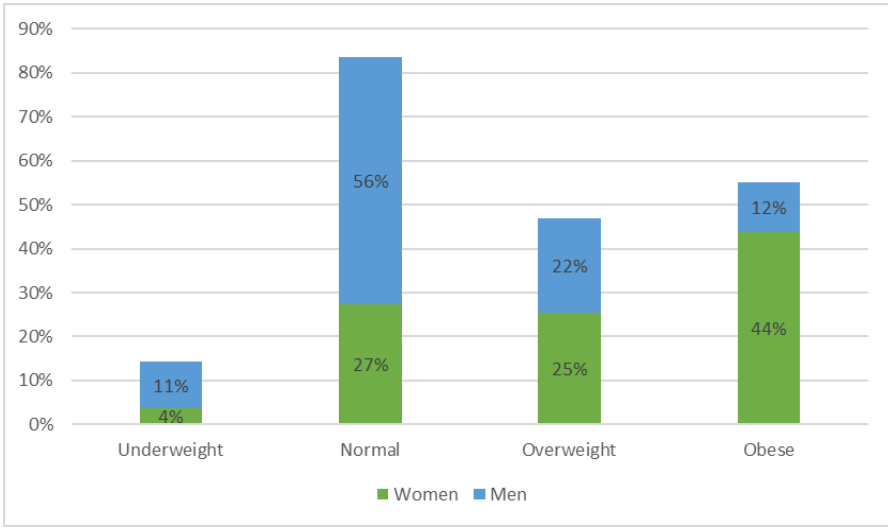


Figure 15 Wave 5: Men & women BMI Categories

The following section shows the movements of respondents (both men and women) between waves across BMI categories. After each table, every wave is discussed individually, where after the movements from one wave to another are discussed briefly.

Within each wave, for ease of interpretation, the respondents who moved to a higher BMI category from normal to overweight and overweight to obese, are highlighted green. Respondents who moved into a lower BMI category from obese to overweight and overweight to normal weight are highlighted blue. These four movements are the movements that were of most interest for this study. For ease of reference, the percentages of these are also provided in brackets.

4.4.3 Movements from wave 1 to wave 2

Table 5 Observed changes between BMI categories from wave 1 to wave 2

	BMI wave 2				
	n = 6679	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	173	214	61	38
	Normal	164	1681	561 (8,4%)	244
	Overweight	32	349 (5,2%)	750	446 (6,7%)
	Obese	19	154	297 (4,4%)	1496

BMI (BODY MASS INDEX)

Observed changes between BMI categories from wave 1 to wave 2

Reading from Figure 11 and 12 above (in Section 4.4.2), there was a slight increase in overweight women (25% to 26%) and obese women (38% to 41%) from wave 1 to wave 2. An increase of overweight men (20% to 24%) and obese men (11% to 13%) was also noted. The cross-tabulation of the BMI categories of waves 1 and 2 show that the majority of the respondents stayed in the same BMI category across the two waves. Table 5 also shows that a greater proportion of respondents moved to a higher BMI category.

4.4.4 Movements from wave 2 to wave 3

Table 6 Observed changes between BMI categories from wave 2 to wave 3

	BMI wave 3				
	n = 8124	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	160	238	56	21
	Normal	130	2039	648 (8,0%)	219
	Overweight	26	521 (6,4%)	1025	505 (6,2%)
	Obese	11	256	457 (5,6%)	1812

BMI (BODY MASS INDEX)

Observed changes between BMI categories from wave 2 to wave 3

Reading from Figure 12 and 13 in Section 4.4.2, there was an increase in overweight (26% to 28%) women and a decrease in obese (41% to 39%) women from wave 2 to wave 3. A slight decrease was observed for overweight (24% to 23%) and obese men (13% to 12%). In the cross tabulation of the BMI categories in wave 2 and wave 3, it is evident that the majority of the respondents stayed in the same BMI category across the two waves, which elucidates the low percentage of mobility of men and women between BMI categories in Figure 12 and 13. Table 6 further indicates that more respondents moved to a higher BMI than a lower BMI.

4.4.5 Movements from wave 3 to wave 4

Table 7 Observed changes between BMI categories from wave 3 to wave 4

	BMI wave 4				
	n = 10 424	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	268	150	12	9
	Normal	275	2891	730 (7,0%)	196
	Overweight	34	578 (5,5%)	1471	711 (6,8%)
	Obese	12	112	346 (3,3%)	2629

BMI (BODY MASS INDEX)

Observed changes between BMI categories from wave 3 to wave 4

Reading from Figure 13 and 14 in Section 4.4.2, there was a decrease in overweight (28% to 26%) women and an increase in obese (39% to 44%) women from wave 3 to wave 4. There was a decrease of overweight (24% to 20%) men. The percentage of men categorised as obese remained the same (12%). In the cross tabulations of BMI categories from wave 3 to wave 4, almost 30 per cent of the respondents remained in the normal weight category (n=2891) and approximately a quarter remained obese (25,2%, n=2629). In the cross tabulations, it is evident that most of the respondents stayed in the same BMI category across the two waves. However, Table 7 shows that a greater proportion of respondents who engaged in BMI mobility moved to a higher BMI category.

4.4.6 Movements from wave 4 to wave 5

Table 8 Observed changes between BMI categories from wave 4 to wave 5

	BMI wave 5				
	n = 12 431	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight	472	232	12	1
	Normal	281	3852	653 (5,3%)	67
	Overweight	7	486 (3,9%)	1888	510 (4,1%)
	Obese	6	47	424 (4,4%)	3493

BMI (BODY MASS INDEX)

Observed changes between BMI categories from wave 4 to wave 5

Reading from Figure 12 and 13 in Section 4.4.2, overweight women decreased somewhat from 26 per cent to 25 per cent and there was no change in obese (44% to 44%) women from wave 4 to wave 5. A small decrease of overweight (20% to 22%) men is evident, with no change in obese (12% to 12%) men. The observations from these two figures are indicative to low mobility between BMI categories. In the cross tabulations of BMI categories from wave 4 to wave 5 (Table 8), the results are consistent with those of Figure 12 and 13: Most of the respondents stayed in the same BMI category across the two waves with very low levels of mobility between BMI categories.

4.5 Social stratification and obesity

This section combines the results of the previous two sections with cross tabulations to indicate the movement of adult respondents between different income classes and different BMI groups. The focus of this study was on income mobility and therefore only the tables showing the movement of respondents between social classes are examined in this section. The tables describing respondents who remained in the same social class are attached in Appendix A.

In every table indicating the movement between waves, for ease of interpretation, the respondents who moved to a higher BMI category from normal to overweight and overweight to obese, are highlighted green. Respondents who moved into a lower BMI category from overweight to normal weight are highlighted blue. These four movements are the movements that are of most interest for this study. For ease of reference, the percentages of these are also provided in brackets.

4.5.1 Movement from wave 1 to wave 2

Respondents who moved from poor to vulnerable

Table 9 Observed changes between BMI categories from wave 1 to wave 2 (respondents who moved from poor to vulnerable)

Moved poor to middle class		BMI wave 2			
	n = 418	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	9	13	5	2
	Normal	13	119	42 (10,0%)	22
	Overweight	4	24 (5,7%)	44	26 (6,2%)
	Obese	0	17	22 (5,3%)	56

BMI (BODY MASS INDEX)

Table 9 shows respondents who experienced income mobility moving from the poor social class to the vulnerable social class. Of these respondents, 10 per cent of respondents moved from normal to overweight and 6,2 per cent respondents moved from overweight to obese. With downward BMI mobility, 5,7 per cent of respondents moved from overweight to normal and 5,3 per cent of respondents moved from obese to overweight. The most respondents remained in the normal BMI category when moving

from a lower income to a higher income between the poor and the vulnerable social class (28,5%, n=119). A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who moved from vulnerable to middle class

Table 10 Observed changes between BMI categories from wave 1 to wave 2 (respondents who moved from vulnerable to middle class)

Moved vulnerable to middle class		BMI wave 2			
	n = 580	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	6	16	3	4
	Normal	8	146	51 (8,8%)	22
	Overweight	2	31 (5,3%)	75	46 (7,9%)
	Obese	1	11	24 (4,1%)	134

BMI (BODY MASS INDEX)

Table 10 shows the respondents who moved from vulnerable to middle class, where a quarter of respondents remained in the normal BMI category (25,1%, n=146) and 23,1 per cent of respondents remained in the obese BMI category (n=134). Moving to a higher BMI category, 8,8 per cent of respondents moved from normal weight to overweight and 7,9 per cent of respondents moved from overweight to obese. On the opposite spectrum, 5,3 per cent of respondents moved from overweight to normal and 4,1 per cent of respondents moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

4.5.2 Movement from wave 2 to wave 3

Respondents who moved from poor to vulnerable

Table 11 Observed changes between BMI categories from wave 2 to wave 3 (respondents who moved from poor to vulnerable)

Moved poor to vulnerable		BMI wave 3			
	n = 637	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	13	20	9	0
	Normal	16	187	60 (9,4%)	18
	Overweight	5	44 (6,9%)	71	33 (5,2%)
	Obese	2	20	33 (5,2%)	106

BMI (BODY MASS INDEX)

Table 11 illustrates respondents who took part in social mobility moving from the poor social class to the vulnerable social class from wave 2 to wave 3. Almost 30 per cent of the respondents remained in the normal weight BMI category (n=187). Of the respondents who engaged in mobility, 9,4 per cent moved from normal weight to overweight and 5,2 per cent moved from overweight to obese. Almost 7 per cent of the respondents moved from overweight to normal weight and about 5 per cent of the respondents moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who moved from vulnerable to middle class

Table 12 Observed changes between BMI categories from wave 2 to wave 3 (respondents who moved from vulnerable to middle class)

Moved Vulnerable to Middle Class		BMI wave 3			
	n = 641	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	9	13	5	2
	Normal	4	149	50 (7,8%)	21
	Overweight	2	36 (5,6%)	71	43 (6,7%)
	Obese	0	15	36 (5,6%)	185

BMI (BODY MASS INDEX)

With respondents moving from the vulnerable social class to the middle class, almost 30 per cent remained in the obese BMI category (n=185). Almost 8 per cent of respondents moved from normal weight to overweight and almost 7 per cent moved from overweight to obese. In terms of adults moving to a lower social class, 5,6 per cent of adults moved from both overweight to normal weight and obese to overweight, respectively. A greater share of respondents moved to a higher BMI than to a lower BMI category.

4.5.3 Movement from wave 3 to wave 4

Respondents who moved from poor to vulnerable

Table 13 Observed changes between BMI categories from wave 3 to wave 4 (respondents who moved from poor to vulnerable)

Moved poor to vulnerable		BMI wave 4			
	n = 1213	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	32	23	2	1
	Normal	56	368	96 (7,9%)	26
	Overweight	6	75 (6,2%)	154	71 (5,9%)
	Obese	2	24	32 (2,6%)	245

BMI (BODY MASS INDEX)

There was quite a lot of mobility in terms of people moving from poor to vulnerable from wave 3 to wave 4. Of these, almost a third of the respondents who partook in this mobility remained in the normal weight category (30%, n=368), whereas the second most respondents remained obese (20,1%, n=245). Moving upwards in BMI categories, almost 8 per cent of the adult respondents moved from normal to overweight and almost 6 per cent of the respondents moved from overweight to obese. Some 75 respondents (6,2%) moved from overweight to normal and 32 respondents (2,6%) moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who moved from vulnerable to middle class

Table 14 Observed changes between BMI categories from wave 3 to wave 4 (respondents who moved from vulnerable to middle class)

Moved vulnerable to middle class		BMI wave 4			
	n = 870	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	23	10	3	0
	Normal	19	236	71 (8,2%)	22
	Overweight	1	39 (4,5%)	125	71 (8,2%)
	Obese	2	7	27 (3,1%)	214

BMI (BODY MASS INDEX)

From wave 3 to wave 4, there was less mobility between respondents who moved from vulnerable to middle class (Table 14) than there was for respondents who moved from poor to vulnerable (Table 13). Table 14 shows that almost 30 per cent of respondents remained in the normal weight category (n=236). About 8,2 per cent of the respondents moved from both normal weight to overweight and from overweight to obese, respectively. A lower percentage of 4,5 per cent of respondents moved to a lower BMI – from overweight to normal and 3,1 per cent moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

4.5.4 Movement from wave 4 to wave 5

Respondents who moved from poor to vulnerable

Table 15 Observed changes between BMI categories from wave 4 to wave 5 (respondents who moved from poor to vulnerable)

Moved poor to vulnerable		BMI wave 5			
	n = 1089	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight	43	25	5	1
	Normal	46	379	65 (6,0%)	4
	Overweight	1	43 (4,0%)	157	33 (3,0%)
	Obese	0	8	33 (3,0%)	246

BMI (BODY MASS INDEX)

There was quite a lot of mobility in terms of people moving from poor to vulnerable from wave 4 to wave 5. Almost 35 per cent of the respondents who partook in this mobility remained in the normal weight category (n=379) whereas the second most respondents remained obese (22,6%, n=246). Within movements to a higher weight class, 6 per cent of respondents moved from normal to overweight and 3 per cent moved from overweight to obese. There are 43 respondents (4,0%) who moved from overweight to normal and 33 respondents (3,0%) moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who moved from vulnerable to middle class

Table 16 Observed changes between BMI categories from wave 4 to wave 5 (respondents who moved from vulnerable to middle class)

Moved vulnerable to middle class		BMI wave 5			
	n = 866	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight	27	12	1	0
	Normal	19	247	46 (5,3%)	5
	Overweight	0	29 (3,3%)	149	45 (5,2%)
	Obese	1	4	33 (3,8%)	248

BMI (BODY MASS INDEX)

There was less mobility from wave 4 to wave 5 between respondents who moved from vulnerable to middle class (Table 16) than the mobility for respondents who moved from poor to vulnerable (Table 15). There were 46 respondents (5,3%) who moved from normal weight to overweight and 45 respondents (5,2%) who moved from overweight to obese. Almost a third of the respondents who moved from the vulnerable class to the middle class remained obese (28,6%, n=248) and 28,5 per cent remained in the normal BMI category (n=247).

4.5.5 Discussion of cross tabulations of social stratification and obesity movements

The cross tabulations of Section 4.5 illustrate movements between different waves, social/income classes and BMI categories, focusing on observed BMI movements of respondents who moved from poor to vulnerable and vulnerable to middle class. BMI movements of respondents who remained in the same social classes are attached in Appendix A.

Across the panel, the vulnerable category is the social class with the greatest income mobility, with the most mobility in and out of this category from wave 3 to wave 4 (refer to Table 3).

The elite category has the smallest number of movers, due to the small size of the elite social class in South Africa and the persistence of being rich. In 2008, the elite social class comprised of 4,8 per cent of the South African population (based on the NIDS panel) and shrunk somewhat to 3,9 per cent in 2017.

In most of the income movements, respondents remained either in the normal BMI category or in the obese BMI category. It is evident that the most shifts in mobility took place from a lower BMI category to a higher BMI category, indicating an increase in BMI. Furthermore, there is an observed positive relationship between respondents who moved from a lower social class to a higher social class and a BMI increase. This very simple observation may be evidence of the nutrition transition, but it does not account for any other factors that may have caused the increase in BMI.

The following section summarises the characteristics of the respondents who took part in social mobility and moved between different BMI categories to see if there are common characteristics that describe these households.

4.6 Characteristics of movers/respondents

The respondents were categorised in seven categories across the panel from wave 1 to wave 5:

1. Respondents who stayed in the same social class and moved from a lower BMI to a higher BMI.
2. Respondents who remained in the same social class and moved from a higher BMI to a lower BMI.
3. Respondents who remained in the same social class and remained in the same BMI category across the five waves of the panel.
4. Respondents who moved from poor to vulnerable and moved from a lower BMI to a higher BMI (normal to overweight and overweight to obese).
5. Respondents who moved from poor to vulnerable and moved from a higher BMI to a lower BMI (overweight to normal and obese to overweight).
6. Respondents who moved from vulnerable to middle class and moved from a lower BMI to a higher BMI (normal to overweight and overweight to obese)
7. Respondents who moved from vulnerable to middle class and moved from a higher BMI to a lower BMI (overweight to normal and obese to overweight)

In each category, the average age of the respondents in the category is displayed as well as the distribution between men and women respondents within that category, the location of the respondent – distinguishing between traditional areas, urban and farms. The race/population group of the respondents is presented. In terms of education, the highest level of education that each respondent attained is displayed. For each category, the number of economically active, unemployed and employed is displayed to illustrate the employment status of the respondents in each category. After Table 17, in which the descriptions discussed above is presented, a discussion of these characteristics follows.

Table 17 Characteristics of movers across the panel (column percentage format)

		1 Stayed in the same socio-economic class and moved from a lower BMI to a higher BMI	2 Stayed in the same socio-economic class and moved from a higher BMI to a lower BMI	3 Stayed in the same socio-economic class and BMI group	4 Moved from poor to vulnerable and moved from a lower BMI to a higher BMI (normal to overweight and overweight to obese)	5 Moved from poor to vulnerable and moved from a higher BMI to a lower BMI (overweight to normal and obese to overweight)	6 Moved from vulnerable to middle class and moved from a lower BMI to a higher BMI (normal to overweight and overweight to obese)	7 Moved from vulnerable to middle class and moved from a higher BMI to a lower BMI (overweight to normal and obese to overweight)
Category Totals	**n=**	**602**	**837**	**11513**	**326**	**230**	**329**	**193**
Average Age		35	40	41	40	42	38	39
Female		*34%*	39%	40%	29%	39%	32%	35%
Male		*66%*	61%	60%	71%	61%	68%	65%
Location								
	Traditional	*18%*	20%	18%	15%	20%	14%	16%
	Urban	*76%*	74%	74%	77%	69%	80%	77%
	Farms	*6%*	6%	8%	7%	11%	6%	7%
Race/Population Group								
	African	*82%*	85%	81%	95%	96%	83%	81%
	Coloured	*15%*	10%	15%	5%	3%	16%	17%
	Asian/Indian	*0%*	1%	1%	0%	0%	0%	1%
	White	*3%*	4%	3%	0%	0%	0%	2%
Best Education								
	Primary Completed (Grade 7)	*7%*	9%	10%	11%	8%	7%	9%
	Secondary Completed (Grade 12)	*22%*	16%	14%	13%	7%	17%	18%
	Tertiary Education	*13%*	9%	8%	5%	5%	11%	9%
	No Schooling	*16%*	20%	20%	18%	22%	23%	21%
Employment Status								
	Not Economically Active	*2%*	4%	5%	6%	7%	5%	5%
	Unemployed (discouraged)	*0%*	1%	1%	1%	2%	1%	1%
	Unemployed (strict)	*3%*	4%	4%	7%	6%	4%	5%
	Employed	*13%*	26%	42%	48%	43%	52%	50%

Source: Author's own calculations

4.6.1 Discussion of characteristics of respondents

Description of the first category: respondents who stayed in the same socio-economic class and moved from a lower BMI to a higher BMI

The average age of this category was the youngest of all the age groups at 35 years old. Sixty-six per cent of the respondents who took part in BMI mobility in this category were males, whereas 34 per cent of them were females. Most of the respondents in this category (82%) were part of the African population group and 76 per cent were located in urban areas. Most of the respondents finished matric and were employed.

Description of the second category: respondents who stayed in the same socio-economic class and moved from a higher BMI to a lower BMI

The average age for respondents in this category was 40 years old. Eighty-five per cent of the respondents were part of the African population group, with the second highest population category being coloured at 10 per cent. Seventy-four per cent of this group of respondents lived in urban areas and 20 per cent lived in traditional areas. Twenty per cent of these respondents had no schooling and only 16 per cent of them completed Secondary School.

Description of the third category: respondents who stayed in the same socio-economic class and in the same BMI group

This category had the greatest number of respondents. Sixty per cent of the respondents were male and 40 per cent of the respondents were female. Similar to the first two categories, the most (74%) of these respondents lived in Urban areas. Eighty-one per cent of the respondents who did not take part in any social mobility, were part of the African population group. Ten per cent of the respondents completed primary school, 14 per cent of the respondents completed secondary school, 8 per cent of the respondents completed tertiary education and 20 per cent of the respondents had no schooling. Despite the fluctuating levels of schooling, 42 per cent of the respondents in this group were employed with only 5 per cent unemployed.

Description of the fourth category: respondents who moved from poor to vulnerable and moved from a lower BMI to a higher BMI (normal to overweight and overweight to obese)

This category is in line with Table 9, 11, 13 and 15 presented in Section 4.5, describing the characteristics of respondents that moved from poor to vulnerable and from a lower BMI to a higher BMI category. The

results of Section 4.5 showed that there were more respondents who moved to a higher BMI than to a lower BMI category. The increase in BMI indicates a potential increase in their health risk. A high 71 per cent of men and a lower 29 per cent of women took part in mobility in this category. About 77 per cent of these respondents lived in Urban areas, 15 per cent lived in traditional areas and 7 per cent lived on farms. Twenty-nine per cent of the respondents had some form of education and 18 per cent of them had no schooling. Almost half of the respondents in this category indicated that they were employed (48%, n=99).

Description of the fifth category: respondents who moved from poor to vulnerable and moved from a higher BMI to a lower BMI (overweight to normal and obese to overweight)

Like the fourth category, the fifth category is also in line with Table 9, 11, 13 and 15. These four tables described the characteristics of respondents who moved from poor to vulnerable. In this category, however, the focus is on respondents who moved from a higher BMI to a lower BMI, indicating a potential decrease in their health risk.

This category had the oldest average age (42) with 61 per cent of the movers being men and 39 per cent women. This category had the lowest number of respondents who lived in urban areas at 69 per cent with 20 per cent living in traditional locations and 11 per cent on farms. A high number of 96 per cent of the respondents were African with 3 per cent Coloured respondents and no White or Asian/Indian respondents. There were 50 respondents (22%) who had no schooling and only 20 per cent had some form of schooling. Forty-three per cent of the respondents indicated that they were employed and 15 per cent indicated that they were unemployed or not economically active.

Description of the sixth category: respondents who moved from vulnerable to middle class and moved from a lower BMI to a higher BMI (from normal weight to overweight and from overweight to obese)

Like the fourth and the fifth category, the discussion of the sixth category contributes to the tables discussed in Section 4.5. Like the fourth category, this category focused on an increase in BMI, but for respondents who moved from the vulnerable class to the middle class (see Table 10, 12, 14 and 16).

Respondents in this category moved from vulnerable to middle class and to a higher BMI category, indicating a potential increase in their health risk. The average age of this category was 38 years old. Thirty-two per cent of the respondents in this category were female and 68 per cent of the respondents were male. This category had the highest number of respondents living in Urban areas (n=8518).

Description of the seventh category: respondents who moved from vulnerable to middle class and moved from a higher BMI to a lower BMI (overweight to normal and obese to overweight)

Respondents in this category moved from vulnerable to middle class and to a lower BMI category, indicating a potential decrease in their health risk factor. The average age of this category was 39 years old. A high 65 per cent of the movers in this category were male and 35 per cent were female. Some 77 per cent of the movers lived in Urban areas. Just 36 per cent of the movers underwent a form of education and 21 per cent had no schooling.

To summarise the comparisons within groups, for those who moved to a higher income group and a higher BMI category were predominantly more male than female. In the move from poor to vulnerable, those that who moved to a higher BMI group were more likely to be better educated (save for those that indicated that they did not have any schooling) and employed, than those who moved to a lower BMI group. This is different for those who moved from vulnerable to middle class. In that case, the individuals who moved to a lower BMI category were more likely to be better educated and employed.

The category with the greatest share of respondents, overall, is the third category indicating adults who remained in the same socio-economic class and in the same BMI category.

When observing the last four categories where respondents took part in some form of socio-economic mobility, it is notable that the categories with the greatest proportion of respondents were the ones moving to higher social classes, as well as higher BMI categories. Seemingly, it is plausible to draw attention to the possibility that upward income mobility leads to an increase in BMI.

The respondents who took part in upward mobility of both socio-economic class and BMI category were more likely to be employed than respondents who participated in downward mobility. Respondents with the least adults who had some form of education were those who engaged in upward mobility in both their income class and their BMI category.

4.7 Regression analysis

In a final effort to link income mobility to obesity outcomes, the estimation of two simple regression models were added to the analysis. The pooled data was used to estimate a simple linear regression model where BMI is a function of income mobility and the available individual characteristics as controls. The simple linear regression model is the preferred method since one is not expecting non-linear relationships, nor does one aim to identify causal effects. The estimating equation can be expressed as follows:

BMI = f (income mobility, gender, age, location, level of education, employment status) with a random error term.

The dependent variable BMI was measured as the level of BMI in wave 5 in the first specification and as the change in the level of BMI between wave 1 and wave 5 in the second specification. The independent variables were measured as follows:

- Income mobility is a categorical variable indicating that a household moved between income classes. The comparator is households that stayed in their original income class (equals zero). Those that moved from poor to vulnerable are coded as 1, from vulnerable to middle class as 2, from middle class to elite as 3.
- Gender is simply male, and female as captured in the NIDS data and male is the comparator category.
- Age is measured in years and the respondent's age in wave 1 was used in the model.
- Location is the simple classification used in the NIDS data where rural traditional areas was the comparator category for urban areas and farms.
- For level of education, Grade R/0 is the comparator category.
- For employment status people that were not economically active are the comparator category.

The estimation methods were a simple Ordinary Least Squares (OLS) linear regression model, using the regress command in Stata®.

The results are summarised in Table 18 below.

Table 18 Regression Results

	Model 1 (BMI in wave 5)		Model 2 (Difference in BMI wave 1 and 5)	
	Coefficient	SE	Coefficient	SE
Income movers (no mobility is the comparator)				
Poor to vulnerable	8.54*	5.149	-6.40	70.245
Vulnerable to middle class	16.27**	6.562*	152.96	89.528
Middle class to elite	12.21	8.379	-50.40	114.309
Gender				
Female	-1.59	4.436	-91.08	60.521
Age	-0.007	.007	-0.05	.101
Location				
Urban	-8.17	4.677	80.33	63.723
Farms	0.94	8.178	-41.71	111.576
Education				
Grade 7	3.24	265.145	-19.55	3617.383
Grade 9	-11.02	265.123	-53.94	3617.087
Grade 12	-6.64	265.097	104.35	3616.720
Bachelor's degree	-6.64	266.966	347.03	3628.694
Employment status				
Unemployed, discouraged	12.61	9.168	219.69	125.080
Unemployed strict definition	3.88	7.208	-133.45	98.340
Employed	1.47	5.077	97.79	69.269
Adjusted R-squared		0.0024		0.0001

Source: Author's own calculations

This is not expected to be a good model of the level of obesity or the change in obesity since the controls do not include physiological or diet predictors of obesity (for which data are not available). At best it can be concluded that there seems to have been a positive relationship between BMI and income mobility in both specifications. In model 1, moving from poor to vulnerable had a positive relationship with BMI that was significant at the 10 per cent level and moving from vulnerable to middle class was positive and significant at the 5 per cent level. In model 2, moving from vulnerable to middle class had a positive relationship with an increase in BMI between waves 1 and 5 and was significant at the 10 per cent level.

The other control variables were insignificant throughout and the overall fit of the model is very poor. It will be worth building more sophisticated empirical models in future.

4.8 Conclusion

The goal of the analysis was to identify respondents who moved between social classes, Body Mass Index (BMI) categories or both. The analysis was conducted by determining the BMI of adult respondents (older than 19 years of age) and categorising them accordingly as underweight, normal weight, overweight or obese. Respondents were categorised in social classes, based on their expenditure, as poor, vulnerable, middle class or elite. Cross tabulations showed movements between social classes and BMI categories.

The largest social class in South Africa is the vulnerable class. These respondents moved out of poverty but are still at risk to fall back into poverty. The stable middle class hovers around 20 per cent. The elite social class contains the smallest group of respondents.

The findings of the BMI of respondents, showed an increase in overweight and obesity across the panel with a higher prevalence of obesity amongst specifically women. Overall, there were more respondents who moved to a higher BMI than to a lower BMI category.

The results of the analysis suggest that movers who moved from a lower income to a higher income experienced an increase in BMI across the panel and therefore, an increase in their health risk.

5 CHAPTER 5: CONCLUSION

5.1 Introduction

This study set out to analyse the prevalence of obesity as a health risk factor across different social classes, to determine whether individuals that experience upward income mobility (moving from a lower to a higher social class) are healthier based on their BMI status.

The background to this comes from literatures linking health and economics. On the one hand, the relationship is from health to economics. People's health determines the human capital that they supply in the labour market and their productivity. Poor health can limit your means to work for an income and the resources to seek health care. Cross country comparisons show that more frequently than not, healthy countries are also wealthy countries. On the other hand, the relationship is from economics to health. Economic growth and increased income have a positive effect on health outcomes. Yet, this is not always a linear relationship. The process of growth and development involves changes in the nature of work and changes in where people live and the goods and services that they have access to. Changes in eating habits and physical activity are known as the nutrition transition. More sedentary work and a shift from traditional diets to carbonated beverages, processed foods and refined sugars often have obesity as a consequence. Obesity is a health risk factor that can lead to many non-communicable diseases such as type II diabetes, cardiovascular diseases, hypertension, musculoskeletal disorders and some cancers. South Africa's recent history has been characterised by economic development and some growth of the middle class, by the nutrition transition and by rising prevalence of obesity.

The National Income Dynamics Study (NIDS) panel data allows one to examine all the elements of this problematic situation. It is possible to observe the same individuals across five waves over almost a 10-year period and analyse their income mobility across different social classes, as well as the changes over different BMI categories.

The following section provides a brief summary of the study, followed by conclusions and recommendations.

5.2 Research summary

5.2.1 Review of the health research literature

Economic growth must be accompanied by development – and various aspects thereof, including health. Good health and economic prosperity tend to support each other (Sen, 1999). Healthy people can use their abilities to achieve higher levels of income and people with higher levels of income have more

resources available to seek medical care, eat more nutritious food and, as a result, live healthier lives. Chapter 2 provided an overview of the literature in this field. The goal was to highlight the gap for an empirical study on the relationship between income mobility and obesity as a health risk factor in South Africa.

Two approaches were used in the discussion of the health research literature. Firstly, better health for growth and development (see Section 2.2) and secondly, growth and development for better health (see Section 2.3).

Better health for growth and development is focused on the influence of good health on economic prosperity. Economic prosperity, specifically economic growth, is influenced by various factors, such as human capital, health, education, research and development, inequality and type of political system (Temple, 1999:112-156). Human capital is regarded an important driver of economic growth (Mulligan & Sala-i-Martin, 1993:793-773) which is influenced by good health. Human capital is produced in the education sector and is enhanced by health (see Temple (1999); Bleakley (2010:283-310); WHO Commission on Macroeconomics Health (2001)). Multiple studies from 1990 to 2018, (Sabina *et al.*, 2020:592) concluded that better health status improves economic growth.

Weil (2014:623-682) noted that income and health are strongly associated, but the extent of the correlation depends on the specific country, how it is measured and the specific period over which it is measured. Bloom and Canning (2000:1207-1209) argued that an increase in income leads to an increase in expenditure on nutrition and accordingly, the potential of a better health status. In the United States, adults with low income tend to be five times more likely to report poor health conditions than adults with higher levels of income, reporting especially high levels of chronic arthritis, diabetes and coronary heart disease (Woolf *et al.*, 2015:1-22).

Yet, the benefits of economic growth are not equally distributed. In their study of 155 papers, Wilkinson and Pickett (2006:1768-1784) found that as many as 70 per cent of these papers indicate that health is worse in societies with high levels of income inequality. In a time-series analysis in the USA conducted by Bor *et al.* (2017:1475-1490) over four decades, they found that health is improving among the middle and upper classes and that health is worsening among the poor.

The link between growth, or income, and health outcomes is strengthened by the nutrition transition. The review of this literature in Chapter 2 showed that the nutrition transition leads to changes in consumption patterns that can lead to significant increases in BMI and a greater risk of obesity. Obesity as a health risk

factor is related to many possible health risks, such as high blood pressure, type II diabetes, cardiovascular diseases, musculoskeletal disorders and some cancers (World Health Organisation, 2020b).

Obesity in South Africa is increasing today and has been on the increase since early studies in the 1990s. The South African Demographic and Health Survey conducted in 1998 found that, by using BMI as an indicator of obesity, 29,2 per cent of men were overweight or obese and 56,6 per cent of women were overweight or obese (Puaone *et al.*, 2002:1038-1048). More recently, the South African National Health and Nutrition Survey (SANHANES) reported that 30,7 per cent of men were overweight or obese, whereas 64 per cent of women were overweight or obese. These percentages indicate an increase in the number of overweight and obese adults from 1998 to 2013 (Shisana *et al.*, 2013:136). Recent Demographic and Health Survey (DHS) data found that approximately 41 per cent of women were obese and 11 per cent of men were obese (National Department of Health (NDoH) *et al.*, 2019:297).

Several papers studied the level of health that South Africans experience considering their income. One of these papers studied the prevalence of obesity in South Africa using BMI to measure the health status of adults relative to their income (Ardington & Case, 2009:1-34). Another paper used a combination of BMI and self-reported health as an indicator of health levels in the country (Ardington & Gasealahwe, 2012:1-36), while another examined the correlation between obesity and diabetes in light of income levels of a household (Matsebula & Ranchhod, 2016:1-13).

Chapter 2 formed the basis of the dissertation, focusing specifically on the relationship between economic growth and health, presenting a review of the South African health literature, focusing on overweight and obesity and the nutrition transition.

5.2.2 Review of class and social mobility literature

Chapter 3 was focused on laying the foundation for the empirical analysis in Chapter 4 by giving an overview of the concepts of social class, income mobility and inequality. The chapter concluded by addressing relevant South African studies of class and social mobility to ensure that the analysis relates to the available South African literature.

Schlemmer (2005:1-14) discussed the size of the rapidly growing African middle class. He emphasised the importance of using complex subdivisions to classify the South African middle class and identifying a 'core' African middle class. He used educational levels, occupational measure and a combined index of income and standard of living to identify these classes. Visagie and Posel (2011) discussed two other ways of defining the middle class. Firstly, by looking at the middle share of the national income distribution and

secondly, by looking at an absolute level of affluence and lifestyle. By using the first approach, the middle class comprised 31,6 per cent of the population, whereas the second approach defined the middle class as 20,4 per cent of the population (Visagie, 2013:7). Burger *et al.* (2015b:1-15) compared four approaches to determine social class, namely occupational skill measure, a vulnerability indicator, an income polarisation approach and subjective social status. Similar to one of Burger's approaches, the vulnerability indicator, Schotte *et al.* (2017:1-45) identified five social classes: chronic poor, transient poor, vulnerable, middle class and elite. They used a probability threshold to determine the average probability of respondents to either enter or exit poverty. Similarly, Zizzamia *et al.* (2019:1-39) highlighted three dimensions in South Africa, namely poverty persistence, vulnerability and stable middle class.

5.2.3 Data analysis

The empirical analysis was conducted by making use of the National Income Dynamics Study (NIDS) from wave 1 to wave 5.

Respondents included in the analysis were adults between the ages of 19 and 70 years of age. Pregnant women were not taken into consideration for the wave in which they indicated that they were pregnant, as BMI is not considered an appropriate tool to examine health risk in pregnant women. For the remainder of the respondents, their BMI was calculated and they were categorised into four categories, namely underweight, normal weight, overweight or obese.

The NIDS adult respondents were simultaneously categorised into four social classes by using total expenditure as the measure of income following Zizzamia *et al.* (2019:1-39). The classification was: poor, for respondents who lived under the poverty line; vulnerable, classifying those with spending greater than the poverty line, but lower than the vulnerability threshold at the 75^{th} percentile of the distribution of spending; the stable middle class, who are those with spending greater than the 75^{th} percentile of the distribution of spending, but less than the level of spending at the elite threshold and the elite, who were the households with monthly spending greater than the elite threshold that was set as two standard deviations greater than the mean of spending.

The above categorisation all took place using the data analysis software, Stata®. After the categorisation, Stata® was used to analyse the mobility of the respondents in the above categories. To determine 'movers' between BMI categories, social classes and BMI categories and social classes combined, cross tabulation methods were used. Dummy variables were later created to analyse characteristics of the movers.

5.2.4 Research findings

In the first section of the results where the respondents were divided into social classes, it could be noted that the largest social class was the vulnerable class. The vulnerable class accounted for 61,8 per cent of the population in wave 1 (2008) and at its smallest, made up 54,2 per cent of the population in wave 3 (2012). The middle class was the second largest social class, followed by the poor and then the elite.

In the analysis of social mobility literature in Chapter 3, many of the authors indicated that the middle class is smaller than most think. This analysis found similar results. In this case, the vulnerable grouping roughly corresponded with the quantum of Zizzamia *et al.* (2019) transient poor and vulnerable groupings. Inequality is a significant concern in South Africa.

The second section of the results were based on the BMI categorisation. Across the panel, the categories with the most respondents were in the normal weight category and the obese weight category. For women, the most common BMI categories to be categorised in were normal weight and obese. The percentages of obese women increased from 2008 to 2017 from 38 per cent to 44 per cent. Men were mostly categorised as normal weight and overweight. The high prevalence of obesity, especially amongst women, indicated that obesity is indeed a health risk factor that is rising in South Africa.

When combining BMI analysis with income mobility analysis, it was evident that the majority of the respondents remained in the same BMI category, as well as in the same social class, from wave 1 to wave 5. The greatest proportion of moves between BMI categories across the waves were respondents moving from normal weight to overweight and from overweight to obese. The biggest share of the respondents who did not move between social classes remained in the normal weight or overweight BMI categories.

For those respondents who moved from a lower social class to a higher social class, an upward shift in BMI categories of between 3 per cent and 10 per cent was noted.

When observing the last four categories where respondents took part in some form of socio-economic mobility, it was notable that the categories with the greatest proportion of respondents were the ones moving to higher social classes, as well as higher BMI categories. Seemingly, it is plausible to draw attention to the possibility that upward income mobility leads to an increase in BMI.

There were more male movers than female movers. The largest number of movers lived in urban areas and were employed. The highest level of education that most of the respondents had was completion of secondary schooling. The respondents who took part in upward mobility of both socio-economic class and

BMI categories were more likely to be employed than respondents who participated in downward mobility.

The simple regression models did not provide much insight into the determinants of the level of BMI or change in BMI. However, even in a very simplified analysis there seems to be a positive relationship between BMI and income mobility in both specifications. There is much scope for further analysis. For instance, including more socio-economic factors to identify the middle class such as ownership of a refrigerator, or in terms of access to public services. Further, in the categorisation of BMI classes, more elaborate category identifiers may include identifying different classes of obesity and including a waist circumference measurement in the calculation.

The following section presents recommendations and policy proposals based on the results discussed in Section 5.2.

5.3 Conclusions and recommendations

The objective of this study was to analyse the prevalence of obesity as a health risk factor across different social classes, to determine whether individuals who experience upward income mobility (moving from a lower to a higher social class) are healthier based on their BMI status. The conclusion is that the prevalence of obesity has been increasing. There seems to be a positive link between income mobility and obesity. This may be evidence of a nutrition transition in a large and representative sample of South Africans.

This poses particular challenges to policy makers in the fields of health economics and public health nutrition, but these fall outside the scope of this study.

There are several recommendations for future work.

There are a number of ways to examine income mobility and social class. Alternative approaches to the classification used in this study can be combined with the analysis of BMI to test the robustness of the results presented here.

There are more indicators of health risk factors available in the NIDS that can shed light on the results. It would be possible to examine hypertension in conjunction with obesity. Also, available food expenditure data can be examined to investigate dietary intake habits.

In all these approaches, more sophisticated econometric models can be used to try to explain the variation in a health risk factor, or to try to identify causal changes.

5.3.1 The informal sector proposal

Burger and Fourie (2019) highlighted the role, value and potential of the informal sector in addressing the unemployment situation in South Africa. In the June 2020 Supplementary Budget Speech, Minister Tito Mboweni indicated that unemployment is the greatest challenge that South Africa faces (Mboweni, 2020). The informal sector forms a vital part of the growth of the South African economy. Keeping this in mind, it is proposed that a job creation initiative is launched where healthy food is grown and sold.

There are currently initiatives like these in place. It is proposed that the existing initiatives are expanded and supported to create an opportunity for the informal sector to grow by planting and selling food. Popular food stalls selling “vetkoek” etc. can be educated and encouraged to sell more nutritious, yet affordable, alternatives, for example sweet potatoes.

A potential challenge with this proposal is the existing preference for unhealthy food items. A lot of information and education are required to overcome this stigma and change the country’s perception that ‘healthy food is not as delicious’ as unhealthy foods.

An increase in availability and knowledge of healthy foods can be a valuable instrument to address the obesity problem in South Africa, while simultaneously creating opportunity for economic growth by decreasing unemployment.

5.3.2 The export promotion strategy

The South African food sector produces, amongst others, a lot of maize, sunflower and citrus. Of these, a large portion is exported as raw, unprocessed, food items. South Africa also imports many processed foods and agro-based products that include the above-mentioned raw items, resulting in negative trade balances (Trade Map, 2018). This presents an opportunity to process and distribute the locally produced items. Expanding on local produce can enable the country to create jobs and increase income levels of South Africans, while simultaneously increasing the quality of the food manufactured in the country.

5.3.3 Increase food education and availability

Studies have found that healthy food bought in South African supermarkets tend to be more expensive than less healthy food items. One way of addressing this problem may be by means of adding to the existing education system to teach children from a young age how to make healthy food choices with limited finances. Another way may be to teach South Africans to grow and cook their own healthy foods,

for example vegetables, like carrots, that grow easily and of which the top can easily be replanted to grow more carrots.

This approach can be combined with a better application of the existing grant system. It is suggested that the social grant system be converted into a voucher system. If this idea comes to pass, the vouchers can be allocated to include certain nutritious food items.

6 REFERENCE LIST

Acemoglu, D. & Autor, D. 2011. Skills, tasks and technologies: Implications for employment and earnings. Handbook of labor economics. Elsevier. p. 1043-1171).

Acemoglu, D. & Johnson, S. 2007. Disease and Development: The Effect of Life Expectancy on Economic Growth. *Journal of Political Economy*, 115(6):925-985.

Alaba, O. & Chola, L. 2013. The social determinants of multimorbidity in South Africa. *International Journal for Equity in Health*, 12(1):63-72.

Ardington, C. & Case, A. 2009. Health: Analysis of the NIDS Wave 1 Dataset. http://www.nids.uct.ac.za/publications/discussion-papers/wave-1-papers Date of access: 25 January 2020.

Ardington, C. & Gasealahwe, B. 2012. Health: Analysis of the NIDS Wave 1 and 2 Datasets. http://www.nids.uct.ac.za/publications/discussion-papers/wave-2-papers Date of access: 29 January 2020.

Autor, D.H., Katz, L.F. & Kearney, M.S. 2005. Rising wage inequality: the role of composition and prices. (0898-2937).

Autor, D.H., Katz, L.F. & Kearney, M.S. 2006. The Polarization of the U.S. Labor Market. *American Economic Review*, 96(2):189-194.

Barro, R.J. 1997. Determinants of economic growth: a cross-country empirical study: The MIT Press.

Beckfield, J. 2004. Does income inequality harm health? New Cross-National Evidence. *Journal of Health and Social Behavior*, 45(3):231-248.

Bedir, S. 2016. Healthcare expenditure and economic growth in developing countries. *Advances in Economics and Business*, 4(2):76-86.

Bleakley, H. 2010. Health, Human Capital, and Development. *Annual review of economics*, 2:283-310.

Bloom, D.E. & Canning, D. 2000. The Health and Wealth of Nations. *Science*, 287(5456):1207-1209.

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

Bor, J., Cohen, G.H. & Galea, S. 2017. Population health in an era of rising income inequality: USA, 1980–2015. *The Lancet*, 389(10077):1475-1490.

Burger, P. & Fourie, F. 2019. A high unemployment and labour market segmentation: A three-segment macroeconomic model. *South African Journal of Economic and Management Sciences*, 22(1):e1-e12.

Burger, R. & McAravey, C. 2014. What does the 'middle class' mean in a polarised, developing country such as South Africa?, 11 March 2014. http://www.econ3x3.org/article/what-does-%E2%80%98middle-class%E2%80%99-mean-polarised-developing-country-such-south-africa Date of access: 4 February 2020.

Burger, R., McAravey, C. & Van Der Berg, S. 2015a. The Capability Threshold: Re-examining the definition of the middle class in an unequal developing country. *Working Papers 16/2015, Stellenbosch University, Department of Economics.* :1-15.

Burger, R., Steenekamp, C.L., van der Berg, S. & Zoch, A. 2015b. The middle class in contemporary South Africa: Comparing rival approaches. *Stellenbosch Economic Working Papers: 11/14*:1-20.

BusinessTech. 2016. Rand vs the dollar: 1978 – 2016. https://businesstech.co.za/news/finance/116372/rand-vs-the-dollar-1978-2016/ Date of access: 24 February 2020.

Caballero, B. & Popkin, B.M. 2002. Chapter 1 - Introduction. *(In* Caballero, B. & Popkin, B.M., *eds*. The Nutrition Transition: Diet and Disease in the Developing World. London: Academic Press. p. 1-6).

Case, A. & Deaton, A. 2009. Health and Well-Being in Udaipur and South Africa. *(In* Wise, D.A., *ed.* Developments in the Economics of Aging. A National Bureau of Economic Research Conference Report. Chicago and London: University of Chicago Press. p. 317-349).

Coovadia, H., Jewkes, R., Barron, P., Sanders, D. & McIntyre, D. 2009. The health and health system of South Africa: historical roots of current public health challenges. *The Lancet*, 374(9692):817-834.

De Pietro, C., Camenzind, P., Sturny, I., Crivelli, L., Edwards-Garavoglia, S., Spranger, A., Wittenbecher, F. & Quentin, W. 2015. Switzerland: Health System Review. *Health systems in transition*, 17(4):1.

Deaton, A. 2003. Health, inequality, and economic development. *Journal of economic literature*, 41(1):113-158.

Dimble, V. & Menon, N. 2017. Health policy, health outcomes, and economic growth.

Esteban, J.-M. & Ray, D. 1994. On the Measurement of Polarization. *Econometrica*, 62(4):819-851.

Fichera, E. & Savage, D. 2015. Income and Health in Tanzania. An Instrumental Variable Approach. *World Development*, 66:500-515.

Gandhi, M. 1922. Freedom's Battle: Being a Comprehensive Collection of Writings & Speeches on the Present Situation (pp. 1): Ganesh & Co.

Gapminder. 2015. Health & Income of Nations in 2015. https://www.gapminder.org/downloads/updated-gapminder-world-poster-2015/ Date of access: 17 April 2020.

GBD 2015 Mortality and Causes of Death Collaborators. 2016. Global, regional, and national life expectancy, all-cause and cause-specific mortality for 249 causes of death, 1980–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet*, 388(10053):1459-1544.

Goos, M. & Manning, A. 2007. Lousy and Lovely Jobs: The Rising Polarization of Work in Britain. *The Review of Economics and Statistics*, 89(1):118-133.

Gradín, C. & Ray, D. 1999. Extensions of a Measure of Polarization, with an application to the income distribution of five OECD countries.

Gravelle, H., Wildman, J. & Sutton, M. 2002. Income, income inequality and health: what can we learn from aggregate data? *Social science & medicine*, 54(4):577-589.

Hall, R.E. & Jones, C.I. 1999. Why Do Some Countries Produce So Much More Output Per Worker Than Others? *The Quarterly Journal of Economics*, 114(1):83-116.

Henry, J. & Kollamparambil, U. 2017. Obesity-based labour market discrimination in South Africa: a dynamic panel analysis. *Journal of Public Health (09431853)*, 25(6):671-684.

International Monetary Fund. 2019. GDP per capita, current prices https://www.imf.org/external/datamapper/NGDPDPC@WEO/USA/CHE/QAT/NOR/MAC/LUX/IRL Date of access: 7 April 2020.

Labadarios, D., Steyn, N.P. & Nel, J. 2011. How diverse is the diet of adult South Africans? *Nutrition Journal*, 10:33-43.

Levy, F. & Murnane, R.J. 1992. US earnings levels and earnings inequality: A review of recent trends and proposed explanations. *Journal of Economic Literature*, 30(3):1333-1381.

Lynch, J.W. & Kaplan, G.A. 1997. Understanding How Inequality in the Distribution of Income Affects Health. *Journal of Health Psychology*, 2(3):297-314.

Mankiw, N.G., Romer, D. & Weil, D.N. 1992. A Contribution to the Empirics of Economic Growth. *The Quarterly Journal of Economics*, 107(2):407-437.

Marmot, M. 2015. The health gap: The challenge of an unequal world. *The Lancet*, 386(10011):2442-2444.

Marmot, M., Friel, S., Bell, R., Houweling, T.A.J. & Taylor, S. 2008. Closing the gap in a generation: health equity through action on the social determinants of health. *The Lancet*, 372(9650):1661-1669.

Martin, S., Rice, N. & Smith, P.C. 2008. Does health care spending improve health outcomes? Evidence from English programme budgeting data. *Journal of Health Economics*, 27(4):826-842.

Matsebula, V. & Ranchhod, V. 2016. Socio-economic correlates with the prevalence and onset of diabetes in South Africa: Evidence from the first four waves of the National Income Dynamics Study. Cape Town: SALDRU, University of Cape Town.

Mbanya, J.C., Assah, F.K., Saji, J. & Atanga, E.N. 2014. Obesity and Type 2 Diabetes in Sub-Sahara Africa. *Current Diabetes Reports*, 14(7):501.

Mboweni, T.T. 2020. Supplementary Budget Speech.

Mhlongo, V. & Daniels, R.C. 2013. Food expenditure patterns in South Africa: Evidence from the NIDS. http://www.nids.uct.ac.za/publications/discussion-papers/wave-3-papers Date of access: 3 February 2020.

Morudu, P. & Kollamparambil, U. 2020. Health shocks, medical insurance and household vulnerability: Evidence from South Africa. *PLoS ONE*, 15(2):1-17.

Mukong, A.K., Van Walbeek, C. & Ross, H. 2017. Lifestyle and Income-related Inequality in Health in South Africa. *International Journal for Equity in Health*(1):1-19.

Mulligan, C.B. & Sala-i-Martin, X. 1993. Transitional Dynamics in Two-Sector Models of Endogenous Growth. *The Quarterly Journal of Economics*, 108(3):739-773.

Muluvhu, T.C., Monyeki, M.A., Strydom, G.L. & Toriola, A.L. 2019. Relationship between obesity and blood pressure among employees in the Vhembe district municipality of Limpopo Province, South Africa. *Cardiovascular Journal of Africa*, 30(6):361-368.

National Center for Chronic Disease Prevention and Health Promotion. 2020. Defining Adult Overweight and Obesity. https://www.cdc.gov/obesity/adult/defining.html Date of access: 24 November 2020.

National Department of Health (NDoH), Statistics South Africa (Stats SA), South African Medical Research Council (SAMRC) & ICF. 2019. South Africa Demographic and Health Survey 2016. Pretoria, South Africa, and Rockville, Maryland, USA: NDoH, Stats SA, SAMRC, and ICF.

Nellas, V., Olivieri, E., Mocetti, S. & Accetturo, A. 2009. Does Unionism Prevent Polarization? Evidence from the Italian Labor Market.1-17.

Ng, M., Fleming, T., Robinson, M., Thomson, B., Graetz, N., Margono, C., Mullany, E.C., Biryukov, S., Abbafati, C., Abera, S.F., Abraham, J.P., Abu-Rmeileh, N.M.E., Achoki, T., AlBuhairan, F.S., Alemu, Z.A., Alfonso, R., Ali, M.K., Ali, R., Guzman, N.A., Ammar, W., Anwari,

P., Banerjee, A., Barquera, … Gakidou, E. 2014. Global, regional, and national prevalence of overweight and obesity in children and adults during 1980–2013: a systematic analysis for the Global Burden of Disease Study 2013. *The Lancet*, 384(9945):766-781.

Ogbuoji, O., Vollmer, S., Jamison, D.T. & Bärnighausen, T. 2020. Economic consequences of better health: insights from clinical data. *British Medical Journal*, 370:m2186.

Organisation for Economic Co-operation and Development (OECD) & World Health Organization (WHO). 2003. Poverty and Health: Oecd Publications Service.

Pickett, K.E. & Wilkinson, R.G. 2015. Income inequality and health: A causal review. *Social Science & Medicine*, 128:316-326.

Piketty, T. 2014. Capital in the twenty-first century: The Belknap Press of Harvard University Press.

Popkin, B.M. 1994. The Nutrition Transition in Low-Income Countries: An Emerging Crisis. *Nutrition Reviews*, 52(9):285-298.

Popkin, B.M. 2001. The Nutrition Transition and Obesity in the Developing World. *The Journal of Nutrition*, 131(3):871S-873S.

Popkin, B.M. 2015. Nutrition Transition and the Global Diabetes Epidemic. *Current Diabetes Reports*, 15(9):64.

Popkin, B.M. 2017. The nutrition transition and global food system dynamics: the accelerating speed of change and global challenges we face in creating a healthier diet for all. University of North Carolina: Department of Nutrition.

Popkin, B.M. & Gordon-Larsen, P. 2004. The nutrition transition: worldwide obesity dynamics and their determinants. *International Journal of Obesity*:S2.

Puaone, T., Steyn, K., Bradshaw, D., Laubscher, R., Fourie, J., Lambert, V. & Mbananga, N. 2002. Obesity in South Africa: The South African demographic and health survey (Vol. 10. pp. 1038-1048).

Rebelo, S. 1991. Long-Run Policy Analysis and Long-Run Growth. *Journal of Political Economy*, 99(3):500-521.

Rodgers, G.B. 1979. Income and inequality as determinants of mortality: An international cross-section analysis. *Population Studies*, 33(2):343-351.

Sabina, A.-W., Lulin, Z., Henry, A.A. & Ebenezer, W.B. 2020. A Comprehensive Review of The Impact of Health Care Expenditure and Health Outcomes on Economic Growth. *International Journal of Scientific Research in Science, Engineering and Technology*, 7(2):585-597.

Sachs, J.D. 2001. Tropical underdevelopment.

SALDRU. 2018. Questionnaires. http://www.nids.uct.ac.za/nids-data/documentation/questionnaires Date of access: 24 March 2020.

Satia, J.A. 2010. Dietary acculturation and the nutrition transition: an overview. *Applied physiology, nutrition, and metabolism*, 35(2):219-223.

Schlemmer, L. 2005. Lost in Transformation? South Africa's emerging African middle class. *CDE FOCUS*(Number 8):1-14.

Schotte, S., Zizzamia, R. & Leibbrandt, M. 2017. Social stratification, life chances and vulnerability to poverty in South Africa Date of access: 26 January 2020.

Schotte, S., Zizzamia, R. & Leibbrandt, M. 2018. A poverty dynamics approach to social stratification: The South African case. *World Development*, 110:88-103.

Seekings, J. 2007. Perceptions of class and income in post-apartheid Cape Town *Centre for Social Science Research, University of Cape Town*, Working paper number: 198.

Seekings, J. 2009. The Rise and Fall of the Weberian Analysis of Class in South Africa between 1949 and the Early 1970s. *Journal of Southern African Studies*, 35(4):865-881.

Sen, A. 1999. Health in development. *Bulletin of the World Health Organization*, 77(8):619-623.

Shisana, O., Labadarios, D., Rehle, T., Simbayi, L., Zuma, K., Dhansay, A., Reddy, P., Parker, W., Hoosain, E. & Naidoo, P. 2015. The South African National Health and Nutrition Examination Survey, 2012: SANHANES-1: the health and nutritional status of the nation.

Shisana, O., Labadarios, … SANHANES-1 Team. 2013. South African National Health and Nutrition Survey (SANHANES-1). Cape Town: HSRC Press

Ssebagala, R.A. 2019. Poor health as a precursor to consumer debt distress in South Africa. *Development Southern Africa*, 36(4):519-536.

Stats SA (Statistics South Africa). 2017. Mortality and causes of death in South Africa: Findings from death notification, 26 March 2020. http://www.statssa.gov.za/?page_id=1854&PPN=P0309.3 Date of access: 2 April 2020.

Stats SA (Statistics South Africa). 2019. Inequality Trends in South Africa: A Multidimensional Diagnostic of Inequality. http://www.statssa.gov.za/?page_id=1854&PPN=Report-03-10-19 Date of access.

Stoop, N., Leibbrandt, M. & Zizzamia, R. 2019. Exploring psychological well-being and poverty dynamics in South-Africa: Evidence from NIDS waves 1-5. Cape Town: SALDRU, UCT: 2019/7), S.W.P.N.V.N.D.P.

Temple, J. 1999. The New Growth Evidence. *Journal of Economic Literature*, 37(1):112-156.

The Global Health Observatory. 2017. World : Mean Body Mass Index (BMI), ages 18+, age standardized: Male & Female, 2017. https://www.who.int/data/gho/map-gallery-search-results?&maptopics=1a7eb31d-4803-42d1-9c92-2890bf9b2c48 Date of access: 23 March 2020.

The World Bank. 2017. World Development Indicators: Life expectancy at birth, total (years). https://databank.worldbank.org/reports.aspx?source=2&type=metadata&series=SP.DYN.LE00.IN# Date of access: 7 April 2020.

The World Bank Group. 2020. Obesity: Health and Economic Consequences of an Impending Global Challenge. Washington, DC: World Bank.

Thomson, S. 2015. What are the Sustainable Development Goals? https://www.weforum.org/agenda/2015/09/what-are-the-sustainable-development-goals/ Date of access: 23 March 2020.

Thornton, A. 2019. These are the world's healthiest nations. https://www.weforum.org/agenda/2019/02/these-are-the-world-s-healthiest-nations/ Date of access: 6 April 2020.

Trade Map. 2018. Bilateral trade between South Africa and World in 2018. https://www.trademap.org/Bilateral.aspx?nvpm=1%7c710%7c%7c000%7c%7cTOTAL%7c%7c%7c2%7c1%7c1%7c2%7c1%7c1%7c1%7c1%7c1 Date of access: 14 February 2020.

van Biljon, P. 2019. The Economic Feasibility of a Universal Basic Income to Address The Socioeconomic Challenges of Automation And Globalization University of South Africa.

Visagie, J. 2013. Who are the middle class in South Africa? Does it matter for policy? https://www.econ3x3.org/article/who-are-middle-class-south-africa-does-it-matter-policy Date of access: 4 February 2020.

Visagie, J. 2015. Growth of the middle class: Two perspectives that matter for policy. *Development Southern Africa*, 32(1):3-24.

Visagie, J. & Posel, D. 2011. A reconsideration of what and who is middle class in South Africa.1-22.

Visagie, J. & Posel, D. 2013. A reconsideration of what and who is middle class in South Africa. *Development Southern Africa*, 30(2):149-167.

Vorster, H.H., Kruger, A. & Margetts, B.M. 2011. The nutrition transition in Africa: can it be steered into a more positive direction? *Nutrients*, 3(4):429-441.

Weil, D.N. 2014. Health and Economic Growth. *(In* Aghion, P. & Durlauf, S.N., *eds*. Handbook of Economic Growth. Elsevier. p. 623-682).

WHO Commission on Macroeconomics Health. 2001. Macroeconomics and health : investing in health for economic development / report of the Commission on Macroeconomics and Health. In Sachs, J.D. (Ed.). Geneva: World Health Organisation.

Wilkinson, R.G. & Pickett, K.E. 2006. Income inequality and population health: a review and explanation of the evidence. *Social science & medicine*, 62(7):1768-1784.

Wolfson, M.C. 1994. When inequalities diverge. *The American Economic Review*, 84(2):353-358.

Woolf, S., Aron, L., Dubay, L., Simon, S.H., Zimmerman, E. & Luk, K.X. Health, C.O.S.A. 2015. How Are Income and Wealth Linked to Health and Longevity?: University, U.I.a.V.C.

World Health Organisation. 2000. Millennium Development Goals (MDGs). https://www.who.int/topics/millennium_development_goals/about/en/ Date of access: 11 March 2020.

World Health Organisation. 2002. Health, Economic Growth, and Poverty Reduction. World Health Organization, Geneva, Switzerland.

World Health Organisation. 2007. Growth reference 5-19 years. https://www.who.int/growthref/who2007_bmi_for_age/en/ Date of access: 25 August 2020.

World Health Organisation. 2020a. Double burden of malnutrition. https://www.who.int/nutrition/double-burden-malnutrition/en/#:~:text=The%20double%20burden%20of%20malnutrition,populations%2C%20and%20across%20the%20lifecourse. Date of access: 18 November 2020.

World Health Organisation. 2020b. Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight Date of access: 8 April 2020.

World Inequality Database. 2018. The Elephant Curve of Global Inequality and Growth, 1980 - 2016. https://wid.world/ Date of access2020.

World Obesity Federation. 2018. Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight Date of access: 6 February 2020.

Zizzamia, R., Schotte, S. & Leibbrandt, M. 2019. Snakes and Ladders and Loaded Dice: Poverty dynamics and inequality in South Africa between 2008-2017. http://www.nids.uct.ac.za/images/papers/2019_02_NIDSW5.pdf. Date of access: 24 January 2020.

7 APPENDIX A

Appendix A links with Section 4.5 which illustrates the movement of respondents between different waves. This section includes respondents who remained in the same social classes but moved between different BMI groups.

7.1.1 Movement from wave 1 to wave 2

Respondents who remained poor

Table 19 Observed changes between BMI categories from wave 1 to wave 2 (respondents who remained poor)

Stayed poor		BMI wave 2			
	n = 376	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	17	15	9	4
	Normal	14	104	33 (8,8%)	23
	Overweight	3	38 (10,1%)	24	23 (6,1%)
	Obese	1	8	15 (4,3%)	45

BMI (BODY MASS INDEX)

When looking at adult respondents who remained poor in both wave 1 and wave 2, the most respondents stayed in a normal weight class (27,7%). It is notable that 33 individuals moved from a normal BMI to overweight and 23 individuals moved from overweight to obesity. Some 38 (8,8%) adults decreased in BMI from overweight to normal BMI and 15 (4,3%) individuals from obesity to overweight.

Respondents who remained vulnerable

Table 20 Observed changes between BMI categories from wave 1 to wave 2 (respondents who remained vulnerable)

Stayed vulnerable		BMI wave 2			
	n = 3059	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	79	108	22	14
	Normal	73	798	273 (8,9%)	117
	Overweight	10	152 (5,0%)	317	197 (6,4%)
	Obese	12	65	124 (4,1%)	698

BMI (BODY MASS INDEX)

More respondents were classified as vulnerable and remained vulnerable from wave 1 to wave 2, compared with the number of respondents who remained poor. More than a quarter of the respondents (26,0%, n=798) remained in the normal BMI class, with a large percentage of respondents remaining obese (22,8%, n=698). Five per cent of the respondents moved from a normal BMI to the overweight BMI category. About six per cent of vulnerable-class respondents moved from overweight into obesity.

Respondents who remained middle class

Table 21 Observed changes between BMI categories from wave 1 to wave 2 (respondents who remained middle class)

Stayed middle class		BMI wave 2			
	n = 562	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	12	11	2	4
	Normal	8	103	38 (6,8%)	10
	Overweight	0	13 (2,3%)	91	38 (6,8%)
	Obese	1	9	33 (5,9%)	189

BMI (BODY MASS INDEX)

Similar to the group of respondents who remained vulnerable, most of the respondents who remained in the middle class from wave 1 to wave 2 stayed in both the normal weight category (18,3%, n=103), as well as in the obese category (33,6%, n=189). Almost 7 per cent of respondents moved from a normal weight to overweight and 6,8 per cent of respondents moved from overweight to obesity. In terms of respondents moving to a lower BMI category, almost 6 per cent of respondents moved from obese to overweight and 2,3 per cent respondents moved from overweight to normal weight.

Respondents who remained elite

Table 22 Observed changes between BMI categories from wave 1 to wave 2 (respondents who remained elite)

Stayed elite		BMI wave 2			
	n = 102	Underweight	Normal	Overweight	Obese
BMI wave 1	Underweight	0	1	0	0
	Normal	1	17	8 (7,8%)	3
	Overweight	1	12 (11,8%)	13	14 (13,7%)
	Obese	0	3	5 (4,9%)	24

BMI (BODY MASS INDEX)

A small number of respondents were classified as elite (n=102) that remained in the elite group from wave 1 to wave 2, but this is expected due to the low number of elite respondents present in the panel. The same percentage of elite respondents were observed in wave 1 (4,8%) and in wave 2 (4,8%). Almost eight per cent that remained elite moved from normal weight to overweight and 14 respondents (13,7%) moved from overweight to obese. Almost 12 per cent of respondents moved from overweight to normal and approximately 5 per cent moved from overweight to obese.

7.1.2 Movement from wave 2 to wave 3

Respondents who remained poor

Table 23 Observed changes between BMI categories from wave 2 to wave 3 (respondents who remained poor)

Stayed poor		BMI wave 3			
	n = 651	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	26	46	12	2
	Normal	20	180	51 (7,8%)	15
	Overweight	1	54 (8,3%)	68	32 (4,9%)
	Obese	2	15	26 (4,0%)	101

BMI (BODY MASS INDEX)

When looking at adult respondents who remained poor in both wave 2 and wave 3, the most respondents stayed in a normal weight class (27,7%, n=651). It is notable that 51 individuals (7,8%) moved from a normal BMI to overweight and 32 individuals (4,9%) moved from overweight to obesity. Some 54 adults decreased in BMI from overweight to normal BMI and 26 individuals from obesity to overweight.

Respondents who remained vulnerable

Table 24 Observed changes between BMI categories from wave 2 to wave 3 (respondents who remained vulnerable)

Stayed vulnerable		BMI wave 3			
	n = 3127	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	60	85	10	12
	Normal	44	795	260 (8,3%)	88
	Overweight	8	208 (6,7%)	396	191 (6,1%)
	Obese	2	110	169 (5,4%)	689

BMI (BODY MASS INDEX)

More respondents were classified as vulnerable and remained vulnerable from wave 2 to wave 3, compared with the number of respondents who remained poor. Of these, about a quarter (25,4%, n=795) of the respondents remained in the normal BMI class. A large percentage of respondents remained obese (22%, n=689). Just more than 6 per cent of vulnerable-class respondents moved from overweight to obesity. Overall, a greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who remained middle class

Table 25 Observed changes between BMI categories from wave 2 to wave 3 (respondents who remained middle class)

Stayed middle class		BMI wave 3			
	n = 716	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	10	10	0	1
	Normal	6	148	46 (6,4%)	17
	Overweight	2	29 (4,1%)	123	59 (8,2%)
	Obese	1	10	40 (5,6%)	214

BMI (BODY MASS INDEX)

Almost a third of the respondents who remained in the middle class from wave 2 to wave 3 stayed in the obese weight category (29,9%, n=214). With upward BMI mobility, almost 7 per cent of the respondents moved from normal to overweight and just more than 8 per cent of the respondents moved from overweight to obese. It is notable that almost 4 per cent of respondents moved from overweight to normal and almost 6 per cent of respondents moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who remained elite

Table 26 Observed changes between BMI categories from wave 2 to wave 3 (respondents who remained elite)

Stayed elite		BMI wave 3			
	n = 120	Underweight	Normal	Overweight	Obese
BMI wave 2	Underweight	0	1	0	1
	Normal	1	15	9 (7,5%)	2
	Overweight	0	3 (2,5%)	25	13 (10,8%)
	Obese	0	2	8 (6,7%)	40

BMI (BODY MASS INDEX)

Similar to movements from wave 1 to wave 2, there is a small number of respondents who were classified as elite and that remained in the elite group from wave 2 to wave 3, but this is expected due to the low number of elite respondents present in the panel. A third of the respondents who remained in the elite social class from wave 2 to wave 3 stayed obese (33,3%, n=40). Almost 8 per cent of the elite-class respondents moved from normal to overweight and almost 11 per cent of the respondents moved from overweight to obese. Just 2,5 per cent of the respondents moved from overweight to normal and 6,7 per cent moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

7.1.3 Movement from wave 3 to wave 4

Respondents who remained poor

Table 27 Observed changes between BMI categories from wave 3 to wave 4 (respondents who remained poor)

Stayed poor		BMI wave 4			
	n = 871	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	29	19	2	1
	Normal	42	290	57 (6,5%)	16
	Overweight	8	68 (7,8%)	104	51 (5,6%)
	Obese	2	18	18 (2,1%)	146

BMI (BODY MASS INDEX)

With adult respondents who remained poor in both wave 3 and wave 4, a third of the respondents stayed in a normal weight class (33,3%, n=290). It is notable that almost 7 per cent of individuals moved from a normal BMI to overweight and almost 6 per cent of individuals moved from overweight to obesity. Some 68 adults (7,8%) decreased in BMI from overweight to normal BMI and 18 adults (2,1%) from obesity to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who remained vulnerable

Table 28 Observed changes between BMI categories from wave 3 to wave 4 (respondents who remained vulnerable)

Stayed vulnerable		BMI wave 4			
	n = 3867	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	110	51	3	4
	Normal	85	1114	285 (7,4%)	80
	Overweight	12	222 (5,7%)	538	267 (6,9%)
	Obese	4	27	123 (3,2%)	942

BMI (BODY MASS INDEX)

In the movements between wave 3 and wave 4, the most respondents remained in the vulnerable social class. Of these, the most respondents who were in a normal BMI category in wave 3 were also in a normal BMI category in wave 4 (28,8%, n=1114). A very large percentage of respondents remained obese (24,4%, n=942). Some 7,4 per cent of respondents moved from normal weight to overweight and 6,9 per cent of respondents moved from overweight to obese. Moving to lower BMI categories, almost 6 per cent of respondents moved from overweight to normal and 3,2 per cent of respondents moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who remained middle class

Table 29 Observed changes between BMI categories from wave 3 to wave 4 (respondents who remained middle class)

Stayed middle class		BMI wave 4			
	n = 972	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	14	14	0	0
	Normal	7	190	60 (6,2%)	9
	Overweight	0	21 (2,2%)	158	79 (8,1%)
	Obese	0	5	35 (3,6%)	380

BMI (BODY MASS INDEX)

Of the respondents who remained in the middle class from wave 3 to wave 4, far more than a third of the respondents remained obese (40%, n=380). Moving to higher BMI categories, 6,2 per cent of respondents moved from normal weight to overweight and 8,1 per cent of respondents moved from overweight to obese. Some 35 respondents (3,6%) moved from obese to overweight and 21 respondents (2,2%) moved from overweight to normal weight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who remained elite

Table 30 Observed changes between BMI categories from wave 3 to wave 4 (respondents who remained elite)

Stayed elite		BMI wave 4			
	n = 174	Underweight	Normal	Overweight	Obese
BMI wave 3	Underweight	0	1	0	0
	Normal	2	26	7 (4,1%)	1
	Overweight	0	5 (2,9%)	40	17 (9,8%)
	Obese	0	1	4 (2,3%)	70

BMI (BODY MASS INDEX)

Of the few respondents who remained elite from wave 3 to wave 4, almost a quarter of the respondents who were in the overweight BMI category in wave 3 were also in the overweight BMI category in wave 4 (23%, n=40). A very high percentage of respondents remained obese (40%, n=70). Just 4,1 per cent of respondents moved from normal weight to overweight and almost 10 per cent of the respondents moved from overweight to obese. Some 5 respondents (2,9%) moved from overweight to normal and 4 respondents (2,3%) moved from obese to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

7.1.4 Movement from wave 4 to wave 5

Respondents who remained poor

Table 31 Observed changes between BMI categories from wave 4 to wave 5 (respondents who remained poor)

Stayed poor		BMI wave 5			
	n = 1051	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight	70	37	0	0
	Normal	35	420	42 (4%)	1
	Overweight	1	63 (6%)	143	29 (2,8%)
	Obese	0	5	25 (2,4%)	180

BMI (BODY MASS INDEX)

With adult respondents who remained poor in both wave 4 and wave 5, almost 40 per cent of the respondents stayed in the normal weight BMI category. Just 4 per cent of respondents moved from a normal BMI to overweight and almost 3 per cent moved from overweight to obesity. A greater percentage of adults decreased in BMI from overweight to normal BMI (6%) and just 2,4 per cent from obesity to overweight. A greater share of respondents moved to a higher BMI than to a lower BMI category.

Respondents who remained vulnerable

Table 32 Observed changes between BMI categories from wave 4 to wave 5 (respondents who remained vulnerable)

Stayed vulnerable		BMI wave 5			
	n = 5103	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight	182	92	3	0
	Normal	99	1635	280 (5,5%)	34
	Overweight	3	190 (3,7%)	749	217 (4,3%)
	Obese	4	16	183 (3,6%)	1416

BMI (BODY MASS INDEX)

Within the overall movements between wave 4 and wave 5, the most respondents remained in the vulnerable social class. Of these, 32 per cent of respondents who were in a normal BMI category in wave 4 were also in a normal BMI category in wave 5. Almost 28 per cent of respondents remained obese and almost 15 per cent remained overweight.

Not a lot of mobility took place within respondents who remained vulnerable from wave 4 to wave 5, with 5,5 per cent that moved from normal weight to overweight and 4,3 per cent that moved from overweight to obese. Despite the low percentages of mobility, there were still more respondents who moved to a higher BMI than to a lower BMI.

Respondents who remained middle class

Table 33 Observed changes between BMI categories from wave 4 to wave 5 (respondents who remained middle class)

Stayed middle class		BMI Wave 5			
	n = 1244	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight	27	8	0	0
	Normal	8	243	60 (4,8%)	8
	Overweight	0	46 (3,7%)	230	63 (5,1%)
	Obese	0	2	56 (4,5%)	493

BMI (BODY MASS INDEX)

Of the respondents who remained in the middle class from wave 4 to wave 5, almost 40 percent of the respondents remained in the obese BMI category (n=493). A high percentage of respondents remained in the normal weight category (19,5%, n=243). Almost 5 per cent of respondents moved from normal weight to overweight and 5,1 per cent moved from overweight to obese. In terms of respondents moving to a lower BMI category, almost 4 per cent moved from overweight to normal and 4,5 per cent moved from obese to overweight.

Respondents who remained elite

Table 34 Observed changes between BMI categories from wave 4 to wave 5 (respondents who remained elite)

Stayed elite		BMI wave 5			
	n = 118	Underweight	Normal	Overweight	Obese
BMI wave 4	Underweight				
	Normal		20	4 (3,4%)	1
	Overweight		3 (2,5%)	33	6 (5,1%)
	Obese		0	4 (3,4%)	47

BMI (BODY MASS INDEX)

Of the few respondents who are classified as elite in wave 4 and wave 5, almost 40 per cent that were in the obese BMI category in wave 4 were also in the obese BMI category in wave 5. A large percentage of respondents remained overweight (28%, n=33). From wave 4 to wave 5, 3,4 per cent of respondents moved from normal weight to overweight and 5,1 per cent of respondents moved from overweight to obese. A greater share of respondents moved to a higher BMI than to a lower BMI category.

8 APPENDIX B

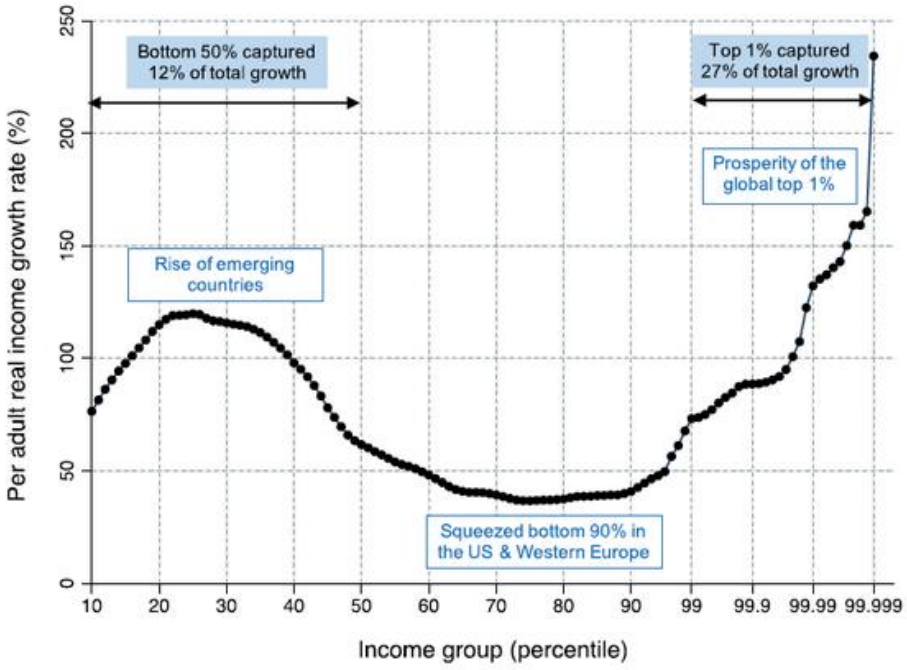


Figure 11 Elephant Curve, 1980-2016

Source: World Inequality Database (2018)