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Health inequality and healthcare policies' efficacy across areas with different deprivation levels within South Africa

By

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DECLARATION

I, Msawenkosi Milton Dlamini, declare that:

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Abstract

Despite South Africa's efforts to reduce socio-economic inequalities since 1994 through policies like the Reconstruction and Development Programme and the Broad-Based Black Economic Empowerment Act, significant disparities remain. While these policies aimed to improve access to services and provide economic opportunities for marginalised communities, their impact has been limited. As a result, health disparities persist, challenging the effectiveness of existing health policies. This thesis seeks to fill a research gap by assessing health inequalities and the efficacy of healthcare policies across regions with varying levels of deprivation in South Africa. It is structured around four interconnected analyses.

The first analysis investigates the impact of localised deprivation on adult health across different areas (traditional authority, formal rural, and formal and informal urban regions) using ordered probit models and data from the National Income Dynamics Study (NIDS). The findings reveal significant health disparities, especially in informal urban areas, where increased deprivation is strongly correlated with poor self-rated health. This highlights the need for targeted health interventions in these regions.

The second analysis explores socio-economic inequalities in chronic illnesses and disabilities among children utilising concentration indices, Oaxaca-Blinder Decomposition, and NIDS data from the 2008 and 2017 waves. The results show stark disparities, with children from wealthier households in formal urban areas benefiting from better health outcomes, while poorer children in informal urban areas are disadvantaged. The third analysis examines diabetes prevalence among South African adults using standardised concentration indices, decomposition techniques and NIDS data. It uncovers varying socio-economic disparities across regions, with some areas showing reduced inequalities while others show increasing disparities.

The final analysis looks at the relationship between public health expenditure and health outcomes from 2005 to 2019 across South African provinces employing two-way fixed effects panel models data from multiple sources. It finds that higher per capita health spending is paradoxically associated with lower life expectancy, indicating inefficiencies in resource allocation. Overall, the study underscores the need for tailored, region-specific healthcare policies to address the diverse challenges and reduce health inequalities across South Africa.

Keywords: Health Inequality, Socio-economic Disparities, Public Health Expenditure, South Africa, Spatial Index of Multiple Deprivation

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ACRONYMS

WHO	World Health Organization
HIV	Human Immunodeficiency Virus
AIDS	Acquired Immunodeficiency Syndrome
SADC	Southern African Development Community
MPI	Multidimensional Poverty Index
UNDP	United Nations Development Programme
UNICEF	United Nations International Children's Emergency Fund
HSRC	Human Sciences Research Council
IDF	International Diabetes Federation
MEDIx	Multiple Environmental Deprivation Index
PIMD	Provincial Index of Multiple Deprivation
SES	Socio-Economic Status
UV	Ultraviolet
DI	Deprivation Index
HRQL	Health-Related Quality of Life
CDI	Canadian Deprivation Index
ODI	Ontario Deprivation Index
GID	General Index of Deprivation
PID	Policy-Perspective Index of Deprivation
SID	Single Indicator of Deprivation
PCA	Principal Component Analysis
NIDS	National Income Dynamics Study
SAIMD	South African Indices of Multiple Deprivation
SIMD	Spatial Index of Multiple Deprivation

SRH	Self-Reported Health
VIF	Variance Inflation Factors
SAM	Severe Acute Malnutrition
TB	Tuberculosis
FE	Fixed Effects
RE	Random Effects
SSA	Sub-saharan Africa
GDP	Gross Domestic Product
GHS	General Household Survey
HST	Health Systems Trust
SAMPI	Multidimensional Poverty Index
Stats SA	Statistics South Africa
YoY	Year-on-Year
NHI	National Health Insurance
CHW	Community Health Worker
ANC	African National Congress
BBBEE	Broad-Based Black Economic Empowerment
HALE	Life expectancy and Healthy Life Expectancy
QALYs	Quality-Adjusted Life Years
LCS	The Living Conditions Survey

Chapter 1: Introduction

This chapter begins by presenting background information on the broad socio-economic inequalities in South Africa and their sources. Extant literature explains that rural areas offer fewer basic socio-economic amenities than their urban counterparts, suggesting that government policies to address inequalities are likely to have less positive outcomes in rural areas (Ameye & De Weerdt, 2020). The first section of the chapter provides a background to the study. Section 1.2 sets out the research problem that this study addresses, namely the lack of empirical evidence on how health inequalities compare in areas with different levels of socio-economic deprivation in South Africa. Given that public health policies do not consider socio-economic differences, this could undermine government initiatives to eradicate health inequalities. Addressing this problem requires an analysis of the mechanisms through which multiple deprivations impact the health of individuals in areas with different levels of deprivation and an examination of trends in socio-economic-related health inequalities between adults and children across urban and rural areas. It is also crucial to draw policymakers' attention to how regional poverty levels influence the efficacy of public health expenditure and how this impact varies across different regions in South Africa. Such evidence is vital to inform policymaking decisions. The outline of the research problem is followed by the study's objectives and a summary of how these are addressed in each chapter in Section 1.3. Section 1.4 discusses the study's contributions, Section 1.5 its limitations, and Section 1.6 the structure of the thesis.

1.1 Background

South Africa is one of the most unequal countries in the world (Ataguba et al., 2015; Adjaye-Gbewonyo et al., 2018; Biyase & Chisadza, 2023). Income inequality across race groups is mainly attributed to both apartheid legacies (Khaoya et al., 2015) and poor governance since 1994 (Hlafa et al., 2019). Apartheid policies denied most citizens economic opportunities and restricted them to under-developed geographical locations. While the democratic government adopted several policies to reduce inequality in economic outcomes following the first democratic election in 1994 (Hyslop, 2005; Momoh, 2015), these mainly comprised macro-economic policies that promoted growth and individual enrichment rather than focusing on redistributing resources (Coovadia et al., 2009; Delobelle 2013).

This resulted in significant socio-economic disparities, including health disparities. Socio-economic inequalities in health refer to differences in health status resulting from the uneven distribution of factors that play an essential role in people's health (Ataguba et al., 2011; Ayala et al., 2011; de Snyder et al., 2011; Chzhen & Ferrone, 2017; Ajide et al., 2023; Omotoso et al., 2023; Wabiri et al., 2013; Willie & Maqbool, 2023). They relate to individuals' social standing measured by income, education, and housing, which affect their health status (Grossman, 1972; Glaeser, 2010). Understanding the impact of socio-economic inequalities on health is vital, as good health is an important determinant of a country's economic development (Makuta & O'Hare, 2015).

While inequalities are generalised in South Africa, some areas are more conducive to promoting good health than others. More specifically, individuals living in areas with higher socio-economic status (SES) tend to experience better health outcomes than those in lower-SES areas. For example, rural areas in South Africa report 49 deaths per 1,000 children under the age of five, while urban areas have a lower child mortality rate of 38 deaths per 1,000 children. This highlights the significant impact of socio-economic factors on health outcomes across different regions (South African Demographics and Health Survey, 2016). It is attributed to less development in rural areas, where, as documented by Porru et al. (2020), residents are often more impoverished, less educated, and face higher unemployment rates than their urban counterparts.

Residents in South Africa's rural areas also confront more barriers to accessing healthcare than those in urban areas. Kobayashi et al. (2018) and Hlafa et al. (2019) argue that despite modernisation efforts in the country's healthcare system in the early 2000s, the situation has remained largely unchanged in the poorer provinces, especially in rural regions. Citizens in areas with minimal economic development contend with inadequate healthcare systems that fail to meet their health needs. The poor socio-economic circumstances in these regions further contribute to adverse health outcomes, as individuals often lack the financial means to afford the necessary healthcare services and resources (Gale et al., 2011; Dyer et al., 2014; Bennett et al., 2019).

It is worth noting that economic development has been uneven across South Africa. While some provinces have experienced a substantial shift from a rural to an urban population (Kobayashi et al., 2018; Muthelo et al., 2021; Sodo et al., 2023), it is unclear whether socio-economic health inequalities are higher in poorer regions than in richer ones. This may imply that the South African government’s limited capacity to influence health outcomes is due to insufficient information presented to policymakers. There is a risk that funds and resources are being allocated to health policies that may not be optimally effective.

Furthermore, poorer regions will likely have less adequate private and public infrastructure. Public health infrastructure in these regions thus needs to be improved because of the lack of private infrastructure (McKee, 2011; Ngobeni et al., 2020). However, the focus has largely been on building infrastructure in more developed areas (Ataguba et al., 2015; Ruff et al., 2011; Khoapa, 2014; Makhathini et al., 2020). This is encapsulated by the "infrastructure-inequality trap", where more developed areas with superior health infrastructure continually demand more resources and funds to maintain their existing level of care compared to less developed areas (Kagwanja et al., 2020; Zodpey et al., 2021). It exacerbates health inequalities between developed and less developed areas in South Africa.

Building on the issues previously discussed, this study explores how multiple forms of deprivation influence health outcomes across different regions of South Africa (Chapter 3). It also examines how SES impacts health outcomes for both children and adults (Chapters 4 and 5), as well as the role of geographical location in shaping these outcomes. Additionally, the study investigates whether uniform public health policies, which do not account for regional differences in deprivation, are likely to be effective. This is further explored in Chapter 6, which assesses the extent to which regional poverty levels hinder the success of public health policies across various areas of the country.

In particular, the study identifies the regions where poverty most significantly undermines the government's efforts to enhance health outcomes for its citizens. Overall, it focuses on unravelling the influence of SES on health outcomes in a context where geographical location is a key determinant of healthcare quality and overall well-being.

1.2 The research problem

The socio-economic inequalities in South Africa identified in the brief background presented above, remain of grave concern to the population and policymakers. Firstly, socio-economic-related health inequalities have persisted despite numerous government interventions since the transition to democracy in 1994 (Achoki et al., 2022). Such interventions were anticipated to significantly improve conditions in the regions hardest hit by socio-economic inequalities. Ideally, effective policies would narrow the health disparity gap, particularly in rural areas and poorer provinces. However, ongoing socio-economic-related health inequalities are due to various unidentified mechanisms and factors that exacerbate these disparities, which remain inadequately understood (Ataguba et al., 2011; Coovadia et al., 2009).

Furthermore, while previous studies have highlighted the existence of health inequalities in South Africa, there is a lack of information specifically analysing these disparities at smaller geographical levels (Noble et al., 2010; Mukong et al., 2017). Most research has focused on broad regional or provincial levels, often overlooking the unique challenges faced in smaller regions such as traditional authority areas, formal rural areas, and urban (formal and informal) regions (Allik et al., 2019).

While it is acknowledged that levels of deprivation differ across the country, there is a lack of knowledge on how health inequalities compare in areas such as traditional authority areas, formal rural areas, and urban formal and informal areas. These differences are likely to undermine the efficacy of government policies which aim to address inequalities (Sidahmed et al., 2023). Consequently, public policies have not been specifically targeted or tailored to address the specific needs of the impoverished segments of the population (Bhorat et al., 2012). There is also a dearth of research that employs advanced econometric methods to examine the relationship between health outcomes health outcomes and their socio-economic determinants in the context of South Africa. Moreover, most existing studies rely on static models and do not adequately address the dynamic aspects of changes in health outcomes.

This study addresses these issues by first employing a spatial lens to analyse the interplay between health, health inequalities, and the impact of policies in areas experiencing varying levels of deprivation. Secondly, it uses panel data in three of the four analyses, enabling a more robust examination of temporal trends. In addition, advanced econometric methods are employed to examine the relationship between health outcomes and their social determinants.

1.3 Objectives and their Achievement

The study problem was approached by pursuing four objectives, namely to:

1) Assess the impact of multiple deprivations on adults' health inequalities within urban and rural areas in South Africa;

2) Investigate inequalities in chronic illness and disability within urban and rural areas in South Africa;

3) Assess inequalities in the prevalence of diabetes among adults in different regions in South Africa;

4) Analyse the efficacy of public health policy across different regions of South Africa.

The investigation is presented in four independent analytical chapters, each focusing on a different aspect of the study (Chapters 3 to 6).

Chapter 3 lays the groundwork by analysing the impact of multiple deprivations on health inequalities within urban and rural settings in South Africa. The chapter follows Noble et al. 's (2010) methodology of constructing a Spatial Index of Multiple Deprivation (SIMD) and examining the level of deprivation in each regional type. The analysis builds on Noble et al. 's (2010) methodology. It uses the SIMD to examine how deprivation influences adult health in different regions rather than merely measuring multiple deprivations in one area. The index for each regional type was calculated by determining the percentage of deprived individuals for each domain and multiplying it by b^{th} weight. The total from each domain is then tallied, producing indices for the different regions that are standardised to a value ranging from 1 to 10, with 10 indicating very deprived and 1 being the least deprived.

Because self-reported health (SRH), which is used as a dependent variable in this analysis, is a categorical variable, the researcher intended to only employ the Ordered Probit Model. However, due to collinearity issues, the analysis integrated this model with the Principal Component Analysis (PCA) Model to address this statistical issue. Examining this theme provided a critical comparative study of how area-level deprivation affects individual health, acknowledging that individuals with lower SES often confront compound challenges like poor living conditions and limited access to services. The chapter thus sets the stage for a nuanced understanding of the complex interplay between socio-economic factors and health, preparing the ground for the subsequent chapters that delve into specific demographic groups and regional disparities.

Chapter 4, entitled "Examination of Socio-Economic-Driven Disparities in Chronic Illness and Disability among South African Children: Exploring Variations within Urban and Rural Areas", focuses on health inequality among young people in areas with different levels of deprivation. It aims to uncover the underlying socio-economic factors contributing to persistent health inequalities in disabilities and chronic illnesses that pose significant public health challenges for this vulnerable population group. The chapter provides a comprehensive picture of the problem of chronic diseases and disability among South African children. A detailed empirical literature review and a relevant theoretical foundation support the investigation.

The analysis pools Wave 1 (2007) and Wave 5 (2017) of the National Income Dynamics Study (NIDS) data were used to create a panel dataset. It covers the period 2008 to 2017, comparing the results in rural formal, traditional authority, urban formal, and urban informal areas. The analysis in this chapter was conducted using concertation curves and concentration index decomposition analysis.

Due to the data constraints of this dataset, chronic illness and disability were measured at a broad level. The child's mother/caregiver or another knowledgeable household member was asked whether the child had any serious illnesses or disabilities. The options encompassed a range of conditions such as tuberculosis (TB); other respiratory problems including asthma, bronchitis, and pneumonia; physical disabilities; issues with sight, hearing, or speech; mental health problems; HIV and AIDS; diabetes; heart disease; cancer; and epilepsy/fits.

Chapter 5**,** entitled "Socio-Economic-Related Inequalities in the Prevalence of Diabetes in South Africa: Regional Disparities", focuses on socio-economic inequalities in diabetes prevalence among adults in areas with different levels of deprivation. It aims to uncover the underlying socio-economic factors contributing to these inequalities. The chapter begins with an overview of the devastating global and South African impact of this condition. This investigation utilises the same dataset and methods as the previous chapter. However, separate analyses are conducted due to the distinct health inequalities and social determinants of health influencing children and adults that stem from the developmental and physiological differences between them. This calls for interventions that are tailored to their different needs. A detailed empirical literature review and relevant theoretical foundation support the investigation.

Having assessed the mechanisms through which multiple deprivations influence health inequalities and how inequalities in the health outcomes of children and adults in areas with different levels of deprivation have changed, it is crucial to examine whether public health policies effectively address the health of the general public in different regions. Such an assessment should also examine how previous public health policies impact health outcomes.

These issues are the focus of Chapter 6, entitled "The Impact of Regional Poverty on Public Health Expenditure Efficacy across South Africa's Provinces: Investigating the Influence of Historical Economic Factors on Health". The analysis begins with background information on the theme and the theoretical foundation that supported the investigation. Annual data spanning 2005 to 2019 was extracted from various sources, including the General Household Survey (GHS) dataset, the Health Systems Trust (HST) database, and annual publications such as National Treasury's Intergovernmental Fiscal Reviews. Life expectancy at birth served as the dependent variable throughout the analysis, while public health expenditure per capita was utilised to measure public health expenditure.

The researcher intended to employ the South African Multidimensional Poverty Index (SAMPI) as a measuring instrument. However, due to data shortages caused by incomplete or inconsistent sources, the provincial deprivation index from Noble et al. 's (2010) study was used as an alternative and acted as a proxy for provincial poverty levels. The index calculation followed a similar approach to the SIMD, but adjustments were made to take into consideration that provinces confront similar socio-economic issues and needs, which aligns with the method used in the SAMPI by Statistics South Africa (2021). Hence, equal b^{th} weight was assigned to each domain. Furthermore, an additional income and material deprivation indicator was introduced as one of the domains, which aligns with the SAMPI approach. This index was calculated for the respective provinces rather than focusing on the regional types employed in Chapter 3. The study employed the two-way fixed effects (FE) model to examine the theme. The use of this model is advantageous in this context as it enables control of time-invariant regional characteristics and common time effects.

Chapter 7 concludes the thesis with a comprehensive summary of the findings, conclusions, and recommendations regarding persistent socio-economic-related health disparities in South Africa.

1.4. Contributions of the Thesis

The apartheid policies in effect from 1948 to the early 1990s in South Africa were the primary drivers of economic inequalities. Apartheid’s defining feature was its spatial orientation, which was achieved by establishing separate residential areas for different racial groups. This led to unequal regional development, with predominantly Black areas suffering from under-development and a lack of essential services and infrastructure compared with those for the White population. The lasting impact of apartheid continues to influence South Africa's spatial and economic landscape, thereby contributing to ongoing health inequalities.

Building on this context, this thesis makes four broad contributions to understanding socio-economic health inequalities in South Africa. The first is that it examines the theme using a spatial lens. This decision was based on the observation that development and challenges have varied across regions since the end of apartheid, reflecting disparities in economic outcomes (Kobayashi et al., 2018). Accordingly, the thesis analyses variations in health outcomes and public policy effectiveness among people with different living standards and levels of deprivation. This approach extends the body of knowledge on health inequalities relating to race (Ataguba et al., 2011; 2015; Mukong et al., 2017), gender (Omotoso & Koch, 2018), and SES (Nkonki et al., 2011; Kobayashi et al., 2018) by establishing a clear link between health inequalities and geographical location.

The thesis' second key contribution is enhancing the granularity traditionally used to examine socio-economic health inequalities. It moves beyond the conventional binary urban-rural classification by utilising smaller units of analysis, including traditional authority areas, formal rural areas, and formal and informal urban areas. The traditional classification often oversimplifies the intricate mix of social and environmental factors influencing health across various spatial scales and contexts. Thompson et al. (2018) and Chen and Du (2015) highlight that over-simplification can overlook specific needs, barriers, and opportunities vital to improving health equity at different governance and service delivery levels. The more detailed approach adopted in this research provides a comprehensive examination of health disparities and the effectiveness of health interventions in South Africa, offering more nuanced and actionable insights.

The third contribution of this thesis is its examination of the changes in health inequalities for both children and adults, going beyond an assessment of the levels of health inequalities at a single point in time. It probes these changes for both demographic groups over time, offering a deeper understanding of the dynamics and causes of health inequalities between children and adults. This comprehensive approach marks a significant advancement in the field. The fourth contribution lies in analysing the efficacy of public health expenditure across different provinces while controlling for regional poverty levels. This analysis uncovered crucial insights which could assist policymakers in identifying regions where public health policies are less effective and where further interventions are necessary. To the best of the researcher's knowledge, no similar study has been conducted in South Africa. The analysis could help to reassess inequality-related policymaking in the country.

1.5. Limitations of the Study

This study confronted three broad limitations, with additional specific limitations detailed in the respective chapters. The first was the inability to access more granular data than that used in the various chapters, particularly at the neighbourhood level. This hindered the ability to precisely capture localised socio-economic factors such as crime and environmental conditions, which are critical in influencing health outcomes. From a statistical perspective, it may have led to either an under-estimation or over-estimation of the true impact of these localised factors. It could thus affect the accuracy and reliability of the study's findings, as the lack of detailed data compromises precision in measuring the direct effects of these socio-economic factors on health outcomes.

Furthermore, the administrative structure in South Africa dictates that public health expenditure is managed at the provincial level. Given that data on expenditure is only publicly accessible for this specific unit of analysis, this study was limited to evaluating the efficacy of public health expenditure at this level. This significantly impacted the study, especially in terms of coherence between the units of analysis employed in Chapters 3 to 5 and those used in Chapter 6. The disparity in units of analysis across these chapters introduces potential inconsistencies in how the effects of health policies and expenditures are measured and compared. These inconsistencies could skew the ability to accurately assess and generalise the findings across various regions and demographic groups.

Lastly, the chapters focusing on health inequalities and their determinants within the general population only cover children and adults, and exclude older people. This hinders the understanding of health disparities across the entire age spectrum. Including an analysis of older people is crucial to comprehend their unique health challenges and to ensure comprehensive healthcare planning for the entire population. The decision to exclude this age group was based on the need to focus on those with higher workforce participation rates and those enrolled at educational institutions, given their significant contribution to South Africa's current and future economy.

1.6. Thesis Structure

This thesis is structured around four topics within the broader spatially oriented socio-economic-related inequalities literature. Chapter 1 provides a brief snapshot of the thesis. Chapter 2 presents the context surrounding socio-economic inequalities at different deprivation levels. Chapter 3 assesses the impact of multiple deprivations on adults' health inequalities within urban and rural areas in South Africa. Chapter 4 investigates inequalities in chronic illness and disability within urban and rural areas in the country. Chapter 5 assesses inequalities in the prevalence of diabetes among adults in different regions of South Africa. Chapter 6 analyses the efficacy of public health policy across different regions. Lastly, Chapter 7 concludes the thesis with a summary and brief discussion of the findings from the three studies and the limitations and recommendations for future research.

Chapter 2: Understanding the South African Landscape

This chapter explores current understanding and the context of the interplay between socio-economic inequality, health outcomes, and trends in public health interventions in South Africa, a nation marked by its unique socio-historical setting.

The historical background to the study is explored in Section 2.1, followed by the various government policies and post-apartheid challenges in Section 2.2. Section 2.3 reviews the literature on prevalent health conditions among children and adults and the multi-faceted factors perpetuating health disparities. Section 2.4 evaluates changes in public healthcare investment over the years in South Africa, drawing comparisons with countries with similar socio-economic profiles. Section 2.5 discusses the integration of each chapter to explore the thesis topic alongside the broad theoretical framework underpinning each analysis, and Section 2.6 presents the chapter summary.

2.1. Historical Legacy of Apartheid

The health landscape in South Africa has been influenced by its history, especially during the apartheid era. This regime, spanning 1948 to 1994, implemented a system of institutionalised racial segregation and discrimination, exacerbating socio-economic disparities among different racial groups (Rich, 1996). Through various policies and legislation such as the Group Areas Act, Black people (Africans, Indians, and Coloureds) were forcibly relocated to designated regions with limited social and economic opportunities. At the same time, the White minority retained access to areas with superior amenities and economic prospects (Grundlingh, 2006).

Spatial segregation had significant implications for health outcomes. Africans, who were predominantly confined to the worst regions known as homelands that lacked essential services and infrastructure, faced heightened vulnerability to infectious diseases due to poor living conditions (Butler et al., 1978). The healthcare services available in these regions were not only inadequate, but also fostered an environment of abuse and neglect, with instances of refusal of emergency treatment and mistreatment common (van der Merwe et al., 2009). Black people also received poor and lower quality levels of education than the rest of the population (Bhorat, 2000). The Bantu Education Act of 1953 established a separate, inferior schooling system to ensure that Africans were trained to fill low-skilled or unskilled positions.

Furthermore, the apartheid government allocated a disproportionate share of educational and healthcare expenditure to cities (urban areas), primarily benefiting White individuals and the privately insured, further exacerbating healthcare disparities (Price, 1978). Several researchers, including Mapadimeng (2013), McKeever (2017), and Alaba et al. (2021), have explored how these entrenched inequalities during the apartheid period resulted in socio-economic segregation that has impacted health across multiple generations.

Similar patterns of health inequalities can be observed globally, particularly in post-colonial societies (Froerer, 2005; Kiwanuka et al., 2008; Kyed & Buur, 2007; Cramb et al., 2019; Kovacic et al., 2019; United Nations Development Programme, 2023; Sharma et al., 2017; Kumar et al., 2021; Kiwanuka et al., 2008); Kiguli et al., 2019; Facchini et al., 2018; Castro et al., 2019; Das et al., 2015; Jat et al., 2015). Countries in Latin America and the Caribbean also suffer the consequences of colonialism and slavery and exhibit differences in healthcare access and quality between those who were oppressed and the former oppressors (Almeida-Filho et al., 2003). Thus, as Nuti (2019) and Sreenivasan (2020) observed, historical injustice has shaped and continues to shape health outcomes across generations and across regions.

2.2. Public Policies and Poor Governance Post-Apartheid

The post-apartheid South African government adopted reforms and programmes to enhance access to essential services and infrastructure among the previously oppressed majority (Parnell & Crankshaw, 2000). The African National Congress (ANC) introduced several policies to improve the well-being of the most vulnerable, with the Reconstruction and Development Programme (RDP) of 1994 being the main initiative (Nokulunga et al., 2018). It aimed to address socio-economic inequalities and improve living conditions for marginalised communities. While not exclusively a health policy, it had implications for health by focusing on housing, water, sanitation, and basic services.

The democratic government also promulgated the Broad-Based Black Economic Empowerment (BBBEE) Act of 2003, a critical policy focused on disadvantaged demographic groups, mainly Africans. It sought to promote economic participation, ownership, and skills development among historically marginalised populations (Musabayana & Mutambara, 2022). In terms of health, the National Health Act 61 of 2003 aimed to improve the health of vulnerable South Africans and establish a healthcare system based on equity, efficiency, and sound governance. It mandated the government to facilitate the provision of primary health and community hospital services across the country's provinces (Thomson & Labuschaigne, 2024).

While these policies increased the size of the Black middle class and improved health and well-being by improving access to basic services and infrastructure in regions that are home to the previously marginalised (Bink & Koch, 2015; Charasse-Pouele & Fournier, 2006; Coovadia et al., 2009; Ataguba, 2011; 2015; Schneider et al., 2014; 2018; Montalvo et al., 2019; Nwosu & Oyenubi, 2021; Weimann, 2013), poor governance and mismanagement have meant that these policies and strategies have primarily benefited only a few Black South Africans. Reddy (2016) highlights that the country continues to grapple with a high disease burden and inadequate healthcare infrastructure to meet the needs of the ever-increasing population.

2.3. Contemporary Health Challenges in South Africa

As noted in Chapter 1, separate analyses were conducted for children and adults to explore the topic of this thesis. This section outlines the most prevalent health conditions and the social determinants of health that are considered generic influencers of children's and adults' health in South Africa and internationally.

2.3.1. Health Conditions in Children

The World Health Organization (WHO) (2022) and the United Nations International Children's Emergency Fund (UNICEF) (2019) note that children's health is inextricably linked to socio-economic inequality. Globally, children from low-income homes or disadvantaged nations face markedly more illness than those from wealthy families in rich nations. Malnutrition is one of the primary health conditions affecting South African children, while several studies (including Harika et al., 2017 and Galani et al., 2022) point to widespread iron and vitamin A deficiency, among other conditions. A lack of access to healthcare compounds these issues, while poverty perpetuates the cycle of poor health.

Iron deficiency is linked to anaemia and impairs the blood's ability to carry sufficient oxygen to the tissues, leading to delays in cognitive and physical development. It has been reported to affect 41.9% of children in South Africa (Muriuki et al., 2020). If left unaddressed, anaemia imposes lasting burdens on families through increased healthcare expenses and diminished productivity while impeding economic growth due to reduced human capital development and potential future workforce constraints. Malnutrition rates differ across provinces and between rural and urban areas, reflecting the disparities in access to nutritious food, healthcare services, and socio-economic resources (Kimani-Murage., 2013; Govender, 2017).

Tuberculosis also poses a persistent threat to children's health in South Africa, with prevalence rates varying significantly across regions (Osman., 2021). Wood et al. (2010) identified hotspots of TB transmission in urban informal settlements and rural areas with limited access to healthcare services, highlighting the spatial dimension of the disease burden. Madhi et al.

(2020) also suggested that disparities in healthcare access and socio-economic factors contribute to the spatial variations in TB prevalence among children.

Respiratory problems, encompassing conditions like asthma and pneumonia, are widespread among children in South Africa (Nantanda et al., 2013). This health condition also demonstrates distinct spatial patterns influenced by environmental factors and socio-economic disparities (Masekela et al., 2018). Research conducted by Kumar et al. (2007) linked air pollution, indoor exposure to smoke, and proximity to industrial areas to the elevated rates of respiratory diseases among children, underscoring the interplay between environmental conditions and health outcomes.

While many other health conditions affect children across South Africa, those discussed here are the most prevalent. The National Department of Health recently implemented strategies to address these challenges (National Department of Health, 2022). The following section examines the most prevalent conditions among South African adults.

2.3.2. Health Conditions in Adults

Global trends, particularly globalisation and urbanisation, affect health disparities among adults in developing countries like South Africa (Nguea et al., 2020; Cash-Gibson et al., 2021; Ventriglio et al., 2021). Rapid urbanisation, which is a common phenomenon in many developing countries, including South Africa, often leads to increased health risks (Wang et al., 2021). Factors such as overcrowding, pollution, and limited access to healthcare (Rahaman et al., 2023; Damte, 2023) contribute to these risks in this context.

Fedacko et al. (2022) note that globalisation has also contributed to the spread of lifestyle diseases such as obesity and heart disease, which were formerly more prevalent in affluent countries. Health disparities are thus not confined to local contexts, but are part of the larger global health landscape. In the case of South Africa, increasing health disparities can be linked to changes in the epidemiology of non-communicable diseases such as diabetes, hypertension, and cardiovascular diseases (Ajaero et al., 2021). More specifically, diabetes prevalence has become an issue of concern. The International Diabetes Federation (IDF) notes a considerable rise in the proportion of adults with diabetes – from about 4.5% in 2010 to approximately 5.4% by 2019 (IDF, 2021). A Western diet comprising highly processed food and reduced physical activity due to a sedentary lifestyle are key drivers of this increase.

The burden of infectious diseases, particularly HIV and AIDS, has also been a key factor driving disparities in adult health in South Africa (Achoki et al., 2022). This epidemic has disproportionately impacted adults, further intensifying disparities (Burrows, 2006; Greco, 2016; Gona et al., 2020; Dumisani Mugauri et al., 2023). Recent data from the Human Sciences Research Council (HSRC) reveals that the HIV prevalence rate among adults rose from 14.0% in 2017 to 18.3% in 2021 (HSRC, 2018). This highlights the persistent challenges in managing the epidemic effectively. South Africa has employed a variety of strategies to manage HIV and AIDS that have resulted in solid gains, including increased access to antiretroviral treatment (Myburgh, Moolla, & Dambisya, 2021). However, their success has been limited by factors such as the lack of infrastructure to support the management of those infected with HIV at the primary care level in certain regions (Julien & Cranick, 2021). The rise in gender-based violence and rape of women and children, as well as reckless sexual behaviour with people not using condoms to protect themselves, perpetuate this epidemic (Kuo et al., 2022).

Mental health issues also make a significant contribution to adult health disparities (Jones, 2013; Merrick et al., 2017; Johnson et al., 2018). Stressors such as poverty, unemployment, and social instability that are common in South Africa exacerbate mental health disorders, increasing the health differences between the rich and the poor (Petersen et al., 2012; Jack et al., 2014; Rogan, 2016; Vigo et al., 2019; Patel et al., 2023). A study conducted by Bantjes et al. (2020) illustrated this association, with people of low SES who suffered widespread poverty and unemployment found to be more likely to suffer mental health disorders than those who lived in relative luxury. These issues contribute to inequalities in economic outcomes amongst adults as people with mental health disorders tend to require more healthcare resources, resulting in low productivity and higher overall healthcare costs (Patel et al., 2016; Jayasankar et al., 2022; Gibson et al., 2021). Such conditions could be aggravated by the stigma surrounding mental health issues, which can deter people from seeking the treatment they require, further compounding existing health differences (Onyeka et al., 2019; Gaiha et al., 2020; Nielsen et al., 2021).

In summary, while a number of other health conditions affect adults in South Africa, diabetes, HIV and AIDS, and mental health conditions are considered the most prevalent, collectively shaping health outcomes and presenting significant challenges to healthcare systems as leading causes of morbidity and mortality among these age groups (Statistics South Africa, 2023).

While various socio-economic and environmental factors influence health disparities, it is important to recognise that generic social determinants of health shape these outcomes in children and adults. The following section focuses on these factors, starting with those affecting children before addressing those relevant to adults.

2.3.3. Social Determinants Shaping Children's Health Inequalities

A complex interaction of socio-economic determinants significantly shapes health differences in children (Backett-Milburn et al., 2003; Turney, 2011; Kumar & Kumar, 2018; Oleribe et al., 2018; Pearce et al., 2019; Malakoane et al., 2020; Rebouças et al., 2022; Sono-Setati et al., 2022). Researchers such as Bolin et al. (2015), Federico et al. (2020 and Liu et al. (2023) identify household income and economic status, access to healthcare, and parental education as the most influential and common independent variables affecting children's health. These factors determine how health outcomes unfold, irrespective of location.

Globally, household income and economic status are critical in determining children's health outcomes (Olson et al., 2010; Yuan et al., 2017; Phiri et al., 2020; Ferreira & Marques, 2021; Karan et al., 2021; Balogun, 2022; Kunin-Batson et al., 2023; Zhang et al., 2023; Han, 2023). A family's financial standing directly influences its access to nutrition, quality healthcare, safe housing and educational opportunities essential for healthy child development and well-being. In the context of South Africa, the association between household income and children's health outcomes has been widely documented, with scholars such as Nkonki et al. (2011) showing that children from poorer households, especially those in rural areas, are more vulnerable to infant mortality, HIV transmission, and lower immunisation coverage. Baard et al. (2021) echoed these findings, revealing the impact of economic factors on managing chronic conditions and finding that children from wealthier families experience lower admission rates to hospitals for conditions like asthma and diabetes. This relationship has also been observed internationally (Croudace et al., 2020; Cooper & Stewart, 2021).

Moreover, children's access to healthcare, or lack thereof, is a key factor contributing to health inequalities between socio-economic classes (Strickland et al., 2011; Nigora & Lenara, 2023). Many children from socio-economically disadvantaged backgrounds face significant barriers to receiving quality healthcare, exacerbating health differences between children of various economic backgrounds. Such inequality is particularly pronounced for children with chronic illnesses and disabilities. For example, Mphahlele et al. (2023) note that, in South Africa, children from less affluent families often experience greater difficulty in accessing specialised healthcare for chronic conditions such as asthma and epilepsy and in managing their disease effectively due to financial constraints and limited healthcare facilities. Similar challenges are experienced in countries with comparable socio-economic conditions to those in South Africa. Studies show that children from less affluent families and regions in Brazil (Cooper & Stewart, 2021; Arrué et al., 2022), Uganda (Namubiru et al., 2022), and Kenya (Mugambi, 2022) are significantly less likely to access healthcare services for chronic conditions than those from wealthier families and areas, leading to higher rates of untreated chronic disease and further increasing the health gap between rich and poor children.

Parental education is a crucial determinant of child health. It influences parents' ability to make informed health decisions, access better healthcare, and create a healthier living environment, leading to improved health outcomes for their children (Gilligan et al., 2020; Balaj et al., 2021). Numerous studies support this relationship. For instance, Koumpagioti et al. (2020) found that higher parental education levels are associated with lower occurrence of respiratory infections and more effective asthma management in children, as educated parents can better recognise symptoms and seek timely medical care. However, children whose parents have low levels of education often face significant challenges in accessing essential health information and services (Voo et al., 2021). This pattern is replicated in international research, highlighting the influence of parental education on child health across diverse cultural and economic settings. Studies by Hasan et al. (2020) in Bangladesh and Emmers et al. (2021) in rural China have shown that maternal education significantly improves children's health outcomes, particularly in areas like disease prevention and nutrition.

These social and economic determinants interact and collectively contribute to health disparities amongst children from different backgrounds. Such complex, multi-faceted interactions result in distinct challenges and differential health outcomes for children from different regions. Consequently, government policies to reduce these health differences, especially for the most vulnerable children in society, should be tailored to address these complexities and account for each group's specific context and needs.

2.3.4. Social Determinants Shaping Adult Health Inequalities

Building on exploring health inequalities in children and their drivers, it is important to recognise that the socio-economic determinants of health for adults present a different landscape (Chung et al., 2021). Unlike children, whose health is more directly affected by their family environment, education, and nutrition, adults face unique challenges shaped by determinants like employment status, income level, and social standing. This is particularly evident in South Africa, where adult health inequalities are intensified by high unemployment rates and pronounced disparities in income and wealth (Gumede, 2021).

Employment emerges as a critical determinant of health, profoundly influencing mental and physical well-being through factors such as job security, working conditions, and access to healthcare and related benefits (Siegrist et al., 2012; Diderichsen et al., 2012; Vanroelen et al., 2021). These challenges are more acute in South Africa, especially compared to countries with similar socio-economic profiles but lower unemployment rates. For instance, in 2022, Botswana and Namibia recorded 25.4% and 20.85% unemployment rates, respectively, markedly lower than South Africa's 29.2% (World Bank, 2022). Coupled with unstable employment in South Africa, this leads to increased stress, anxiety, and limited access to healthcare, contrasting sharply with countries with more stable labour markets (De Witte et al., 2012; Mngoma et al., 2021). The informal sector in South Africa exacerbates these issues, with little job security or benefits for workers who depend on their meagre earnings in the sector to feed themselves and their family members, leaving them without the funds to access healthcare (Suhartini & Jones, 2019; Bhan et al., 2020).

Worldwide, income is another pivotal determinant of health. Green et al. (2021) highlight that higher income generally ensures better access to quality healthcare, nutritious food, and healthier living conditions, all vital to maintaining good health. Conversely, lower income often means restricted access to essential health resources, leading to poorer health outcomes (Hormazábal, 2016). In the context of South Africa, studies by Masilela et al. (2020) and Beidelman et al. (2023) found that adults in lower income brackets are more prone to preventable diseases like hypertension and diabetes, largely due to limited healthcare access and unhealthy lifestyles associated with economic constraints.

Social status is another factor intrinsically tied to employment and income and correlates highly with adult health outcomes in South Africa and worldwide (Timalsina, 2011; Gordon et al., 2020; Hoebel & Lampert, 2020; Kivimäki et al., 2021). Social status affects access to resources and psychological well-being (Meneses et al., 2006; McDonald & Heath, 2008; Ubink, 2007; Kislitsyna, 2015; Sosu & Schmidt, 2017). Research by Gordon et al. (2020) in South Africa and Bridger Staatz et al. (2021) in developing nations shows that lower social status leads to high-stress levels, marginalisation, and greater susceptibility to mental health disorders such as depression and anxiety. This further increases the health gap between the rich and the poor.

In summary, factors such as employment, income, and social status are interconnected and collectively contribute to the health disparities observed in South African adults. Unlike those affecting children, these determinants are more closely tied to broader socio-economic conditions, highlighting the complex interplay of various factors in shaping adult health.

2.4 Measuring Health Outcomes and Disparities

In examining health outcomes and disparities, several key metrics are essential to capture the complexity of healthcare access, quality, and socio-economic inequalities in South Africa. Metrics such as access to healthcare, life expectancy, Healthy Life Expectancy (HALE), Quality-Adjusted Life Years (QALYs), and Self-Reported Health Status (SRH) provide comprehensive indicators of both the availability and quality of healthcare.

Access to healthcare reflects individuals' ability to obtain timely and necessary medical services, with factors such as geographic proximity, financial affordability, and availability of healthcare facilities playing crucial roles (Burger & Christian, 2020). Limited healthcare access remains prevalent in South Africa, especially in rural and underserved regions, where infrastructure gaps hinder access to quality care (Gordon & Mbonigaba, 2020).

Life expectancy and HALE further quantify health disparities. Life expectancy measures the average years lived (Jaba et al., 2014), while HALE adjusts for years lived in good health, accounting for time spent in morbidity (Gona et al., 2020). In South Africa, these metrics expose significant health inequalities, as they often vary widely based on socio-economic conditions and regional disparities. Such variations reflect deeper systemic inequities, where factors like income, education, and access to healthcare contribute to unequal health outcomes across the population (Ataguba et al., 2011; Omotoso et al., 2023).

The Quality-Adjusted Life Years measure integrates both quality and quantity of life by adjusting for time in different health states (Bendavid et al, 2011). Widely used in evaluating healthcare interventions, QALYs are particularly relevant in resource-limited settings like South Africa, where it is essential to prioritise interventions for overall health impact (Lartey et al., 2020). Other researchers have used Disability-Adjusted Life Years (DALYs) to assess health outcomes, combining morbidity and mortality to account for overall health burden and inequities (Senkubuge et al., 2021).

Self-Reported Health Status (SRH) provides subjective but valuable insights into perceived health, correlating strongly with objective morbidity and mortality outcomes (Zere & McIntyre, 2003). SRH data from low-income communities in South Africa indicate worse self-rated health when compared to those in wealthier regions, highlighting disparities linked to restricted healthcare access (Zimbalist, 2017). Other studies like those by Gomez-Olive et al (2013) similarly relied on SRH to underscore socio-economic health disparities within developing regions.

Collectively, these health metrics support a nuanced understanding of health outcomes and disparities in South Africa, facilitating targeted policies to address regional health inequities.

2.5 Measuring Deprivation Levels

Comprehensive measurement of deprivation levels is essential to address the socio-economic disparities that impact health. (Maluleke, 2020). Common indices such as the SAMPI and the Provincial Index of Multiple Deprivation (PIMD) aggregate indicators—including income, employment, education, health, housing, and access to basic services—to depict deprivation across South African regions (Noble et al., 2010; Rogan, 2016). The SAMPI combines health, living standards, and education, while the PIMD highlights deprivation by region and race, illuminating inequalities rooted in historical segregation. Researchers such as Notten (2024) also use the Material Deprivation Index (MDI), which assesses access to essential goods like food, clean water, and electricity, capturing deprivation in under-resourced regions. Studies by Smith and Noble Glassman (2020) utilised the MDI to reveal gaps in access to basic needs across different socio-economic groups.

The Living Conditions Survey (LCS) provides a household-level perspective, assessing income, education, housing, and asset ownership (Vergunst & Swartz, 2020). Through such surveys, household-level data helps to highlight the impact of deprivation on health and informs policy development for poverty alleviation and health improvement. Studies like those by Leibbrandt et al. (2012) employed similar surveys to understand poverty and health risks within South African households.

Each of these measures—the SAMPI, PIMD, BNI, and LCS—offers distinct insights into deprivation, creating a multidimensional understanding that supports targeted public health and socio-economic interventions aimed at reducing inequalities.

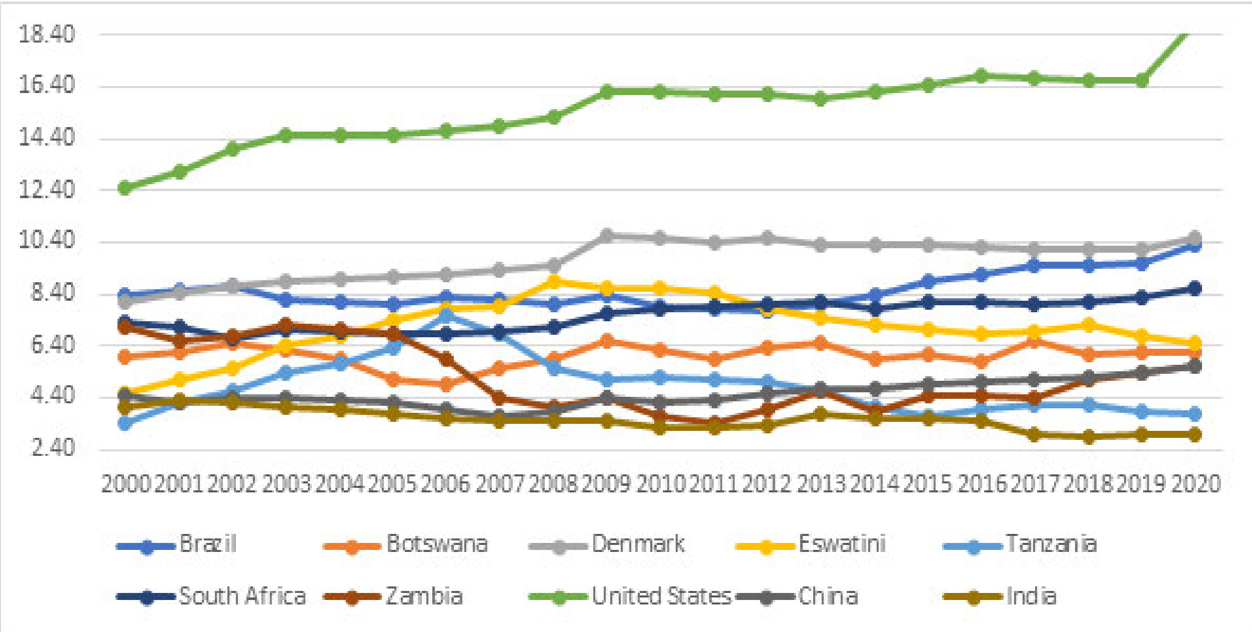
2.6. Trends in Public Health Expenditure

Public health expenditure, often measured as a percentage of a country's Gross Domestic Product (GDP), is a key indicator of a government's commitment to improving the health of its population (Piabuo & Tieguhong, 2017). Jaba et al. (2014) highlight that such investment influences health outcomes, including life expectancy at birth. Figure 2.1 presents statistics produced by the World Bank on public health expenditure from 2000 to 2020 and shows the trends in public health expenditure in South Africa and other nations as a percentage of GDP.

Over this period, health expenditure as a percentage of GDP in South Africa rose from 7.34% to 8.58%, indicating solid commitment to improving healthcare. This aligns with the increase in public health investment by the democratic government to improve the health of the previously disadvantaged (see Section 2.3). The population's general health improvement is reflected in life expectancy at birth, as observed in Figure 2.2.

Figure 2.2 traces the trend in life expectancy at birth between 2000 and 2021 in South Africa and other developed and developed countries. An important observation is increased government investment in public health as a share of GDP compared to improved overall life expectancy at birth. Several researchers (van Rensburg, 2014; Whyle & Olivier, 2016; Visagie et al., 2021; Mtshali, 2018; Maredza et al., 2020) concluded that, despite the rise in public healthcare spending in South Africa over the years, there has been minimal improvement in health measures such as infant mortality rates and life expectancy at birth, highlighting the need for more effective allocation of resources to address health disparities.

Figure 2.1: Trends in Public Health Expenditure as a Percentage of GDP (2000-2020)



Note: This figure was compiled using data from the World Bank.

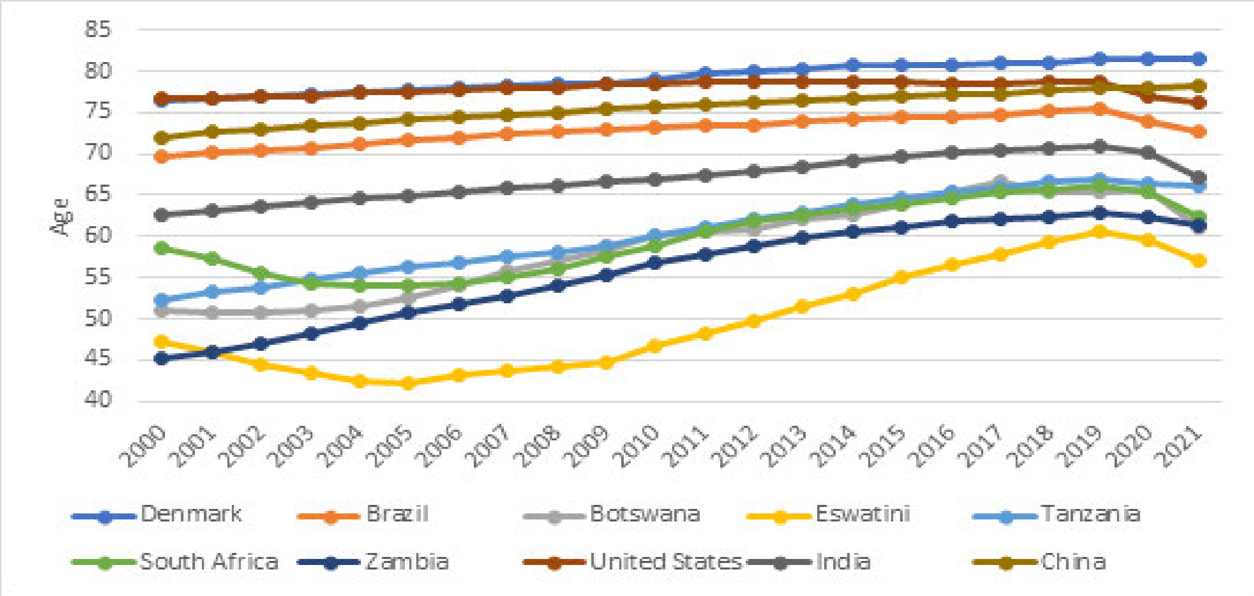
These trends suggest inefficiencies in public health institutions as they struggle to translate increased public health expenditure into longer life expectancy. They may point to deeper systemic issues, including inefficiencies in fund distribution and utilisation, regional resource shortages, and challenges such as insufficient healthcare facilities, a scarcity of medical professionals, poor governance, and logistical issues in remote areas (Anselmi et al., 2018; Anselmi et al., 2018; Kabir et al., 2023). In this instance, past economic activity, including previous public health investment, does not influence the current health status of the population.

While limited research has been conducted on the relationship between public health expenditure and health outcomes, studies at the provincial level have produced mixed findings. Hlafu et al. (2019) and Bhiza (2015) found that increased public expenditure in more affluent provinces such as the Western Cape and Gauteng was more positively related to better health outcomes than in poorer provinces like the Eastern Cape and KwaZulu-Natal. However, this may be due to the failure to account for the prevalence of deprivation (poverty) in each province, which could further diminish the effectiveness of public health expenditure.

Many individuals in impoverished areas cannot afford user fees, transport to healthcare facilities, or medication, significantly limiting their access to essential healthcare (Sarker et al., 2023). These challenges are acute in South Africa's poorest provinces and rural and remote regions, where poverty is widespread, and healthcare services are scarcer and often of lower quality (Wabiri et al., 2013; Willie & Maqbool, 2023). Similar issues have been identified in countries such as India and Brazil that have a significant number of rural or impoverished provinces, where, in contrast to urban areas or better-off provinces, financial constraints and limited healthcare infrastructure impede access to healthcare (Sahoo et al., 2023; Massuda et al., 2023).

The lack of basic health services or inadequate healthcare infrastructure might thus compromise the effectiveness of public health expenditure compared to more affluent regions with superior healthcare facilities. To the researcher's knowledge, no study has examined the efficacy of public health policies when regional deprivation is accounted for, either in South Africa or internationally. Furthermore, public institutions' ability to mediate past economic activities such as public health expenditure from the previous period significantly influences the current health status of the general population in South Africa. Chapter 6 contributes to the literature by conducting this analysis.

Figure 2.2: Comparative Analysis of Life Expectancy at Birth (2000-2021)



Note: This figure was compiled using data from the World Bank.

The following section provides an overview of how the different chapters form an integrated whole to explore the topic at hand and discusses the underlying theoretical framework and the significant contributions to the literature made by each chapter. A detailed discussion of the theoretical frameworks and contributions to knowledge is provided within each chapter.

2.5. Integration of Analysis and Contribution to the Literature

The thesis is built on interconnected studies focusing on distinct yet interrelated aspects of health inequalities and public health policies. Chapter 3 lays the groundwork by analysing the impact of multiple deprivations on health inequalities across the selected regions. It provides a critical comparative study of how area-level deprivation affects individual health. It acknowledges that individuals in lower socio-economic areas often face compound challenges like poor living conditions and limited access to services.

Chapter 3's theoretical foundation is based on the Agglomeration Economic Model and the Material/Structural Explanation, providing a macro-economic perspective on health disparities. This approach is crucial as it facilitates an in-depth analysis of how various factors such as poverty, limited education, and inadequate healthcare access collectively contribute to unequal health outcomes in diverse socio-economic settings. The chapter contributes to the body of literature by examining the mechanisms of multiple deprivations using a more granular approach than that employed by other researchers. This sets the stage for a nuanced understanding of the complex interplay between socio-economic factors and the health of individuals across the selected regions, preparing the ground for the subsequent chapters, which delve into specific demographic groups and regional disparities.

Chapters 4 and 5 build on this foundation, examining socio-economic-driven disparities in chronic illness and disability among children and the socio-economic implications of diabetes among adults in South Africa, respectively. These chapters contribute to the literature by exploring how different socio-economic conditions influence the health of individuals in these age groups across traditional authority areas, formal rural areas, and formal and informal urban areas, focusing on the most prevalent conditions in each group. Similar to Chapter 3, a more granular approach is employed than that used by other researchers to explore health inequalities among children and adults.

The broad theoretical approach underpinning these two chapters is the Social Determinants of Health framework, enriched by the concept of inter-sectionality, which adds depth to the understanding of the health determinants of children with chronic illnesses and disabilities and adults who have diabetes. This framework plays a critical role in recognising the evolution of these determinants over time, acknowledging the complex interplay between individual characteristics and broader socio-political and economic structures.

Lastly, Chapter 6 investigates the efficacy of public health expenditure across South Africa's provinces while uniquely controlling for regional poverty levels within each province. This in-depth analysis addresses a gap often overlooked in similar studies, namely the direct influence of regional poverty on the effectiveness of health spending. By incorporating this variable, the chapter offers a more comprehensive understanding of how health outcomes are not merely a product of health expenditure, but are also significantly shaped by the socio-economic context of each region. Chapter 6 also explores the influence of historical economic factors on current health outcomes by adding the lagged values of public health expenditure and income.

The Grossman Model is the main theoretical framework underpinning this chapter. Adapted to the South African context, it enables an economic analysis of health as a function of public health expenditure, income, and poverty. This model bridges individual health choices and broader economic factors and offers a comprehensive view of how public health policies and regional poverty levels interact to influence health outcomes. By weaving together these diverse theoretical perspectives, the thesis offers a holistic view of the many factors shaping health outcomes across South Africa's regions. Through this multi-faceted lens, we delve into the inter-connections between individual behaviours, socio-economic conditions, and healthcare infrastructure to provide a comprehensive and nuanced understanding of health inequalities in the country.

Overall, the thesis presents an in-depth, multi-faceted analysis of socio-economic health inequalities and the impact of public health policies in South Africa. The combination of insights in all the chapters results in a detailed, well-grounded understanding of the connections between socio-economic dimensions, regional characteristics, and health.

2.6. Chapter Summary

This chapter provided a broader context for the analytical chapters (Chapters 3, 4, 5, and 6) to enable the reader to understand the broader context of the results. The chapter discussed the historical legacies of apartheid, which generally shaped socio-economic inequality and regional inequalities. It highlighted the policy of the democratic government that worked ineffectively to address the legacy of apartheid more broadly and in regions with different deprivation levels. As a result of this situation, social and economic inequalities and the burden of diseases remained prevalent in the country. The chapter provided the rationale for investigating health inequality and related policies in various geographical analysis units that depict different socio-economic contexts. The following chapter is an analytical one that focuses on the impact of multiple deprivations on health inequalities within urban and rural areas in South Africa.

Chapter 3: Assessing the Impact of Multiple Deprivations on Health Inequalities Within Urban and Rural Areas in South Africa

This chapter addresses the problem of socio-economic inequalities in South Africa by assessing the relationship between area-level deprivation and individual health by comparing results in specific areas with different levels of deprivation, notably urban formal, urban informal, rural formal and traditional authority areas. The chapter follows Noble et al.'s (2010) methodology of constructing a provincial index of multiple deprivations but deviates from it by constructing areas (urban formal and informal, rural formal and traditional areas).

Chapter 3 is organised as follows: Section 3.1 briefly introduces the theme, and Section 3.2 discusses the relevant literature. Section 3.3 discusses the chapter's contribution to the literature, while Section 3.4 examines the theoretical framework that explains how multiple deprivations influence health outcomes in South Africa's various regions. Section 3.5 focuses on the data and method utilised in this analysis. Section 3.6 presents the results, and Section 3.7 discusses them. Section 3.8 presents a summary and conclusions, and Section 3.9 presents the chapter summary.

3.1. Introduction

This chapter examines the impact of multiple deprivations on health inequalities within urban and rural areas in South Africa, a topic that has garnered global attention. Anchoring this exploration is a focus on the intricate relationship between area-level deprivation and individual health, a concern that transcends borders and contexts. Pivotal studies ranging from McIntyre et al. (2002) to Woodward et al. (2023) have delved into this issue, revealing the multi-faceted nature of deprivation and its effects. Notably, individuals in areas with lower SES often confront challenges like poor living conditions and limited access to essential services, making their geographical location and SES significant determinants of their health outcomes (Walsh et al., 2010; Fecht et al., 2018). By conducting an in-depth analysis of these disparities, this chapter provides a comprehensive understanding of deprivation's implications for health, drawing on research from various continents to present diverse perspectives.

A number of empirical studies align with the objectives of this study, including McIntyre and McIntyre (2002), Gadalla and Fuller-Thomson (2008), Noble et al. (2010), Livingston et al. (2013), Dowdall et al. (2017), Lane et al. (2018), Pearce et al. (2011), Kashem et al. (2019), Chung et al. (2018), Allik et al. (2019), Woodward et al. (2023), Bradford et al. (2023) and Strömberg et al. (2023). These researchers emphasise that deprivation affects health outcomes as a direct result of its influence on individuals' mental and physical well-being. The following section presents a detailed review of the international and local empirical studies that align with the objectives of the study's analysis.

3.2. Literature review

Many international studies that have examined the multiple forms of deprivation did not explicitly explore how they correlate with health outcomes. Pearce et al. (2010), Kashem et al. (2019), and Chung et al.'s (2018) studies are exceptions, and they offer valuable insights into the effects of environmental and socio-economic factors on health outcomes, which are discussed in detail below.

Pearce et al.'s (2010) comprehensive study explored the relationship between environmental deprivation and health inequalities in the United Kingdom. Their dataset was developed by extracting information from various government documents, leading to the creation of the Multiple Environmental Deprivation Index (MEDIx). This index encapsulates diverse facets of environmental deprivation, encompassing exposure to pollution, proximity to industrial facilities, climate factors, ultraviolet (UV) radiation, and access to green spaces. Significantly, their methodology echoes the approach in South Africa, where we constructed the PIMD. The studies thus focus on investigating deprivation, with the MEDIx somewhat akin to the PIMD.

Alongside environmental factors, Pearce et al. (2010) integrated socio-economic variables like income deprivation and demographic details such as age and sex. The primary aim was to explore the connections between diverse environmental characteristics and the socio-economic gradient in health outcomes across the United Kingdom. Using a methodological approach that combined empirical data with Geographic Information Systems, Pearce et al. (2010) compared environmental deprivation measures to area-based income deprivation indices across the United Kingdom's census wards. The wards were segmented into quintiles based on their environmental and income deprivation status, and the correlations with health outcomes, indicated by mortality records, were assessed.

The findings underscored significant socio-spatial disparities in environmental deprivation. Areas with higher income deprivation were consistently linked with greater environmental deprivation. Notably, the MEDIx was found to correlate significantly with health outcomes, independent of age and sex, and this persisted even after adjusting for income deprivation. This suggests that the adverse health impacts of environmental deprivation were more pronounced in lower-income areas.

Pearce et al.'s (2010) comprehensive study offered valuable methodological insights for research in South Africa. In detailing their approach, this study focuses on their use of specific indices and data analysis techniques, which parallel the construction of the PIMD in South Africa. This comparison underscores the relevance of their methodology to the South African context.

Kashem et al. (2019) explored the association between personal deprivation and health-related quality of life (HRQL) in Alberta, Canada. The study employed the Canadian Deprivation Index (CDI) and the Ontario Deprivation Index (ODI) to gauge individual-level deprivation, along with the EQ-5D-5L, a comprehensive tool for assessing HRQL across five dimensions, namely, mobility, self-care, usual activities, pain/discomfort, and anxiety/depression. Within each of these indices, there were five levels of severity. Multivariable linear regression models were employed to analyse the relationship between deprivation and HRQL.

The study revealed that individual deprivation had a significant impact on HRQL. In particular, the most deprived individuals experienced lower HRQL across all dimensions, as assessed by the EQ-5D-5L. This pattern demonstrated a consistent inverse relationship with the Composite CDI and the ODI. Concluding that individual-level deprivation is a crucial factor influencing HRQL, the study emphasises the need for poverty reduction strategies targeting personal and neighbourhood-level deprivation to improve overall health outcomes. Kashem et al.'s exploration of the relationship between individual deprivation and HRQL was thus a fundamental foundation of the analysis in the South African setting.

Building on the global narrative, Chung et al.'s (2018) study collected data from face-to-face surveys of a random sample of households in Hong Kong to explore deprivation's impact on health. It employed an innovative approach to measure deprivation, the Deprivation Index (DI), which encompasses both material and social aspects. Meticulously crafted, it offers a deeper and more nuanced understanding of poverty which goes beyond just income factors. Its comprehensive nature could contribute to developing a similar index tailored to the South African context. Integrating their methodology with the specific types of deprivation this study examined in South Africa enhanced understanding of these complex issues and how they manifest within this unique setting.

Chung et al. (2018) utilised the SF-12 v2 questionnaire to measure the general population's health. This tool is widely recognised for its comprehensive assessment of HRQL. Employing multivariable ordinal logistic regression, the study examined the relationship between deprivation and health outcomes as quantified by the DI. The analysis adjusted for income poverty, socio-demographic elements, and lifestyle influences.

The findings displayed a consistent pattern: individual-level deprivation, as measured by the DI, consistently correlated with a decline in physical and mental health. Remarkably, this correlation persisted even after considering factors like income, poverty and various socio-demographic aspects. This inverse relationship between deprivation and health echoes the findings of Pearce et al. (2010 and 2011) and resonates with those of Kashem et al. (2019). The converging results highlight a consistent narrative across different cultures and geographical contexts, underscoring the far-reaching impact of deprivation on health. They thus suggest that the detrimental effects of deprivation on health are a global phenomenon, cutting across regional and cultural lines.

Drawing from these rich research findings, the intricate link between different forms of deprivation and health outcomes is evident. Pearce et al., Kashem et al., and Chung et al.'s research shed light on how deprivation impacts health inequalities globally. However, there remains a notable gap in understanding how multiple forms of deprivation affect health in developing countries, particularly in South Africa. This area of research is mainly unexplored; to the best of the researcher's knowledge, only McIntyre et al. (2002), Noble et al. (2010), and Dowdall et al. (2017) have examined the influence of multiple deprivation in South Africa's unique socio-economic and geographical context.

McIntyre et al.'s (2002) pioneering study on deprivation patterns in South Africa used data from the 1996 South African census. The census provided the necessary socio-economic and demographic data to construct the deprivation indices discussed in the study. They then used mortality indicators to establish the correlation between deprivation and health outcomes. Specifically, they focused on potential years of life lost per death and the percentage of deaths due to infectious diseases. These indicators were selected to reflect differences in the mortality burden and the prevalence of preventable diseases, which are crucial to assess health disparities.

Unlike the analysis in this research, which covered all geographical types, McIntyre et al.'s 2002 study focused exclusively on urban districts due to the under-reporting of deaths in rural areas. They developed three indices to measure deprivation: The General Index of Deprivation (GID), the Policy-Perspective Index of Deprivation (PID), and the Single Indicator of Deprivation (SID). The GID was crafted using PCA of census data and included variables such as education status, rural residency, and access to basic services like water and electricity. This approach is similar to the PIMD, the central variable in analysis in this study. The PID presented a simpler index formulated from demographic groups identified as priorities in policy documents, including the elderly, children, and residents of rural areas. The SID, designed for its straightforwardness and easy monitoring, concentrated on a single variable: lack of access to piped water. This variable was selected due to its strong correlation with other deprivation-related variables.

The study's findings revealed a strong correlation between all three deprivation indices, namely, the GID, PID, and SID and indicators of ill health. Specifically, the GID was positively correlated with mortality indicators such as potential years of life lost per death and the percentage of deaths due to infectious diseases in urban districts, suggesting a significant relationship between higher levels of deprivation and worse health outcomes. This strong correlation across all indices highlights the multi-faceted nature of deprivation and its consistent association with adverse health conditions in South Africa.

As mentioned above, a notable limitation of McIntyre's study is its confinement to urban districts. This limitation, driven by the scarcity of rural mortality data, could lead to incomplete understanding of the broader scope and severity of deprivation and health disparities across South Africa. Furthermore, since the study was conducted in the early 2000s, it is possible that its findings may not accurately represent the current state of health inequities. Socio-economic and health landscapes can evolve significantly over such an extended period, and this temporal gap potentially limits the study's applicability in drawing contemporary conclusions about health inequities in South Africa.

Noble et al. (2010), whose study forms the basis of the analysis in this chapter, utilised census data to develop the PIMD. This index employed wards as the unit of measurement to assess deprivation levels in the Eastern Cape. Constructed from various carefully chosen domains, the PIMD offered a multi-dimensional perspective on deprivation, extending beyond the traditional focus on income poverty.

The index comprises several key domains. The first, Income and Material Deprivation, assessed household income levels and the absence of essential household items such as refrigerators, televisions, and radios. The Employment Deprivation domain focused on unemployment rates using the official definition and included those not working due to illness or disability. Health Deprivation was another critical domain, measured through years of potential life lost, thus reflecting the health challenges within different communities. Education Deprivation was also considered, targeting the region's educational attainment levels. This domain specifically looked at the number of individuals between 18 and 65 years old without secondary-level schooling or higher. Lastly, the Living Environment Deprivation domain provided insight into the quality of living conditions. It examined access to basic amenities like piped water, sanitation, electricity, telephone services, housing quality, and the extent of overcrowding.

Noble et al. (2010) found that municipalities such as Qaukeni, Mbizana, Ntabankulu, and Port St Johns (particularly in the former Transkei homeland) had the highest levels of deprivation. Despite its valuable findings, the study's primary limitation was its narrow focus on the Eastern Cape, and its neglect of other provinces. Furthermore, it did not explore the direct correlation between regional deprivation and individual health outcomes.

Recognising a gap in Noble et al.'s (2010) study, which did not directly link regional deprivation to individual health, Dowdall et al. (2017) focused on this specific relationship. They utilised the NIDS dataset to examine the association between neighbourhood-level deprivation and depression in South Africa. The South African Indices of Multiple Deprivation (SAIMD) modelled at the small-area level and using data from the 2007 Community Survey was employed to assess neighbourhood deprivation.

Bearing a resemblance to the PIMD measure used in this research study, the SAIMD encompassed four key components, namely Income and Material Deprivation, which focuses on economic health through household income and access to basic amenities; Employment Deprivation, which emphasises the relationship between unemployment rates, health-related work incapacity, and mental health; Education Deprivation, which evaluates educational attainment and its effects on well-being; and Living Environment Deprivation, which concentrates on the quality of living conditions, including access to essential services like water, sanitation, electricity, and housing. Depression was measured using the CES-D 10 scale, a well-recognised instrument in mental health research.

Dowdall et al. (2017) used Ordinary Least Squares regression models for their econometric analysis, estimating the associations between neighbourhood-level deprivation and depression. The results showed that residents in more deprived neighbourhoods exhibited more symptoms of depression, even when individual-level factors were accounted for. Notably, the living environment and employment deprivation domains were most significant in predicting this relationship.

3.3. Contributions of the Chapter to the Literature

Nevertheless, the methodology used by Dowdall et al. (2017) assumed consistent domain weights and stable regional associations. Given South Africa's rich cultural and historical diversity, this assumption might have skewed the results. Recognising this limitation, a region-specific approach is essential to weigh the dimensions of the deprivation index differently for each region. This highlights the importance of tools like the PIMD, which is adept at capturing regional nuances. In support of this, Noble et al. (2010) championed the PIMD for its ability to dissect deprivation levels across detailed geographical segments. The current study contributes a meaningful dimension to the existing literature by addressing these limitations.

Expanding on the foundational work of Noble et al. (2010), the researcher performed light modifications to the PIMD and titled it the SIMD. The latest dataset is utilised in this study to create these indexes for selected areas, including traditional authority regions, rural formal areas, formal urban areas, and informal urban zones rather than limiting the analysis to one region. Secondly, the researcher delved deeper by incorporating the SIMD into a multivariate analysis rather than examining one geographical area as Noble et al. (2010) had done. This nuanced approach enabled the researcher to explore and comprehend how multiple deprivations influence individuals' health within these regions. In shedding light on these complex dynamics, the study provides novel, essential insights that augment the existing body of knowledge.

Aligned with this innovative methodology, the research pursued defined objectives. The study was initiated by probing the relationship between varying levels of deprivation in selected regions and the SRH of the adults living there. Individual attributes like race, gender, and marital status were carefully accounted for to isolate the effects of deprivation. In addition, the study aimed to determine how deprivation mechanisms function in these distinct contexts within South Africa, highlighting both unique differences and shared patterns.

3.4. Theoretical Foundation

This section discusses the Agglomeration Economic Model and the Material/Structural Explanation of the Black Report that were employed to unravel the multi-faceted impact of deprivation on health outcomes.

3.4.1. The Agglomeration Economic Model

Glaeser (2010) explains that agglomeration economics refers to the accumulated advantages derived from the proximity of companies and individuals in urban composites or industrial clusters. This facilitates lower transportation and communication costs, enhancing the feasibility and cost-effectiveness of transactions compared to interactions with distant businesses (Bolter & Robey, 2020). These dynamic regions often see a general increase in income due to the efficiency gains and competitive advantages produced by such economic clusters.

In areas with a high concentration of integrated firms, the average income tends to be elevated, empowering individuals to invest more in their health and well-being. Higher purchasing power can translate into increased access to healthcare services, more nutritious food, and healthier lifestyles. The concentration of businesses within a particular area can also indirectly influence public health through environmental policies (Glaeser & Gottlieb, 2009). For instance, a higher density of firms can prompt the adoption of stringent regulations to curb industrial pollution, fostering a cleaner environment that contributes to overall health improvement. This symbiotic relationship underscores the potential for agglomeration economics to shape health outcomes through direct economic means and broader socio-environmental mechanisms.

3.4.2. The Material/Structural Explanation

The Material/Structural Explanation detailed in the Black Report (1980) provides a cornerstone for interpreting health inequalities, offering both 'hard' and 'soft' lenses through which to examine the socio-economic determinants of health. This theory emphasises that poor health frequently stems from challenging life circumstances such as demanding work and earning low wages, which are crucial factors in determining an individual's social and economic position.

The 'hard' version of the theory focuses on the tangible aspects of deprivation such as inadequate sanitation, unstable housing, and insufficient healthcare infrastructure. These are not abstract hardships, but tangible realities that significantly influence the health pathways of individuals living within these settings. Conversely, the 'soft' version of the material/structural explanation delves deeper into the less tangible factors contributing to health disparities. These elements, often woven into the social and economic fabric of communities, relate to the quality of relationships, social support networks, community cohesion, cultural norms, and perceived levels of stress and well-being.

3.4.3. Integrative Analysis of Deprivation's Role in Health Disparities

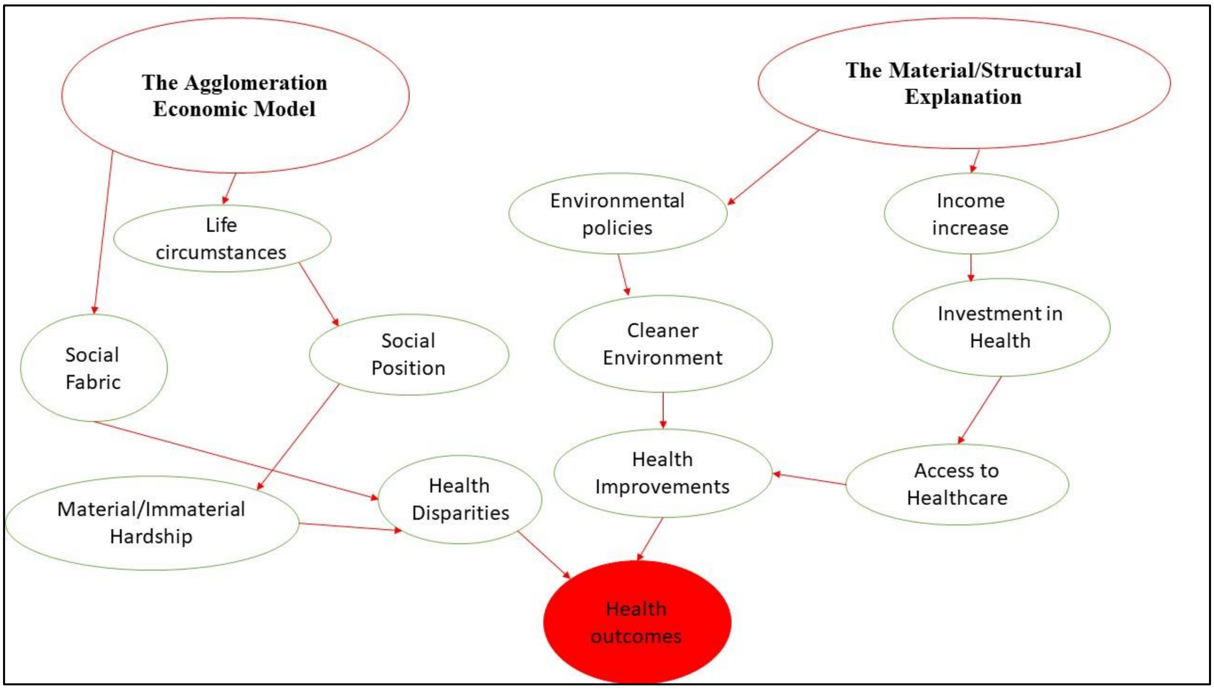
In mapping the health disparities in South Africa's distinct geographical landscapes, this study uses the Agglomeration Economic Model and the Material/Structural Explanation as theoretical frameworks to explain how various forms of deprivation impact health outcomes. By integrating both theories, it provides a comprehensive lens to examine how different aspects of deprivation—both tangible and intangible—influence health outcomes across settings, including traditional authority areas, formal rural areas, formal urban areas, and informal urban areas.

Traditional authority areas that are largely guided by customary governance structures often experience economic stagnation, translating into limited healthcare access and a lack of basic amenities (Ivanovich, 2015). Here, the 'hard' aspects of the Material/Structural Explanation are prominently displayed, namely inadequate sanitation, insufficient water and electricity provision, unstable housing, and an under-funded healthcare system. The Agglomeration Economic Model further helps understand the economic dynamics, where the lack of concentrated economic activity results in fewer resources for health-promoting infrastructure and services.

While somewhat more stable, formal rural areas still face significant deprivations. They might not have the extreme economic disadvantages seen in traditional authority regions but 'soft' elements such as limited educational opportunities, social isolation, and reduced access to healthcare professionals play a substantial role in health disparities (Daniels et al., 2013). The distance from economic agglomerations, as outlined in Glaeser's framework, further limits these communities' access to the resources and opportunities available in more urbanised areas.

Moving from the rural context, formal urban areas present a complex scenario. While they frequently serve as hubs of economic vibrancy, aligned with the principles of agglomeration economics, they also exemplify the 'double-edged sword' of such concentration. There is generally better access to healthcare services, nutritious food, and robust housing (Tydeman-Edwards et al., 2018) which are deemed to be 'hard' factors. However, these areas also introduce significant 'soft' challenges. High levels of competition, lifestyle pressures, and social stratification contribute to stress and other health-compromising factors, even for individuals with higher SES.

Figure 3.1: Conceptual Framework of Socio-Economic Influences on Health Outcomes in South Africa



Note: This figure represents the main variables (nodes) and hypothesised effects (edges) and is the author's work.

Figure 3.1 visually represents the study's conceptual framework, illustrating the main variables (or nodes) and the hypothesised effects (or edges) on health outcomes within the South African context. It demonstrates how the Agglomeration Economic Model and the Material/Structural Explanation each influence a range of intermediary factors that ultimately shape health outcomes. Specifically, the Agglomeration Economic Model impacts the social fabric, life circumstances, and material/immaterial hardship, which affect social position and health disparities. The Material/Structural Explanation addresses factors such as increased income, investment in health, and access to healthcare, leading to health improvements. Together, these pathways highlight how socio-economic and environmental mechanisms contribute to health disparities, providing a comprehensive map that guides the empirical investigation and lays the foundation to explore the determinants of health across different geographical settings.

3.4.4 Direction of Relationships in the Framework and Hypothesis

The conceptual framework in Figure 3.1 defines the positive and negative relationships between various factors and health outcomes, as outlined by the Agglomeration Economic Model and the Material/Structural Explanation. According to the Agglomeration Economic Model, certain factors such as increased income, investment in health, and environmental policies are expected to positively impact health outcomes. These factors contribute to improved access to healthcare, reduced exposure to environmental hazards, and enhanced availability of health resources. This positive influence is generally stronger in formal urban areas, where concentrated economic activity enables greater access to services and resources that support health.

For its part, the Material/Structural Explanation suggests that factors such as material and immaterial hardship, along with social position disparities, are likely to have a negative impact on health outcomes. These factors often lead to poor living conditions, limited healthcare access, and higher levels of stress, all of which negatively affect health. This negative impact is particularly pronounced in informal urban areas, where socio-economic and environmental deprivations are most severe. In these settings, high levels of poverty, inadequate infrastructure, and social instability make residents especially vulnerable to adverse health outcomes.

Based on the conceptual framework illustrated in Figure 3.1 above, the study aimed to test the following hypotheses:

H1: while regional multiple deprivations detrimentally affect all residents' SRH, this adverse influence will be especially pronounced in informal urban areas. Such a perspective arose from the widely recognised challenges that plague informal urban settings, often marked by deficits in healthcare resources, infrastructural development, and accessibility. These factors make these areas particularly vulnerable to the heightened health implications of socio-economic and environmental deprivations compared to other regions.

Concluding the discussion in this section and considering the stated hypothesis, informal urban areas exemplify the health challenges identified by the theory. These areas, characterised by high population density and pronounced economic difficulties, grapple with 'hard' deprivations like inadequate living environments and insufficient sanitation. Simultaneously, as highlighted by Zebro et al. (2020), they face 'soft' challenges such as social upheaval and heightened stress levels. Moreover, the Agglomeration Economic Model suggests that economic benefits due to the proximity of businesses and services often fail to translate into tangible benefits for residents of informal settlements. Instead of experiencing the economic growth that companies enjoy in these circumstances, these local communities endure persistent economic struggles, underscoring a clear disconnect between corporate success and the lived realities of people in informal urban areas.

Building on the insights from these models, this study examined the relationship between multiple deprivation levels and adult health in diverse rural and urban contexts across South Africa. The following sections detail the data and methodologies used to investigate the core theme of this research.

3.5. Methodology

3.5.1. Data

The NIDS dataset was harnessed for quantitative analysis to delve into the effects of multiple deprivations on SRH outcomes across various regions. To enhance the granularity of the analysis, urban and rural regions were classified into distinct categories: traditional authority areas, formal rural areas, formal urban areas, and informal urban areas. Utilising the NIDS data's fifth wave (2017), the study integrated records from all the provinces, creating a holistic dataset for quantitative investigation. Initiated in 2008 and overseen by the South African Labour and Development Research Unit at the University of Cape Town, the NIDS is recognised as South Africa's first panel data (Woolard et al., 2010). Its primary objective of documenting the livelihoods of individuals and households resonates deeply with the central theme of this research project.

Building on this foundation, the quantitative analysis considered several variables to understand how resources might mitigate the health impacts of deprivation. These variables, as presented in Table 3.1, connect factors such as personal demographic characteristics and the accessibility of services to individuals' SRH.

Table 3.1: Description of variables used in the study

Variable	Description	Categories/Values	Used in SIMD
Self-reported health status	Indicates the respondent's self-reported health status	1: Excellent, 2: Very Good, 3: Good, 4: Fair, 5: Poor	NO
Geographical region	Indicates the type of geographical area where the respondent resides	Traditional Authority Area, Rural Formal, Urban Formal, Urban Informal	NO
Race	Racial identification of the respondent	African, Indian, Coloured, White	NO
Gender	Gender of the respondent	Male, Female	NO
Age	Age of the respondent	Continuous	NO
Marital status	Current marital status of the respondent	Married, Living with Partner, Widow/Widower, Divorced, Never Married	NO
Fridge ownership	Whether the household owns at least one fridge/freezer	0: No, 1: Yes	YES
TV ownership	Whether the household owns at least one TV	0: No, 1: Yes	YES

Employment status	The respondent's current employment status	Employed, Unemployed	YES
Healthcare utilisation	Indicates whether or not the respondent has utilised healthcare services	Utilised Healthcare Services, Never Utilised Healthcare Services	YES
Education level	The highest level of education achieved by the respondent	No Schooling, Incomplete Primary, Completed Primary, Incomplete Secondary, Completed Secondary, More than Secondary	YES
Access to electricity	Whether the household has access to electricity	0: No, 1: Yes	YES
Access to water	Proximity of water source to dwelling	The water source is less than 100m, and the water source is 1 km or more from the dwelling	YES
Access to sanitation	Type of sanitation facility available to the household	Flush Toilet, Chemical Toilet, Ventilated Pit Latrine, Unventilated Pit Latrine, Bucket Toilet, No Toilet Facility	YES
Housing quality	Categories of the quality of housing	1: High-Quality Housing: Formal, permanent structures like houses or flats. 2: Informal or Low-Quality Housing: Informal, temporary structures like shacks or huts. 3: Traditional or Alternative Housing: Non-conventional structures using alternative building materials and techniques.	YES
Household income	Provides information on household income per capita	Household per Capita Income, Log Household Income per Capita	YES

*Note: in relation to the 'Access to sanitation' variable, a Chemical Toilet is a portable, waterless system that uses chemicals to decompose waste. A Ventilated Pit Latrine is a pit toilet with a ventilation system to minimise odour and flies. An Unventilated Pit Latrine is a basic pit toilet lacking ventilation, often leading to odour and fly issues. A Bucket Toilet is a rudimentary toilet where a bucket collects waste and requires manual emptying. No Toilet Facility implies a total lack of toilet facilities, resulting in open defecation.

The following section sets out the methodology adopted to explore the impact of multiple deprivations on health inequalities within urban and rural areas in South Africa.

3.5.2. Empirical Methods of Estimation

This study extended the methodological approaches of Noble et al. (2010) by introducing three distinct specifications. The researchers' study constructed the PIMD, which we replicated and applied to the NIDS dataset. It was then titled the Spatial Index of Multiple Deprivation (SIMD). This is further discussed below in the first specification. In this study, SRH serves as the dependent variable, representing the respondents' health outcomes. The independent variables listed in Table 3.1 above include both personal demographic characteristics and socio-economic factors that may influence SRH. Key independent variables of interest include the SIMD and its squared term ($SIMD^2$), which capture the extent of deprivation in various domains across regions, as well as demographic and socio-economic factors such as age, gender, race, and marital status. These variables allow us to explore how different aspects of deprivation and personal characteristics impact SRH outcomes.

Importantly, this analysis was conducted exclusively for adults. Within these frameworks, the Adult SRH was retained as the dependent variable in its original five-category form. The focus on adult populations necessitated a nuanced understanding of the diverse factors influencing health outcomes, particularly in varying residential contexts. Since adults and children live under the same roof and share the same SES, the mechanisms through which multiple deprivation influences health for children and adults are similar. Hence, this chapter serves as a basis for analysing children (Chapter 4) and adults (Chapter 5).

Returning to this analysis, considering the complexities arising from the interplay between multiple determinants and health outcomes, the importance of the study's first specification became clear: the development of the SIMD. In the form of the SIMD, this specification enabled acknowledgement and a thorough examination of the myriad factors influencing health outcomes in different residential scenarios. Drawing on Noble et al. (2010), data from Wave 5 of the NIDS datasets was used to develop the SIMD. The index was crafted for each selected region to capture diverse deprivation facets. Five domains were the primary focus, namely health, employment, education, living environment, and income and material deprivation, which were represented as rates.

The index was constructed at the most miniature workable spatial scale to prevent bias within the SIMD. This necessitated that the selected regions had relatively even population sizes (Noble et al., 2010). Wards that are administrative divisions within municipalities were suggested as the ideal geographical units to create the SIMD due to their minimal diversity in population size. This standard approach aimed to maintain consistency and objectivity in assessing the various forms of deprivation across different locales.

However, for this study, it was decided to employ different geographical units: traditional authority areas, formal rural areas, formal urban areas, and informal urban areas. This deviation was strategic, driven by the aim to delve deeper into the intricacies of deprivation in diverse living environments within South Africa. The selected regions represented unique developmental, infrastructural, and socio-economic landscapes, presenting challenges distinct from those observed in typical ward divisions.

Table 3.2: Domains and Associated Indicators of Deprivation in SIMD 2017

Domain	Indicator	Threshold
Income and material deprivation	Household income per capita	Households with a per capita income below the national poverty line (R945) are considered deprived.
	Ownership of fridge/freezer	Households marked as 'No' for owning at least one fridge/freezer are considered deprived.
	Ownership of TV	Households marked as 'No' for owning at least one TV are considered deprived.
Employment deprivation	Employment status	Unemployed individuals are considered deprived.
Health deprivation	Access to healthcare services	Individuals who do not have a regular healthcare provider or travel a significant distance to access healthcare services are considered deprived.
Education deprivation	The highest level of education attained	Individuals with no formal education or below primary education are considered deprived.
Living environment deprivation	Access to electricity	Households marked as 'No' for having electricity are considered deprived.
	Access to water	Households with a water source 1 km or more from the dwelling are considered deprived.
	Access to sanitation	Households with a bucket toilet, pit latrine without ventilation, or no toilet facilities are considered deprived.
	Housing quality	Households living in informal dwellings or shacks are considered deprived.

Adopting this approach facilitated a more profound understanding of deprivation's varied manifestations, offering insights that extend beyond the homogeneous population framework provided by wards. For instance, traditional authority areas may illuminate deprivations rooted in traditional and communal living arrangements, while informal urban areas reveal the challenges of rapid urbanisation and population density. Consequently, this approach enabled a more comprehensive and representative analysis of deprivations, allowing for the development of targeted interventions that address each area's unique needs and circumstances, and thereby contributing to more equitable and sustainable development outcomes.

Thereafter, continuing to draw on the work of Noble et al. (2010) and recognising South Africa's prevailing needs, the five domains of deprivation outlined above were identified. In order to comprehensively represent deprivation in each domain, a concise set of carefully selected indicators were included to encapsulate the complex nature of deprivation given the data available in the Wave 5 dataset.

Another significant consideration involved determining the threshold of deprivation for each indicator, namely, establishing the point at which an individual was considered deprived according to a specific indicator. The thresholds for individuals deprived in each region are presented in Table 3.3 below. Aligning with the approach of other researchers (Noble et al., 2010; Mclntyre et al., 2002), national and international standards were leveraged to ascertain deprivation across various indicators. For example, the national poverty line was applied as the household income per capita benchmark. Consequently, individuals with an income falling below the monthly lower-bound poverty line of R945 were classified as deprived based on this criterion.

For a more detailed account, Table 3.2 above summarises the domains and indicators included in the SIMD and the thresholds indicating which individuals were considered deprived by the study. The selected domains, critical for measuring deprivation, were systematically integrated to develop an index of multiple deprivation applicable to each geographical region. This integration process aligned with the methodology delineated by Noble et al. (2010), involving three pivotal stages: (1) weighting, (2) standardisation, and (3) transformation.

Initially, the head count of individuals deprived in each region, as detailed in Table 3.3 above, was multiplied by weights. These weights are explained in Table 3.4. Given the completely different socio-economic problems inherent in the selected regional types, the b^{th} weight for each domain varied based on the literature's insights into the specific regional type and the multi-faceted nature of the issues confronting these regions.

Table 3.3: Deprivation Headcounts for Each Indicator in Different Geographical Types (%)

Indicator	**Traditional Authority**	**Formal rural**	**Formal urban**	**Informal urban**
Income and material deprivation	59,56	36,50	27,07	40,23
Ownership of fridge/freezer	2,27	31,15	12,36	22,55
Ownership of TV	21,46	26,73	11,77	19,96
Employment status	14,06	9,86	11,50	14,25
Access to healthcare services	5,42	5,80	5,80	7,46
Highest level of education attained	24,70	24,90	10,95	12,57
Access to electricity	14,07	27,49	7,30	14,31
Access to water	1,83	0,31	0,06	0,12
Access to sanitation	50,17	31,95	5,58	29,65
Housing quality	2,45	15,04	9,92	29,95

For traditional authority areas, both income and material, and health deprivation were heavily weighted at 0.25 due to prevalent poverty and limited healthcare facilities. Employment and education deprivation weighted 0.15, influenced by prevalent subsistence agriculture and limited educational resources. Living environment deprivation was notable, with a weight of 0.20, underscoring infrastructural challenges.

In rural formal areas, income and material deprivation, employment deprivation, and health deprivation were of primary concern, given weights of 0.25, 0.20, and 0.20, respectively, emphasising economic challenges, limited job prospects, and constrained healthcare access. Education deprivation weighted 0.15, while living environment deprivation was 0.20 due to potential infrastructural limitations.

Table 3.4: Weights Allocated to Deprivation Domains Across Different Geographical Areas

Geographical Area	**Income and Material**	**Employment**	**Health**	**Education**	**Living Environment**
Traditional Authority	0.25	0.15	0.25	0.15	0.20
Rural Formal	0.25	0.20	0.20	0.15	0.20
Urban Formal	0.20	0.25	0.15	0.15	0.25
Urban Informal	0.25	0.25	0.20	0.15	0.15

Urban formal areas had a balanced weight distribution with income and material deprivation at 0.20. Employment deprivation stood out at 0.25 due to competition for jobs, whereas health and education deprivation were at 0.15. Living environment deprivation held a weight of 0.25, highlighting superior infrastructure.

For urban informal areas, high levels of economic instability and poor living standards led to weights of 0.25 each for income, material deprivation, and employment deprivation. Healthcare and education access constraints were noted with weights of 0.20 for health and 0.15 for education deprivation. Living environment deprivation was at 0.15. These weights set the stage for the results derived from the SIMD estimation. Subsequently, the multiplied numbers from the weights and thresholds were integrated to form a single index for each region. Following this foundational understanding of the methodology, the subsequent section delves into the results derived from estimating the SIMD.

Furthermore, the indices of each region were standardised and assigned values within a range of 0 to 10, where zero indicated the least deprived area and 10 the most deprived. The exponential distribution was used as a statistical transformation on the standardised indices following standardisation (Msthali et al., 2023). As evidenced by Noble et al. (2010), Otavova et al. (2023), and Tonboot et al. (2023), this transformation is a common practice. It proved crucial in this study's context, amplifying differences in higher deprivation values while ensuring that all domains were on a comparable scale. In line with McIntyre et al.'s (2002) observation, this approach made the subsequent weighting and summation of the indices more meaningful and consistent.

Transitioning from the foundational work of the SIMD, the research then proceeded to the second specification, focusing on a detailed comparative analysis. Given that SRH is ordinal and encompasses five categories, an Ordered Probit Model, an approach particularly suited for this data structure, was utilised to discern the mechanisms through which multiple deprivations influence individuals' health across the selected regions. However, an unforeseen challenge emerged when the respective models for each region were estimated, which was related to collinearity, notably concerning the SIMD variable.

This collinearity issue is particularly problematic in regression analysis, as it complicates the statistical interpretation. As Belsley (1991) explains, collinearity occurs when two or more predictor variables in a regression model exhibit close alignment, making it difficult to isolate the individual effects of each predictor. The presence of collinearity posed a serious threat, undermining the significance of certain variables and casting doubt on the accuracy of the coefficient estimates, raising concerns about potential distortions in their magnitude and even direction.

Given these concerns, active measures were taken to diagnose the extent of collinearity in the model. Using variance inflation factors (VIFs) as the diagnostic tool, the study evaluated the predictors which had been used. Although the VIFs remained within the acceptable range (below the conventional threshold of 10), indicating relatively controlled collinearity, the model still encountered persistent challenges. In this study, models were estimated for each region. Collinearity issues prompted Stata to systematically exclude the pivotal SIMD variable from the analyses. This exclusion was significant considering the centrality of SIMD in the analytical framework. Subsequently, certain variables were removed based on the VIF outcomes. Despite these adjustments, the model remained resistant.

Confronted with the constraints of merely eliminating variables and the enduring issue of collinearity, an alternative was explored, namely PCA. This strategic statistical technique refines datasets by aggregating diverse variables, including age, race, gender, and marital status, into fewer pivotal categories termed principal components (Dascalu & Cozma, 2009). As described by Sufian (2005), principal components are newly constructed variables originating from the original set. They encapsulate the consolidated variance in the data and are systematically arranged in descending order of significance.

The new components are independent and capture the core, distinct information from the original dataset. Such a technique is invaluable for precise data interpretation, especially in addressing the challenges of collinearity. The most crucial insights were identified by employing PCA, thus sidestepping the potential confusion caused by multiple interrelated variables. Consequently, this strengthens the accuracy and reliability of the analytical conclusions.

The initial step in conducting PCA is the extraction of eigenvalues, which are pivotal to the process as they indicate the amount of variance accounted for by each principal component. This systematic arrangement ensures that the first principal component accounts for the maximum variance, while each subsequent component, orthogonal to its predecessor, encapsulates the next highest level of distinct variance.

Given the significance of these eigenvalues, it is essential to understand their importance. They are crucial in determining the components to be included in the subsequent analysis. The decision to include a component is based either on the "eigenvalue greater than one" criterion or on a "cumulative proportion" of variance that is considered acceptable, often falling within the 70-80% range (Sufian, 2005). Mathematically, extracting these eigenvalues requires solving the fundamental characteristic equation, denoted as equation (2.1).

$$\det(\boldsymbol{A} - \lambda\mathbf{I}) = 0 \quad (2.1)$$

In the equation above, **A** represents the covariance matrix of the original variables, a key input for PCA that captures the extent of variance shared between different pairs of variables. The λ represents the eigenvalues the researcher wants to compute, each corresponding to a different principal component, and **I** is the identity matrix. This matrix equation sets the stage for eigenvalue extraction by stipulating a condition (the determinant of (**A**-λ**I**) must be zero) to ensure the existence of non-zero solutions, which are the eigenvalues themselves.

The subsequent step in PCA estimates the loadings (or eigenvectors) that illustrate the original variable's contribution to the principal components. The eigenvectors can be represented and calculated through the following equation (3.2):

$$\boldsymbol{AX} = \lambda \mathrm{X} \quad (3.2)$$

In this equation, 'A', 'λ', and 'X' serve the same roles as detailed in equation (3.1). Here, 'X' denotes the eigenvector (loading) corresponding to 'λ', demonstrating how the original variables combine to form the principal component. The coefficients of the original variables for each principal component, produced by equation (3.2) and represented by the entries of the eigenvectors, clarify how the original variables are integrated to form each principal component. Understanding this process is essential for the subsequent stages of analysis, particularly for interpreting the regression results. It allows researchers to comprehend the significance of each component in relation to the original variables, enhancing the overall clarity and application of PCA in the study (Dascalu & Cozma, 2009).

The third specification of the analysis built on the insights gleaned from the previous specification, progressing from the broad application of PCA to a more targeted exploration of how multiple deprivations affect individuals' SRH across the selected regions. In conjunction with the insights derived from the PCA, the Ordered Probit Model was used in this critical phase. This joint approach allowed the researcher to examine the influence of the SIMD variable, effectively addressing concerns of collinearity. The equation that best describes this specification is represented by equation (3.3).

$$\mathbf{Pr}(\boldsymbol{SRH} = \boldsymbol{y}) = \Phi(\alpha_y - \beta_1 * \mathrm{PCA}_1 - \beta_2 * \mathrm{PCA}_2 - \beta_3 * \mathrm{PCA}_3 - \ldots - \beta_k * \mathrm{PCA}_k) \ (3.3)$$

In the equation, SRH acts as the dependent variable. Φ represents the cumulative distribution function of the standard normal distribution, connecting the linear combination of predictors to a probability and ensuring that it ranges between 0 and 1 (Daykin & Moffat, 2002). α_y is the threshold that separates the categories of the ordinal dependent variable. $\beta_1,\ \beta_2, \beta_3, \ldots . \beta_k$ are the coefficients of the principal components, the new variables that were formed ($\mathrm{PCA}_1, \mathrm{PCA}_2, \mathrm{PCA}_3, \ldots, \mathrm{PCA}_k$), as discussed in the second specification. This model necessitates the inclusion of only the components with eigenvalues exceeding one or including components until the cumulative proportion falls within the acceptable range of 70-80% for variance within a particular dataset.

The PCA_k coefficients represent the influence each principal component has on the probability of reporting a specific health status. Given the distinct environmental and socio-demographic characteristics inherent to each geographical setting, the equation was estimated separately for each selected region, allowing for a more nuanced understanding of regional disparities in the SRH variable. It is important to note that interpreting the results of the Ordered Probit Model requires a particular focus on both the magnitude and direction of the coefficients of the principal components. According to Daykin and Moffat (2002), each coefficient represents the change in the expected value of the log odds of the dependent variable for a one-unit change in the predictor, with all other variables held constant.

Lastly, the magnitude of the coefficients was evaluated to understand the relative significance of the various principal components. Larger absolute values denote a more robust relationship with the SRH variable. Stata served as the primary computational tool to facilitate this analysis. Given these methodological considerations, the results can be used to comprehensively discuss the statistical outcomes.

3.6. Results

3.6.1. Descriptive Statistics

Table 3.5 presents the general characteristics of the sample derived from Wave 5 of the NIDS, including 23,496 individuals. Most of these participants, numbering 10,421, reside in formal urban areas. Traditional authority areas follow closely with a population of 9,171 individuals, while formal rural and informal urban areas are home to 2,241 and 1,663 individuals, respectively.

Moving beyond the broad overview in Table 3.5, Table 3.6 offers a more detailed examination of individual-level variables by area. This in-depth perspective illuminates the diverse landscapes and inherent demographic variations represented in the fifth wave of the NIDS.

Table 3.5: General Characteristics of the Sample

Characteristics	Wave 5
Total number of individuals	23,496
Number residing in traditional authority areas	9,171
Number residing in formal rural areas	2,241
Number residing in formal urban areas	10,421
Number residing in informal urban areas	1,663

*Note: calculated using Wave 5 of the NIDS.

In assessing the mean health score across different South African regions, traditional authority and formal rural areas both record a mean health score of 3.76. Given the five-category SRH scale, this suggests that the average health perception in these regions is slightly above 'neutral' or 'fair'. The standard errors of 0.011 and 0.0216 for these regions indicate a relatively uniform health status in traditional authority areas and more variability in formal rural areas.

Table 3.6: Descriptive Statistics of an individual-level variable by Area

Variables	Traditional Authority	Rural Formal	Formal Urban	Informal Urban
Health (Mean±SD)	3.76 ±0.011	3.76 ±0.0216	3.77 ±0.0104	3.878 ±0.0246
Race				
- African (%)	99,8	67	63	93
- Indian (%)	0,15	27,26	23,36	6,49
- Coloured (%)	0,01	2,72	2,97	0,00
- White (%)	0,05	3,39	10,28	0,06
Gender				
- Male (%)	37,68	44,22	42,28	42,63
- Female (%)	62,24	55,73	57,64	57,31
Marital Status	21,58	25,52	29,18	18,58
- Married (%)	4,15	12,99	7,38	9,92
- Living with a partner (%)	11,50	6,11	7,72	5,77
- Widow/Widower (%)	1,44	2,28	3,58	2,47
- Divorced (%)	61,23	53,06	52,04	63,26
- Never Married (%)	21,58	25,52	29,18	18,58
SES (Mean±SD)	R1349±27.69	R2097± 66.54	R4252±138.76	1772± 61.38

*Note: The imputations for these categorisations were calculated using Wave 5 of the NIDS.

Meanwhile, formal urban areas display a marginally superior mean health score of 3.77. Supported by a minor standard error of 0.0104, this suggests a consistent health perception leaning towards 'good' in these urban settings. Conversely, informal urban regions register a peak health score of 3.878. This hints at a more positive average health perception in these regions. However, the larger standard error of 0.0246 underscores a more diverse range of health outcomes.

In addition to health scores, significant variations in racial composition is observed across these regions. Traditional authority and informal urban areas have a higher concentration of African people, constituting 99.8% and 93%, respectively. By contrast, rural formal and formal urban areas exhibit greater racial diversity. This reflects various socio-economic and environmental conditions that can influence health status.

One of the main indicators of SES is income (Tonboot et al., 2023; Otavova et al., 2023), and disparities become evident across these regions. Formal urban areas boast the highest mean income, amounting to R4,252, whereas traditional authority areas have the lowest, with a mean SES of R1,349. These variations suggest differences in access to healthcare services and the overall quality of living conditions in these areas, which can significantly affect the reported health outcomes.

Table 3.7: Descriptive Statistics of Deprivation Indicators by Area Type

Variables	Traditional Authority	Rural Formal	Formal Urban	Informal Urban
Access to Electricity (%)	85,90	72,47	92,70	85,69
No Access to Electricity (%)	1,41	27,49	7,30	14,31
Access to Water (%)				
- Less than 100m	23,80	15,98	94,25	13,71
- 1 km or more	1,83	0,31	0,06	0,12
Access to Sanitation (%)				
- Flush Toilet	6,52	50,29	90,73	53,64
- Chemical Toilet	2,31	2,28	0,91	5,83
- Ventilated Pit Latrine	40,85	15,26	2,54	10,52
- Unventilated Pit Latrine	45,04	22,80	3,35	19,84
- Bucket Toilet	1,95	3,08	1,21	7,10
- No Toilet Facility	3,173	6,069	1,017	2,706
Housing Quality (%)				
- High Quality	68,05	62,96	77,53	56,95
- Low Quality	2,45	15,04	9,92	29,95
- Alternative Housing	2,22	12,81	4,07	8,18

*Note: The imputations for these categorisations were calculated using Wave 5 of the NIDS.

By integrating the findings from Table 3.5 with the insights derived from the deprivation indicators in Table 3.6, a multi-layered picture of the various factors influencing health status in these selected regions is presented. Unquestionably, access to amenities like electricity, water, and sanitation is pivotal in shaping individual health outcomes. In traditional authority and informal urban areas, a considerable majority of residents, 85.90% and 85.69%, respectively, have access to electricity, which is crucial for various health-related aspects like food preservation and preparation.

However, a conspicuous 27.49% of rural formal areas report no access to electricity, underscoring a notable deprivation that can significantly impact health and well-being. This could perpetuate health disparities between rural and urban areas by impacting the preservation and preparation of food and limiting access to information and health-related services that require electricity.

In terms of sanitation, marked disparities are evident. In formal urban areas, 90.73% of residents have access to flush toilets. In contrast, only 6.52% of traditional authority areas enjoy such access, highlighting a significant gap in basic sanitation facilities between these regions. Informal urban and rural formal areas demonstrate moderate access, with 53.64% and 50.29%, respectively, using flush toilets. The high prevalence of unventilated pit latrines in traditional authority (45.04%) and rural formal (22.80%) areas could suggest compromised sanitary conditions, increasing the risk of the spread of infections and diseases.

Furthermore, the use of bucket toilets in informal urban areas (7.10%) underscores varying levels of deprivation and their potential health impacts across different regions. Adequate sanitation is vital to prevent infectious diseases and enhance community health. However, a bivariate analysis may not fully represent the complex relationship between deprivation and health. As such, the following section analyses the results from a multivariate analysis for deeper understanding.

3.6.2. Results from the SIMD by Regional Type

As shown in Table 3.8, which presents the SIMD results for various geographical regions, the levels of deprivation in 2017 varied significantly. Rural formal regions recorded the highest deprivation with a SIMD score 3.9, making them the most deprived among the studied regions. Formal urban regions exhibited the least deprivation, registering a SIMD score 0.1.

Table 3.8: SIMD Results for Each Geographical Region in 2017

Variables	Traditional Authority	Rural Formal	Formal Urban	Informal Urban
SIMD	1,9	3.9	0,1	1,4

*Note: Calculations based on Wave 5 of the NIDS dataset.

While not as deprived as rural formal areas, traditional authority and informal urban areas still showed significant deprivation levels with SIMD scores of 1.9 and 1.4, respectively. These findings underscore clear disparities in deprivation across the geographical regions, emphasising the pronounced vulnerability of rural formal areas.

3.5.3. Results from the Principal Component Analysis

This section presents the results of utilising PCA to distil complex data into principal components. Table 3.9 presents the results derived from the eigenvalues and the explained variance. As noted previously, the 'eigenvalue greater than one criterion' is crucial in determining the number of significant components to be included in the subsequent analysis. The results indicate that components 1 through 6 meet this criterion, with each exhibiting an eigenvalue above one. Together, these six components account for approximately 79.26% of the variance in the data, with each subsequent component contributing incrementally less to the explained variance. In simpler terms, these six components effectively capture the main patterns in the data, providing a clear summary without losing essential details.

Table 3.9: Eigenvalues and Variance Explained

Components	**Eigenvalue**	**Difference**	**Proportion**	**Cumulative**
Comp 1	2.133	0.419	0.194	0.194
Comp 2	1.714	0.125	0.156	0.350
Comp 3	1.589	0.344	0.145	0.494
Comp 4	1.245	0.215	0.113	0.607
Comp 5	1.030	0.023	0.094	0.701
Comp 6	1.007	0.059	0.092	0.793
Comp 7	0.948	0.064	0.086	0.879
Comp 8	0.883	0.638	0.080	0.959
Comp 9	0.246	0.098	0.022	0.981
Comp 10	0.147	0.090	0.013	0.995
Comp 11	0.057	0.000	0.005	1.000

*Note: The computations were performed using Wave 5 of the NIDS, and the results are the product of equation (2.1).

This cumulative proportion falls within the acceptable range of 70-80% for variance within a dataset, striking a balance between preserving data integrity and ensuring practical simplicity. Although including a seventh component raised the cumulative explained variance to 87.88%, it did not meet the preferred eigenvalue threshold. This suggested that the marginal increase in explained variance might not warrant the added complexity of the model. Therefore, the study opted to retain only the first six components.

Transitioning from a broad overview of the principal components, the analysis shifts to a detailed examination of the individual variables' contributions in Table 3.10. Although Table 3.9 initially presented 11 components, the investigation prioritised only the first six. This concentrated approach revealed essential insights, emphasising the unique impact of each variable on the principal components.

A case in point is Component 1, which is significantly shaped by variables such as the SIMD (0.552), its squared variant (0.486), and the 'African' ethnicity descriptor (0.478). These findings suggest that Component 1 may be particularly sensitive to elements such as SES or racial disparities, emphasising these variables' specific influences within the broader analysis. In simpler terms, this component likely represents economic and racial factors, capturing how income and ethnic background impact health and deprivation.

Component 3 shows a strong positive loading from 'Age' (0.617) and 'Widow' (0.568), possibly representing factors related to life stage and social aspects of health. Interestingly, 'Coloured' has a substantial loading on Component 6 at 0.911, indicating a significant unique contribution to this component, perhaps highlighting specific cultural or demographic factors.

Table 3.10: Interpretative Eigenvector Loadings for Principal Component Analysis

Variables	Comp 1	Comp 2	Comp 3	Comp 4	Comp 5	Comp 6
SIMD	0.552	0.429	-0.021	0.044	0.047	0.001
$SIMD^2$	0.486	0.513	-0.070	0.042	0.062	0.011
Age	-0.146	0.248	0.617	0.081	-0.001	-0.111
Male	0.001	-0.045	-0.300	0.303	0.020	-0.097
African	0.478	-0.463	0.179	0.059	-0.043	-0.057
Coloured	-0.142	0.118	0.013	0.215	0.167	0.911
Indian	-0.393	0.457	-0.260	-0.204	-0.055	-0.239
Married	-0.176	0.178	0.206	0.704	-0.117	-0.186

Living with Partner	0.007	0.090	-0.240	-0.337	-0.272	0.147
Widow	-0.018	0.112	0.568	-0.423	-0.145	0.101
Divorced	-0.060	-0.004	0.048	-0.136	0.923	-0.145

Note: The computations were performed using Wave 5 of the NIDS, and the results are the product of equation (2.2).

In contrast, 'Divorced' shows a strikingly high loading on Component 5 at 0.923, suggesting that this component may encapsulate elements of personal life changes and social support networks. 'Married' loads heavily on Component 4 with a value of 0.704, pointing to the influence of marital status on this component, potentially related to familial stability or emotional support.

Moving beyond the initial insights provided by the PCA, the study now presents the results obtained from combining the PCA with the Ordered Probit Model for each selected region. This approach reveals how deprivation mechanisms operate across these regions, emphasising the contrasts and parallels within these environments.

3.6.4. Geographical Regression Analysis

Table 3.11 highlights the profound health implications of rising deprivation levels in traditional authority areas. The Ordered Probit Model underscores this with markedly negative coefficients for PCA1 (-2.995) and PCA2 (-2.740). These coefficients suggest that as deprivation scores on these components rise, SRH status diminishes. To put it more simply, for each unit increase in the values of these negative principal components, residents face a significant decline in their SRH rankings, reflecting worsening health perceptions. This finding supports H1, which suggests that multiple deprivations detrimentally affect health, particularly in areas facing high levels of socio-economic challenges.

The impact of PCA1 is particularly pronounced and linked with variables such as SIMD (0.552) and SIMD squared (0.486). This connection underscores the complex, non-linear effects of deprivation on health outcomes. In PCA3, the negative coefficient, predominantly influenced by 'Age' (with a loading of 0.617) and 'Widow' (0.568), suggests deteriorating health perceptions as these variables’ values increase. In other words, people’s health may change as they age, especially for those who are widowed, highlighting the influence of life stages and social factors on health.

Similarly, PCA4 (-0.161), guided by the 'Married' variable, bears a negative coefficient, hinting that higher marital prevalence in regions might correspond with declining health perceptions. This may indicate that in areas where more people are married, pressures or challenges could impact their health, possibly related to financial or social responsibilities. These results align with findings from previous studies, which linked age and marital status to health outcomes, further validating the hypothesis that social and demographic factors contribute to adverse health effects under conditions of deprivation. (Gibson et al., 2021 Green et al., 2021; Ajide et al., 2023). These insights emphasise the need for a deeper understanding of how specific demographic characteristics such as SIMD, age and marital status interact with health outcomes in these regions.

Table 3.11: Ordered Probit Regression Results for Traditional Authority Areas

Variable	Coefficient	Std. Error	z-value	P>|z|	95% Conf. Interval
PCA1	-2.995	0.314	-9.550	0.000	(-3.610, -2.380)
PCA2	-2.740	0.226	-12.130	0.000	(-3.182, -2.297)
PCA3	-0.049	0.021	-2.370	0.018	(-0.090, -0.009)
PCA4	-0.161	0.046	-3.500	0.000	(-0.251, -0.071)
PCA5	-0.295	0.040	-7.300	0.000	(-0.374, -0.216)
PCA6	0.255	0.113	2.250	0.025	(0.033, 0.477)
/cut1	-4.228	0.224			(-4.667, -3.790)
/cut2	-3.379	0.222			(-3.814, -2.944)
/cut3	-2.369	0.221			(-2.802, -1.936)

Note: Coefficients are significant at the 0.05 level, derived from Wave 5 of the NIDS using equation (2.3).

Interestingly, PCA6 provides an intriguing counter-narrative. Its positive coefficient of 0.255 indicates improved SRH perception with each unit rise in this component. A significant contributor to PCA6 is the 'Coloured' demographic variable (loading of 0.911). This suggests that certain attributes or dynamics specific to this demographic, possibly rooted in cultural or community support systems, may buffer some of the negative impacts of deprivation.

The findings from the Ordered Probit Model in Table 3.12 echo the trends observed above in formal rural areas. Notably, the coefficients for PCA1 (-1.789) and PCA2 (-1.857) are negative. This indicates that perceived health status tends to decline as the scores on these components increase. In simpler terms, this means that as deprivation increases, health perceptions worsen, indicating that people in more deprived areas feel less healthy overall. Variables PCA3 to PCA5 exhibit trends consistent with the previously discussed model. However, it is worth highlighting that the magnitude of most coefficients in this model is less pronounced than in the traditional authority areas, pointing to a more moderated influence of deprivation on health outcomes in formal rural settings.

This comparative moderation in the coefficients' magnitude may indicate certain protective factors inherent to formal rural areas, such as better access to health-related resources, certain community amenities, or stronger social structures that buffer the full impact of deprivation on residents' health perceptions. In other words, the effects of deprivation may be less severe in formal rural areas because there are potentially more community resources or support systems to help residents maintain better health despite economic challenges.

Table 3.12: Ordered Probit Regression Results for Formal Rural Areas

Variable	Coefficient	Std. Error	z-value	P>|z|	95% Conf. Interval
PCA1	-1.789	0.289	-6.180	0.000	(-2.356, -1.222)
PCA2	-1.857	0.265	-7.020	0.000	(-2.376, -1.339)
PCA3	-0.150	0.030	-4.930	0.000	(-0.210, -0.090)
PCA4	-0.072	0.033	-2.200	0.028	(-0.137, -0.008)
PCA5	-0.206	0.041	-5.030	0.000	(-0.286, -0.125)
PCA6	0.012	0.018	0.660	0.506	(-0.023, 0.048)
/cut1	-11.378	1.423			(-14.167, -8.588)
/cut2	-10.581	1.422			(-13.367, -7.795)
/cut3	-9.497	1.419			(-12.278, -6.717)
/cut4	-8.546	1.417			(-11.323, -5.769)

Note: Coefficients are significant at the 0.05 level, derived from Wave 5 of the NIDS using equation (2.3).

Unlike the general trend observed for the PCA6 variable above, PCA6 for formal rural residents demonstrates a negligible direct effect on SRH, evidenced by a coefficient nearing zero (0.012). The dominant loading of 'Coloured' on PCA6 indicates that within these specific formal rural settings, belonging to the 'Coloured' demographic does not notably impact health perceptions.

As detailed in Table 3.13, the Ordered Probit Model uncovers negative correlations for PCA1 (-2.229) and PCA2 (-2.200) in formal urban areas, akin to other regions. These negative coefficients denote that as deprivation scores increase within these components, a corresponding deterioration in health perception occurs. Simply put, this means that as levels of deprivation increase, people's perception of their health worsens, indicating that higher deprivation is linked to feeling less healthy. Compared to the traditional authority and formal rural areas, the intensity of these effects implies distinct regional variations. Unique regional differences become evident when compared with the impacts observed in traditional authority and formal rural areas. Notably, the effects in formal urban areas are less pronounced than in traditional authority areas yet more significant than those observed in formal rural regions.

Table 3.13: Ordered Probit Regression Results for Formal Urban Areas

Variable	**Coefficient**	**Std. Error**	**z-value**	**P>|z|**	**95% Conf. Interval**
PCA1	-2.229	0.148	-15.020	0.000	(-2.519, -1.938)
PCA2	-2.200	0.136	-16.180	0.000	(-2.466, -1.933)
PCA3	-0.085	0.015	-5.590	0.000	(-0.114, -0.055)
PCA4	-0.148	0.015	-9.650	0.000	(-0.178, -0.118)
PCA5	-0.220	0.017	-12.610	0.000	(-0.255, -0.186)
PCA6	0.027	0.008	3.330	0.001	(0.011, 0.042)
/cut1	1.539	0.237			(1.075, 2.003)
/cut2	2.342	0.237			(1.878, 2.806)
/cut3	3.366	0.238			(2.900, 3.831)
/cut4	4.194	0.238			(3.727, 4.661)

Note: Coefficients are significant at the 0.05 level, derived from Wave 5 of the NIDS using equation (2.3).

The Ordered Probit Model in Table 3.14 shows that, in informal urban areas, PCA1 (-3.675) and PCA2 (-2.723) possess notably negative coefficients, underscoring the most pronounced adverse effects on SRH compared to the other regional types. This suggests that people living in informal urban areas experience the strongest negative impact on health perception due to deprivation, likely due to limited access to healthcare and essential resources. It strongly supports the hypothesis that informal urban areas, where deprivation is highest, experience the most severe health impacts, aligning with the literature that highlights the compounded effects of deprivation in urban informal settings (Kovacic et al., 2019; Melore & Nel, 2020).This result emphasises the significant influence of severe deprivation on health outcomes.

However, a shift occurs with PCA3-PCA5, which, unlike the trends seen in previous models, have positive coefficients related to SRH: 0.053, 0.419, and 0.138, respectively. This deviation suggests the presence of protective social factors within these communities. For instance, PCA3, heavily influenced by the 'Age' and 'Widow' variables, hints at potential health-supportive dynamics, perhaps owing to life experiences or unique social support systems available to older or bereaved individuals. On the other hand, PCA4's association with the 'Married' status implies that the community bonds, social stability, and support inherent in marital relationships might contribute to improved health perceptions.

Table 3.14: Ordered Probit Regression Results for Informal Urban Areas

Variable	Coefficient	Std. Error	z-value	P>|z|	95% Conf. Interval
PCA1	-3.675	0.421	-8.730	0.000	(-4.500, -2.850)
PCA2	-2.723	0.328	-8.290	0.000	(-3.366, -2.079)
PCA3	0.053	0.042	1.250	0.210	(-0.030, 0.136)
PCA4	0.419	0.165	2.550	0.011	(0.097, 0.742)
PCA5	0.138	0.128	1.080	0.282	(-0.113, 0.388)
PCA6	2.584	0.664	3.890	0.000	(1.282, 3.887)
/cut1	-2.207	0.133			(-2.468, -1.946)
/cut2	-1.470	0.119			(-1.703, -1.237)
/cut3	-0.442	0.114			(-0.665, -0.219)
/cut4	0.512	0.114			(0.289, 0.736)

Note: Coefficients are significant at the 0.05 level, derived from Wave 5 of the NIDS using equation (2.3).

In light of these insights, the shift in deprivation status revealed by the regression results presented above is particularly influential. By incorporating additional contextual factors and covariates, the analysis indicated a significant transition: informal urban areas, rather than formal rural areas, as initially suggested by the SIMD results in the appendix, emerged as the most deprived. This unexpected outcome highlights the intricate complexity of deprivation and demonstrates that its implications are far-reaching, extending well beyond mere numerical rankings.

3.7. Discussion

This chapter examined deprivation mechanisms across diverse South African regions, revealing distinct patterns and common challenges that affect SRH. The findings contribute to a deeper understanding of the varying impacts of multiple deprivations on adults' health in these areas, each marked by its unique set of circumstances.

The disparity in living conditions is striking in traditional authority regions, home to a 99% African demographic. While 85% of the inhabitants enjoy electricity, only 23% live near water sources—even though 68% of the people in these regions reside in high-quality housing. Such inconsistencies, previously highlighted by Ivanovich (2015), designate these areas as distinctly deprived. The unevenness in vital service accessibility highlights the intricate challenges tied to resource allocation, which shape community health outcomes. The multivariate analysis further illuminates this, showing prominent negative coefficients for PCA1 at -2.995 and PCA2 at -2.740, indicative of a significant health downturn as deprivation increases. This trend, accentuated by the shortfall in sanitation and clean water, resonates with King's (2005) observation of amplified health hurdles stemming from entrenched poverty and restricted healthcare access in traditional authority settings.

In the rural formal regions, inhabited by 67% African and 27% Indian populations, we witness a nuanced shade of deprivation—subtle yet undeniably significant. Of concern is that 28% of these residents lack electricity, and only 15.98% benefit from proximate water access: a scenario demanding urgent attention. Interestingly, the influence of this deprivation on SRH, although evident, is more muted when compared to the other regional types, demonstrated by PCA1 and PCA2 values of -1.789 and -1.857, respectively. This subdued impact is consistent with the findings of Daniels et al. (2013), who posit that the subtle advantages of rural life such as reduced pollution, availability of fresh produce, and tight-knit community bonds, may cushion some of the harshest effects of deprivation.

In contrast to rural areas, formal urban areas which are home to 63% African and 10.28% White populations, boast enhanced basic amenities, as evident in 93% of residents having access to electricity and 94% to a nearby water source. While these benefits lead to improved health outcomes, they concurrently camouflage disparities rooted in diverse socio-economic contexts, information accessibility, and the extent of support networks. The urban backdrop does offer layers of protection, often derived from increased service availability, a spectrum of economic opportunities, and expanded social networks (Tydeman-Edwards et al., 2018). However, the multivariate analysis, revealing PCA1 at -2.229 and PCA2 at -2.200, underscores that urban settings are not fully shielded from the health-related consequences of deprivation. Akyelken (2020) concurs, emphasising that urban advantages do not fully counteract the challenges stemming from unequal resource distribution and quality, thereby underlining persistent urban health disparities.

Lastly, in informal urban areas, where, according to the data, two racial groups reside—93% African and 7% Indian—the challenges are distinctly evident. While electricity is accessible to 86% of residents, a pressing concern is that the same percentage lacks water sources nearby, a disparity made even more pronounced given that 30% live in low-quality housing. The multivariate analysis exposes an even grimmer reality, with extremely high negative coefficients for PCA1 (-3.675) and PCA2 (-2.723), indicating profound health effects under multi-deprivation conditions. This vulnerability, highlighted in both Zebro et al. (2020) and Weimann and Oni's (2019) studies, is likely due to compounded adversities, including overcrowding, inadequate access to basic services, and environmental hazards.

Despite the challenges in informal urban areas, the positive coefficients in PCA3 (0.053), PCA4 (0.419), and PCA5 (0.138) highlight protective social factors at play. For example, PCA3 and PCA4 suggest that age, widowhood, and marital stability might provide health-enhancing mechanisms, perhaps due to experiential wisdom or social support. Likewise, PCA5's association with 'Divorced' points to resilience stemming from personal adversity. These elements suggest that social connections are vital in buffering against health risks, even in deprived settings. This resonates with Szkody et al.'s (2021) findings, which highlight protective social factors as significant enhancers of health and well-being.

The analysis highlights the intricate health consequences of regional disparities in multiple deprivations. Although the negative repercussions on health are consistent, there is considerable variation in severity and underlying factors across regions. This complexity calls for the development of customised intervention strategies which consider each area's unique realities.

3.8. Conclusions and Recommendations

This chapter examined the mechanisms by which multiple forms of deprivation impact the health of adults in selected South African regions, utilising data from Wave 5 of the NIDS datasets. The comprehensive research initially involved compiling the SIMD index for each region to encapsulate various aspects of deprivation. We had originally planned to apply this index within a multivariate analysis to offer a broad view of the deprivation-health dynamic.

However, faced with issues of collinearity, the analysis employed PCA in conjunction with an Ordered Probit Model. This methodology was chosen to scrutinise how the SIMD index and other demographic factors influence adult health across these regions. The shift in strategy allowed for a more nuanced understanding of the similarities and differences in health outcomes within diverse geographical contexts.

In traditional authority areas, we observed profound deprivation, manifested in striking disparities in living conditions, notwithstanding certain modern conveniences. Compared with the availability of high-quality housing for a few, the scarcity of clean water and healthcare illustrates the complex dynamics of resource allocation and its bearing on health. In rural formal areas, deprivation appeared less intense but presented distinct challenges, particularly insufficient access to fundamental utilities. These findings underline the crucial role of environmental factors in shaping health outcomes.

Despite having more substantial basic amenities, formal urban areas demonstrated persistent health disparities, exacerbated by socio-economic factors and unequal access to supportive resources. While offering certain health advantages, the urban milieu also posed unique health determinants not encountered in its rural counterparts. Conversely, informal urban areas were marked by the harshest deprivations. Here, residents faced acute water shortages and substandard housing, directly correlating with poorer health indicators. However, amidst these deprivations, protective social factors emerged, suggesting that the strong community ties, social support, and resilience within these regions could serve as vital buffers against some adverse health outcomes.

These insights give rise to several policy recommendations. For traditional authority areas, infrastructural enhancement is paramount. Given the stark disparities in water access and the availability of quality housing, the focus should be on increasing access to clean water and fortified healthcare networks. Introducing community-centric health initiatives such as mobile health clinics and localised health awareness campaigns could significantly improve health outcomes in these regions.

Rural formal areas present a unique blend of challenges and inherent strengths. Policies here should pivot towards engaging private-sector collaboration to bridge the utility access gap. Given the documented subtle health advantages of rural living, like decreased pollution and enhanced community cohesion, it would be prudent to design policies that both amplify and capitalise on these intrinsic benefits. Such strategies could range from creating green corridors for fresh produce access to promoting community-led wellness initiatives that bank on local solidarity.

A comprehensive health-focused urban planning approach is essential for formal urban regions. While these areas benefit from various amenities, they are not devoid of concealed health challenges. Policy initiatives should alleviate these urban health concerns, emphasising reduced housing and employment disparities while enhancing mental health and wellness structures. A practical step might be incorporating green spaces and recreational areas within urban designs. These enhance the urban environment and encourage physical activity and community interactions, leading directly to improved health outcomes.

For informal urban areas, urgent steps should be taken to prioritise foundational human rights such as secure housing, access to sanitation, and basic healthcare. Key strategies could encompass granting definitive land rights, expediting the establishment of accessible healthcare units, and revamping sanitation and waste management protocols. Recognising the significance of the identified protective social factors, it is essential to draft policies which foster community-centric initiatives. These could range from community health ambassador programmes to local support groups, all of which harness these communities' innate resilience and solidarity to augment health outcomes.

Regarding future research avenues, a more granular SIMD focusing on neighbourhoods would be invaluable in pinpointing localised deprivations to guide area-specific health policies. Moreover, incorporating previously omitted dimensions such as crime data is critical in future SIMD constructions, as these profoundly impact mental and physical health. Employing panel data methodologies in subsequent research could also significantly refine the understanding by following subjects longitudinally, isolating specific environmental determinants from other compounding factors. This comprehensive approach could reinforce the fight against health inequality, considering the evolving nuances of deprivation in different community landscapes.

In conclusion, addressing the health implications of deprivation demands a tailored, context-aware policy approach. Cross-sectoral collaboration that intertwines health-centric interventions with broader socio-economic and infrastructural development is indispensable in tackling the health disparities observed. These strategies should be sensitive to each region's specific deprivations and demographic composition.

3.9. Chapter Summary

This chapter examined localised deprivation and its effects on adult health in various residential contexts in South Africa, including traditional authority areas, formal rural areas, formal urban areas, and informal urban areas. The SIMD for each selected region was first constructed using data from the fifth wave of the NIDS The index facilitated an assessment of the health repercussions of multiple deprivation in South Africa, with SRH chosen as the dependent variable.

In attempting multivariate analysis with the index, collinearity issues were encountered while estimating the ordered probability model. Principal Component Analysis was integrated with the Ordered Probit Model to address this, enhancing understanding of the analytical relationship between health and multiple deprivation. The study uncovered significant disparities in SRH across various residential areas in South Africa. Principal Component Analysis indicated a strong correlation between increased deprivation and poor self-rated health in all selected regions, underscoring the severe health consequences of socio-economic factors. These effects were notably more severe in informal urban areas. Certain demographic groups and social structures, particularly within 'Coloured' communities, seemed to mitigate the health impacts, pointing to intricate relationships between health, deprivation, and social factors.

The findings highlight the critical need for targeted health interventions and policies that consider the unique socio-economic dynamics of South Africa's diverse residential areas. In particular, such strategies should address the heightened vulnerability of individuals in informal urban areas, tailoring resources to mitigate the health risks associated with deprivation.

The following chapters examine changes in socio-economic-related health inequalities in the health outcomes of children (Chapter 4) and adults (Chapter 5) and the social determinants influencing these inequalities to determine the dynamics and determinants influencing these inequalities and determinants using similar regions as in Chapter 3.

Chapter 4: Examination of Socio-Economic-Driven Disparities in Chronic Illness and Disability Among South African Children: Exploring Variations Within Urban and Rural Areas

This chapter investigates the problem of inequality by analysing chronic illness and disability among children in urban formal, urban informal, rural formal, and traditional authority areas. The investigation differs from the investigation carried out in Chapter 3, considering that children might be differently affected by inequalities from adults. Due to data constraints, the dependent variable throughout the analysis is chronic illness and disability at a broader level. These encompass a range of conditions such as TB and other respiratory problems including asthma, bronchitis, and pneumonia; physical disabilities; issues with sight, hearing, or speech; mental health problems; HIV and AIDS; diabetes; heart disease; cancer and epilepsy/fits.

The remainder of this chapter is structured as follows: Section 4.1 briefly introduces the chapter. Section 4.2 provides the literature review, and Section 4.3 discusses the chapter's contribution to the literature. Section 3.4 presents the investigation's theory, while Section 4.5 outlines the methodology. Section 4.6 presents the results, followed by a discussion and conclusion of the chapter in Sections 4.7 and 4.8. Finally, Section 4.9 offers the chapter summary.

4.1. Introduction

This chapter investigates the socio-economic disparities influencing chronic illness and disability among South African children by examining the differences in health within urban and rural environments. It aims to uncover the underlying socio-economic factors that contribute to the persistent health concerns and disabilities, including HIV and AIDS, respiratory conditions, undernourishment, and mental health issues that pose significant public health challenges for this vulnerable population. Notably, chronic malnutrition affects nearly 27% of South African children under the age of five, a distressing statistic that may lead to long-term health and developmental consequences, impacting educational achievement and the quality of life (Govender et al., 2021). By focusing on the social determinants of health such as access to resources and infrastructure, this research illuminates the intricate linkages between a child's environment and their health prospects.

Building on the exploration of socio-economic disparities, this chapter acknowledges that parental SES is pivotal to providing children with essential resources such as nutrition, healthcare, education, and decent living conditions, but also determines the family's living environment. Influenced by factors like access to clean water, sanitation, and pollution exposure, this environment is deeply intertwined with the socio-economic standing of a family (Robertson, 2006; Kelly, 2019) and is crucial in shaping children's health outcomes. Such social and economic determinants that are dynamic and influenced by the forces of urbanisation, globalisation, and public health policy shifts (Tomlinson, 2017; Westwood & Slemming, 2019) contribute to the multi-faceted health inequalities among South African children, which is a primary concern of this research (Westwood & Slemming, 2019).

Expanding on socio-economic disparities, it is essential to explore how changes in these determinants currently influence health inequalities among South African children. The rapid pace of urbanisation introduces significant alterations in living conditions and resource distribution, which can have varying impacts on existing health disparities (Beckfield et al., 2013). In addition, globalisation is reshaping health landscapes by affecting dietary patterns, physical activity levels, and exposure to international health trends and policies (Tausch, 2012). These shifts call for adaptive public health policies that are attuned to these dynamic changes, ensuring that they adequately address the specific needs of vulnerable groups, particularly children.

4. 2 Literature Review

To enrich the exploration of the socio-economic disparities affecting children's health outcomes in South Africa, this chapter commences with an in-depth review of international literature on the subject. This review aims to frame the South African context within a broader global perspective, providing a multi-faceted understanding of how socio-economic factors influence child health across different settings. Analysing global studies, which employ diverse analytical approaches such as cross-country comparisons and country-specific evaluations, offers valuable insights into how socio-economic variables create health disparities among children.

These international findings serve as a comparative backdrop against which the unique aspects of the South African context can be examined. The global insights are adapted to or contrasted with local data and conditions, considering factors such as South Africa's specific historical, cultural, and economic landscape, which includes its unique history of apartheid and ongoing socio-economic challenges. This approach enables the researcher to identify universal and context-specific health disparities determinants. In doing so, it provides a solid foundation for the research, allowing for the development of targeted interventions and policies that are both globally informed and locally relevant to effectively address current inequalities and prepare for future challenges in child health in South Africa.

The research focuses on studies that have decomposed children's health outcomes within rural and urban settings or across different provinces (states). This approach is designed to uncover the unique health challenges and resource availability in these varied environments. The review also includes studies on trends in health disparities, with a clear distinction between rural and urban areas. However, it should be noted that only a few studies provide such detailed analysis. These are discussed below.

In their comparative study, Pradhan and Arokiasamy (2010) utilised a methodology similar to that proposed for this study in the South African context. Their in-depth analysis of the socio-economic determinants of child mortality in India employed data from the National Family Health Survey. The primary objective was to decompose socio-economic factors contributing to the under-two child mortality rate across various Indian states. This was achieved through a two-stage analytical process: calculating concentration indices for under-two mortality to measure socio-economic inequalities and then decomposing these indices using the Oaxaca-Blinder decomposition method.

The findings revealed a national concentration index of -0.1616, indicating that child mortality predominantly affected poorer population segments. However, this overarching figure obscured substantial state-level variations, reflecting India's diverse socio-economic conditions. For instance, states like Goa and Delhi exhibited high concentration indices, highlighting severe inequalities and higher child mortality in disadvantaged groups. By contrast, states like Uttar Pradesh and Bihar, with lower SES and higher child mortality rates, showed lower concentration index values, suggesting a more uniform distribution of child mortality across socio-economic strata. The decomposition analysis identified several factors contributing to these disparities, notably poor household economic status and maternal illiteracy, which are especially prevalent in certain states. The study's methods and findings helped anchor this study’s analysis by providing a benchmark, enabling the researcher to build on and refine its methodology.

Fagbamigbe et al. (2020) conducted a comparative study of low- and middle-income countries to examine and decompose inequalities related to severe acute malnutrition (SAM) in children under five. They utilised data from the Demographic and Health Survey. The study, which mirrors this study’s approach to decomposing various factors contributing to health outcomes, explored the relationship between maternal literacy and SAM, categorising mothers into 'educated' and 'uneducated'. Despite its comparative nature, their study aligns closely with this study's approach in South Africa, where the purpose was to unravel the complex factors contributing to health outcomes among children.

Fagbamigbe et al. (2020) findings highlighted significant maternal educational disparities in the prevalence of SAM. For example, in countries such as Cameroon, Chad, and Ethiopia, children of uneducated mothers exhibited notably higher prevalence. This pattern underscored a considerable health gap associated with maternal literacy levels in these areas. Employing the Oaxaca-Blinder decomposition method, their analysis revealed that individual, household, and neighbourhood factors contributed to the educational inequalities observed in SAM development. Crucially, the research indicated that neighbourhood SES and residential location were key determinants in most countries studied.

Pradhan and Arokiasamy (2010) and Fagbamigbe et al. (2020) highlight significant socio-economic inequalities in child health outcomes, emphasising the impact of SES. While their findings are highly relevant to their specific contexts, they may not be entirely applicable to the South African landscape, given the distinct health challenges faced by children in this country compared to those studied. Shifting focus, this researcher initially concentrates on research that examines these inequalities within a single time period within the South African context before reviewing studies that decompose socio-economic-related inequalities in children's health outcomes over time.

The researcher found no other study which specifically decomposed inequalities in children's health outcomes in South Africa. Alaba et al.'s (2021) research is unique in that it compares and decomposes socio-economic-related inequalities among children in India and South Africa. To fully appreciate the findings of this study, particularly its comparative approach, it is essential to understand the broader landscape of research on children's health disparities in South Africa. Although previous research in this area has not involved the decomposition of the findings, a review provides detailed insight into the challenges and factors influencing health disparities in this country.

In the broader context, extensive research has been undertaken to explore the issue of children's health inequalities within South Africa. Nkonki et al. (2011) made a significant contribution to this field by demonstrating the increased susceptibility of infants from economically disadvantaged backgrounds to adverse health outcomes, thereby highlighting the critical role of economic status in such disparities. In a complementary study, Obuaku-Igwe (2015) compared social health inequalities between South Africa and various global regions. This research revealed that children from low-income South African families are at greater risk of chronic health issues, further emphasising the correlation between SES and health outcomes in this context. Building on these findings, Ohonba et al. (2019) underscored the significant influence of maternal education in reducing health inequalities among South African children.

These studies suggest that, similar to the findings from international research discussed above, children from economically disadvantaged backgrounds and low-income families in South Africa are more susceptible to adverse health outcomes. This raises the question: what factors contribute to exacerbating these health differences? The only study that has decomposed inequalities in children's health outcomes in South Africa is that by Alaba et al. (2021). To examine and decompose these inequalities, Alaba's research focused on three key health indicators: full immunisation coverage, food insecurity, and malnutrition. Utilising data from the Demographic and Health Surveys of 2015/16, the study applied Erreygers Normalised concentration indices to measure the variation of these health issues across different socio-economic strata, defined by household wealth. Furthermore, it employed decomposition analysis to identify the primary factors contributing to the observed socio-economic disparities in child health.

The results revealed a pronounced socio-economic gradient in food security and malnutrition in India and South Africa. Interestingly, while full childhood immunisation in South Africa was found to be more common in poorer households, the opposite was true in India, where immunisation was more prevalent among wealthier households. The decomposition analysis identified key drivers of these health inequalities, including SES, place of residence, maternal education, and maternal age. These findings are particularly relevant to this study's analysis of socio-economic-related inequalities in children's health outcomes within rural and urban areas. Notably, the inclusion of place of residence as a significant factor in the decomposition analysis highlights the distinct challenges.

There is, however, one significant limitation of Alaba et al.'s 2021 study, namely, its comparative approach. The study might miss healthcare and socio-economic factors unique to South Africa by focusing on both countries. India and South Africa have distinct health systems, cultural contexts, and economic conditions. Therefore, the determinants of child health inequalities in the former would differ greatly from those in the latter. For example, malnutrition rates and causes, the accessibility of health services, and how maternal education affects children's health differ significantly between the two countries (Lambert & Wood, 2005; Panagariya, 2013; MacQuilka et al., 2018). By incorporating data and analysis from both contexts, the study provides a broad overview but may not delve deeply into the nuances and specific challenges faced by South Africa alone. This could lead to a somewhat generalised interpretation of the South African situation, potentially overlooking critical local factors or issues unique to the country.

A significant limitation of the studies conducted by Alaba et al. (2021), Pradhan and Arokiasamy (2010), and Fagbamigbe et al. (2020) is their focus on cross-sectional data, which restricts their ability to examine the evolution of socio-economic-related inequalities in children's health outcomes and the factors driving these disparities over time. This is particularly relevant when considering the dynamic nature of these inequalities. A longitudinal analysis of inequalities in children's health outcomes provides a more comprehensive perspective as it examines various dynamic factors, including education, parental SES, gender, and ethnicity (Mweemba et al., 2023).

The shifts in the factors influencing children's health outcomes over time play a crucial role in influencing individuals' access to resources, opportunities, and power across various areas of life. Najafi et al. (2018) highlight that this is a key determinant of health inequalities. In contexts where social protection and public services are either lacking or unevenly distributed among different population groups, these evolving factors can significantly intensify or reduce societal health inequalities. Therefore, adopting a longitudinal approach to examine these factors provides a more detailed understanding of the changes in these inequalities and their driving forces over time. While international studies such as those by Wagstaff et al. (2003) and Musheiguza et al. (2021) analysed and decomposed these inequalities, the body of research in this specific area remains relatively limited.

Wagstaff et al.'s (2003) study on the decomposition of socio-economic-related inequalities in child malnutrition in Vietnam across different periods is a pivotal contribution. The authors used the height-for-age z-score to measure child malnutrition and analysed data from the Vietnam Living Standards Surveys of 1993 and 1998. They applied the concentration index and the recent influence function regression decomposition method to examine the disparities between the two periods.

The analysis revealed an increase in health inequalities over time. The study found that in 1993, Vietnam's child malnutrition scenario was primarily influenced by disparities in household consumption levels and various unobserved factors at the commune level. By 1998, these disparities had not only persisted but also intensified. A significant factor contributing to growing inequality was the increase in household consumption. During this period, Vietnam saw a notable rise in average household income, leading to a general decrease in malnutrition rates. However, this was not uniformly experienced. Wealthier families benefitted more substantially, resulting in a widening gap in malnutrition rates between richer and poorer families. The study thus highlighted the role of household income as a protective factor against malnutrition. While it focused on Vietnam, its methodological approach and findings provided a critical foundation for this study, serving as an essential reference for the analysis of similar inequalities in the South African context.

More recently, Musheiguza et al. (2021) comprehensively analysed stunting trends among children in Tanzania and the underlying socio-economic factors. Utilising data from the Tanzania Demographic and Health Surveys of 2004, 2010, and 2016, the study focused on children aged three to 59 months. The researchers employed the concentration index to quantify stunting inequality and used Wagstaff et al.'s (2003) decomposition methods, discussed above, to determine the contribution of various factors.

The findings indicated a significant decrease in child stunting, from 45.5% in 2004 to 35.6% in 2016. The results from the concentration index suggested that stunting predominantly persisted among the poorer segments of the population in Tanzania. The decomposition analysis of the concentration index showed that disparities in household wealth and maternal education were major contributors to these inequalities. Notably, while the contribution of wealth disparities to stunting showed a decreasing trend over the years, the influence of maternal education increased.

4.3. Contributions of the Chapter to the Literature

While the insights from these international studies are valuable, there is a notable research gap in the South African context, especially regarding the trends in children's health inequalities and the factors driving them. Furthermore, it is crucial to explicitly connect this research to the geographical areas where children reside. This localised approach is informed by studies like those by Cai et al. (2017) and Mweemba et al. (2023). Its importance is also emphasised in the work of researchers such as Pradhan and Arokiasamy (2010), Obuaku-Igwe (2015), Ohonba et al. (2019), and Fagbamigbe et al. (2020). Their findings highlight the significant impact of a neighbourhood's economic status and location on health inequalities, underscoring the need to analyse health disparities that consider the specific regional contexts in which children live.

Building on the identified shortcomings of the studies discussed above, this chapter presents a unique contribution to the field. It is the first to simultaneously explore the changes in chronic diseases and disabilities among South African children and the factors driving these disparities within urban and rural contexts. This work also addresses the often oversimplified urban-rural dichotomy commonly found in prior research, a concern highlighted by Altman and Bland (1997). Adopting a more granular approach enriches the existing literature, differentiating between formal rural areas, areas under traditional authorities, formal urban areas, and informal urban areas. Utilising this detailed unit of analysis, this study offers a comprehensive examination of varied conditions across different regions, encompassing aspects of governance, infrastructure, access to resources, and socio-economic circumstances.

Traditional authority areas, governed by traditional authorities and customary law, often lack robust infrastructure and resources. Limited access to healthcare, education, and economic opportunities often translates to reliance on local, traditional diets, which may or may not be balanced. Furthermore, the agricultural nature of these areas might mean more physical activity. However, it also comes with the challenges of limited health awareness and resources to manage and prevent chronic conditions like diabetes (King, 2005).

Despite support from local government, formal rural areas still grapple with challenges in healthcare, education, and economic opportunities. Limited access to diverse food options often leads to dependence on staple, carbohydrate-rich diets, which can be a risk factor for diabetes. Furthermore, while there might be more physical activity due to the farming lifestyle, a lack of awareness and preventive care pose risks for the population, especially when compared to their urban counterparts who benefit from more developed infrastructure and a broader range of services (Statistics South Africa, 2023).

Formal urban areas, with their well-developed infrastructure, provide better access to public and private services, promoting a higher quality of life. This can mean diverse diets, which can either be beneficial or detrimental (due to easier access to processed, high-sugar, and high-fat foods which can increase the risk of diabetes). Simultaneously, urban lifestyles can be largely sedentary due to occupational shifts and reliance on transportation which decreases daily physical activity.

Informal urban areas, characterised by informal settlements, represent a unique challenge. While they might be geographically close to urban amenities, their limited access to essential services leads to significant health disparities. Overcrowded conditions, reliance on fast, processed foods due to economic constraints, and limited areas for physical activity further exacerbate diabetes risk factors in these regions (Richards et al., 2007).

By utilising these classifications that transcend traditional country-level, urban, rural, or provincial ones, the study aimed to provide a more comprehensive understanding of health disparities among South African children with chronic illnesses and disabilities. In line with this approach, its objectives included a thorough examination of how socio-economic-related inequalities in children's chronic illnesses and disabilities have evolved across various settings, namely formal rural areas, areas under traditional authorities, formal urban areas, and informal urban areas. In addition, the study sought to investigate how the determinants of these health inequalities differ within these distinct regions, offering a nuanced view of the factors impacting health disparities in South Africa.

4.4. Theoretical Foundation

The concept of the social determinants of health is a comprehensive framework to examine the development of health disparities among a nation's chronically ill and disabled children. It posits that factors at the individual level such as birth, development, everyday life, and work interact with broader social, political, and economic policies, all of which impact health outcomes (Cockerham et al., 2017; WHO, 2021).

The notion of intersectionality was incorporated into the Social Determinants of Health framework to deepen comprehension of health disparities. Crenshaw (1989) described intersectionality as the intertwined nature of social classifications like race, gender, and SES, leading to overlapping and inter-dependent systems of discrimination or disadvantage. Integrating intersectionality into the Social Determinants of Health framework enabled a more comprehensive examination of how these factors intersect with SES, influencing health inequalities related to socio-economic factors in chronic diseases and disabilities among children in various regions. It promoted a more detailed understanding of health disparities among South African children with chronic conditions and disabilities. Incorporation of intersectionality into the Social Determinants of Health framework is how this study differs from other studies in this area, which adopted a broader approach.

Apartheid's lasting impact has significantly influenced the social determinants of health among South African children with chronic illnesses and disabilities. Persistent inequalities affect children across formal rural areas, areas under traditional authorities, and formal and informal urban areas due to poverty, insufficient critical infrastructure and services, and limited economic opportunities (Von Fintel, 2018). Although these challenges vary by region, they disproportionately burden poor children with chronic illnesses and disabilities, intensifying region-specific socio-economic health disparities (Robertson, 2006).

For instance, rural regions typically have elevated poverty levels, restricted access to healthcare and education, and inadequate transportation infrastructure compared to urban areas (Robertson, 2006). Children with chronic diseases and disabilities in rural regions confront numerous difficulties in accessing essential resources and services. Conversely, urban areas may offer more healthcare and education opportunities, but are plagued by disparities based on income and race. Furthermore, overcrowding and sub-standard living conditions in informal settlements significantly affect children with chronic diseases (Jayathilaka et al., 2020).

The interplay between socio-economic factors and health outcomes is complex and multi-faceted, especially when considering children with chronic diseases and disabilities. In rural areas, limited access to specialised healthcare services and a lack of awareness of chronic conditions can lead to delayed diagnoses and inadequate treatment. Despite having better healthcare infrastructure, urban environments often witness disparities in access and quality of care based on SES.

In areas under traditional authorities, cultural beliefs and practices can either complement or conflict with modern healthcare approaches. This could influence treatment choices and health outcomes. These varied scenarios underscore the importance of a comprehensive analysis that considers macro-level socio-economic factors and micro-level community and individual dynamics. Such an approach is vital to understand the full spectrum of challenges faced by children with chronic illnesses and disabilities in different South African contexts.

Areas falling under traditional authorities exhibit distinct challenges regarding health inequalities for children with chronic diseases and disabilities. In these areas, traditional healers play a vital role in addressing family dynamics and disputes and providing medical assistance where needed. However, they often lack the necessary resources and training to effectively manage chronic conditions and disabilities (King, 2005). Cultural barriers to using Western healthcare may also exist in these areas, further exacerbating health disparities among children (King, 2005).

Factors such as migration patterns and economic growth further intensify disparities between regions. When families move from formal rural regions and areas under traditional authorities to urban areas in search of better job opportunities and healthcare, already over-burdened resources are further stressed (Tomlinson, 2017). Richards et al. (2007) suggest that competition for resources and the instability of informal settlements worsen health disparities among children with chronic conditions and disabilities in urban settings.

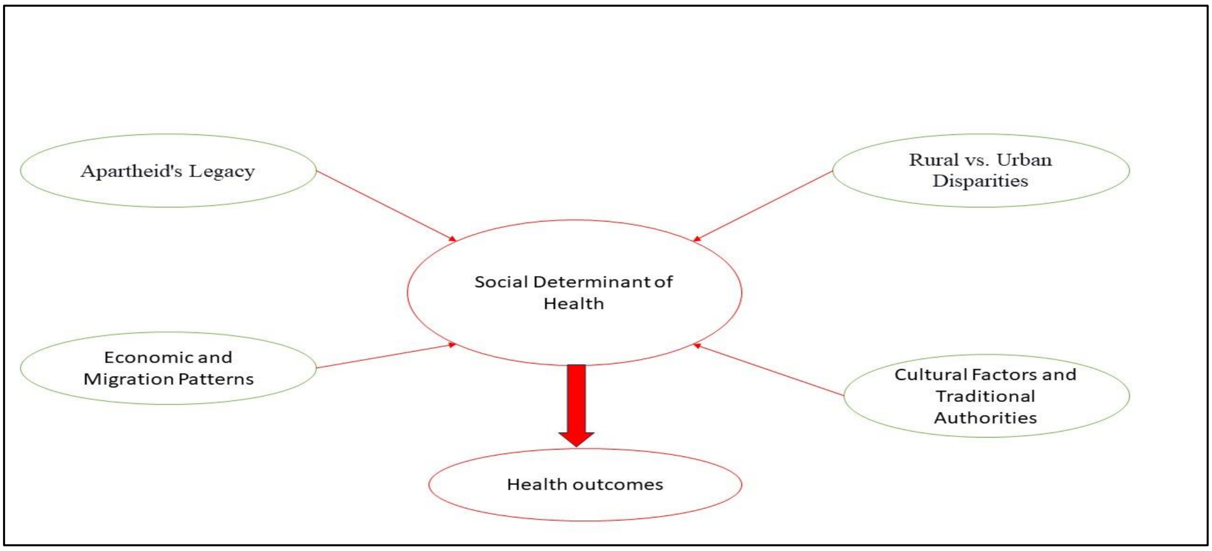
The conceptual framework depicted in Figure 4.1 summarises the multifactorial influences on health outcomes in South Africa's diverse socio-economic landscape. At the core of this framework is the Social Determinants of Health, which are affected by apartheid legacies, highlighting the enduring impact of historical segregation on current health disparities. The framework also considers the dichotomy between rural and urban disparities, acknowledging these settings' different challenges. Cultural factors and the role of traditional authorities are factored into the framework, recognising their impact on health decisions and outcomes, particularly in areas where modern healthcare is intertwined with traditional practices. Economic and migration patterns are included to account for the dynamic nature of health disparities as populations shift in search of better opportunities, affecting the distribution of and access to health resources.

Based on the conceptual framework, which is illustrated in Figure 4.1 below, the study aimed to test the following hypotheses:

H1: The rise in socio-economic-related inequalities in chronic diseases and disabilities among children between 2008 and 2017 is more prevalent in informal urban and formal rural areas than in other geographical types. This hypothesis assumes that informal urban and formal rural areas face unique challenges regarding access to healthcare and socio-economic resources, which may exacerbate existing disparities.

H2: Children's age, maternal education, receipt of social grants, and medical aid coverage are the most influential determinants of the changes in socio-economic-related inequalities in chronic diseases and disabilities among South African children throughout the survey period. These factors were selected based on their well-established relationship with child health outcomes in the existing literature and their potential to offer insights into the mechanisms driving disparities in health outcomes across different geographical contexts.

Figure 4.1: Conceptual Framework of Socio-Economic Influences on Children's Health Outcomes in South Africa



Note: This figure is the author's work.

In summary, the theoretical framework laid a robust foundation to examine the complex interplay of socio-economic factors influencing health disparities among South African children with chronic illnesses and disabilities. The enduring impacts of apartheid, stark contrasts between rural and urban living conditions, cultural intricacies within traditional authority areas, and shifts in migration patterns have collectively shaped the landscape of health equity challenges. By integrating the concept of intersectionality into the Social Determinants of Health framework, the analysis was able to more accurately dissect the nuances of socio-economic inequalities. It moved beyond broad assessments, focusing on individuals' specific challenges across different geographical contexts.

The following section details the data and methods employed to test the hypotheses as the study transitioned from theoretical reflections to empirical validation. This phase was crucial in validating the theoretical assertions about the rise in socio-economic inequalities in chronic illnesses and disabilities among children from 2008 to 2017. The research aimed to illuminate the factors perpetuating health disparities in order to contribute to strategies to promote equitable health outcomes for all South African children, regardless of SES or geographical location.

4.5. Methodology

4.5.1 Data

The study employed the panel component of the NIDS datasets for quantitative analysis to investigate the evolution of socio-economic-related inequalities in chronic illnesses and disabilities among children and the underlying social factors across different geographical regions of South Africa. The scarcity of panel data makes the NIDS a valuable research resource. The South African Labour and Development Research Unit at the University of Cape Town collected the NIDS dataset in multiple waves. Data from Waves 1 (2008) and 5 (2017) were used for quantitative investigation to address the study's objectives.

The primary goal of the NIDS dataset is to assess the livelihoods and health of individuals and households over time, making it well-suited to explore quantitative changes in socio-economic-related disparities in chronic illnesses and disabilities among children in different regions of South Africa. The dataset provides a wealth of information, including disability rates and the health and education details of the sampled children over time.

Table 4.1 below presents the essential variables and descriptions of the variables employed in the study.

Table 4.1: Description of variables used in the study

Variable	Description	Categories/Values
Chronic illnesses and disabilities	Presence or absence of disability or chronic illness	1: Presence, 0: Absence
Age	The age group of children at the time of data collection	0-5, 6-10, 11-15
Race	Racial identification of children	African, Non-African (including Indian, Coloured and White children)
Gender	Gender of children	Male, Female
Mother's education	Mother’s level education	No education, Incomplete primary, Completed primary, Incomplete secondary, Complete secondary, More than secondary education
Religious affiliation	Religious identity of the family	Religious, Non-religious

Parental marital status	Marital status of parents	Married, Unmarried (including living together, widowed, divorced, and never married)
Medical aid coverage	Presence or absence of medical aid coverage	Covered, Uncovered
Social grant recipient status	Whether or not the child receives a social grant	Recipient, Non-recipient
Geographical type	Area type based on the 2001 census NIDS indicators	Traditional authority areas, Rural formal, Urban formal, Informal urban areas
Household income per capita	The ratio of monthly household income to the number of family members	Computed value

The following section outlines the methodology used to examine changes in disparities related to socio-economic factors in chronic illnesses and disabilities among children across various regions.

4.5.2. Empirical Methods of Estimation

To fulfil the study's objectives and validate the hypotheses outlined above, this study expanded the methodology Wagstaff et al. (2007) used by employing four unique specifications.

4.5.2.1. The Concentration Curve

The initial specification employed concentration curves to estimate the population sample distribution based on SES and the dependent variable within each geographical type for each period. The concentration curve displays the cumulative percentage of the population sample, ranked by SES on the X-axis and the cumulative percentage of the dependent variable on the Y-axis, as outlined by Wagstaff et al. (1991).

This approach was the first step in evaluating the extent of disparities in the outcome variable. Two variables served as anchors for this measure: the health variable and a measure of the standard of living (Ataguba et al., 2011). The socio-economic measure used to estimate the concentration curves (and indices in the next section) is household income per capita. This variable is divided into quintiles on the concentration curve, with children ranked from the lowest to the highest income levels.

The deviation of the concentration curve from the line of equity (a 45-degree line) indicates the magnitude of inequality in the distribution of chronic illnesses and disabilities among children of different socio-economic circumstances. Conversely, if the concentration curve coincides with the equity line, this suggests that the burden of chronic illnesses and disabilities is evenly distributed across children of different socio-economic circumstances (Keeton, 2014).

4.5.2.2 The Concentration Index

The second specification calculates each geographical region's concentration index (CI) for 2008 and 2017. As defined by Wagstaff et al. (1991), the CI represents twice the area between the equity line and the concentration curve. Formally, a standard CI can be derived by computing twice the covariance between a health variable (H) and a living standard measure (r), as specified by Wagstaff et al. (2007). This concept can be expressed mathematically using Equation (4.1):

$$C = \frac{2}{\mu} cov\,(H, r) \quad (4.1)$$

The CI varies between negative (-1) and positive (+1). A negative value indicates that the burden of a certain outcome such as chronic illnesses and disabilities is concentrated among children whose parents have relatively lower incomes (Keeton, 2014). A positive CI value signifies that the burden of the outcome variable is concentrated among children with parents with relatively higher incomes (Keeton, 2014).

Despite this, to enable statistical analysis, this study utilised the regression-based CI described mathematically by O'Donnell et al. (2010), which is expressed in the following equation:

$$2\sigma^2 (\frac{H_i}{\mu}) = \alpha + \beta\, r_i + \sum \varphi_j\, x_{ji} + \varepsilon_i \quad (4.2)$$

In Equation (4.2), σ^2 is the variance of the rank variable; μ is the mean of the health outcome; α represents the intercept; the parameter β is an estimation of the CI; r is used as the ranking variable, which is the household income per capita in the context of the study; φ_j represents the parameter vectors of the determinant variables X_{ji} (these covariates were discussed in Section 4.4.2), and ε_i denotes the random stochastic error.

The estimation of this variation of the CI is conducted using the Linear Probability Model (LPM) for each year and each geographical region. Nevertheless, since the LPM is characterised by heteroscedasticity, the third specification addresses this statistical issue by employing robust standard errors in Equation (4.2). This estimation forms the basis to examine the change in the CI technique, which is presented in the subsequent section.

4.5.2.3 The Decomposition of the Change in the Concentration Index

The fourth specification dissects the CI for each geographical region from 2008 to 2017 to enable the decomposition of the socio-economic factors contributing to inequalities in children's chronic illnesses and disabilities over time (O'Donnell et al., 2010). In simpler terms, it analyses how each variable contributed to the increase or decrease in overall inequalities in the outcome variable. However, before outlining the methods for the decomposition of the change in CI, the method for the cross-sectional decomposition of the CI presented by Wagstaff et al. (2007) is reviewed. This is represented by Equation (4.3):

$$C = \sum_k \left(\frac{\beta_k \bar{\bar{X}}_k}{\mu}\right) C_k + \frac{GC_\varepsilon}{\mu} \quad (4.3)$$

In the above equation, $\bar{\bar{X}}_k$ is the mean of each determinant; and C_k is the CI for the k determinant. The CI for the individual determinants is calculated similarly to C. $G.C._\varepsilon$ is the generalised CI for the error term. Importantly, Equation (3.3) comprises two parts: explained and unexplained components. The explained part is the sum of the CIs of the k regressors, and the weight of these is the elasticity of H concerning $X_k(\eta_k = \beta_k \frac{\bar{\bar{X}}_k}{\mu})$.

The final term captures the unexplained part, $\frac{G.C._\varepsilon}{\mu}$, which is the socio-economic-related inequalities in the outcome variable that cannot be explained by systemic variation in the regressors by SES. However, the final term is anticipated to converge towards zero in a well-defined model. In contrast to the cross-sectional decomposition of the CI discussed previously, the study examined the evolution of socio-economic-related disparities in chronic illnesses and disabilities among children by applying the decomposition of the change in the CI to Equation (4.3), which produces the following equation:

$$\Delta C = \sum_k \eta_{kt}(C_{kt} - C_{kt-1}) + \sum_k C_{kt-1}(\eta_{kt} - \eta_{kt-1}) + \Delta\left(\frac{GC_\varepsilon}{\mu}\right) \quad (4.4)$$

Equation (4.4) Δ indicates the first difference, and *t* denotes the period under investigation between 2017 and 2008. Moreover, in the above equation, the change in the decomposition of the CI is weighted by the second-period elasticity, η_{kt} and the differences in elasticities by the first-period CI, C_{kt-1}. An alternative to Equation (4.4) is to weigh the differences in the CIs by the first-period elasticity and that of the second-period CI as shown in Equation (4.5):

$$\Delta C = \sum_k \eta_{kt-1}(C_{kt} - C_{kt-1}) + \sum_k C_{kt}(\eta_{kt} - \eta_{kt-1}) + \Delta(\frac{GC_\varepsilon}{\mu}) \quad (4.5)$$

In evaluating the outcomes from utilising Equations 4.4 and 4.5, a positive sign suggests that the variable of interest exacerbates disparities in chronic illnesses and disabilities among children in relation to socio-economic factors over time (Wagstaff et al., 2003). Conversely, a negative sign indicates that the variable reduced inequalities between Waves 1 and 5. The following section presents the estimation results obtained by means of the methods outlined in this section.

4.6. Results

4.6.1. Descriptive Statistics

The analysis of the descriptive statistics is dealt with in this section. It presents and evaluates the findings from Table 4.2, which underscore the variations in the percentage of children with chronic illnesses or disabilities across a range of geographical regions in South Africa while considering their demographic characteristics.

The findings suggest that between 2008 and 2017, there was a consistent decline in the number of children in South Africa with chronic illnesses and disabilities in all regions. This trend is conspicuous in informal urban areas. The percentage of affected Black children fell from 9.13% to 3.23%, while that of non-Black children in informal urban areas dropped drastically by 12.82% to 1.15%. This suggests that policy interventions or improved healthcare access had positive health outcomes for children in these areas during this period.

Moreover, the data points to a correlation between health coverage and the prevalence of chronic illnesses and disabilities. In 2008, children with health coverage generally exhibited higher prevalence rates than those without coverage, notably in traditional authority and informal urban areas. However, by 2017, the gap between these two groups had narrowed, with children with coverage experiencing a decrease in prevalence in all regions except rural formal areas, where prevalence marginally increased. This trend signifies that broadening health coverage may be crucial in diminishing disparities in chronic illnesses and disabilities among children.

Table 4.2 further reveals a link between receiving a social grant and the prevalence of chronic illnesses and disabilities. In 2008, children who received social grants typically had higher prevalence rates of chronic diseases and disability than those who did not. In 2017, this trend continued in formal rural, traditional authority, and formal urban areas. However, it was reversed in informal urban areas, where children who did not receive a social grant exhibited higher prevalence than those who did. This underscores social grants' potential role in reducing socio-economic disparities and enhancing health outcomes for children with chronic illnesses and disabilities.

Table 4.2: Percentage of Children with Chronic Illnesses and Disabilities in Diverse Geographical Regions across Social Grant Status

	Rural formal areas		**Traditional authority areas**		**Formal urban areas**		**Informal urban areas**	
	2008	2017	2008	2017	2008	2017	2008	2017
Black	4.68	4.02	4.70	3.49	5.68	4.15	9.13	3.23
Non-Black	4.68	1.45	0.12	23.08	8.52	4.60	12.82	1.15
Ages 0-5	2.78	2.50	4.60	3.18	5.06	2.86	6.73	1.50
Ages 6-10	6.42	3.82	4.56	3.47	8.75	6.63	9.29	5.11
Ages 11-15	5.11	3.32	5.03	4.03	7.58	3.35	15.85	2.75
Male	3.70	3.20	4.44	4.07	6.83	5.00	7.78	3.48
Female	4.86	3.15	4.98	2.96	6.57	3.56	10.77	2.46
Covered	4.55	6.67	12.09	6.29	7.97	3.59	19.23	8.47
No coverage	4.26	3.02	4.53	3.36	6.44	4.41	9.19	2.75
Received social grant	4.91	3.10	5.18	3.63	7.20	4.71	8.42	2.90
Did not get a social grant	3.35	3.63	3.26	2.87	5.98	3.20	10.92	3.98

*Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.

Table 4.2 above shows that demographic characteristics are essential in understanding the distribution of chronic illnesses and disabilities amongst children in different regional types. However, other factors, like parental education, influence these inequalities.

Table 4.3 shows the relationship between maternal education and the proportion of children with chronic illnesses and disabilities across the selected regions. The data indicates that from 2008 to 2017, there was a general decrease in chronic illnesses and disabilities among children, accompanied by increasing maternal education, most notably in formal urban areas for mothers with more than secondary education (from 20.00% to 0.94%). However, there are exceptions, such as increased prevalence in informal urban areas for mothers with no education (from 14.29% to 25.00%). This highlights the complex interplay between maternal education and region. These differences suggest that policies and interventions should be tailored to specific regional contexts to address children's health disparities.

Table 4.3: Changes in the Percentage of Children with Chronic Illnesses and Disabilities Across Different Regions in South Africa Based on Maternal Education Levels

	Rural formal areas		**Traditional authority areas**		**Formal urban areas**		**Informal urban areas**	
	2008	2017	2008	2017	2008	2017	2008	2017
No education	4.67	4.44	2.26	2.56	3.10	4.44	14.29	25.00
Incomplete primary	2.35	1.36	6.81	5.24	5.56	2.94	4.00	3.50
Completed primary	7.24	2.17	6.68	4.09	8.87	2.07	4.88	4.20
Incomplete secondary	4.49	4.08	3.10	3.87	5.99	4.66	8.21	2.65
Complete secondary	4.29	1.61	4.79	2.69	5.63	3.78	9.09	0.77
More than secondary	1.20	1.20	10.37	2.01	20.00	0.94	30.00	14.29

*Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.

Household income also plays a crucial role in determining access to healthcare and children's overall well-being. Table 4.4 shows the changes in the percentage of children with chronic illnesses and disabilities using the income quantiles they fall under across the different geographical regions. It points to a significant association between being from a low-income household and an elevated prevalence of chronic health conditions and disabilities among children across all geographical categories in the two years examined.

Moreover, the health discrepancies between middle-income households in rural formal and urban formal localities diminished, whereas the gap between the traditional authority and informal urban sectors grew. Intriguingly, affluent families witnessed a reduction in the proportion of children suffering from chronic health issues and disabilities in rural formal regions (from 1.41% to 0.00%) and urban formal areas (from 8.42% to 4.13%).

Table 4.4: Variations in the Proportion of Children with Chronic Illnesses and Disabilities by Income Quantiles across Distinct Regional Categories

Income levels	Rural formal areas		Traditional authority areas		Formal urban areas		Informal urban areas	
	2008	2017	2008	2017	2008	2017	2008	2017
Lower	97.18	95.65	96.54	98.07	88.61	89.26	94.12	100.00
Middle	1.41	4.35	0.00	2.22	2.97	6.61	5.88	0.00
High	1.41	0.00	3.46	0.00	8.42	4.13	0.00	0.00

*Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.

In conclusion, the descriptive statistics unveil considerable disparities in the prevalence of chronic illnesses and disabilities among children across various geographical regions, with marked differences by age, maternal education level, and income. However, to gain a more comprehensive understanding of disparities in the distribution of chronic illnesses and disabilities, the following section introduces visual representations through concentration curves. These illustrations emphasise socio-economic-related inequalities in the outcome variable across distinct timeframes and geographical areas.

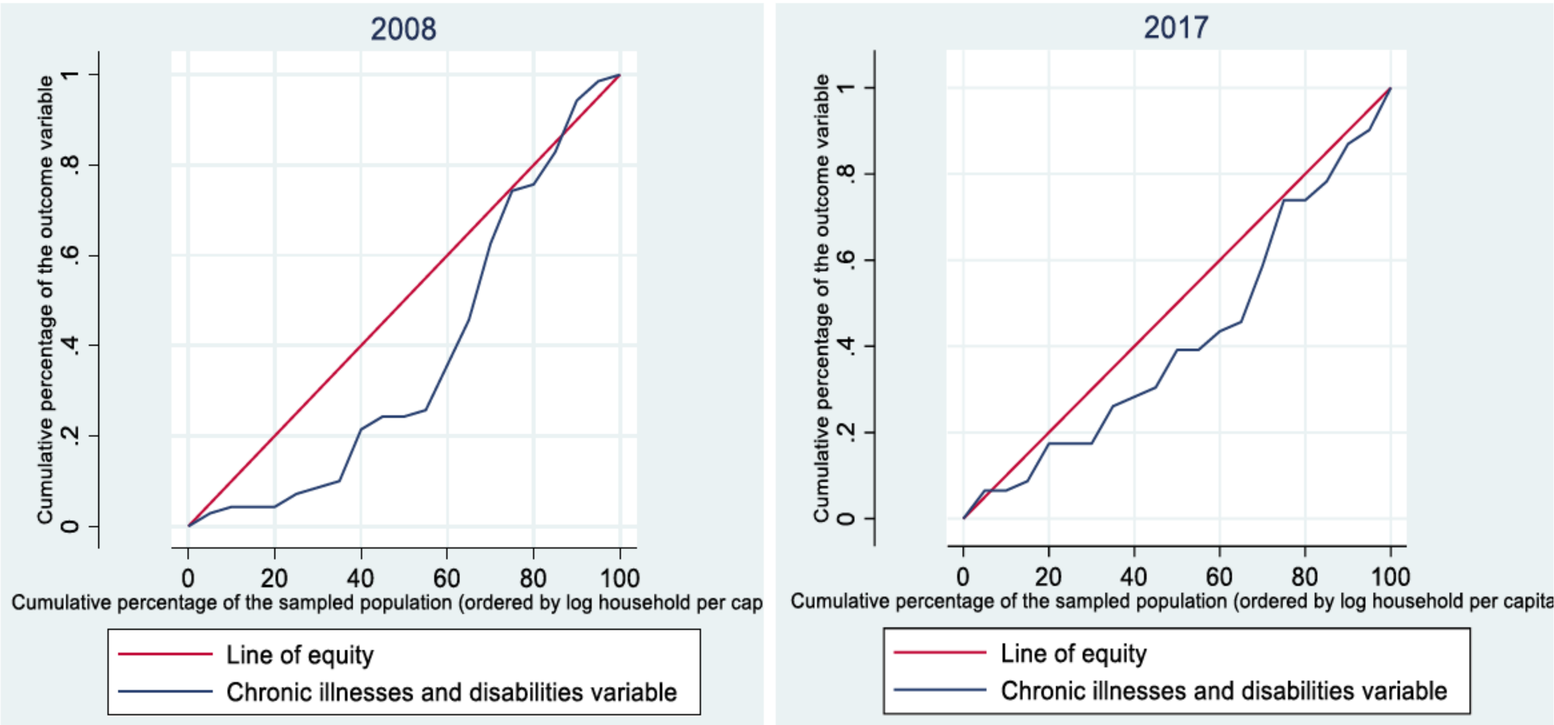
4.6.2. Results of the Concentration Curves for 2008 and 2017

Figure 4.2 displays the concentration curves for formal rural areas in 2008 and 2017. The 2017 curve is closer to the equity line, signifying decreased socio-economic-related disparities in chronic illnesses and disabilities among children in such regions over time. Furthermore, both concentration curves lie below the 45-degree line, indicating that the disadvantages associated with these conditions are primarily concentrated among affluent children in these regions.

Figure 4.3 presents the concentration curves for children with chronic illnesses and disabilities in traditional authority areas in 2008 and 2017. Like formal rural areas, socio-economic-related inequalities diminished slightly among children in traditional authority areas over time.

Figures 4.2 and 4.3 show an overall reduction in socio-economic-related health inequalities in chronic illnesses and disabilities among children in rural areas, which was more pronounced in formal rural areas than in traditional authority areas. These trends were anticipated, as it was hypothesised that socio-economic-related inequalities in chronic illnesses and disabilities among children from these regions would be lower than those among children in informal urban areas. This finding is due to the substantial public funds and resources being allocated to policy initiatives such as expanding healthcare facilities in rural areas that have improved access to medical care for children with chronic illnesses and disabilities (Burger & Christian, 2020).

Figure 4.2: Changes in the Concentration Curves for children living in formal rural areas



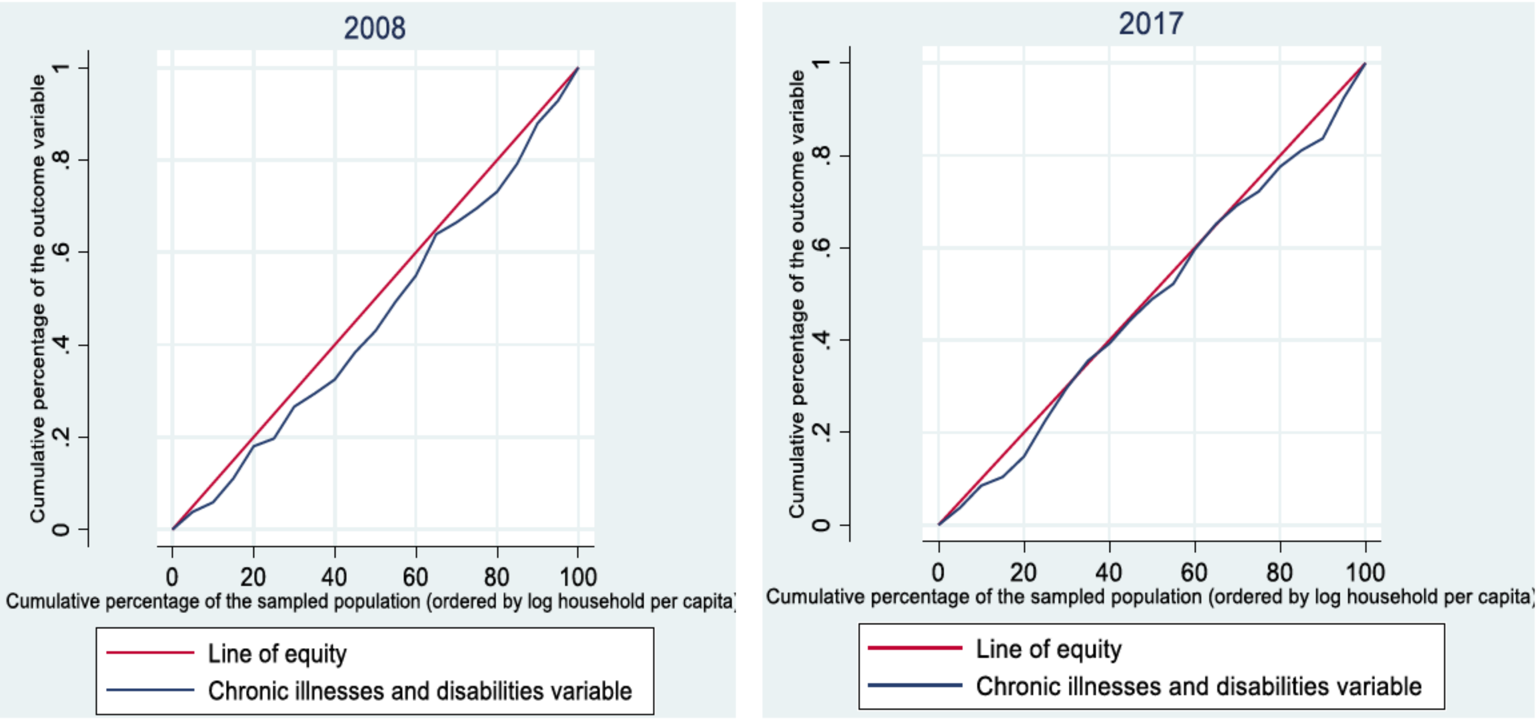
***Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.**

In both periods, the disadvantages related to these conditions are predominantly concentrated among affluent children in these regions.

Figure 4.4 depicts the concentration curves for children living in formal urban areas in 2008 and 2017. The fact that the 2017 curve is more distant from the 45-degree line than the 2008 curve indicates an increase in socio-economic-related disparities in the outcome variable throughout the survey period. In 2008, the concentration curve closely aligned with the equity line, suggesting that the burden of chronic illnesses and disabilities was evenly distributed among children from diverse socio-economic backgrounds. However, by 2017, the situation had changed, and the inequalities had intensified, with the burden increasingly affecting children from affluent families.

These findings support the hypothesis that inequalities will be largest in urban settings. Several factors could explain the abrupt shift in the burden of chronic illnesses and disabilities among children in formal urban areas. Kimani-Murage et al. (2010) suggest that increased affluence in South Africa's urban regions has resulted in lifestyle changes such as sedentary habits and unhealthy dietary choices, which may have contributed to the higher prevalence of chronic illnesses among wealthy children. However, this shift might stem from a combination of factors explored in the following section.

Figure 4.3: Changes in the Concentration Curves for children living in traditional authority areas



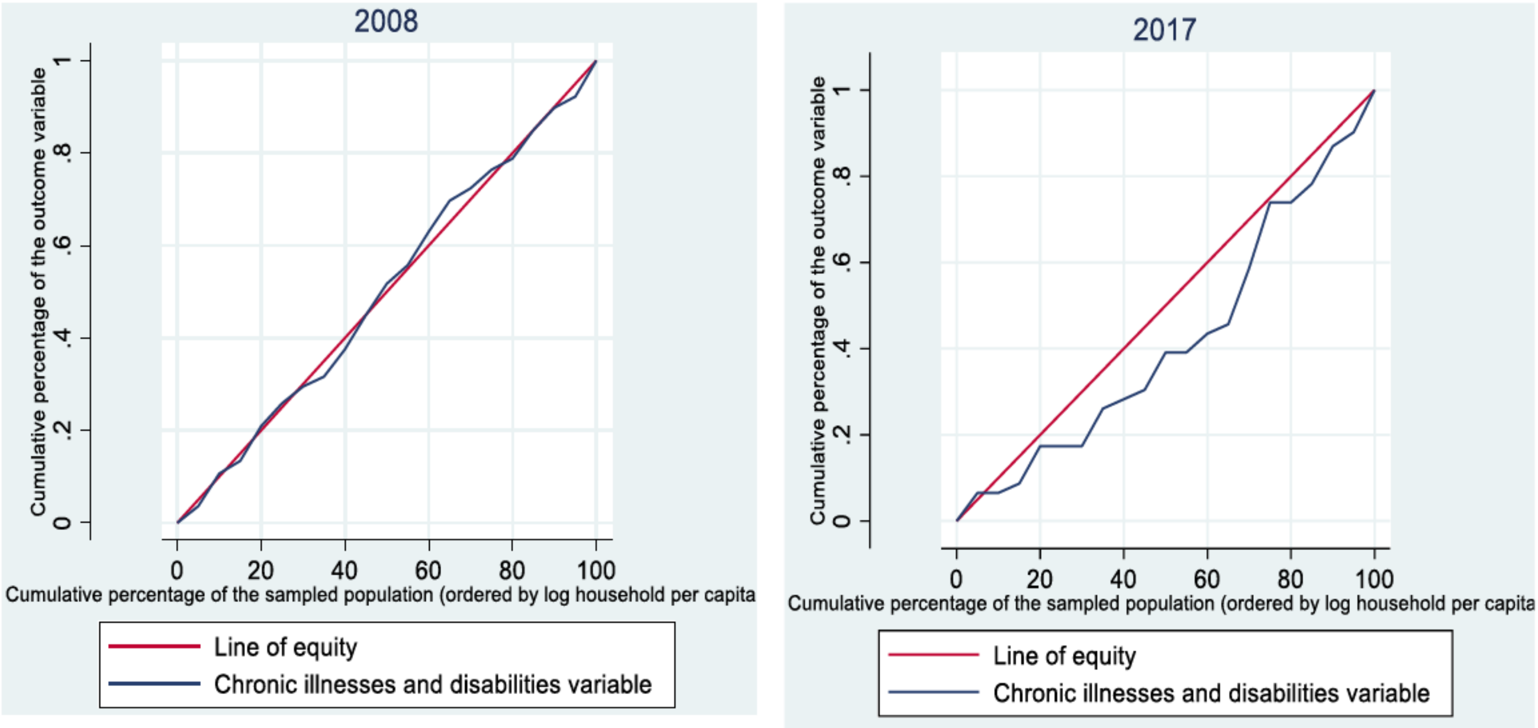
***Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.**

Lastly, Figure 4.5 illustrates the concentration curves for children living in informal urban areas from 2008 and 2017. The 2017 concentration curve is further from the line of equity than its 2008 counterpart, signifying an increase in socio-economic inequalities in relation to chronic illness and disabilities among children in this region. This supports the hypothesis that the most substantial change in these inequalities would be observed in urban settings.

The growth of informal urban areas in South Africa due to urbanisation has given rise to several challenges for families living in these locations. For example, these areas frequently lack adequate healthcare infrastructure, making access to healthcare difficult (Melore & Nel, 2020). Consequently, residents may not receive timely medical attention or preventive care, increasing their susceptibility to chronic illnesses and disabilities.

The 2017 concentration curve demonstrates this reality for children in informal urban areas, which is the only one that lies above the equity line. This observation underscores that impoverished children in this region disproportionately bear the burden of socio-economic-related disparities in chronic illnesses and disabilities.

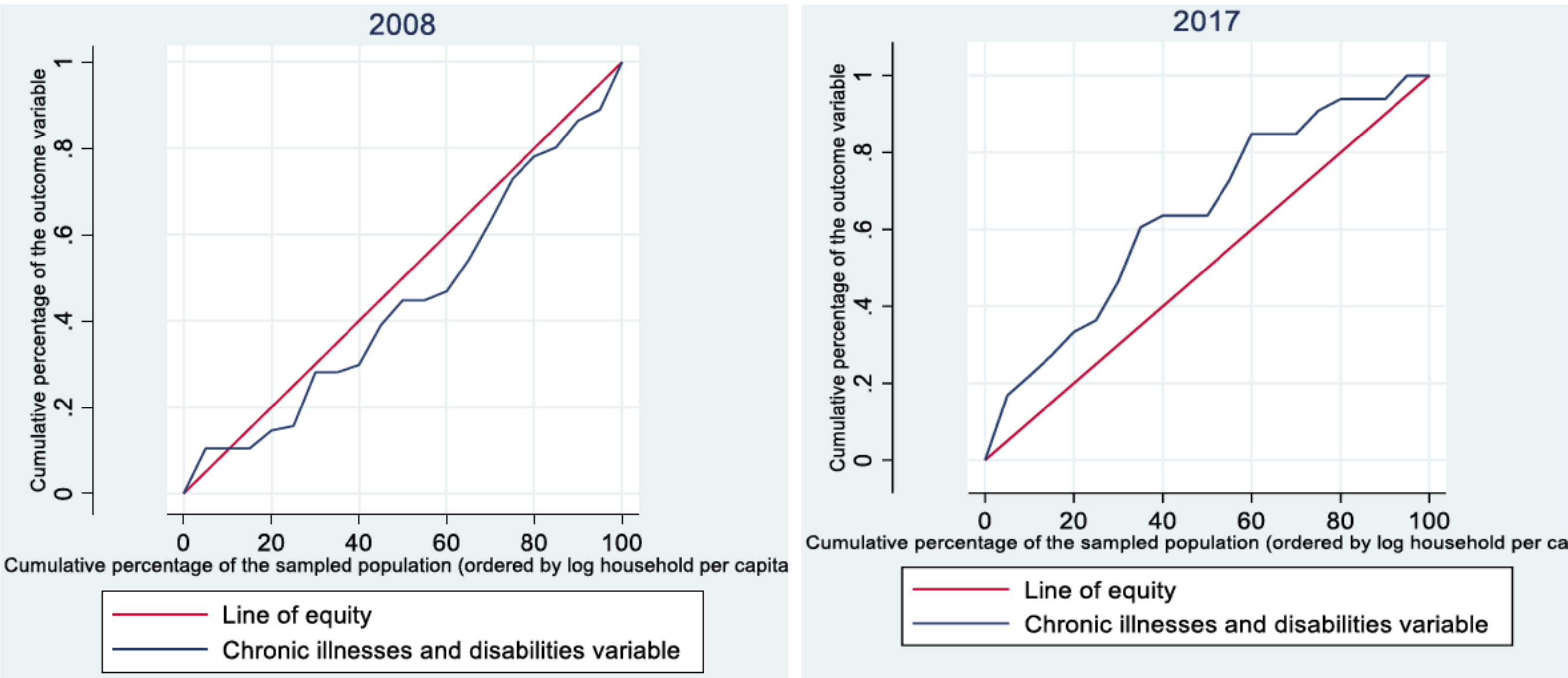
Figure 4.4: Changes in the Concentration Curves for children living in formal urban areas



*Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.

An examination of the differences in chronic illnesses and disabilities in children between 2008 and 2017, which considered socio-economic factors across various geographic types (including formal rural areas, traditional authority regions, formal urban areas, and informal urban areas), revealed the presence of inequalities in the outcome variable.

Figure 4.5: Changes in the Concentration Curves for children living in informal urban areas



*Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset.

To gain deeper insight into this matter, the next section utilises a regression-based concentration index to study fluctuations in the magnitude of these disparities while accounting for other variables that could affect the relationship among the distinct regional classifications.

4.6.3. Results of the Regression-Based Concentration Index for 2008 and 2017

Table 4.5 presents an analysis that assesses changes in socio-economic-related inequalities in chronic illnesses and disabilities among children in South Africa after controlling for social determinants across formal rural areas, traditional authority areas, formal urban areas, and informal urban areas. As detailed in the methodology section, the study utilised regression-based concentration indices calculated separately for each geographical type.

In formal rural areas, the distribution of socio-economic disparities in chronic illnesses and disabilities among children shifted significantly between 2008 and 2017. The disparities decreased by 100%, transitioning from being concentrated among the wealthy to becoming evenly distributed between the rich and poor. This means that over time, health inequalities in formal rural areas lessened, leading to a more equal distribution of chronic illnesses and disabilities across socio-economic groups. This finding partially supports H1, as it shows significant changes in inequality patterns in formal rural areas, although the direction of change differs from the expectation of increasing inequalities.

In contrast, traditional authority areas saw increased disparities between 2008 and 2017, with the outcome predominantly observed among affluent children. This indicates that health inequalities in traditional authority areas grew over time, with wealthier children increasingly affected by chronic conditions and disabilities.

Formal urban areas experienced a shift from low-income populations in 2008 to high-income populations in 2017, resulting in increased disparities. In other words, by 2017, children from wealthier families in formal urban areas were more likely to experience chronic illnesses and disabilities, indicating a reversal in who was most affected.

In informal urban areas, the outcome concentration shifted from the high-income group in 2008 to the low-income group in 2017, reducing disparities, with the largest absolute value index observed in 2017. This suggests that in informal urban areas, chronic illnesses and disabilities became more common among lower-income children by 2017, thereby reducing the inequalities seen in 2008. These results provide support for H1, as they confirm that informal urban areas experience distinct shifts in inequality patterns.

The impact of various covariates on chronic illnesses and disabilities among children in different geographical regions reveals that the dependent variable's social factors differ in each area and have undergone significant transformation over time. In formal rural areas, the 2008 study found that male children, those on medical aid, and children with mothers who did not complete primary or secondary education were more likely to report chronic illnesses and disabilities. By 2017, however, children receiving child support grants, belonging to religious families, having mothers with higher education levels, and having married parents were less likely to report chronic illnesses and disabilities.

In traditional authority areas, the 2008 study indicated that children aged 6-10, male, from religious families, and with married parents were less likely to report chronic illnesses and disabilities. By 2017, children of African descent, with mothers who completed secondary education or higher education, and with married parents were less likely to report chronic illnesses and disabilities.

In formal urban areas, the 2008 study found that children who were Black, had mothers with incomplete or complete primary education and whose mothers completed secondary education were less likely to report chronic illnesses and disabilities. By 2017, children with mothers holding qualifications beyond high school were less likely to report chronic illnesses and disabilities.

Table 4.5: Changes in the concentration indices and social determinants of the health variables in 2008 and 2017: children from different geographical types

	Rural formal areas		**Traditional authority areas**		**Formal urban areas**		**Informal urban areas**	
	2008	2017	2008	2017	2008	2017	2008	2017
CI	0.313*** (0.099)	0.000 (0.099)	0.008 (0.041)	0.088 (0.066)	-0.035 (0.050)	0.136* (0.069)	0.225*** (0.085)	-0.452*** (0.140)
Ages 6-10	0.046 (0.087)	-0.072 (0.083)	-0.015 (0.023)	-0.0057 (0.029)	0.140*** (0.031)	0.131*** (0.044)	-0.114** (0.048)	0.201*** (0.076)

Ages 11-15	0.0061 (0.079)	-0.076 (0.079)	0.024 (0.025)	0.0810** (0.038)	0.079** (0.036)	0.105** (0.044)	0.084 (0.072)	-0.075 (0.073)
Male	-0.018 (0.068)	0.011 (0.058)	-0.009 (0.019)	0.032 (0.028)	0.062** (0.024)	0.109*** (0.038)	-0.033 (0.040)	0.079 (0.070)
African	0.136 (0.090)	0.123** (0.061)	0.068* (0.035)	-0.864 (0.577)	-0.116*** (0.029)	-0.166*** (0.053)	-0.085 (0.111)	0.105** (0.049)
Child grant recipient	0.129** (0.058)	-0.014 (0.087)	0.096*** (0.019)	0.021 (0.050)	0.122*** (0.028)	0.148*** (0.048)	-0.032 (0.049)	0.138 (0.097)
Medical aid coverage	-0.237*** (0.084)	0.246 (0.273)	0.267*** (0.100)	0.126 (0.090)	0.039 (0.033)	0.049 (0.067)	0.535** (0.243)	0.452** (0.181)
Religious	0.083* (0.050)	-0.343 (0.251)	-0.113*** (0.032)	0.007 (0.050)	0.013 (0.030)	0.046 (0.056)	0.040 (0.065)	0.365 (0.232)
Incomplete primary	-0.245*** (0.076)	0.090 (0.205)	0.155*** (0.048)	0.209* (0.110)	-0.058 (0.050)	-0.252** (0.106)	-0.112* (0.064)	-0.815*** (0.285)
Completed primary	0.185 (0.229)	0.145 (0.204)	0.119** (0.053)	0.204 (0.150)	-0.044 (0.050)	-0.259*** (0.077)	0.001 (0.108)	-0.823*** (0.304)
Incomplete secondary	-0.185*** (0.069)	0.292 (0.231)	0.012 (0.034)	0.037 (0.054)	0.018 (0.036)	-0.130** (0.063)	-0.067 (0.089)	-0.612** (0.289)
Completed secondary	-0.246** (0.109)	0.030 (0.207)	0.028 (0.038)	-0.046 (0.055)	-0.048 (0.039)	-0.070 (0.070)	-0.109 (0.089)	-0.711** (0.285)
More than secondary	-0.236** (0.112)	-0.235*** (0.064)	0.215** (0.108)	-0.062 (0.061)	0.202* (0.113)	-0.026 (0.140)	-0.288** (0.113)	-0.262 (0.352)
Married parents	0.112 (0.115)	0.145 (0.127)	-0.004 (0.024)	-0.116*** (0.033)	0.061** (0.030)	0.015 (0.046)	-0.063 (0.052)	-0.081 (0.050)

Constant	-0.122 (0.110)	0.191 (0.134)	0.047 (0.058)	0.943 (0.579)	0.097** (0.047)	0.057 (0.078)	0.218* (0.124)	0.311** (0.126)
R^2	0.0347	0.0289	0.0140	0.0113	0.0293	0.0240	0.0740	0.0757

*Note: Computed using Wave 1 (2008) and Wave 5 (2019) of the NIDS dataset; Standard errors are in parentheses. *** 1% level of significance; ** 5% level of significance; * 10% level of significance; Estimates are based on Equation (4.2).

In informal urban areas, the 2008 study showed that male children aged 6-10, African, recipients of child support grants, and with married parents were less likely to report chronic illnesses and disabilities. In 2017, the social factors changed significantly, and children aged 11-15, with mothers having incomplete or complete primary and secondary education, more than a matric qualification, and with married parents, had a lower probability of reporting chronic illnesses and disabilities. Overall, the findings indicate partial acceptance of H1, as certain regions such as informal urban areas align with the expected disparities in chronic illnesses, although the observed decrease in disparities in formal rural areas does not fully support the hypothesis.

It is crucial to note that the analysis establishes correlations and does not infer causality. An in-depth examination of each factor's contribution to the disparities in chronic illnesses and disabilities is provided in the subsequent section.

4.6.4. Results from Decomposing the Change in the Concentration Index

Table 4.6 presents a comprehensive overview of the evolution of socio-economic-related disparities in chronic illnesses and disabilities among children from various regions. It illustrates how changes in children's health outcomes over time can be attributed to shifts in the elasticities and inequalities of the social determinants used to forecast the disparities.

In formal rural areas, the observed characteristics accounted for a substantial 158.79% of the change in disparities in chronic illnesses and disabilities, while the residual factors made up the remaining 258.79%. Between 2008 and 2017, the largest contributor to reducing these disparities was the decline in inequalities among children with medical aid coverage, accounting for -128.44% of the reduction.

Table 4.6: The Oaxaca-type decomposition of the percentage changes in the determinants of poor health amongst children from the different geographical types between 2008 and 2017

	Rural formal areas		**Traditional authority areas**		**Formal urban areas**		**Informal urban areas**	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Ages 6-10	0.024	-07.67	-0.002	-02.50	0.022	12.87	0.027	-03.99
Ages 11-15	-0.026	08.31	0.026	32.50	0.034	19.88	0.012	-01.77
Male	-0.006	01.92	0.002	02.50	-0.001	-00.59	-0.013	01.92
African	-0.068	21.73	0.009	11.25	0.008	04.68	0.001	-00.15
Child grant recipient	0.151	-48.24	-0.014	-17.50	-0.058	-33.92	-0.037	05.46
Medical aid coverage	0.402	-128.44	0.014	17.50	0.025	14.62	0.111	-16.40
Religious	-0.342	109.27	0.005	06.25	0.004	02.34	0.045	-06.65
Incomplete primary	-0.148	47.28	-0.059	-73.75	0.045	26.32	0.127	-18.76
Completed primary	-0.077	24.60	-0.024	-30.00	0.044	25.73	0.057	-08.42
Incomplete secondary	0.260	-83.07	-0.019	-23.75	0.157	91.81	-0.010	01.48
Completed secondary	0.115	-36.74	-0.099	-123.75	-0.056	-32.75	-0.264	39.00
More than secondary	-0.003	00.96	-0.034	-42.50	0.001	00.59	0.008	-01.18
Married parents	0.215	-68.69	-0.096	-120.00	-0.063	-36.84	-0.010	01.48
Totals	**0.497**	**-158.79**	-0.291	**-363.75**	**0.162**	**94.77**	**0.054**	**-07.98**
Residuals	**-0.810**	**258.79**	0.371	**463.75**	**0.009**	**05.23**	**-0.731**	**107.98**
Differences $(\mathbf{CI_t - CI_{t-1}})$	**-0.313**	**100.00**	**0.080**	**100.00**	**0.171**	**100.00**	**-0.677**	**100.00**

* Note: Estimates are based on Equations (4.4) and (4.5). The totals are obtained from Tables 4.10 (formal rural areas), 4.11 (traditional authority areas), 4.12 (formal urban areas), and 4.13 (informal urban areas) in Appendix A.

This suggests that increased access to medical aid may have helped level the playing field in terms of health outcomes for children in formal rural areas. It aligns with H2, as medical aid coverage emerges as a key determinant in reducing health inequalities.

Other factors that played a significant role in reducing inequalities in this region included disparities among children with chronic illnesses and disabilities whose mothers did not complete secondary education (-83.07%), those with married parents (-68.69%), and those receiving the child support grant (-48.28%). These reductions imply that maternal education, family structure, and social support (e.g., child grants) were also key in narrowing health gaps among children in formal rural areas. They support H2, confirming that maternal education, family structure, and social support are essential determinants of health outcomes.

In traditional authority areas, the observed characteristics accounted for -363.75% of the variance in chronic illnesses and disabilities, while residual factors comprised the remaining 463.75%. This region's main driver of socio-economic inequalities was the increased disparities among children aged 11-15, accounting for 32.50% of the inequality between 2008 and 2017. This suggests that as children aged, health disparities became more pronounced in traditional authority areas, possibly due to growing socio-economic divides as children entered adolescence.

Other factors contributing to the observed inequalities in this region included disparities in medical aid coverage (17.50%), African ethnicity (11.25%), and religious affiliation (6.25%). These findings indicate that access to medical aid, ethnicity, and religious background all played a role in shaping health outcomes in traditional authority areas, potentially creating or reinforcing health inequalities. They further support H2 by highlighting age and medical aid as influential factors in this region, contributing to the observed disparities in child health outcomes.

In formal urban areas, the observed characteristics accounted for 94.77% of the changes in chronic illnesses and disabilities, while residual factors accounted for the remaining 5.23%. The critical factor driving the increase in overall socio-economic inequalities between 2008 and 2017 was the disparities between mothers of children with chronic illnesses and disabilities who had incomplete secondary education, accounting for 91.81% of the increase. This significant influence indicates that lower maternal education levels were closely associated with increased health inequalities in formal urban settings.

Other variables contributing to rising inequalities in this region included disparities between mothers with incomplete (26.32%) or complete (25.73%) primary education, as well as those between children aged 11-15 (19.88%). These results suggest that maternal education and children's age were significant factors in widening health disparities, likely because mothers' education influenced access to healthcare and health knowledge. The role of maternal education in widening health disparities among children in formal urban areas strongly aligns with H2, which identifies maternal education as a key determinant of health inequalities.

In informal urban areas, only 7.98% of the variations in chronic illnesses and disabilities among children were due to the observed traits, while the remaining 107.98% could be attributed to unobserved traits. The most significant factor in reducing socio-economic-related inequalities in this region was disparities between mothers with incomplete primary education, accounting for a decline of 18.86%. This suggests that as maternal education improved in informal urban areas, health inequalities among children were reduced.

Other notable contributors included decreasing inequalities among children with medical aid coverage (16.40% reduction), those with mothers who completed primary education (8.42% reduction), and children aged 6-11 with these conditions (3.99% reduction). These results imply that factors such as medical aid access, maternal education, and younger age were instrumental in narrowing health disparities in informal urban settings. They support H2, demonstrating that access to social determinants such as medical aid and maternal education plays a significant role in reducing socio-economic-related health disparities in informal urban areas.

4.7. Discussion

This research uncovered the variations in chronic disease and disability disparities among South Africa's diverse geographical regions and the social determinants contributing to these disparities. Over the past decade, health has been increasingly acknowledged as an intrinsic right, particularly for children with diabetes.

Through the nation's constitution and Bill of Rights, South Africa has crafted a comprehensive legislative framework championing the freedom and equality of citizens with chronic illnesses and disabilities. For instance, this framework steers the provision of complementary healthcare to people with disabilities, enhances the accessibility of all health-related services, and champions a rights-based approach to disability management, moving away from a purely medical standpoint (ACPF, 2011). Such progressive shifts in public sentiment and policy have propelled the mobilisation of resources and expertise to address health disparities. The synergy between governmental interventions, research endeavours, and community engagement has paved the way for a more equitable healthcare landscape for children across different socio-economic strata. However, it is noteworthy that certain government bodies have exhibited greater efficacy in their initiatives than others.

Socio-economic disparities related to chronic diseases and disabilities among children have decreased in both rural and informal urban settings. This can be linked to several initiatives and pilot projects by local and provincial governments and non-governmental organisations (Masuku & Jili, 2019). For instance, the Rural Health Outreach Programme has played a role in decreasing disparities in chronic diseases and disabilities among children in rural areas (Clarke & Aldous, 2014). Another initiative, the Western Cape Child Health Services Programme, emphasises early detection and treatment of chronic diseases and disabilities in children residing in informal settlements (Western Cape Government, 2017).

Conversely, the prevalence of chronic diseases and disabilities among children has risen in both traditional authority areas and formal urban regions. In the former, inadequate access to healthcare and traditional governance contribute to increased socio-economic inequalities in children's chronic diseases (King, 2005). In the latter, it might result from ongoing urbanisation pressures, which overburden local government institutions in delivering sufficient services to the expanding urban populace (Tomlinson, 2017).

4.8. Conclusion

This chapter examined the evolution of socio-economic-related disparities in chronic illnesses and disabilities among children residing in different geographical regions (formal rural areas, traditional authority areas, formal urban areas, and informal urban areas) in South Africa using Waves 1 and 5 of the NIDS datasets. It employed a combination of concentration curves, a regression-based concentration index, and the decomposition of the concentration index technique to analyse changes in the underlying social factors contributing to these disparities. The results showed that disparities in chronic illnesses and disabilities and the social determinants driving these disparities vary across different geographical regions.

Reduced socio-economic disparities in chronic illnesses and disabilities among children in both formal rural and informal urban areas in South Africa can be attributed to various initiatives and pilot programmes implemented by local and provincial governments and non-profit organisations (Kumar et al., 2018). One such example is the Rural Health Outreach Programme, successfully implemented in formal rural areas, reducing disparities in chronic illnesses and disabilities among children in these regions (Mkhize et al., 2019). Another is the Western Cape Child Health Services Programme, which provides health services to children in informal settlements, focusing on early diagnosis and treatment of chronic illnesses such as asthma and malnutrition and disabilities such as developmental delays and speech and language disorders (Western Cape Government, 2017).

The results of this study indicate that regional local governments should consider each region's specific needs when developing future initiatives to further reduce these inequalities. This should include initiatives geared at increasing access to healthcare services, improving the quality of care, and providing social support for married parents of children affected by these conditions in formal rural areas. In informal urban areas, local governments should aim to not only improve access to healthcare, but also provide educational opportunities for mothers with children affected by chronic illnesses and disabilities, particularly for children aged 6-11.

In contrast, the incidence of chronic illnesses and disabilities among children has increased in both traditional authority and formal urban areas. In traditional authority areas, access to healthcare is limited since indigenous communities govern these territories. As a result, socio-economic inequalities in chronic illnesses among children in this region have worsened over time (Dorrington et al., 2017). Ongoing urbanisation in formal urban areas has likely put a strain on local government institutions to provide adequate services to the growing urban population (Williams et al., 2019).

To mitigate these inequalities, local governments should implement region-specific programmes. For example, policymakers in traditional authority areas could implement public policies that prioritise improved access to medical care and the quality of care for children aged 11-15 with chronic illnesses and disabilities from religious families. In formal urban areas, policymakers should focus on improving maternal education and, more critically, increasing access to public hospitals and clinics, particularly for children aged 11-15 with chronic illnesses and disabilities.

To expand on this research, subsequent studies could investigate specific chronic conditions affecting children to present a more precise portrayal of health disparities across South Africa's distinct geographic regions. Moreover, additional inquiry is required to comprehend the influence of unmeasured factors, such as variations in environmental conditions and the quality of health infrastructure, which were not accounted for in the analysis due to constraints in the NIDS dataset.

Addressing these research gaps could guide the formulation of focused national and regional health policies to further reduce health disparities among South African children. By recognising the unique characteristics of each geographic area and shifting from a universal approach, policymakers can identify customised interventions that cater to the particular requirements of diverse regions in South Africa, ultimately improving the welfare of children suffering from chronic diseases and disabilities.

In conclusion, this study suggests that interventions should be specific to an area to reduce socio-economic disparities in the incidence of serious illnesses or disabilities among children in South Africa. By understanding the different issues children encounter in each regional type, policymakers can design and implement public health policies that cater to the specific needs of these geographical regions. Ultimately, these focused efforts could create a more equitable and healthier future for South Africa's future generation.

Therefore, policymakers and public health practitioners should address the growing inequalities in formal urban and traditional authority areas while improving health equity in formal rural and informal urban areas. To achieve this, they should target social determinants of health such as education, medical aid coverage, and ethnicity, ensuring that children from all socio-economic backgrounds have equal access to quality healthcare services and the opportunity to have a healthy life.

4.9. Chapter Summary

This chapter adopted a more granular approach to evaluate changes in socio-economic-related inequalities in chronic illnesses and disabilities, as well as the determinants influencing these inequalities among children from traditional authority areas, formal rural areas, formal urban areas, and informal urban areas (the same regional types used in Chapter 3). Utilising the panel aspect of the NIDS, the concentration indices were calculated and the Oaxaca-Blinder Decomposition was implemented to analyse changes in the concentration index between 2008 and 2017.

The findings suggested that there were significant socio-economic disparities among children with disabilities and chronic illnesses residing in areas that fall under traditional authorities, formal rural and urban, and informal urban areas. They also reveal substantial shifts in the distribution of disparities across these regions, with formal rural areas having experienced decreased inequality. At the same time, the levels of those ruled by traditional authorities increased. Formal urban areas recorded a shift favouring wealthier groups, while there was a shift towards economically disadvantaged populations in informal urban areas. Moreover, the decomposition analysis demonstrated that the social factors driving these disparities transformed over time, exerting unique effects in every region.

This highlights the importance of implementing area-specific policy strategies to address the ever-evolving and distinct challenges that each regional type encounters. Designing interventions that cater to the specific requirements of communities in areas that fall under traditional authorities, formal rural and urban, and informal urban areas can contribute to reduced health inequalities and ultimately improve the quality of life of children affected by chronic illnesses and disabilities throughout the country.

Building on the foundation laid by this chapter, the following chapter shifts its focus to adult health. It examines changes in socio-economic-related inequalities in diabetes, a condition which has become the leading cause of death among adults, and how its determinants have changed over time for adults from traditional authority areas, formal rural areas, formal urban areas, and informal urban areas.

Chapter 5: Socio-Economic-Related Inequalities in the Prevalence of Diabetes in South Africa: Regional Disparities

This chapter focuses on socio-economic inequalities in diabetes among adults in areas with varying levels of deprivation. It aims to uncover the underlying socio-economic factors contributing to persistent diabetes among adults.

The remainder of this chapter is structured as follows: Section 5.1 briefly introduces the investigation. Section 5.2 provides the literature review, while Section 5.3 discusses the chapter's contribution to the literature, and Section 5.4 offers the theoretical framework underpinning the investigation. Section 5.5 outlines the methodology. Section 5.6 presents the results, followed by a discussion and conclusion of the chapter, respectively, in Sections 5.7 and 5.8. Finally, Section 5.9 is the summary of the chapter.

5.1. Introduction

Globally, diabetes is a mounting health crisis, with 537 million adults affected in 2021 (6.88% of the global population). According to the International Diabetes Federation, this number will rise to 783 million (8.07% of the global population) by 2045 (Tönnies et al., 2021).

In South Africa, the prevalence of diabetes has climbed at an alarming rate, in line with global patterns. As at 2021, the country documented more than four million adults with diabetes, making up 7.18% of the population. The prevalence of this chronic illness is expected to worsen; by 2045, it is predicted that more than 7.5 million South Africans, representing roughly 10.66% of the population, will have diabetes (Pheiffer et al., 2021). The upsurge highlights not only the magnitude of this health crisis but also aligns with a 2021 report issued by Statistics South Africa, naming diabetes as one of the top three leading causes of death in the country (Statistics South Africa, 2021).

Wide-ranging social determinants have shaped the prevalence of diabetes in South Africa. For example, adopting the Western culture introduced fast food and sedentary living that often accompany urbanisation and economic advancement, fundamentally changing dietary habits and activity levels (Popkin et al., 2012). These changes ushered in meals that were higher in calories but lacked nutrients, with fewer opportunities for exercise, heightening vulnerability to diabetes (Hu, 2011). Studies in South Africa have shown a significant rise in these unhealthy food options, especially in urban areas where fast food outlets are more accessible (Ramkisson et al., 2016; Nkosi et al., 2020). This shift from traditional, nutrient-rich diets to energy-dense, processed foods directly correlates with the growing incidence of obesity, a major risk factor for Type 2 diabetes (South African Medical Research Council, 2022).

However, the influence of these lifestyle changes on diabetes prevalence is not uniform across the population. The burden of these changes disproportionately affects individuals on the lower end of the socio-economic ladder, who often have limited access to healthier food options and opportunities for physical activity (Drewnowski & Specter, 2004). This inequity in health determinants exacerbates the challenge of diabetes management in South Africa, particularly among disadvantaged populations.

The challenge of addressing diabetes in South Africa is compounded by inconsistencies in regional healthcare systems that support disease care, with much of this variation hinging on an individual or region's socio-economic standing (Chitewere et al., 2017). Individuals in more affluent regions or of higher SES are often better equipped to address the critical demands of living with diabetes. Those less fortunate, especially in impoverished regions, have inadequate resources and support. Thus, managing diabetes in South Africa is not only a matter of individual SES, but is also significantly influenced by the socio-economic conditions of the region, underscoring the need for comprehensive and equitable healthcare solutions across all socio-economic and regional divides. Hence, there is a need to analyse and compare results in areas with different levels of deprivation.

5.2. Literature Review

To deepen understanding of the socio-economic factors influencing diabetes prevalence among South African adults, the study first reviews international research on the impact of SES on health outcomes in adults, specifically emphasising the differences between rural and urban areas or between various provinces. Global studies that employed a variety of methodologies such as cross-country comparisons and detailed national analyses offer valuable insights into how socio-economic factors create disparities in health outcomes among adults. This perspective promotes an understanding of how global socio-economic factors may manifest as regional disparities within South Africa. By analysing how other countries have addressed or failed to address these disparities, the unique challenges and opportunities in the South African context can be better identified, allowing for a more targeted and effective approach to addressing the regional nuances of diabetes prevalence.

The focus is on studies that have decomposed these outcomes in rural versus urban settings, highlighting the distinct factors driving these disparities. Given the limited number of studies offering such comprehensive analyses, the review also includes those tracking trends in health outcomes among adults, categorising the findings by rural and urban environments whenever possible. This thorough exploration of the international literature establishes a robust foundation for the more focused examination of the situation within South Africa.

Cai et al. (2017) investigated the causes of health inequality in urban and rural China from 1991 to 2006. This analysis drew on data from six waves of the China Health and Nutrition Survey, spanning 1991 to 2006. The focus was on the health status of adults using SRH scores, and the study explored how these scores were influenced by various factors such as income, education, lifestyle, home environment, and health insurance. It utilised the recent influence function regression decomposition method to better understand these relationships. The regression allowed for a comprehensive decomposition of the weighted covariance between health outcomes and socio-economic rank.

The findings revealed a noticeable decline in average health status from 1991 to 2006 among both urban and rural populations. Interestingly, and in contrast to the findings of many studies conducted in South Africa and other developing countries, which are discussed below, rural populations in China exhibited better average health scores than their urban counterparts. The decomposition results indicated that higher income and secondary education significantly reduced health inequalities in both settings throughout the study period. Conversely, factors such as advancing age, unhealthy lifestyles, and inadequate home environments were linked to an increase in health inequalities. A notable difference was observed in the effect of health insurance on health inequality. It was found to decrease inequality in urban areas, but it unexpectedly increased it in rural areas.

Cai et al. (2017) point to significant differences between urban and rural populations in China, highlighting the need to explore regional disparities within South Africa. Although this chapter and this study utilise different measures, the principles and results of Cai et al.'s research enhanced the current data analysis and interpretation. This approach provides a wider perspective on how socio-economic factors may influence health outcomes differently across various settings.

McElroy and Walsh's (2023) comparative study investigated the prevalence of depressive symptoms and socio-economic inequalities across nine high-income European countries, particularly emphasising the impact of housing quality. Utilising data from the European Social

Survey, the research explored these dynamics within the same set of countries. The study primarily focused on key variables such as depressive symptoms, housing quality, and SES indicators, including income, education, and financial strain, alongside demographic factors. Like Cai et al.'s study, the recent influence function method was used to analyse the risk factors associated with depressive symptoms, focusing on housing quality and employment status.

The study's findings suggested that inequalities in depressive symptoms predominantly affect the poorer segments of the population in each of the surveyed countries. Austria and Belgium demonstrated the lowest levels of these inequalities, while France exhibited the highest. The research indicated that housing problems are linked to higher inequalities in depressive symptoms in six of the nine countries studied. In a significant departure from traditional socio-economic indicators such as education and income, which showed no direct association, financial strain measured by income levels was identified as a crucial factor affecting these inequalities.

In their recent study, Mweemba et al. (2023) explore inequalities in SRH among adults with hypertension in Zambia. Specifically, they investigate the health disparities between rural and urban areas and the factors contributing to these differences. This study also assessed the impact of HIV on these health differences, given the interplay between HIV, hypertension, and health in SSA. It utilised data from the Zambia Household Health Expenditure and Utilization Survey, a nationally representative survey conducted in 2015. The primary variable of interest was the respondents' hypertension status, with other key variables including demographic characteristics (age, sex, marital status, region, educational attainment), per capita household expenditure, and district HIV prevalence. The research applied a linear probability model to assess associations between SRH and the independent variables. It was followed by a Blinder-Oaxaca decomposition analysis to identify health inequalities between urban and rural hypertensive patients and determine the health gap's determinants. This approach parallels this study, which decomposes the factors contributing to socio-economic-related health inequalities within rural and urban areas.

In contrast to Cai et al.'s (2017) observations in China, Mweemba et al.'s findings revealed that urban patients reported better SRH than their rural counterparts. Education emerged as a significant determinant in the decomposition analysis. Higher educational levels were positively correlated with better health, especially in rural areas, thus highlighting the critical role of education in reducing health disparities. Socio-economic status, reflected in household expenditure, was another key factor. Higher expenditure was linked to improved health amongst hypertension patients, emphasising the impact of economic well-being on health outcomes. Consistent with the findings of Cai et al. (2017), the study also identified age as an important variable, with advanced age associated with poorer health ratings amongst hypertensive patients, thereby contributing to the observed health disparities.

Although the conclusions of international studies like those by Cai et al. (2017), McElroy and Walsh (2023), and Mweemba et al. (2023) cannot be directly applied to urban and rural populations in South Africa, they offer valuable insights. One notable limitation of these studies is their focus on static conditions; thus, they do not address how socio-economic inequalities and the factors driving these disparities evolve over multiple periods, as discussed in Chapter 3. A longitudinal approach, which examines health inequalities over time, can provide a more comprehensive understanding.

Internationally, a limited number of studies have decomposed changes in socio-economic-related inequalities in health outcomes, including the pioneering study by Wagstaff et al. (2003), as well as those by Musheiguza et al. (2021), Nawa et al. (2019), Adeyanju et al. (2017), and the sole South African study by Omotoso and Koch (2018) in the context of adult health. The first two studies, focusing specifically on children's health, were discussed in Chapter 3, and the last two are discussed below.

Adeyanju et al.'s (2017) study does not focus solely on adults, but addresses children's and mothers' health in Nigeria, a country with health and colonial profiles similar to South Africa's. This enabled the researcher to draw meaningful conclusions relevant to the analysis in this chapter. The study analysed socio-economic inequalities in access to maternal and child healthcare in Nigeria over 18 years from 1990 to 2008, utilising data from the Nigerian Demographic and Health Survey. It specifically examined key maternal and child healthcare variables such as antenatal care, skilled birth attendance, vaccination, and treatment for diarrhoea and fever/cough. Like the methods employed in this chapter, the study utilised concentration curves and indices to measure these inequalities across SES. Decomposition analysis explored the factors contributing to these inequalities over time.

The findings revealed that in 1990, the most pronounced inequalities were in maternal access to skilled assistance during delivery. While inequalities in childcare services decreased between 1990 and 2008, the disparities in maternal care increased. In both child and maternal healthcare, these inequalities were concentrated among people with low incomes throughout the study period, underscoring significant socio-economic barriers that affect access to essential health services in Nigeria. The study identified the main factors contributing to these inequalities as socio-economic elements like household wealth, the educational levels of women and their partners, and exposure to media.

In alignment with this chapter's objectives, Omotoso and Koch (2018) sought to comprehend the impact of changes in the social determinants of health inequalities in South Africa over the past decade, focussing on the post-apartheid era. The data was sourced from the 2004, 2010, and 2014 South African General Household Surveys. The study employed ill-health status and disability as health measures and income, education, social grant status, and employment status as the socio-economic measures. Concentration indices and the Oaxaca-Blinder decomposition method were used to measure and analyse socio-economic health inequalities and their primary social determinants over the study period, aligning with the methods employed by Adeyanju et al. (2017) and those used in this study. These techniques were applied for the respective periods under analysis.

The study revealed evolving inequalities in ill-health status from 2004 to 2014. Health disparities increased from 2004 to 2010, particularly affecting the poorer segments of the population. Interestingly, a shift occurred between 2010 and 2014, when these inequalities became more prevalent among wealthier individuals, suggesting decreased health disparities among the poorer groups. The key factors driving this transition included socio-economic elements, particularly employment status and differences across provinces. The reduction in health inequalities during the 2010 to 2014 period can be largely attributed to enhanced employment opportunities and a decrease in regional disparities.

Similar patterns were observed in the context of disability. Disability inequalities were more concentrated among the poor in both 2004 and 2010, but this trend reversed from 2010 to 2014, with a higher concentration of disability reported among wealthier individuals. The decrease among the poor was largely due to reduced socio-economic disparities across racial groups, improvements in educational attainment, and diminishing provincial differences. In the context of this study, these factors collectively point to overall improvement in the socio-economic conditions of historically disadvantaged groups, leading to a more equitable health landscape in terms of disability.

5.3. Contributions of the Chapter to the Literature

A critical limitation of Omotoso and Koch's (2018) study is its lack of detailed focus on specific geographic locations within South Africa. This is particularly significant given the country's varied socio-economic and health scenarios across different regions. South Africa's regions differ markedly in terms of economic development, healthcare accessibility, educational opportunities, and other health-related social determinants. The pronounced disparity between rural and urban areas in terms of school and healthcare infrastructure plays a crucial role in health outcomes, highlighting a significant divide in access to essential services. By not delving into these regional variances, the study may not fully capture how local factors influence health disparities. This is especially pertinent considering that some South African regions may demonstrate distinct health inequality patterns due to historical socio-economic disadvantages.

Moreover, the study's use of cross-sectional data from the General Household Surveys of 2004, 2010, and 2014 introduces a limitation in its methodology. This approach provides snapshots of health inequalities at specific intervals, but falls short of capturing these disparities' longitudinal or life-course dimensions. Consequently, the study may not adequately portray the evolving nature of health inequalities where factors like variations in employment, migration trends, or policy changes over time are crucial. Understanding these dynamic elements is essential for a comprehensive analysis of health disparities, and their absence in the study's design could mean missing out on significant insights into how health inequalities develop and change over an individual's life or across different generations.

This chapter enhances the literature by utilising the panel dimension of the NIDS, which tracks the same individuals from Waves 1 to 5 of the NIDS dataset to capture the evolution of health inequalities over time. Furthermore, it provides a novel perspective by examining the evolution of socio-economic-related inequalities in diabetes prevalence among South African adults while linking these changes to the regional types of the individuals' living environments. This systematic approach highlights the influence of region-specific social determinants on health disparities.

Departing from the approach of earlier studies like Cai et al. (2017) and Mweemba et al. (2023), which predominantly utilised a basic urban-rural dichotomy, this research takes a more nuanced and detailed route. It categorises formal rural, traditional authority, formal urban, and informal urban areas. This refined analysis comprehensively examines the diverse conditions impacting these distinct regions' governance, infrastructure, resource access, and socio-economic factors.

It allows for a finer-grained analysis of changes in socio-economic-related inequalities and their prevalence, thus illuminating the disparities within both rural and urban areas in South Africa.

Regions under traditional authorities, which are governed by traditional leadership structures, pose unique challenges and exhibit distinct characteristics. Historically, these regions have been vital in preserving cultural traditions, but have experienced profound socio-economic neglect. The scarcity of modern healthcare infrastructure in these areas propels many residents towards traditional healing methods. Although local traditions tend to limit the intake of processed foods, certain area-specific dietary practices have been linked to an elevated risk of diabetes (Ivanovich, 2015). While physical activity may be inherently integrated into some traditional lifestyles, a notable gap exists in awareness of modern preventive measures against diabetes.

Despite backing from local government, formal rural areas continue to confront healthcare, education, and economic hurdles (Daniels et al., 2013). The limited variety of food available often results in reliance on staple foods rich in carbohydrates (Temple et al., 2011), directly increasing the risk of diabetes (Rivellese et al., 2012). While an agricultural-centric lifestyle might inherently include physical activity, a lack of awareness and pre-emptive healthcare exacerbates the diabetes threat for these communities.

Although formal urban areas benefit from more advanced infrastructure, facilitating access to public and private services and thus improving the overall quality of life, these advantages come with drawbacks. While accessibility facilitates a diverse diet, it is a double-edged sword as processed, high-sugar, and high-fat foods increase the risk of developing diabetes (Tydeman-Edwards et al., 2018). The urban lifestyle, with its work practices and increased dependence on motorised transport, often inclines towards sedentariness, further reducing engagement in routine physical activity (Micklesfield et al., 2017).

Informal urban areas marked by informal settlements pose a distinct set of challenges. Despite their proximity to urban facilities, restricted access to basic services results in pronounced health inequalities. The combined effects of overcrowding, dependence on fast, processed foods driven by financial limitations, and limited space for physical activity increase these communities' predisposition to diabetes (Zerbo et al., 2020).

This study utilised these classifications, transcending traditional country-level, urban, rural, or provincial categories to examine socio-economic-related inequalities in diabetes prevalence in

South Africa's regions. Recognising the unique regional variations, the research centred around integrated objectives. Firstly, it aimed to investigate the temporal trends and variations in socio-economic-driven disparities in diabetes prevalence among adults in various regional contexts, including traditional authority areas, formal rural areas, formal urban areas, and informal urban areas. This was achieved using advanced analytical tools such as concentration curves and indices. Secondly, the study sought to analyse the impact of variations in Social Determinants of Health on these disparities, focusing on adults in different geographical contexts. This aspect of the research utilised the Decomposition of the Change in the Concentration Index, providing detailed insight into how these determinants influence diabetes prevalence in these varied settings.

5.4. Theoretical Foundation

The theoretical framework for this research is grounded in two current theories relating to health and its determinants, namely, the Social Determinants of Health Theory and the Health Belief Model. They provide a firm foundation to understand the complex socio-economic disparities impacting diabetes prevalence in South Africa.

The Social Determinants of Health Theory underscores the critical influence of socio-economic factors, education, employment and physical surroundings on health outcomes (Berkowitz & Orr, 2023). Income, in particular, plays a dominant role, serving as both an enabler and a barrier (Nyoka, 2019). In South Africa, the implications of income disparities are deeply felt. Those in lower income brackets, especially in areas that fall under traditional authorities and informal urban regions, bear the brunt of these disparities, facing challenges magnified by limited resources and barriers to necessities such as healthcare and quality education (Daniels et al., 2013).

However, assuming that affluence automatically guards against health issues would be an oversimplification. Formal urban areas also grapple with unique health challenges despite their economic advantages. Factors such as sedentary lifestyles, smoking and concerns related to Body Mass Index (BMI) can have significant health repercussions, regardless of wealth (Zerbo et al., 2020).

A more in-depth examination of the determinants of health outcomes highlights the connection between education and health. Areas with notable educational deficits, predominantly traditional authority and certain rural areas, often lack access to quality healthcare services and vital health information (Balfour et al., 2012). Nonetheless, it is important to recognise the myriad of other factors, both obvious and subtle, that can influence diabetes prevalence across diverse regions. It is thus imperative to examine individuals' perceptions and beliefs regarding health.

The Health Belief Model offers a framework to understand individual health behaviours by examining perceptions of health and their influence on health-related decisions. Developed by Hochbaum, Rosenstock, and Kegels (Champion & Skinner, 2008), the model enables deeper exploration of individual perceptions of:

(a) Susceptibility to a disease

(b) The disease's severity

(c) The benefits of taking preventive action

(d) The barriers impeding such action

In the diverse landscape of South African society, where socio-economic disparities are pronounced, these perceptions are coloured by more than just income. For instance, while some individuals in urban settings might have the economic means to seek quality healthcare, their beliefs about health may be influenced by their immediate social circle, past experiences with the healthcare system, and prevalent urban lifestyle norms (Heaton & Kalule-Sabiti, 2007). They might be aware of their susceptibility to diabetes, but cultural or social pressure might deter them from seeking early intervention.

Conversely, a person in a rural setting such as an area under a traditional authority, while possibly having limited resources, could have strong communal ties and shared beliefs that shape his/her perceptions of health (Ivanovich, 2015). Traditional beliefs can provide an alternative lens through which diseases are understood and managed. While modern medicine may be less accessible in such settings, traditional remedies and communal support might offer a sense of protection and agency (King, 2005). However, this could also mean that certain preventive measures might be overlooked or under-utilised from a modern medical standpoint.

Delving deeper into the intricacies of diabetes prevalence in South Africa, it becomes evident that comprehensive understanding requires the integration of insights from the Social Determinants of Health with the individual perspectives offered by the Health Belief Model. While the Social Determinants of Health presents a panorama of environmental and socio-economic factors, the Health Belief Model sheds light on the personal beliefs and perceptions that influence health decisions. Together, these theories provide a multi-faceted lens through which to explore the myriad factors influencing diabetes outcomes in South Africa's diverse landscape.

Figure 5.1 illustrates a conceptual model that merges the previously discussed theories—the Social Determinants of Health and the Health Belief Model—and their combined effects on health outcomes. The central element of the model is "Health outcomes", marked in red to emphasise its significance as the endpoint of various influencing factors. From this focal point, the model extends into two primary paths. The first addresses the Social Determinants of Health, with factors such as "Socio-economic Factors", "Education", "Employment", and "Physical Surroundings" each contained within its bubble and directly influencing health outcomes. These determinants highlight the impact of external social and economic conditions on health status.

The second path pertains to the Health Belief Model, which considers how individual perceptions shape health behaviours. Four key perceptions are involved: perception of susceptibility to disease, perception of disease severity, perception of prevention benefits, and perception of barriers to prevention. Each element is connected and interacts with health outcomes, demonstrating how personal beliefs and attitudes towards health risks and preventive measures can profoundly influence decisions and results.

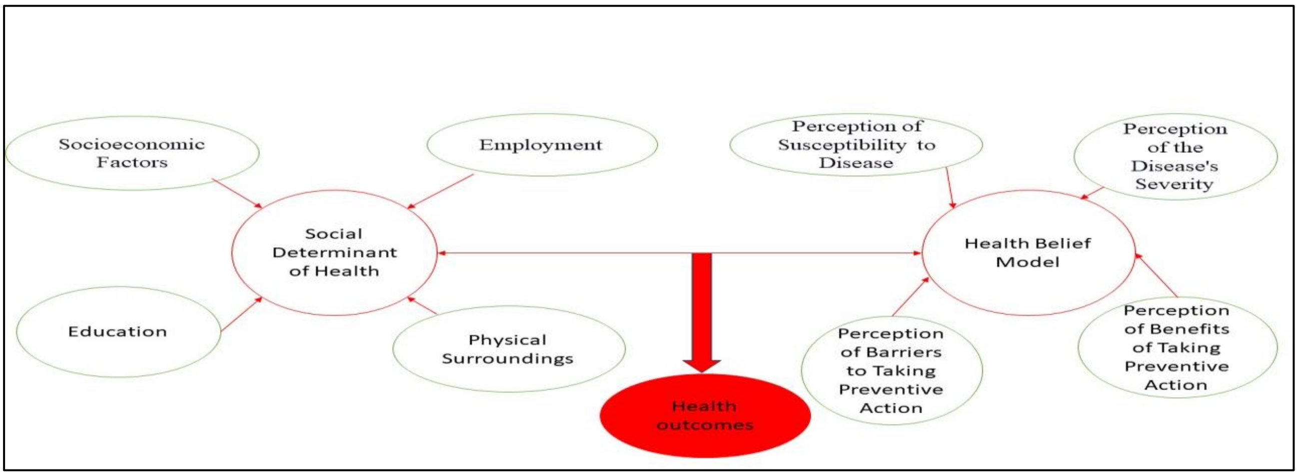
The convergence of these two paths at the point of health outcomes underlines the intricate relationship between societal influences and individual beliefs in determining health. The model suggests that thorough understanding, and improvement of health outcomes require consideration of both the broader social milieu and individual health beliefs.

Based on the conceptual framework illustrated in Figure 5.1, this study aimed to test the following hypotheses:

The first (H1) was that urban settings (both formal and informal urban areas) are likely to exhibit the most pronounced socio-economic disparities in diabetes prevalence among adults over time, informed by the distinct socio-economic dynamics unique to these areas that can amplify health disparities.

The second hypothesis (H2) was that variations in the Social Determinants of Health, particularly factors such as a lack of exercise and a BMI indicative of obesity, significantly influence disparities in diabetes prevalence across different geographical contexts, with the emphasis on those Social Determinants of Health that have been identified as impacting diabetes in various research papers.

Figure 5.1: Conceptual Framework of Socio-Economic Influences on Adults' Health Outcomes



Note: This figure is the author's work.

In summary, the theoretical foundation of this research, anchored in the Social Determinants of Health theory and the Health Belief Model, provides a robust framework to understand the multi-faceted nature of diabetes prevalence in South Africa. These theories illuminate the complex interplay between environmental, socio-economic, and personal belief factors that shape health outcomes. With the theoretical underpinnings clearly outlined and the hypotheses – focusing on urban-rural socio-economic disparities and the influence of various Social Determinants of Health on diabetes prevalence – firmly established, the following section discusses the data and methodologies employed. It details the approaches and analytical tools used to rigorously test these hypotheses, offering deeper insight into the intricate dynamics of diabetes prevalence across South Africa's diverse landscape.

5.5. Methodology

5.5.1 Data

The study utilised the panel component of the NIDS datasets for quantitative analysis to explore the progression of socio-economic-related inequalities in diabetes prevalence among adults and examine the underlying social factors affecting these inequalities across various geographical regions in South Africa.

The NIDS dataset originated from the South African Labour and Development Research Unit at the University of Cape Town and represents a pioneering initiative in South African research.

Initiated in 2008, it is considered South Africa's first panel data, with information collected in successive waves over time (Brophy et al., 2018). This dataset meticulously examines dynamic changes in the livelihoods of individuals and households, providing insights into the evolution of living conditions and well-being over time.

Table 5.1: Description of variables used in the study

Variable	Description	Categories/Values
Diabetes	Indicates whether or not the individual suffers from diabetes	1: Presence, 0: Absence
Age	The age group of the respondent	18-39: Young adults, 40-59: Middle-aged adults, 60+: Senior adults
Gender	Gender of the respondent	Male, Female
Household income per capita (Monthly)	Monthly household income divided by the number of family members	<R10,000, R10,001-R17,500, >R17,500
Geographical type	Area types based on the 2001 census NIDS indicators	Rural formal, Traditional authority, Urban formal, Urban informal
Employment status	Current employment status of the respondent	Employed, Unemployed
Education level	The highest level of education achieved	No schooling, Incomplete primary, Completed primary, Incomplete secondary, Completed secondary, More than secondary.
Exercise habits	Frequency of respondent's exercise	Never, Occasionally (ranges from rarely to regularly)
Marital status	Current marital status of the respondent	Married, Living with partner, Widow, Divorced, Never Married
Race	Racial identification of the respondent	African, Non-Black (other racial categories combined)
BMI status	BMI categorisation of the respondent	Underweight, Normal, Overweight, Obese
Healthcare utilisation	Whether or not the respondent has utilised healthcare services	Utilised healthcare services, Never utilised healthcare services

Given its comprehensive nature, the NIDS dataset is particularly well-suited for quantitative analysis of socio-economic disparities related to diabetes prevalence across different South African regions. Rich in detail, it includes information on demographic factors, income, and educational attainment and specifies whether individuals have diabetes. Waves 1 (2008) and 5 (2017) data were utilised for this study to fulfil the research objectives. Table 5.1 above presents the variables used alongside their descriptions.

The following section outlines the approach adopted to investigate variations in diabetes prevalence related to socio-economic disparities across South African regions.

5.5.2. Empirical Methods of Estimation

The study's methodologies were underpinned by two primary hypotheses: The first (H1) was that urban settings (both formal and informal urban areas) are likely to exhibit the most pronounced socio-economic disparities in diabetes prevalence among adults over time, informed by the distinct socio-economic dynamics unique to these areas that can amplify health disparities.

The second hypothesis (H2) was that variations in the Social Determinants of Health, particularly factors such as a lack of exercise and a BMI indicative of obesity, significantly influence disparities in diabetes prevalence across different geographical contexts, with the emphasis on those that have been identified as impacting diabetes in various research papers.

Three specifications, as detailed in the following sub-sections, were employed to test these hypotheses and systematically address the research objectives.

5.5.2.1. The Concentration Curve

The first specification applied concentration curves to assess the distribution of the sample population using SES and the dependent variable within each geographical category throughout each timeframe. In line with the methodology proposed by Wagstaff et al. (1991), these curves plot the cumulative proportion of the sample population, organised by SES, on the horizontal axis against the cumulative proportion of the dependent variable on the vertical axis. Income per capita per household was the selected living standard measure to plot the concentration curves and subsequent indices. This metric is divided into five groups on the concentration curve, categorising individuals from the lowest to the highest income brackets.

Any shift of the concentration curve away from the line of equality, represented by a 45-degree line, reveals the degree of disparity in diabetes prevalence among adults from diverse economic backgrounds. When the concentration curve lies above the line of equality, diabetes is predominant among adults in lower economic strata. Conversely, if the curve is below the equality line, it signifies this condition's concentration among adults from higher economic backgrounds. However, if the concentration curve aligns with the line of equality, this suggests that diabetes prevalence is uniformly experienced across all the adults' economic strata (Keeton, 2014).

5.5.2.2. The Concentration Index

The second specification calculated the concentration index for 2008 and 2017 across each geographical type. The Erreygers (2009) concentration indices were applied to quantify the magnitude of health inequalities. The concentration index, which serves as a numerical equivalent of the concentration curve, was technically defined as twice the covariance between a health-related variable and the rank of the SES measure.

The concentration index can range between -1 and +1. A negative concentration index value implies that the impact of specific outcomes, such as diabetes, is mainly borne by adults with relatively lower incomes (Keeton, 2014). Conversely, a positive concentration index value signifies that the impact of the outcome variable predominantly affects adults with relatively higher incomes (Keeton, 2014). To determine the value of the concentration index, denoted as 'b β ' in Equation (5.1), a straightforward ordinary least squares regression was performed utilising the 'Coindex' command in Stata. This mathematical relationship is expressed in the following equation:

$$2\sigma_r^2(h_i/\mu) = \alpha + \beta r_i + \sum_i \gamma_j X_{ij} + \varepsilon_i \quad (5.1)$$

In Equation (5.1), σ^2 denotes the variance of the rank variable, while μ represents the mean of the health outcome, specifically the diabetes variable in this context. The term α is the intercept, and β estimates the concentration index. The variable r serves as the ranking variable and, in the context of this study, corresponds to household income per capita. ε_i stands for the random stochastic error.

The next step delves deeper.

5.5.2.3. The Decomposition of the Change in the Concentration Index

The decomposition of the change in the concentration index was explored, providing a detailed examination of the specific factors that have contributed to shifts in socio-economic disparities across different geographic areas over time. This nuanced analysis provided deeper insight into these evolving inequalities' dynamics (O'Donnell et al., 2010). To expand further, the study investigated how the individual factors referenced in Table 5.1 above impacted increases or decreases in disparities related to the outcome. The existing literature informed the selection of these variables.

However, before discussing the methods used to analyse the change in the concentration index, the cross-sectional concentration index decomposition techniques as detailed by Wagstaff et al is discussed. (2007). This is formulated as Equation (5.2):

$$C = \sum_k (\frac{\beta_k \bar{\bar{X}}_k}{\mu}) C_k + \frac{GC_\varepsilon}{\mu} \quad (5.2)$$

In Equation (5.2) above, $\bar{\bar{X}}_k$ is the mean of each determinant, and C_k is the concentration index for the k determinant. The concentration index for these determinants is computed like C. Moreover, GC_ε is the generalised concentration index for the error term. Most importantly, Equation (5.2) comprises two parts: explained and unexplained components. The explained part is the sum of the concentration indices of the k regressors, and the weight of these is the elasticity of H with respect to $X_k(\eta_k = \beta_k \frac{\bar{\bar{X}}_k}{\mu})$.

The unexplained part, $\frac{G.C._\varepsilon}{\mu}$, which is the final term in Equation(5.2) captures the socio-economic-related inequalities in the outcome variable that cannot be explained by systemic variation in the regressors by SES. O'Donnell et al. (2010) suggest that the final term is expected to be minimal in a well-structured model.

Contrary to the cross-sectional concentration index mentioned above, this study probed the shift in socio-economic differences in diabetes rates by applying the decomposition of concentration index changes to Equation (5.2), resulting in:

$$\Delta C = \sum_k \eta_{kt}(C_{kt} - C_{kt-1}) + \sum_k C_{kt-1}(\eta_{kt} - \eta_{kt-1}) + \Delta(\frac{GC_\varepsilon}{\mu}) \quad (5.3)$$

Equation (5.3) Δ indicates the first difference, and *t* denotes the period under investigation between Waves 1 and 5. Moreover, in the above equation, the change in the decomposition of the concentration index is weighted by the second-period elasticity, η_{kt} and the differences in elasticities by the first-period concentration index, C_{kt-1}. An alternate formulation is to weigh the differences in the concentration indices by the elasticity of the initial period and the concentration index of the latter period, given by:

$$\Delta C = \sum_k \eta_{kt-1}(C_{kt} - C_{kt-1}) + \sum_k C_{kt}(\eta_{kt} - \eta_{kt-1}) + \Delta(\frac{GC_\varepsilon}{\mu}) \quad (5.4)$$

In examining the results derived from Equations 5.3 and 5.4, a positive value suggests that the specific variable intensifies socio-economic disparities in diabetes prevalence over time (Wagstaff et al., 2003). Conversely, a negative value signals reduced disparities between the two waves. The following section presents the results achieved using the techniques detailed here.

5.6. Results

5.6.1. Descriptive Statistics

Table 5.2 illustrates the changes between 2008 and 2017 for the entire sample. The study population decreased by nearly 4,000 individuals from 2008 to 2017, primarily due to attrition, namely the loss of participants or the inability to track those who had participated in 2008 (Brophy et al., 2018). This decline was observed among both male and female participants.

Geographically, traditional authority areas experienced a reduction of approximately 1,800 individuals, while the population in formal rural areas decreased by 2017. Conversely, formal urban areas registered a modest growth of nearly 400 people, with a slight uptick in the population of informal urban areas.

Moving from the broad demographic overview in Table 5.2, Table 5.3 zooms in on diabetes prevalence within these demographically diverse groups, affording a closer examination of prevalence within the specified categories. Between Waves 1 and 5, the overall prevalence of diabetes in South Africa decreased slightly, falling from 4.28% to 3.98%. Among males, it dropped from 3.05% to 2.76%, while among females prevalence dropped from 4.92% to 4.57%.

Table 5.2: General Characteristics of the Sample

Characteristics	2008	2017
Total number of individuals	23,633	20,076
Number of males	8,333	7,755
Number of females	15,300	12,321
Number residing in traditional authority areas	10,479	8,666
Number residing in formal rural areas	2,645	2,399
Number residing in formal urban areas	9, 691	7,313
Number residing in informal urban areas	1,700	1,698

*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets.

However, regional variations became more evident during this period. Diabetes rates in traditional authority and formal rural areas declined, with the most notable decrease in formal rural areas, where prevalence dropped from 3.84% to 3.17%. In contrast, formal urban areas witnessed a rise in diabetes prevalence from 3.10% to 4.47%, which may indicate underlying socio-economic shifts or changes in lifestyle patterns within these regions (Macclesfield et al., 2017).

Table 5.3: Prevalence of Diabetes across Different Demographic Groups

Characteristics	2008 (%)	2017 (%)
Total number of individuals with diabetes	4.28	3.98
Number of males with diabetes	3.05	2.76
Number of females with diabetes	4.92	4.57
Number of residents in traditional authority areas with diabetes	3.84	3.67
Number of residents in formal rural areas with diabetes	3.84	3.17
Number of residents in formal urban areas with diabetes	3.10	4.47
Number of residents in informal urban areas with diabetes	3.61	3.53

*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets.

The rate of diabetes in informal urban areas remained relatively unchanged, with only a minor reduction from 3.61% to 3.53%. The distinct regional variations in diabetes prevalence across the different waves suggest that social and economic factors might play a role in these disparities, which we explore in Tables 5.4 and 5.5, respectively.

The data in Table 5.4 offers a nuanced perspective of the prevalence of diabetes across various demographic characteristics within these regions over time. Some notable trends emerge between 2008 and 2017. In terms of ethnicity, Black individuals living in traditional authority areas experienced a significant increase in diabetes prevalence, rising from 4% in 2008 to a startling 20% in 2017.

This contrasts with other demographics, such as those from other ethnicities, where the changes were relatively modest across different areas.

Table 5.4: Demographic Characteristics of Individuals with Diabetes

Characteristics	2008 (%)				2017 (%)			
	Traditional Authority	Rural Formal	Formal Urban	Informal Urban	Traditional Authority	Rural Formal	Formal Urban	Informal Urban
Black individuals	4	3	4	4	4	20	3	2
Other ethnicities	0	4	5	2	0	4	4	4
Age 18-39	1	1	1	2	5	0	1	0
Age 40-59	6	5	7	4	5	4	21	4
Age 60+	9	9	14	14	11	8	11	10
Married	6	6	7	6	7	4	7	4
Single/unmarried	3	20	3	3	3	22	2	2

*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets.

Age also plays a crucial role in diabetes prevalence. While younger age groups (18-39) showed minimal changes, the 40-59 age bracket in formal urban areas witnessed a major surge, jumping from 7% in 2008 to 21% in 2017. This might point to increasing lifestyle or environmental risk factors in urban settings affecting middle-aged individuals (Werfalli et al., 2018).

Marital status also offers insights. Diabetes prevalence among single or unmarried individuals in traditional authority areas jumped from 3% to 22%, underscoring the potential socio-cultural or economic factors affecting this particular demographic. While Table 5.4 highlights demographic variations in diabetes, Table 5.5 further explores the relationship between these variations and SES, providing comprehensive insights into the interplay between demographic and economic factors in diabetes incidence.

In 2008, formal urban areas reported the highest mean household income per capita among diabetic individuals at R1,583. Of those, 44% earned between R10,000 and R17,500 a month. On the opposite end of the spectrum, traditional authority areas had the lowest mean household income of R468 per month for the same demographic.

Table 5.5: Socio-economic Characteristics of Individuals with Diabetes

Characteristics	Location	2008	2017
Mean household income per capita (Rands)	Traditional Authority	468	1,427
	Rural Formal	**1,008**	**3,017**
	Formal Urban	1,583	8,142
	Informal Urban	616	2,344
Individuals living on less than R10,000 per month (%)	Traditional Authority	4	31
	Rural Formal	3	4
	Formal Urban	5	2
	Informal Urban	4	2
Individuals living on R10,000 to R17,500 per month (%)	Traditional Authority	6	35
	Rural Formal	4	5
	Formal Urban	44	5
	Informal Urban	5	2
Individuals living on more than R17,500 per month (%)	Traditional Authority	1	1
	Rural Formal	6	1
	Formal Urban	4	1
	Informal Urban	1	0

*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets. Please refer to Appendix B for a detailed discussion of the guiding principles for selecting income brackets.

By 2017, there was a shift in formal urban areas, with diabetic individuals' mean household income rising to R8,142 per month. Conversely, the percentage of diabetic residents in informal urban areas earning less than R10,000 a month increased from 4% to 31%. However, in formal urban areas, there was a drop in the number of individuals earning between R10,000 and R17,500 monthly - from 44% in 2008 to 5% in 2017.

Table 5.6 shifts the focus to the health-related characteristics and lifestyle factors of individuals with diabetes over both periods. In both traditional authority and formal urban areas, individuals with an obese BMI are prominent, comprising 7% and 6% of the population respectively in 2008. This information is crucial as it underscores the need for tailored interventions in these specific areas to address obesity, a condition that is closely related to diabetes.

Further analysis reveals striking disparities in the level of physical activity among diabetic individuals. Formal urban areas recorded a higher percentage of individuals engaging in exercise (4%) in 2008, falling slightly to 3% in 2017. In contrast, traditional authority and informal urban areas showcased alarming trends, with the percentage of individuals abstaining from exercise at 5% and 4% in 2008 and 2017, respectively. This emphasises the critical need for strategies to promote physical activity as a pivotal component of diabetes management, especially in regions with low levels of exercise engagement.

Table 5.6: Health-Related Characteristics and Lifestyle Factors of Individuals with Diabetes (2008 vs. 2017)

Characteristics	**2008 (%)**				**2017 (%)**			
	Traditional Authority	Rural Formal	Formal Urban	Informal Urban	Traditional Authority	Rural Formal	Formal Urban	Informal Urban
Individuals not exercising	5	3	5	5	4	4	5	3
Individuals exercising	1	3	4	2	2	2	3	1
Smokers	1	2	3	1	1	2	3	0
Non-smokers	4	0	6	5	4	4	5	3
Underweight BMI	3	1	4	5	5	2	3	3
Normal BMI	2	1	3	2	2	1	2	1
Overweight BMI	5	2	4	3	4	5	4	4
Obese BMI	7	7	6	5	5	3	4	2
Utilised healthcare services	5	4	5	5	4	3	4	2
Did not utilise healthcare services	1	0	1	0	2	4	0	1

*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets; The percentages do not sum to 100% due to missing values and the selective reporting of characteristics, reflecting only a portion of the total population.

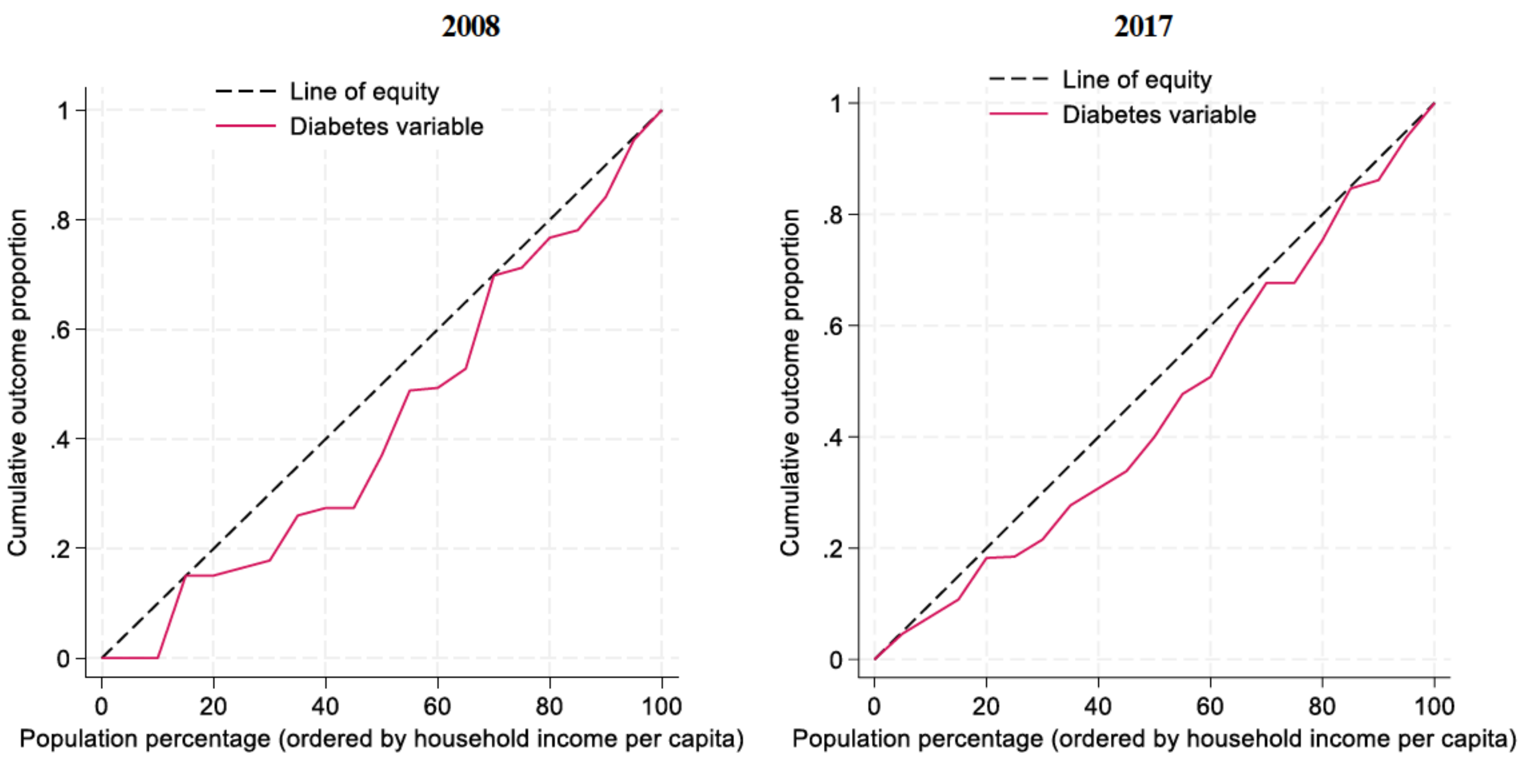
Moreover, a discernible trend of individuals not using healthcare services is prevalent in 2017. In both rural formal and informal urban areas, 4% of individuals with diabetes did not access these essential services. This poses significant questions regarding the availability and awareness of healthcare services in these regions and could serve as a foundation to shape future policies. It highlights the need to bolster access to and utilisation of healthcare specifically tailored to the needs of diabetic individuals in these areas, thereby addressing any latent barriers to healthcare services.

These results underscore that sociocultural and economic factors affect the prevalence of diabetes in the selected regions. However, for a more profound understanding of the disparities in diabetes prevalence among South African adults, the following section presents visual representations of these inequalities employing concentration curves.

5.6.2. Results of the Concentration Curves for Waves 1 and 5

Figure 5.2 displays the concentration curves for traditional authority areas in 2008 and 2017. Both curves lie below the equity line, suggesting that in both waves, the prevalence of diabetes is disproportionately concentrated among the economically advantaged. The concentration curve from 2017 is closer to the line of equity than that for 2008, indicating that inequalities in diabetes prevalence became more balanced in these areas than they were during 2008.

Figure 5.2: Changes in the Concentration Curves for Adults with diabetes living in traditional authority areas

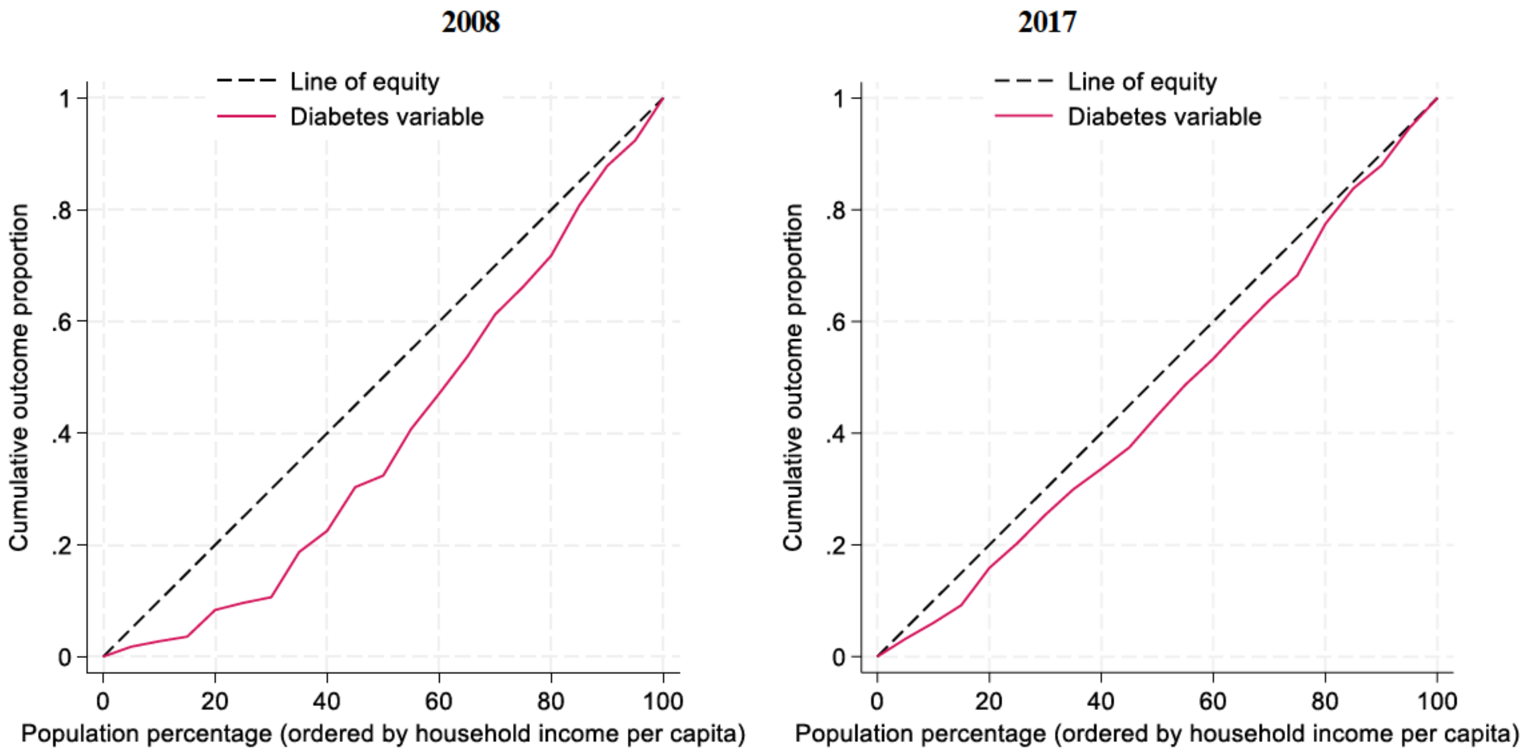


*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets.

Figure 5.3 presents the concentration curves for adults with diabetes residing in formal rural areas for 2008 and 2017. Similar to the observations in traditional authority areas, socio-economic inequalities are predominantly concentrated among the economically advantaged. Furthermore, over time, these inequalities decreased somewhat.

Figure 5.4 presents the concentration curves for adults with diabetes in formal urban areas across 2008 and 2017. Unlike earlier observations, there was a slight increase in these inequalities over time, especially among individuals in the 80th quantile and higher. This trend is apparent as the curve for 2017 is further from the 45-degree line than the 2008 curve. Nonetheless, the disparities are predominantly found among the economically advantaged.

Figure 5.3: Changes in the Concentration Curves for Adults with diabetes living in formal rural areas



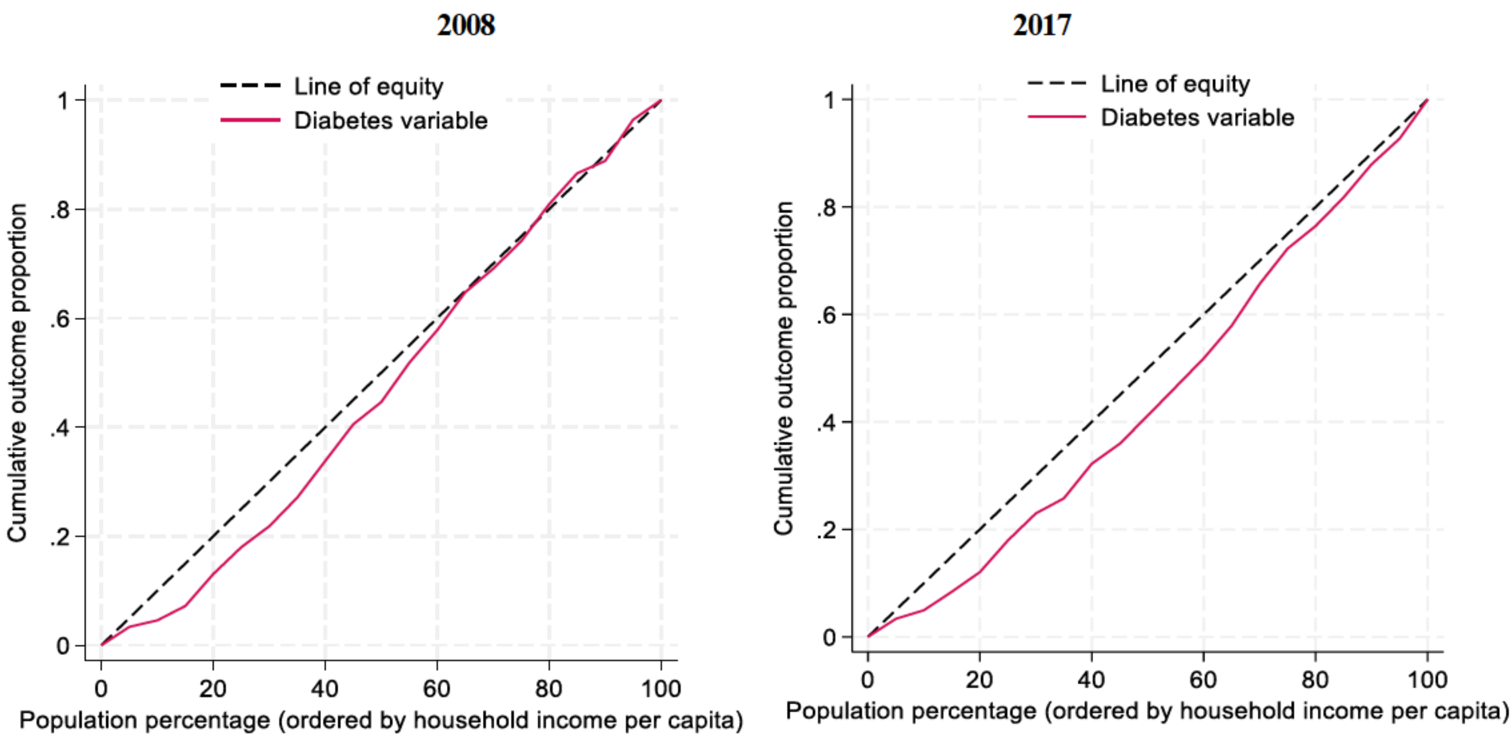
*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets.

This trend aligns with the hypothesis that the greatest inequalities will likely be observed in urban environments. The notable shift in the incidence of diabetes in such areas can be attributed to several factors. Kimani-Murage et al. (2010) proposed that rising affluence in South Africa's urban centres, leading to changes in lifestyle such as increased sedentary behaviour and poor dietary choices, might be a key contributor to the higher prevalence of diabetes among adults in these areas. However, this change may result from a mix of factors, which we examine in the following section.

Lastly, Figure 5.5 illustrates the concentration curves for adults in informal urban areas from 2008 to 2017. The curve for 2008 is notably farther from the line of equity than the other Wave 1 concentration curves, indicating pronounced socio-economic inequalities among individuals with diabetes in these areas in 2008, particularly for those in the 30th to 80th quantiles. By 2017, these disparities were mainly observed among the economically disadvantaged — a trend distinct from the curves for other areas, except for individuals between the 80th and 100th quantiles.

Consistent with Figure 5.4, these observations substantiate the hypothesis that the most pivotal shifts occurred in urban environments. The mushrooming of informal urban areas across South Africa due to urbanisation poses many challenges for government entities. The local governments responsible for these areas are struggling to deliver sufficient healthcare and infrastructure to meet the demands of the influx of migrants (Melore & Nel, 2020). As a result, inhabitants of these areas frequently encounter obstacles in managing their health conditions, exacerbated by economic constraints.

Figure 5.4: Changes in the Concentration Curves for Adults with diabetes living in formal urban areas

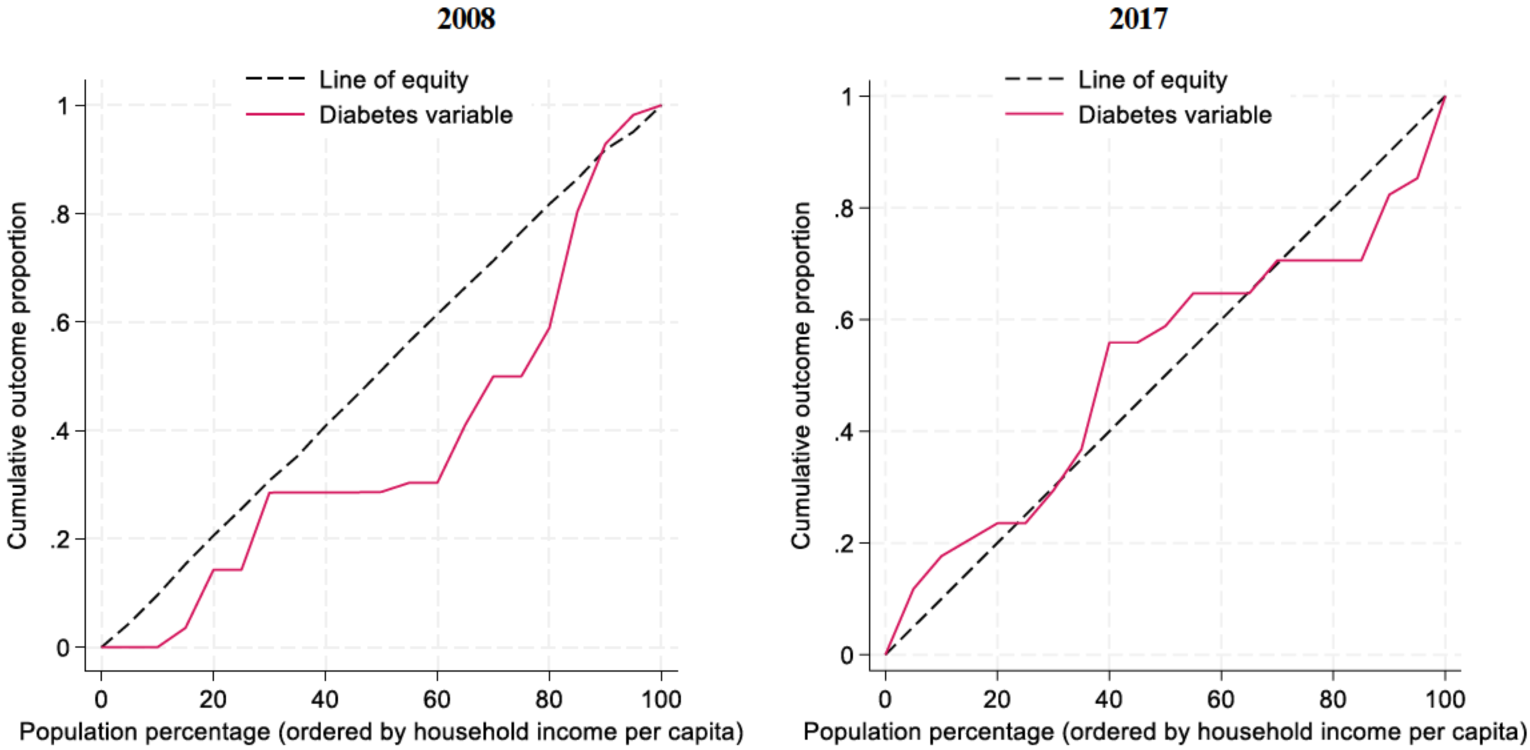


*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS dataset.

This notion is corroborated by the 2017 concentration curve for urban informal areas, which is uniquely situated above the equity line compared to the other areas' curves. It underlines that individuals at the lower end of the socio-economic spectrum are bearing the brunt of socio-economic disparities in diabetes.

Having examined the concentration curves for 2008 and 2017 across various areas, the results of the concentration index are analysed for both waves to further quantify these inequalities.

Figure 5.5: Changes in the Concentration Curves for Adults with diabetes living in informal urban areas



*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS dataset.

5.6.3. Results of Concentration Index for 2008 and 2017

Table 5.6 presents the results of the concentration index for each area in 2008 and 2017 utilising the Erreygers (2009) concentration indices. The concentration index decreased from 0.036 to 0.014 in traditional authority areas between the two waves. Both positive values signify that diabetes is predominantly prevalent among the wealthier segments of these areas. This finding suggests that, although diabetes remained more common among wealthier groups in traditional authority areas, the gap between socio-economic groups narrowed over time. This observation is consistent with the findings from the concentration curve, where the curve is positioned below the line of equity. The magnitude of this disparity diminished. Nonetheless, the p-values of 0.000 in 2008 and 0.006 in 2017 affirm the statistical significance of this inequality across both periods.

Consistent with this finding, the concentration index in formal rural areas decreased from 0.018 in Wave 1 to 0.0129 in 2017. This trend is consistent with the insights from Figure 5.3, suggesting a marginal reduction in socio-economic inequalities. In other words, socio-economic disparities in diabetes prevalence appear to have decreased slightly in formal rural areas. However, the elevated p-value in 2017 indicates that the changes in the concentration index for the rural formal areas did not reach statistical significance at the 0.05 level in 2017.

Conversely, the concentration index in formal urban areas increase from 0.013 in 2008 to 0.020 in 2017. This observation corresponds with the findings in Figure 5.4, indicating a widening socio-economic gap in the prevalence of diabetes, particularly among the affluent. This increase suggests that diabetes became more prevalent among wealthier individuals in formal urban areas, reflecting growing health inequalities in these regions. The p-value in both waves is below 0.05, signifying that the change in the concentration index for formal urban areas is statistically significant.

Table 5.6: Changes in the concentration indices in Waves 1 and 5: diabetic adults in different geographical areas

	Index value		**Standard error**		**p-value**	
	2008	*2017*	*2008*	*2017*	*2008*	*2017*
Traditional Authority	*0.036*	*0.014*	*0.005*	*0.005*	*0.000*	*0.006*
Rural Formal	*0.018*	*0.0129*	*0.008*	*0.009*	*0.026*	*0.162*
Formal Urban	*0.013*	*0.020*	*0.005*	*0.005*	*0.020*	*0.000*
Informal Urban	*0.041*	*-0.003*	*0.013*	*0.010*	*0.002*	*0.753*

*Note: Computed using Waves 1 (2008) and 5 (2017) of the NIDS datasets. Standard errors are in parentheses. Estimates are based on Equation (5.1).

Informal urban areas demonstrate a notable transformation, shifting the concentration index from 0.041 in 2008 to -0.003 in 2017. This aligns well with the patterns depicted in Figure 5.5, with the fifth wave highlighting marked inequalities among the economically less privileged. The shift indicates that by 2017, diabetes prevalence had moved from higher-income to lower-income groups, reducing socio-economic inequalities in these areas. The p-value in 2008 is below 0.05, rendering the index statistically significant. However, in 2017, the p-value exceeded 0.05, indicating that the index is not statistically significant.

In summary, the results provide partial support for Hypothesis H1. While formal urban areas show widening socio-economic disparity in diabetes prevalence—consistent with the expectation that urban settings would exhibit pronounced disparities—this trend was not uniformly observed across all urban settings. Informal urban areas, in particular, displayed a reduction in disparities, with diabetes prevalence shifting towards lower-income groups by 2017. Therefore, H1 is supported in formal urban areas, but not in informal urban areas. Having illuminated these disparities through the concentration index, the following section delves deeper by revealing the unique factors propelling the observed inequalities in diabetes prevalence.

5.6.4. Results from Decomposing the Change in the Concentration Index

Table 5.7 presents the results of the Oaxaca-type decomposition, illustrating the shifts induced by the selected variables in socio-economic-related disparities in diabetes prevalence among South African adults across various regions.

Table 5.7: The Oaxaca-type decomposition of the percentage changes in the determinants of diabetes amongst adults from the different geographical types between 2008 and 2017

	Traditional Authority		Rural formal		Formal Urban		Informal Urban	
	Total	Percent	Total	Percent	Total	Percent	Total	Percent
Black Individuals	0,006	-12	0,040	327	0,021	-79	0,115	119
Age 40-59	-0,006	13	-0,005	-38	-0,007	26	0,001	1
Age 60+	-0,033	73	-0,027	-224	-0,027	98	-0,018	-18
Male	0,013	-30	0,020	165	-0,003	12	0,022	22
Married	-0,004	10	0,003	23	-0,005	19	-0,007	-7
Income less than R17,500	0,001	-3	0,004	31	-0,005	17	0,014	14
Income of more than R17,500	-0,001	2	0,002	13	-0,001	4	-0,002	-2
Completed primary	0,001	-2	-0,001	-7	-0,003	10	-0,001	-1

Incomplete secondary	0,000	1	0,001	5	0,001	-5	-0,002	-2
Completed secondary	0,001	-2	0,000	3	0,005	-19	0,000	0
More than secondary	0,000	0	0,000	-3	-0,001	2	-0,002	-2
Employed	0,002	-4	0,001	6	0,005	-19	0,009	9
Exercises regularly	-0,003	7	-0,004	-30	0,004	-15	-0,001	-1
Smoker	0,001	-1	-0,001	-5	0,000	0	0,001	1
Normal BMI	-0,002	4	-0,003	-26	-0,009	34	-0,004	-5
Overweight BMI	-0,001	3	0,004	30	0,001	-5	0,002	3
Obese BMI	-0,010	22	-0,015	-121	-0,001	2	-0,013	-14
Utilised healthcare services	-0,009	21	-0,006	-48	-0,005	18	-0,016	-16
Totals	**-0,045**	**100**	**0,012**	**100**	**-0,027**	**100**	**0,097**	**100**
Residuals	**0,023**		**-0,017**		**0,034**		**-0,141**	
Differences $(\mathbf{CI_t - CI_{t-1}})$	**-0,022**		**-0,0051**		**0,007**		**-0,044**	

* Note: Estimates are based on Equations (5.3) and (5.4). The totals are obtained from Tables 5.12 (traditional authority areas), 5.13 (formal rural areas), 5.14 (formal urban areas), and 5.15 (informal urban areas) in Appendix B.

In traditional authority areas, changes in socio-economic-related inequalities in the prevalence of diabetes are highlighted by the dynamics of several variables. For instance, disparities diminished by 12% for Black individuals compared to their non-Black counterparts, indicating a narrowing in socio-economic disparities in diabetes prevalence between Black and non-Black groups in these areas. This contrasts sharply with age-related disparities, as those aged 60 and older experienced a substantial 73% surge in disparities compared to the reference group aged 18-39. This suggests that older adults in traditional authority areas are seeing widening inequalities in diabetes prevalence, with age becoming a more significant factor in these disparities.

Gender also plays a role and there was a 30% reduction in disparities among males compared to females, indicating that gender-based health disparities in diabetes prevalence have become less pronounced among males in traditional authority areas. Furthermore, significant disparities are observed in different BMI categories where those with an obese BMI recorded a 22% increase in disparities relative to their counterparts. This suggests that obesity may be a significant contributor to widening diabetes disparities in these areas.

The findings support H2, as variations in the Social Determinants of Health, particularly obesity (BMI indicative of obesity) and exercise habits, show substantial influence on disparities in diabetes prevalence across regions. Obesity in particular emerges as a major factor associated with widening disparities, particularly in traditional authority areas, formal rural, and informal urban areas, highlighting its critical role in shaping diabetes inequalities across diverse settings.

Several variables exhibit similar dynamics in rural formal areas to those in traditional authority areas, with distinct impacts on the prevalence of diabetes. For instance, Black individuals experienced a significant 327% increase in disparities compared to their non-Black counterparts, indicating a sharp rise in diabetes-related inequalities for Black individuals in rural formal settings. This contrasts with the age dynamics, where individuals aged 60 and older showed a substantial 224% reduction in disparities compared to the younger age bracket of 18-39, suggesting that older adults in rural formal areas face fewer inequalities in diabetes prevalence than younger adults. However, the gender dynamic diverges with males encountering a 165% increase in disparities compared to females, indicating notable growth in gender-based health inequalities for males in these rural areas.

Contrasting with the findings from rural areas, the positive difference between the concentration indices (0.007) in formal urban areas signals increased disparities. In these areas, identifying as Black led to a 79% reduction in disparities compared to non-Blacks, indicating that disparities in diabetes prevalence between Black and non-Black individuals narrowed over time, and suggesting some convergence in health outcomes within formal urban settings. Furthermore, marked disparities, with an increase of 98%, were observed among individuals aged 60 and older compared to the reference category, indicating that older adults in formal urban areas face widening inequalities in diabetes prevalence, with socio-economic factors more prominently impacting this age group.

Lastly, in informal urban areas, the concentration index showed a significant decline of -0.044, indicating substantial shifts in disparities. In these locales, identifying as Black led to a remarkable 119% increase in disparities compared to non-Blacks, suggesting that Black individuals in informal urban areas are experiencing greater socio-economic inequalities in diabetes prevalence. Age continued to play a pivotal role. Individuals aged 60 and older encountered an 18% reduction in disparities compared to those in the 18-39 age bracket, implying that older adults in informal urban areas face fewer socio-economic disparities in diabetes prevalence than younger adults, perhaps reflecting improved access to healthcare or support networks for older populations. Concurrently, disparities among males rose by 22% in comparison to females, indicating a moderate increase in gender-based health disparities, where males in these settings face slightly higher inequalities in diabetes prevalence.

These results point to marked differences in the evolution of disparities across regions. The most alarming growth in disparities for Black individuals was observed in rural formal areas, while their counterparts in formal urban areas experienced a significant reduction. Age-related disparities were most amplified in the formal urban areas, but moderated in informal urban areas. The male-female disparity spectrum varied widely, with rural formal areas presenting the sharpest increase. This complex interplay of variables across regions highlights the multi-faceted nature of socio-economic-related inequalities in diabetes prevalence in South Africa.

5.7. Discussion

The findings of this study shed light on the dynamic disparities in diabetes prevalence among South African adults across regions. In traditional authority areas, affluence emerged as a primary driver of diabetes, affirmed by a consistently higher concentration index across both waves. This correlation between wealth and diabetes prevalence aligns with Tanaka et al. (2012). It is reinforced by Micklesfield et al. (2017), who pinpointed the wealthier segments of society's lifestyle choices as risk-enhancing.

In traditional authority areas, the male gender was associated with reduced diabetes-related disparities. Prozesky and Mouton (2019) suggested this could be due to enhanced job or business opportunities for men in specific areas, while McLaren et al. (2013) noted that such avenues might ensure that men have better access to healthcare, explaining the reduced diabetes prevalence observed among males compared to females. Conversely, this study’s data indicate that being 60 or older was associated with an increased concentration index in these areas. This aligns with the findings of Tanaka et al. (2012), who noted a correlation between more advanced age and financial constraints, such as diminished income due to retirement and rising health-related expenses. Similarly, Werfalli et al. (2018) emphasised that the natural ageing process, including reduced organ efficiency, could exacerbate these disparities.

In rural formal areas, there is evidence of a marginal decline in the concentration index, suggesting improved health trends. However, it is primarily the affluent who continue to exhibit pronounced disparities in diabetes, reflecting the patterns observed in traditional authority areas. In terms of the determinants most significantly impacting these disparities, ethnicity emerges as a noteworthy factor, with being Black associated with an amplification of socio-economic-related inequalities in diabetes prevalence. This observation aligns with the findings of Shifa et al. (2022), who pointed to constrained access to healthcare, lifestyle shifts due to urbanisation, and persistent socio-economic challenges as significant influencers among Black individuals. Furthermore, McLaren et al. (2014) underscored Black communities' unique socio-economic hardships in specific regions, reinforcing the results.

Surprisingly, the data unveil a notable reduction in socio-economic-related inequalities in diabetes prevalence among individuals aged 60 and older in formal rural areas. This is likely due to the expansion of healthcare by the South African government. However, numerous studies emphasise that services in low-income areas often under-perform, with a lack of trust in the healthcare system and the feeling that their needs are dismissed being common among residents (Motala et al., 2008; Van der Hoeven et al., 2019). A more convincing explanation might be the 'levelling phenomenon' outlined by Saeed et al. (2015). This suggests that as individuals age, the likelihood of certain health conditions, such as diabetes, becomes more uniformly spread across various socio-economic strata, leading to diminished disparities. Such harmonisation may be attributable to various factors, including universal access to specific types of care for older people or the cumulative effects of lifestyle on those with higher SES as they age.

The analysis of formal urban areas revealed notable intensification in the concentration index, underscoring the escalating health disparities spurred by urbanisation. This conforms with the findings of Van Huyssteen (2009) and Shifa et al. (2022), who highlighted widening health disparities in the urban settings of developing nations. As anticipated, the age group 60 and older showed increased diabetes disparities, a pattern that holds across both traditional authority and formal urban areas. Moreover, the findings suggest that government initiatives have benefitted Black communities, as being Black correlated with a substantial reduction in these disparities compared to other ethnicities. These observations are congruent with research conducted by Mhlanga and Garidzirai (2020).

Lastly, in a departure from the trends in other regions, informal urban areas experienced a shift in diabetes-related disadvantage, transitioning from the affluent in the initial wave to economically challenged individuals by the fifth. Being of Black ethnicity in these areas amplified the disparities, a viewpoint that aligns with the observations by Shifa et al. (2022). Interestingly, the decrease in disparities among those aged 60 and older mirrors the patterns discerned in rural formal areas, suggesting the potential influence of a broader, national healthcare strategy on these outcomes.

5.8. Conclusions and Recommendations

This chapter examined the progression of socio-economic disparities related to diabetes prevalence among South African adults in various geographical regions, drawing from Waves 1 and 5 of the NIDS datasets. The comprehensive approach combined concentration curves, the Erreygers (2009) concentration indices, and a decomposition of the concentration index technique to scrutinise the social factors that influence these disparities.

The analysis revealed discernible socio-economic disparities in diabetes prevalence, with the contributing determinants varying across South Africa's distinct regions. This investigation highlights the necessity of understanding regional social intricacies when addressing socio-economic disparities in diabetes among South African adults. Such evaluations, spanning multiple regions, highlight the varying influence of public health policies on health inequalities among the adult demographic.

The study found that affluence correlates strongly with diabetes prevalence in traditional authority areas. This calls for action. Policymakers should design programmes that promote healthier lifestyles among the affluent and raise community awareness of the risks of not adopting these plans. The gender disparities observed in this study can also not be overlooked. Urgent measures are required to enhance women's access to healthcare. Furthermore, given the heightened diabetes risk for those aged 60 and older in traditional authority areas, financial aid in the form of subsidies could be beneficial. Community health screening and education that target the elderly would also promote early detection and treatment of diabetes.

In rural formal areas where diabetes disparities are predominantly evident among the affluent and Black population, it is imperative to address the specific socio-economic challenges these communities face. Enhancing access to healthcare and understanding the health implications of urbanisation are critical. While reduced disparities were observed among older people, it is vital to probe the 'levelling phenomenon' and not solely attribute this to overarching healthcare initiatives. Such insights would guide strategies to promote health equity across varied demographic and socio-economic groups.

In formal urban areas, the escalating disparities, mainly influenced by urbanisation and predominantly seen among the affluent, require tailored urban health initiatives that target high-risk age groups, especially those over 60. Although commendable strides have been made by the government to improve the situation of Black communities, amplifying such efforts could promote health equity across diverse urban ethnic groups.

In contrast, informal urban areas displayed a shift in health disparities, which were more prominent among the poor in 2017. The heightened disparities observed among Black individuals warrant specific interventions. The reduced disparities among those aged 60 and older suggest that national healthcare policies have positively impacted on this group. Deeper exploration of these patterns is vital to refine healthcare strategies in these areas.

Future research could adopt a more granular focus to examine individual neighbourhoods or cities to identify the environmental and infrastructural characteristics unique to these locales. Such in-depth investigation could assist local governments in formulating health strategies that are finely tuned to the distinct needs of their communities. Exploring these research avenues would help to shape South African health policies more effectively by reducing disparities in diabetes rates arising from socio-economic factors. The ultimate goal is to cultivate a holistic approach that benefits every citizen.

5.9. Chapter Summary

In this chapter, the NIDS datasets from 2008 and 2017 were utilised to investigate socio-economic disparities in diabetes among South African adults. A standardised concentration index and a technique for decomposing changes in the concentration index were utilised to determine evolving disparities. The results suggest that disparities in diabetes prevalence varied across different regions. Reduced inequalities were observed in areas under traditional authorities, with formal rural areas also demonstrating fewer inequalities. However, formal urban areas manifested escalating disparities, predominantly among the affluent, while informal urban regions exhibited pronounced inequalities, adversely affecting the economically less privileged. A detailed Oaxaca-type decomposition revealed nuanced disparities among Black individuals across various age cohorts and between genders.

The findings underscore the importance of region-tailored interventions to address diabetes disparities among South African adults. Unique regional challenges demand custom-built public health initiatives to ensure equitable health results across all socio-economic brackets and locations. The focus should be on addressing these disparities, especially in urban regions, and advocating for consistent access to quality healthcare for all, regardless of socio-economic standing.

Building on the foundation laid by the preceding chapters and considering data limitations, the following chapter examines the efficacy of public health expenditure across different regions of deprivation while taking into account the respective regions' poverty levels.

Chapter 6: The Impact of Regional Poverty on Public Health Expenditure Efficacy Across South Africa's Provinces: Investigating the Influence of Historical Economic Factors on Health

This chapter examines how varying regional poverty levels influence the efficacy of public health spending in South Africa. It aims to uncover how the distribution of poverty across the country's provinces impacts the allocation and effectiveness of healthcare resources. Additionally, the chapter examines whether historical economic factors, measured by lagged values of public health expenditure and income per capita, influence the health of individuals from different regions. By exploring this relationship, the chapter offers a more nuanced comprehension of the intricate interplay between socio-economic determinants and healthcare resource administration, ultimately seeking to guide more impactful and balanced health policies in the context of South Africa's unique challenges.

The remainder of this chapter is structured as follows: Section 6.1 briefly introduces the investigation. Section 6.2 presents the literature review, while Section 6.3 discusses the chapter's contributions to the literature. Section 6.4 offers the theoretical framework underpinning the investigation. Section 6.5 outlines the methodology. The results are presented in Section 6.6, followed by a discussion and conclusion of the chapter, respectively, in Sections 6.7 and 6.8. Finally, Section 6.9 presents a summary of the chapter.

6.1. Introduction

Poverty is a significant challenge in South Africa that profoundly affects the well-being and quality of life of a large portion of the population. Based on the upper-middle income poverty line of R1,499 per person per month, the World Bank (2022) estimates the country's poverty rate at 62.2%. Furthermore, the extent and severity of poverty varies widely across different regions. These disparities reflect the nation's historical and structural inequalities, particularly affecting rural and under-developed areas. In these regions, most adults live under economically challenging conditions (Sokhela, 2013; Ivanovich, 2015).

Widespread poverty leads to significant health-related challenges, limiting access to vital needs and services such as proper nutrition, sanitation, and healthcare. In turn, this increases the population's exposure and vulnerability to various health risks, including infectious diseases, chronic conditions, and the hazards associated with violence and accidents (Gray & Maharaj, 2017). Poverty also shapes individuals' health behaviours and preferences, often resulting in low levels of awareness and diminished demand for healthcare and preventive care (Bhorat et al., 2012; Sherry, 2014). The pervasive issue of poverty not only exacerbates health problems, but also significantly hinders the achievement of optimal health outcomes.

Regarding sanitation, the lack of clean water and adequate waste disposal facilities in many impoverished communities directly impacts public health. Statistics South Africa (Stats SA, 2021) reports that approximately 11% of South African households lack adequate sanitation facilities. As discussed in Chapter 3, Section 3.5.1, this increases the incidence of waterborne diseases such as cholera and diarrhoea, particularly in rural areas.

The healthcare system itself is strained by the high burden of diseases associated with poverty. For example, TB remains a significant public health issue, with South Africa having one of the highest TB rates in the world. The correlation between poverty and TB is evident, as the disease predominantly affects those in over-crowded living conditions with limited access to quality healthcare. In 2021, the Department of Health reported more than 360,000 cases of TB, with a significant number occurring in lower-income areas.

Moreover, poverty influences health behaviours and preferences. Schneider et al. (2009) highlight the prevalence of low levels of awareness and diminished demand for healthcare and preventive measures among the impoverished. For instance, there is a lower rate of health screenings and vaccinations in these communities, contributing to higher rates of preventable diseases. The pervasive issue of poverty not only exacerbates health problems, but also significantly hinders the achievement of optimal health outcomes in South Africa (Castro-Leal, 1999; Sabi, 2021). It creates a vicious cycle where poor health further entrenches poverty, making it increasingly challenging to break free from this detrimental loop.

This context, where poverty perpetuates poor health outcomes, underscores the critical role of public health expenditure in influencing health outcomes. Such expenditure reflects the government's commitment to providing health services. However, its effectiveness varies across South Africa's diverse socio-economic landscape. It is significantly influenced by regional poverty levels and other socio-economic factors, which affect demand for and supply of health services (Skordis-Worrall et al., 2011; Hlafu et al., 2019). This raises important questions about the equitable distribution and impact of public health resources in these regions. It is crucial to demonstrate to policymakers that in cases like this, a policy not tailored to the features of the area's deprivation characteristics might not produce good outcomes. Hence the need for this study.

6.2. Empirical Literature Review

To understand the complex relationship between public health expenditure and health outcomes, it is valuable to explore international studies before delving into the specific context of South Africa.

Works such as those by Choudhury and Nath (2012), Makuta and O'Hare (2015), Bunyaminu et al. (2022), and Oladosu et al. (2022) offer comparative insights and enhance one's understanding of the global dynamics at play in health expenditure and outcomes.

In their study with objectives similar to this one, Barenberg et al. (2017) focused on understanding the impact of public health expenditure on the infant mortality rate in Indian states from 1983-84 to 2011-12. The research aimed to quantify the relationship between public health spending and the infant mortality rate while considering additional factors such as per capita income, female literacy, and urbanisation. Utilising a panel data set that covered 31 Indian states and union territories, the study employed a Simultaneous Equation Model for its analysis.

The analysis found that raising public health expenditure by 1% of a state's GDP was significantly associated with fewer infant fatalities, notably approximately eight fewer deaths per 1,000 live births. However, the degree to which increasing public spending diminished infant mortality rates differed vastly across India's diverse states. For instance, Kerala, Maharashtra, and West Bengal observed improvements in these health indicators, but states like Bihar, Gujarat, Orissa, and Uttar Pradesh did not experience comparable improvement.

Makuta and O'Hare (2015) examined the influence of public health spending and the quality of governance on sub-Saharan African health outcomes from 1996 to 2011 using a dataset from 43 nations. The health outcomes were under-five mortality and life expectancy. The analysis used a two-stage least squares technique and reviewed the interplay between public health spending and the quality of governance to evaluate whether the latter modifies the effect of the former on health outcomes.

The researchers concluded that public health expenditure significantly affected health outcomes. They found that public health spending reduced under-five mortality and increased life expectancy. The study also showed that good governance improved the impact of public health expenditure. The overall elasticity of public health spending in relation to under-five mortality was more substantial than in countries with lower-quality governance.

Oladosu et al.'s (2022) recent study examined the impact of public health expenditure on health outcomes in Nigeria and Ghana. Utilising annual time series data from 2000 to 2018 sourced from the World Bank, the WHO, and the International Health Metrics Evaluation, the authors employed linear regression analysis to investigate the relationship between public health spending and health outcomes. Health outcomes were measured using malaria and HIV and AIDS mortality. Missing data was addressed by means of linear interpolation statistical analysis using the Statistical Package for the Social Sciences. The key variables were public health expenditure as a percentage of GDP and health outcomes, while the control variables included GDP, female school enrolment, and urban population density. A simulation analysis explored the potential effects of increasing public health expenditure to 15% of GDP.

The findings showed that public health spending in Nigeria and Ghana is relatively low. The results for the relationship between public expenditure and health outcomes varied between these two countries. Higher public health spending correlated with decreased health outcomes in Ghana, but this effect was insignificant. Contrary to expectations, higher public health spending correlated positively with better health outcomes in Nigeria. While malaria and HIV mortality rose in that country, the study found that boosting expenditure can improve lives. It also found that GDP, education levels, and living in urban areas significantly affected health outcomes.

Similarly, Ullah et al. (2022) explored the impact of healthcare expenditure on Pakistan's population's health status from 1995Q1 to 2017Q1. This study is particularly relevant as healthcare spending in Pakistan has increased significantly over the past two decades. It is crucial for policy makers to understand its effect on health outcomes. The study employed the Quantile Autoregressive Distributed Lag approach, a recent, advanced technique in time series analysis. It provides a nuanced understanding of healthcare spending's asymmetrical impacts across different quantiles of health outcomes, capturing both short- and long-term effects.

The study demonstrates that public healthcare spending significantly impacted health outcomes in Pakistan in both short- and long-term scenarios. Notably, increased healthcare expenditure correlated with enhanced life expectancy, reduced death rates, and decreased infant mortality, suggesting that government investment in healthcare is substantially improving health indicators in the country. However, the influence of healthcare spending varies across different states and is shaped by different political regimes, economic conditions, and demographic characteristics.

Transitioning to the South African context, Bidzha (2015) sought to determine whether public healthcare spending enhanced health outcomes in the country. The research utilised demographic and medical statistics from South Africa's national health surveys between 2002 and 2012 to gauge the influence of public expenditure on well-being at the provincial level. Two health indicators were the dependent variables: infant mortality rates and life expectancy at birth. This relationship was assessed by pooling ordinary least squares with FE and random effects (RE) models. The analyses revealed a significant linkage between public health expenditure, infant mortality, and birth expectancy. This suggested that public health expenditure effectively improved health in South Africa.

In a study with similar objectives to the current one, Hlafu et al. (2019) investigated the relationship between public health expenditure and health outcomes across South Africa’s nine provinces between 2002 and 2016. The study utilised panel data from various sources, including the South African Health Review and Statistics South Africa (Stats SA, 2021). The authors employed the under-five mortality rate and life expectancy at birth to measure health. Several econometric techniques were employed, including FE and RE panel data estimation, to account for time effects and provincial heterogeneity. The Hausman specification test was used to determine the appropriate model. In addition, the study used the seemingly unrelated Regression Model and the Least Squares Dummy Variable Model for a nuanced, separate analysis of each province.

The study found that the link between public health spending and health results differed noticeably among the provinces. This suggests that public health investment’s performance in improving health outcomes is influenced by distinct factors in each province such as governance, the administrative framework, infrastructure, and health challenges. For example, in some provinces, a rise in public health expenditure was associated with a drop in the under-five mortality rate and an increase in life expectancy. However, this relationship was not as clear-cut or significant in other provinces. These inconsistent findings demonstrate the importance of context-specific strategies and policies in public healthcare.

6.3. Contributions of the Chapter to the Literature

A critical examination of these studies reveals a common limitation: the lack of a detailed analysis of regional poverty levels and their potential impact on the efficacy of public health expenditure. In South Africa in particular, given that the primary purpose of government spending on healthcare is to improve the health circumstances of those living in poverty, their results are biased (Yaqub et al., 2012). Their failure to include a variable that captured the provincial poverty level casts doubt on the findings' applicability across different regions and socio-economic contexts, especially in those where poverty is intertwined with other social determinants of health.

Furthermore, these studies do not consider the role of historical economic factors such as past income levels and health investment in shaping current health outcomes. This is crucial, as the effects of income and public health expenditure on health are not immediate, but manifest through intermediary factors. These include access to healthcare services, educational opportunities, nutritional status, access to sanitation and clean water, and housing and living conditions. Such factors often act as channels through which past economic activities influence current health outcomes. As a result, past economic activity may influence current health outcomes.

The current study's argument is supported by Francis and Webster's (2019) study, which explored the interplay between historical economic factors and health outcomes in South Africa by analysing how poverty, inequality, and health are interconnected, and are influenced by historical elements like colonialism and apartheid. These factors have not only exacerbated poverty and inequality, but also impacted health, creating a mutually reinforcing cycle that has worsened over time. However, the study's limitation lies in its methodology. It employed a qualitative and historical approach utilising broad historical categories for analysis rather than multivariate analysis to pinpoint the specific impacts of these historical economic factors on health outcomes.

As noted previously, Ullah et al. (2022) also highlighted the significance of historical spending. The study revealed a strong correlation between past healthcare investment and current health indicators in Pakistan. It is important to note, however, that the relationship between historical economic factors and health outcomes, while significant, is specific to Pakistan's context. These findings may not directly apply to contexts such as South Africa, where different realities and healthcare systems exist.

Against this background, the study aimed to enhance the existing literature by investigating the impact of regional poverty levels on the relationship between public health expenditure and the general public's health across South Africa's provinces. In addition, given increasing concern about corruption in the country, there is a pressing need for more current analyses to accurately represent the evolving socio-political environment, as previous studies, though insightful, may not fully capture present-day dynamics. The research also explored the potential for delayed effects of public health expenditure and income per capita on health outcomes. This approach provides a more comprehensive and nuanced understanding of the factors influencing health outcomes in South Africa.

6.4. Theoretical Foundation

6.4.1. The Grossman Model

The study builds on the Grossman Model (1972) to examine the complex relationship between public health expenditure, health, and poverty, focussing on South Africa's provinces. The model is a pivotal contribution to the economic analysis of health and healthcare, as it treats health as both a consumption and an investment good (Grossman, 1972). It posits that individuals demand healthcare to increase their stock of health capital, enhancing their utility and productivity.

The model assumes that health capital depreciates over time and that individuals can invest in health through medical care and other inputs to maintain or improve their health status (Zweifel, 2012). It also implies that the optimal level of health depends on the individual's preferences, and income, and the price of health inputs.

6.4.2. Limitations of the Grossman Model

However, the Grossman Model presents limitations and challenges, notably when applied to a developing country like South Africa. Firstly, the model is rooted in a micro-level perspective that emphasises individual choices and outcomes (Fayissa & Gutema, 2008). The model used in this study is the equivalent of the Grossman Model at the macro level. It is relevant as the theory ignores the macro-level determinants of the supply and quality of health services such as public health expenditure, health system performance, and governance. Secondly, the Grossman Model does not allow for the heterogeneity and diversity characterising the country and its regions, including differences in income, poverty, and health needs across the provinces.

Third, the model does not consider economic factors' dynamic and lagged effects on health outcomes, such as the impact of past income and public health expenditure on current health status through various intermediary factors. Therefore, a more comprehensive and nuanced theoretical framework is needed to address these limitations and challenges and capture the multi-faceted relationship between public health expenditure, health, and poverty in South Africa.

6.4.3. Theoretical Framework

The current study aimed to develop a framework by adapting and extending the Grossman Model from its original micro-level focus to a broader macro-level approach. This adaptation was tailored to South Africa, incorporating additional variables and mechanisms. The focus was shifted from individual health outcomes to the provincial level, assessing the aggregate and comparative effects of public health expenditure and poverty across South Africa's nine provinces, as captured by Equation (6.1):

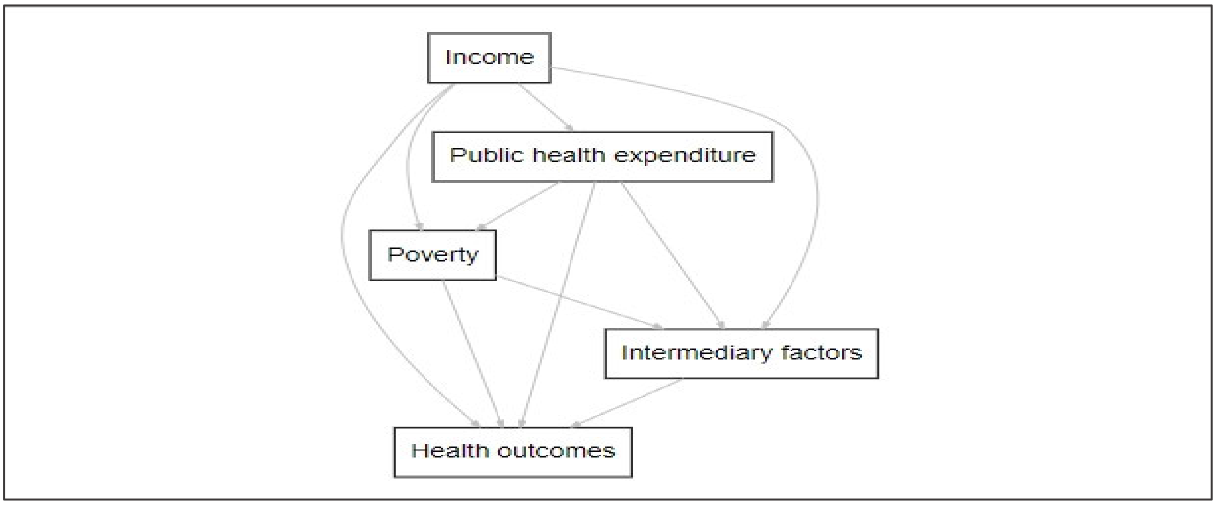
$$Health\ outcome = h\ (\text{income, public health expenditure, poverty, public health expenditure} * \text{poverty, lagged public health expenditure, lagged income}) \quad (6.1)$$

Increased provincial income levels could significantly drive human development and economic growth in South Africa. Higher income levels could lead to increased consumer spending, investment in local businesses, and improved access to education and healthcare (Rogerson & Rogerson, 2011). Enhanced economic activity and development could foster improved living conditions, create more employment opportunities, and increase public health funding. Collectively, these factors would contribute to improved overall health and well-being by providing access to essential health services, reducing health issues, and improving living standards.

Central to the framework of the current study is considering public health expenditure as a potential key variable that influences health outcomes alongside income. It represents the government's per capita investment in health services, which is crucial to improve the availability, accessibility, and quality of healthcare. Such investment directly affects the provision of healthcare services. It indirectly influences health outcomes by shaping the overall healthcare system, including developing and maintaining medical facilities, training and the availability of healthcare professionals, and implementing public health initiatives. Comprehensive improvement in the healthcare system can lead to more effective medical care, better preventive measures, enhanced health education, and stronger healthcare infrastructure, all essential to improving the population's health.

The current study also analysed regional poverty levels in its adapted model as these are indicators of various socio-economic and environmental factors that significantly impact health in different provinces, including nutrition, sanitation, living conditions, and pollution. The multi-faceted nature of poverty often leads to a challenging cycle of adverse health outcomes (Sherry, 2014). Due to their exposure to adverse socio-economic and environmental conditions, individuals living in poverty are typically more susceptible to a range of diseases and health complications.

Figure 6.1: The relationship between public health expenditure, health, and poverty



Note: This figure represents the main variables (nodes) and hypothesised effects (edges) and is the author's work. It was created using DiagrammeR in R. The direction and strength of these effects were empirically tested.

A key aspect is how regional poverty levels might interact with the relationship between public health expenditure and health outcomes. This is an important consideration as impoverished areas are likely to have more need for healthcare than wealthier areas. For instance, in poorer provinces such as the Eastern Cape, where poverty rates remain high, there may be amplified demand for fundamental public health services, including basic medical care and infectious disease management. In contrast, regions like Gauteng, with higher average earnings, could prioritise health matters differently, for example, heightened focus on preventative care and long-term disease administration. Given these contrasting scenarios, it is imperative to scrutinise the interaction between poverty levels and public health expenditure, as this substantially moulds the medical needs and results within each province.

Furthermore, the study integrated an analysis of the potential delayed effects of public health expenditure and income on health outcomes in this model. This is based on the understanding that the impact of these economic factors might not manifest immediately, but could be mediated over time through various factors (Ullah et al., 2021). These intermediary factors act as channels through which past economic activities may influence current health outcomes.

Figure 6.1 demonstrates how poverty, public health spending, income, and intermediary factors are interconnected and impact health outcomes. It suggests that public health spending and income positively correlate with health outcomes, meaning that an increase in either can lead to improved health. This study's framework also emphasises the importance of poverty as a factor that directly influences health outcomes and may change how public health spending affects health. The impacts of poverty, public health spending, and income on health outcomes can also be felt through intermediary factors, including environmental conditions, education levels, access to healthcare, and sanitation standards. This model highlights the complex relationships between health determinants and the significance of considering them when examining health dynamics in South Africa's provinces.

Based on the theoretical framework, which is illustrated in Figure 6.1 above, the study aimed to test the following hypotheses:

H1: It is proposed that poverty, measured by the PIMD, reduces the effectiveness of public health expenditure. This investigation was informed by the observation that regions with higher poverty levels could experience different health outcomes from wealthier regions, potentially affecting the impact of health spending. Consequently, variations in this influence were anticipated across South Africa's diverse provinces and the study sought to empirically assess how these differing poverty levels interact with public health expenditure.

H2: It is proposed that past economic activities, measured by the lag values of income per capita and public health expenditure per capita, would significantly impact health outcomes. This hypothesis stemmed from the assumption that economic conditions and health investment in previous years could have lasting effects on the current health status of a population (Ullah et al., 2021).

In summary, the theoretical framework integrating the adapted Grossman Model emphasises the intricate dynamics between public health expenditure, income, and health outcomes at the provincial level in South Africa. It considers the immediate impacts of these variables and their historical influence and interactions, especially across regions with varying poverty levels. This multi-faceted relationship enables a nuanced view of how economic factors impact health outcomes in diverse socio-economic circumstances.

The following section discusses the data and methodology used in the study, explaining how the hypotheses were tested and the intricate interplay of these pivotal elements were explored in the complex South African healthcare landscape.

6.5. Methods

6.5.1. Data

The study utilised quantitative annual data spanning 2005 to 2019 extracted from various sources, including the GHS dataset, the HST database, and annual publications such as National Treasury's Intergovernmental Fiscal Reviews. Table 6.1 below presents the relevant variables and their description. After collecting the necessary information for each province, the data were merged into a single quantitative dataset and analysed at the provincial level.

Table 6.1: Description of variables used in the study

Variable	Description	Categories/Values	Used in PIMD
Life expectancy at birth	Represents the average number of years a new-born can expect to live, based on current mortality rates.	Life expectancy values for both sexes across all provinces in South Africa.	NO
Provinces	Refers to the different administrative regions within South Africa.	Eastern Cape, Free State, Gauteng, KwaZulu-Natal, Limpopo, Mpumalanga, Northern Cape, North-West, Western Cape.	YES
Public health Expenditure	Represents total government spending on healthcare services per province.	Continuous	NO
Public health expenditure per capita	Calculated as total public health expenditure divided by the population of the province.	Continuous	NO
Income per capita	Calculated as the GDP in constant prices of each province divided by the size of each province's population.	Continuous	NO
Population growth rate	Calculated as the percentage difference between the current and previous population.	Continuous	NO
HIV prevalence	Represents the percentage of the population aged 15-49 estimated to be HIV-positive per province.	Continuous	NO
Female literacy rate	Represents the percentage of women aged 15 and above who can read and write a short, simple statement with understanding per province.	Continuous	NO
Disability grant	Indicates whether individuals reported receiving a disability grant.	1: Yes, 2: No	YES
Highest level of education attained	Represents the highest level of education attained by individuals.	Levels of education range from primary (0-8) to high school (8-18), and post-high school qualification (19-24).	YES
Access to electricity	Indicates whether a household has access to electricity.	1: Yes, 2: No	YES
Fuel for cooking	Represents the type of fuel households use for cooking.	1: Electricity from mains, 2: Electricity from generator, 3: Gas, 4: Paraffin, 5: Wood, 6: Coal, 7: Animal dung, 8: Solar energy.	YES

Access to water	Indicates whether households have access to piped water.	1: Yes, 2: No	YES
Sanitation type	Represents the type of toilet facility used by households.	Ranges from flush toilets (connected to mains or septic tanks) to chemical toilets, pit latrines (with or without ventilation), and bucket toilets. Each can be located in the dwelling, on-site, or offsite.	YES
Housing quality	Represents the type of region in which households reside.	1: Urban formal, 2: Urban informal, 3: Traditional authority, 4: Rural formal.	YES
Asset ownership	A composite variable of several asset variables, including a radio, refrigerator, television, telephone, and car, which determines a household's asset ownership.	1: Radio, 2: Refrigerator, 3: Television, 4: Telephone, 5: Car.	YES
Unemployment	The official criteria define the unemployment rate per province.	Continuous	YES

Throughout the examination, life expectancy at birth was the dependent variable, while public health expenditure per capita represented the primary independent variable under scrutiny. Public health spending per capita was used rather than total public health expenditure because the dependent variable was life expectancy at birth. As shown in the table above, public health expenditure per capita signifies the average financial provision designated to medical care for each person within a populace. Hence, increasing per capita public health spending has the potential to bring about improved health, consequently increasing the person's life expectancy. By employing the per capita measurement, a direct connection can be drawn between the health resources reserved for each person and the overall health effects for the individual, as reflected in life expectancy.

The following section sets out the methodology employed to investigate how regional poverty levels and public health expenditure influence overall health across South Africa's provinces.

6.5.2. Empirical methods of estimation

This study builds on Hlafu et al.'s (2019) methodological approaches by introducing three distinct specifications, with life expectancy at birth as the dependent variable. In the first specification, the focus was on developing the PIMD, drawing inspiration from Noble et al. (2010). To this end, data from the GHS from 2005 to 2019 was utilised. The domains of the PIMD were designed to quantify a range of deprivations that individuals face, incorporating five critical domains: health, education, standard of living, income, and material deprivation.

Table 6.2: Domains, Associated Indicators, and Thresholds of Deprivation in the PIMD

Domain	Indicator	Threshold
Health	Disability grant	A household is considered deprived in this dimension if at least one member receives a disability grant due to his/her inability to work.
Education	Highest level of education attained	Individuals with less than five years' (Grade 4) formal schooling are considered deprived.
Standard of living	Access to electricity	Households marked as 'No' for having electricity are considered deprived.
	Fuel for cooking	Households using wood, coal, paraffin, or animal dung for cooking are considered deprived.
	Access to water	Households without access to piped water in the dwelling are considered deprived.
	Sanitation type	Households without a flush toilet in the dwelling are considered deprived.
	Housing quality	Households living in informal areas or traditional authority areas are considered deprived.
Income and material deprivation	Asset ownership	A household that does not own more than one radio, refrigerator, television, telephone, or car is considered deprived.
	Unemployment	Households are considered deprived if all adults (aged 15 to 64) are unemployed.

Traditionally, poverty is measured through uni-dimensional metrics like income or expenditure. While effective in measuring absolute poverty, these fail to capture its multi-faceted nature. The PIMD is a vital tool that enables a quantitative assessment of poverty levels across South Africa's diverse provinces, transcending conventional money-based measures. In constructing the PIMD, the primary focus was to comprehensively and consistently capture the essence of deprivation over time. This required the researcher to select indicators from the GHS dataset that were consistently available from 2005 to 2019.

For instance, a variable in the health domain was chosen to identify whether an individual receives a disability grant. This indicator was selected because a significant health condition is a prerequisite for the grant to be awarded, thus reflecting the prevalence and severity of health impairments in the population. Regarding the threshold in this dimension, households were deemed deprived if at least one member was receiving a disability grant.

In line with the study's objectives, which mirror the domains in the SAMPI, an additional indicator was incorporated in the standard of living domain: fuel used for cooking. This indicator assesses poverty levels based on a household's reliance on basic and potentially hazardous materials such as wood, coal, paraffin, or animal dung for cooking. Using these fuels indicates a lower standard of living and a lack of access to modern amenities, leading the researcher to consider households relying on them as deprived in this respect. Table 6.2 above presents a comprehensive overview of all the domains, indicators, and thresholds that were employed in constructing the PIMD, ensuring a thorough and nuanced measurement of poverty. (The results of the deprivation headcounts for each indicator are detailed in Tables 6.17-6.31 in Appendix C, which was calculated using the GHS data for each province from 2005 to 2019.)

Also integral to this specification is the weighting stage, a crucial aspect of the process that determines the relative importance of each dimension and indicator in assessing the poverty experienced by households in these provinces. In line with the methodology used in the SAMPI and acknowledging that, despite their unique characteristics and challenges, the provinces share fundamentally similar socio-economic structures, the study implemented a nested weighting system. This entails weighing all domains equally and assigning equal weights to the indicators within each domain.

Table 6.3 below summarises the details of the weighting structure that was employed. Different from Chapter 3 and to align with the approach used in SAMPI by Statistics South Africa to calculate this index for the respective provinces, this study assigned equal b^{th} weight to each domain. Assigning equal weights for domains in this chapter, where the SIMD for provinces was created, is justified by Stats SA (2020) because this ensures uniform representation across these regions (provinces) with similar characteristics while assigning different weights to domains in regions such as traditional authority areas, formal rural areas, formal, and informal urban areas (as done in the analysis in Chapter 3) acknowledges the distinct socio-economic dynamics and priorities within each of these regions.

The Health and Education indicators are each assigned a weight of 1/4, underscoring their critical role in comprehending the poverty landscape across the provinces. Furthermore, aligned with the SAMPI approach, the study introduced an additional income and material deprivation indicator. This is represented by the Unemployment indicator, which carries a weight of 1/8. Its inclusion is particularly pertinent given its significant impact on income deprivation and material hardship. It thus enhances the index's robustness and sensitivity, providing a more thorough depiction of poverty's multi-faceted nature.

Table 6.3: Indicators and their Weights

Domain	Indicator	Weight
Health	Disability grant	1/4
Education	Highest level of education attained	1/4
Standard of living	Access to electricity	1/20
	Fuel for cooking	1/20
	Access to water	1/20
	Sanitation type	1/20
	Housing quality	1/20
Income and material deprivation	Asset ownership	1/8
	Unemployment	1/8

With that in mind, the calculated rates presented in Tables 6.17-6.31 in Appendix C were multiplied by their respective weights and then combined to compute a composite score for each province for each year. The final step in the specification was to standardise these combined scores, assigning values within a range of 0 to 10. On this scale, zero indicates the least deprived area, and ten indicates the most deprived. This facilitates a clear, scaled representation of deprivation levels across the provinces.

In the second specification, the PIMD figures derived from the previous specification were utilised to explore whether the regional poverty levels affect the relationship between public health expenditure and overall health across South Africa's provinces. The study employed the two-way FE model for this and the subsequent specification to accomplish this. The use of this model is advantageous in this context as it enables control over time-invariant regional characteristics and common time effects. This methodological choice ensures a more nuanced and precise analysis of the intricate interplay between public health spending, regional poverty, and health outcomes.

To implement this approach, the two-way FE model was estimated using equation (6.2):

$$LE_{it} = \beta_0 + \beta_1 ln\left(\frac{PHE}{pop}\right)_{1it} + \beta_3 ln\,(PIMD)_{3it} + \beta_4 ln\,(GDP\ per\ capita)_{4it} + \beta_5 ln\,(PGR)_{5it} + \beta_6 ln(FLR)_{6it} + \beta_7 ln\,(\text{HIV})_{7it} + \beta_8 \left(GP * \frac{PHE}{pop} * PIMD\right)_{8it} + \beta_9 \left(WC * \frac{PHE}{pop} * PIMD * \frac{PHE}{pop} * PIMD\right)_{9it} + \beta_{10} \left(NW * \frac{PHE}{pop} * PIMD\right)_{10it} + \beta_{11} \left(KZN * \frac{PHE}{pop} * PIMD\right)_{11it} + \beta_{12} \left(MP * \frac{PHE}{pop} * PIMD\right)_{12it} + \beta_{13} \left(LP * \frac{PHE}{pop} * PIMD\right)_{13it} + \beta_{14} \left(FS * \frac{PHE}{pop} * PIMD\right)_{14it} + \beta_{15} \left(NC * \frac{PHE}{pop} * PIMD\right)_{15it} + f_t + \varepsilon_{it} \quad (6.2)$$

In Equation (6.2), life expectancy at birth is the dependent variable, measured for each province (i) at time (*t)*. The independent variables include the logarithms of the following: public health expenditure per capita, GDP per capita to estimate income, the population growth rate, the female literacy rate, and the HIV prevalence rate, all specific to each province and time period. Utilising logarithmic transformations for these variables linearises their relationships with life expectancy, creating a more interpretable model that translates effects into percentage changes and accounts for potential skewness in the data distributions.

The PIMD is also included in its original form, specific to each province and period, providing a nuanced view of poverty. Furthermore, Equation (6.2) included variables to capture time effects **(**f_t**),** which is crucial as it allows the model to account for temporal trends and variations, thereby improving the accuracy and relevance of the findings in a dynamic socio-economic context (Imai & Kim, 2021).

A significant aspect of Equation (6.2) includes an interaction term between per capita public health expenditure, the PIMD, and the provincial dummy variables. This was crucial as it provided insight into how regional poverty levels influenced changes in provincial public health expenditure between 2005 and 2019, compared to the changes experienced by the reference category, namely the Eastern Cape province. It was essential to understand the varying impacts of poverty levels across provinces.

The last specification involved re-estimating Equation (6.2), but with a key difference: it used the lagged values of public health expenditure per capita and GDP per capita as explanatory variables. This modification was designed to test the possibility that past economic activity could significantly impact the current health status of the population. To conduct this analysis, an equation similar in structure to Equation (6.3) was used, adapting it to reflect the influence of these historical economic factors.

$$LE_{it} = \beta_1 ln(GDP\ per\ capita)_{i,t-1} + \beta_2 ln(GDP\ per\ capita)_{i,t-2} + \beta_3 ln(\frac{PHE}{pop})_{i,t-1} + \beta_4 ln(\frac{PHE}{pop})_{i,t-2} + +\beta_5 ln\ (GDP\ per\ capita)_{5it} + \beta_6 ln\ (PGR)_{6it} + \beta_7 (FLR)_{7it} + \beta_8 ln\ (\text{HIV prevalence})_{8it} + \beta_9 \left(PIMD * \frac{PHE}{pop} * PIMD\right)_{9it} + \beta_{10} \left(GP * \frac{PHE}{pop} * PIMD\right)_{10it} + \beta_{11} \left(WC * \frac{PHE}{pop} * PIMD\right)_{11it} + \beta_{12} \left(NW * \frac{PHE}{pop} * PIMD\right)_{12it} + \beta_{13}\ (KZN)_{13it} + \beta_{14}\ (MP)_{14it} + \beta_{15} \left(LP * \frac{PHE}{pop} * PIMD\right)_{15it} + \beta_{16} \left(FS * \frac{PHE}{pop} * PIMD\right)_{16it} + \beta_{17} \left(NC * \frac{PHE}{pop} * PIMD\right)_{17it} + f_t + \varepsilon_{it} \quad (6.3)$$

Some scholars such as Schultz et al. (2010) and Ullah et al. (2018) have argued that two lags of independent variables can sufficiently capture the delayed effects of economic growth and public health investment. Two lags of each variable were included in the analysis, as shown in

(6.3). This enabled the researcher to investigate past economic activity's ability to influence a population's current health, which is vital as it allows for a more thorough understanding of the temporal dynamics.

Lastly, when interpreting the results from a two-way FE model, it is essential to understand that the process involves more than just determining the direction of the coefficients; their magnitude is equally important as it quantifies the extent and significance of the impact of each variable (Imai & Kim, 2021). This provides crucial insights into these variables' practical and measurable influence on the dependent variable. R software was used as the primary computational tool to facilitate this analysis.

Based on these methodological considerations, a detailed discussion of the statistical findings follows below.

6.6. Results

6.6.1. Descriptive Statistics

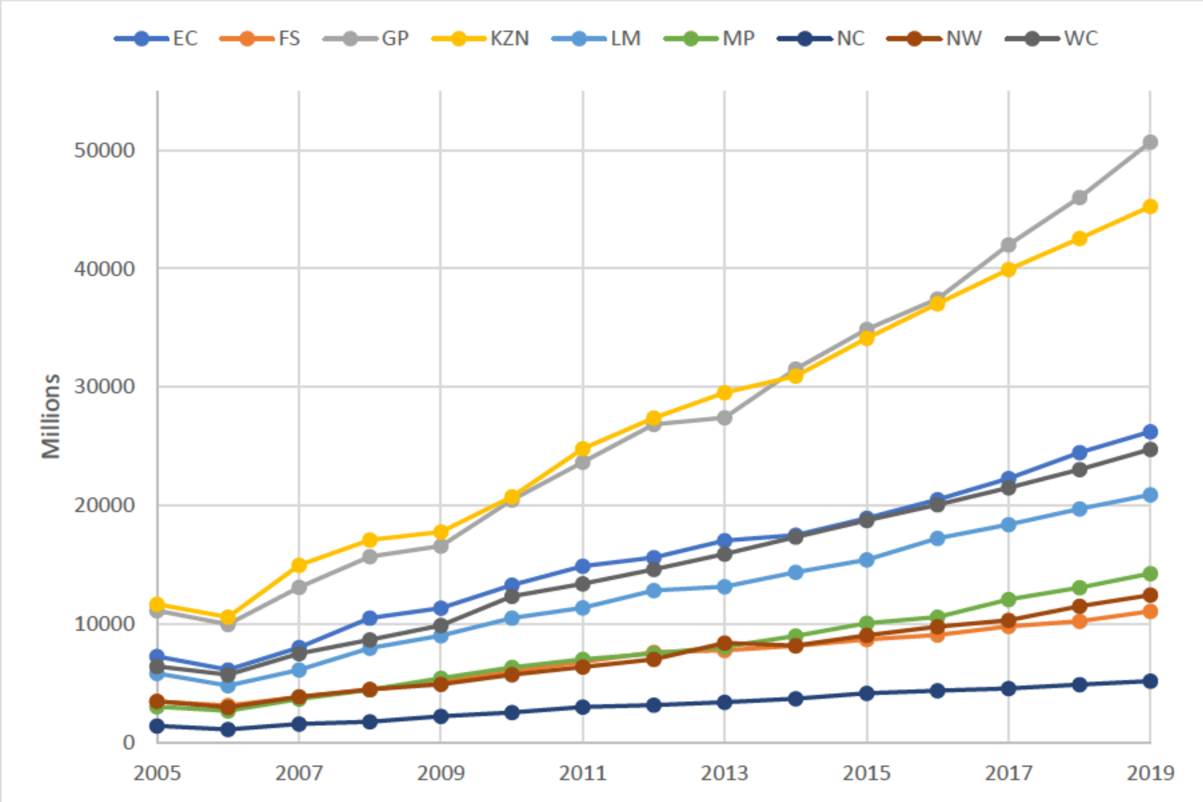
This section describes the study’s main variables: public health expenditure, public health expenditure per capita, life expectancy, income per capita, and poverty. Different methods were used to compare these variables across South Africa’s nine provinces and examine their trends over time.

6.6.1.1. Public Health Expenditure

Over the past few decades, the South African government has significantly expanded its spending on public healthcare, mainly aiming at guaranteeing citizens who were historically disadvantaged greater access to services. Figure 6.2 illustrates the clear upward trend in all provinces and years. Over a period of 14 years, Gauteng and KwaZulu-Natal were the top spenders. In 2005, Gauteng spent R11.12 billion, whilst KwaZulu-Natal spent R11.66 billion. By 2019, however, Gauteng's spending had grown to R50.67 billion, and KwaZulu-Natal's saw an upsurge to R45 billion.

Mpumalanga occupies the middle ground in growth, with health expenditure increasing from R3.013 billion in 2005 to R14.259 billion in 2019, a rise of R11.246 billion in 14 years. Despite being less impressive than provinces like Gauteng and KwaZulu-Natal, this reflects considerable commitment to enhancing public health services. At the other end of the scale, the Northern Cape maintained consistently low levels of public health expenditure. From 2005 to 2019, its spending on healthcare was stable but meagre compared to other provinces. The budget allocation started at a low R1.41 billion in 2005 and grew to a modest R5.18 billion in 2019.

Figure 6.2: Trends in public health expenditure by province (2005-2019)



*Note: This figure is the author's work and was compiled using National Treasury's provincial database data.

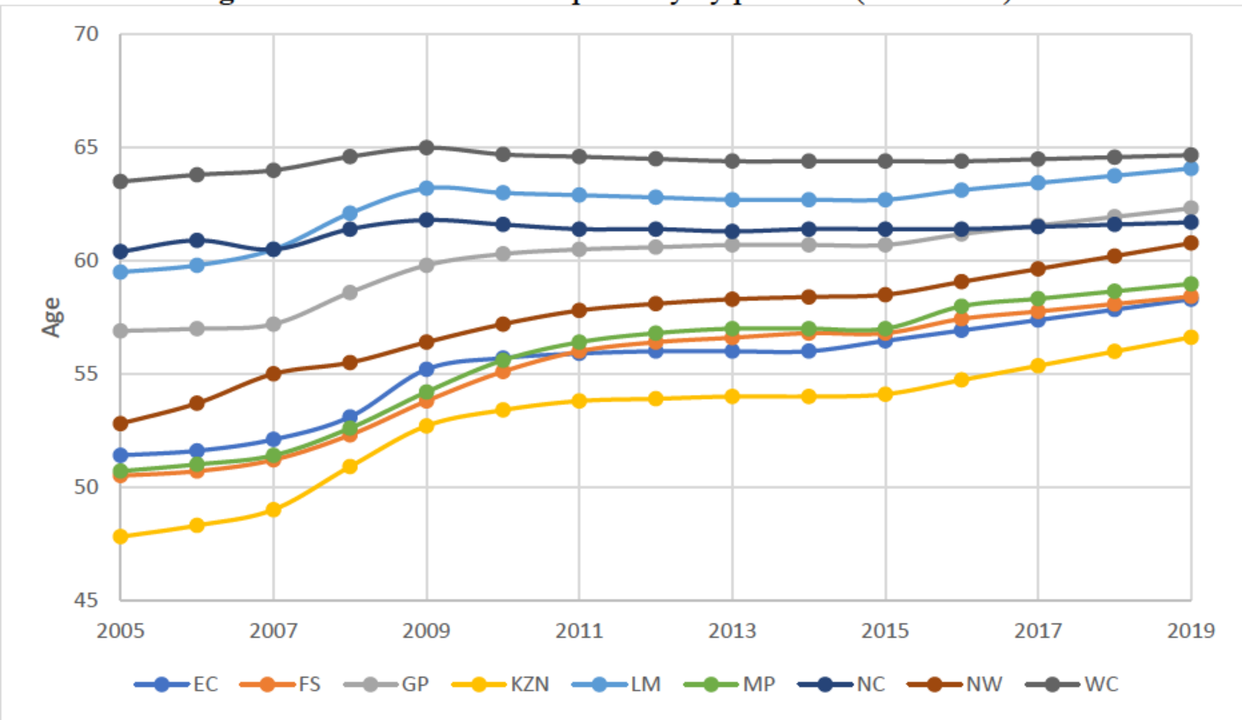
The increase in public health expenditure across South Africa's provinces indicates an upward trend in healthcare funding. This may have implications for health outcomes, warranting further exploration. In the subsequent analysis, the potential impact of these expenditure patterns on life expectancy across various provinces is investigated, examining the data to discern any correlations or trends.

6.6.1.2. Life Expectancy Trends Across Provinces

Building on the understanding of public health expenditure trends, the focus shifts to the corresponding changes in life expectancy, where, as illustrated in Figure 6.3, distinct patterns can be observed across the provinces.

The Western Cape had the highest life expectancy, from 64 to 65 years between 2005 and 2019. This modest increment denotes an improvement in the province's healthcare and living standards. A striking fact is that its life expectancy aligns with its level of public health expenditure, being among the top spenders (see Figure 6.2). Life expectancy in Gauteng rose significantly from 57 years in 2005 to 62 years by 2019. This placed Gauteng among the top three provinces in 2018 in terms of life expectancy, closely following the Western Cape and Limpopo. It indicates progress in healthcare and overall living conditions within the province.

Figure 6.3: Trends in Life Expectancy by province (2005-2019)



*Note: This figure is the author's work and was compiled using data from the Health Barometers published by the Health Systems Trust.

Although the Northern Cape recorded the lowest public health expenditure of all the provinces, it had the biggest improvement in life expectancy from 53 to 61 years between 2005 and 2019, surpassing five others. In contrast, KwaZulu-Natal, the second largest spender on public health, recorded the lowest improvement in life expectancy, from 48 years in 2005 to 57 in 2019. This intriguing divergence between provinces' public health expenditure and improvement in life expectancy suggests that other factors are at play, in concert with issues beyond public health expenditure, that significantly affect life expectancy.

The life expectancy data for South Africa's provinces over 14 years reveal notable disparities in health outcomes. While some provinces, such as the Northern Cape, showed significant improvement, others experienced only marginal increases. These variations suggest a complex pattern rather than a uniform upward trend, reflecting diverse levels of improvement in healthcare and living conditions. This nuanced picture underscores the ongoing need for targeted efforts to address regional disparities in access to quality healthcare, ensuring equitable health improvements across all provinces.

Closer examination is required to enhance understanding of the connection between public health expenditure and life expectancy. The following section presents summary statistics on these variables, offering a deeper perspective of this relationship.

6.6.1.3. Summary Statistics of Life Expectancy and Public Health Expenditure per Capita

To deepen the analysis, this section presents a comprehensive summary of statistical data on life expectancy and public health expenditure per capita across the provinces. The remainder of the analysis focuses on public health expenditure per capita, as it provides a more accurate reflection of individual resource allocation and its impact than aggregate spending.

Table 6.4 presents the summary statistics of each province's life expectancy and public health expenditure per capita. The average, minimum, maximum and standard deviation are shown for life expectancy. The statistics illustrate marked disparities in average life expectancy, which ranges from 53 years in KwaZulu-Natal to 64 in the Western Cape.

These disparities underscore the substantial variations in health outcomes among provinces, with standard deviations indicating the degree of variability within each region. While the Western Cape reports the highest average life expectancy, it also displays the lowest standard deviation, suggesting a more consistent life expectancy distribution. Conversely, provinces like KwaZulu-Natal exhibit lower average life expectancy and higher standard deviations, signalling greater variations in health outcomes. These findings are supported by Figure 6.3.

An analysis of public health expenditure per capita reveals significant diversity across provinces. Gauteng leads with an average expenditure of R3,084 (see Figure 6.4), closely followed by the Western Cape at R3,423. In contrast, despite ranking second in aggregate expenditure, KwaZulu-Natal falls fifth in public expenditure per capita. This discrepancy can be attributed to the province’s distinct health needs and the fact that it is the second-largest province in South Africa (Statistics South Africa, 2021).

At the lower end of the scale, the Eastern Cape and Mpumalanga report the lowest average public health expenditure per capita, at R2,888 and R2,291, respectively. This is in stark contrast to their rankings based on aggregate expenditure. Similar to KwaZulu-Natal, factors such as a larger population and distinct health needs in these provinces could explain the discrepancies observed between Figure 6.2 and Table 6.4. Furthermore, the range of public health expenditure per capita across provinces is considerable. For instance, Gauteng's maximum per capita allocation was R4,910 against the Eastern Cape's minimum of R2,054 from 2005 to 2019. The standard deviation also reflects this wide variation, highlighting disparities in resource allocation among the provinces.

Table 6.4: Summary Statistics of Life Expectancy and Public Health Expenditure by Province

	Average Life Expectancy	**Min Life Expectancy**	**Max Life Expectancy**	**Std Dev Life Expectancy**	**Average Public Health Expenditure Per Capita**	**Min Public Health Expenditure Per Capita**	**Max Public Health Expenditure Per Capita**	**Std Dev Public Health Expenditure Per Capita**
EC	55	51	58	2.23	2888	2054	4137	680.85
FS	55	51	58	2.78	3047	1192	4790	1156.13
GP	60	57	62	1.76	3084	1385	4910	1122.02
KZN	53	48	57	2.74	2982	1591	4436	922.64
LP	62	60	64	1.38	2450	1186	3667	792.02
MP	56	51	59	2.87	2291	1231	3376	677.84
NC	61	60	62	0.41	3353	862	5839	1583.09
NW	57	53	61	2.33	2338	949	3659	866.81
WC	64	64	65	0.38	3423	1515	5333	1207.26

*Note: These categorisations were calculated using the data from publications by National Treasury and the Health Systems Trust.

This section explored summary statistics of life expectancy and public health expenditure by province, revealing disparities in resource allocation. The following section examines year-on-year (YoY) percentage changes to investigate the impact of economic factors on health status and deepen understanding of these relationships.

6.6.1.4. Annual Trends in Health and Economic Indicators

This section examines annual health and economic indicators trends across the provinces based on YoY percentage changes. This very useful analytical tool provides a 'snapshot' of the dynamic nature of the relationships between important historical economic variables such as public health expenditure per capita and income per capita and the overall health status within these regions. The objective was to determine the nature of the relationship between these variables and life expectancy at birth, specifically whether it was non-existent, positive, or negative.

Table 6.5 presents the annual trends in life expectancy, per capita public health expenditure, and per capita income in Gauteng, highlighting the YoY percentage changes. The changes reveal the interconnectedness of these factors and their potential impact on health outcomes. Gauteng has consistently improved life expectancy, mainly reflecting positive YoY changes.

However, a noteworthy observation in this table is the substantial increase in life expectancy in 2008, marked by a YoY change of 2.45%. This suggests that investment in public health expenditure and income in the preceding year may have positively influenced health outcomes, emphasising the importance of consistent healthcare spending in enhancing life expectancy.

The data highlights varying trends in public health expenditure per capita over time, with a significant rise of 18.19% in 2006. Interestingly, the same year marked the highest annual increase in per capita income, showing a remarkable surge of 592.73%. Such variations in these economic factors could influence the accessibility and quality of healthcare services, potentially impacting life expectancy in this province.

Table 6.5: Annual Trends in Life Expectancy and Public Health Expenditure in Gauteng

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,18	18,19	592,73
2007	0,35	15,39	-42,22
2008	2,45	13,34	-32,32
2009	2,05	11,77	44,01
2010	0,84	4,10	90,26
2011	0,33	15,74	-91,24
2012	0,17	5,24	-8,98
2013	0,17	0,46	4,93
2014	0,00	9,52	-0,17
2015	0,00	16,96	39,62
2016	0,79	6,45	-26,97
2017	0,62	6,06	32,89
2018	0,62	5,71	17,60
2019	0,61	5,41	12,69

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

However, it is important to note that these economic fluctuations were not immediately reflected in the YoY percentage change in life expectancy for that year or the subsequent one. As noted previously, the effect primarily became evident in 2008. This might suggest a two-year lag in the influence of economic factors working through the intermediaries mentioned earlier, or other factors could have contributed to the surge in life expectancy in 2008.

Moving to Table 6.6, which shows annual trends in life expectancy, public health expenditure per capita, and income per capita in the Northern Cape, a notable observation is substantial fluctuations in life expectancy. In 2007, a sharp negative YoY change of -0.66% indicates a decline in life expectancy. However, in 2008, the Northern Cape experienced the highest positive YoY percentage change, with a figure of 1.49%, suggesting that investment in public health or income in that year or the preceding year(s) may have positively influenced health outcomes, akin to the findings for Gauteng.

Table 6.6: Annual Trends in Life Expectancy and Public Health Expenditure in Northern Cape

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,83	41,25	-92,48
2007	-0,66	29,20	518,29
2008	1,49	22,60	-30,67
2009	0,65	18,43	37,31
2010	-0,32	17,77	92,46
2011	-0,32	14,57	-13,86
2012	0,00	10,09	-8,13
2013	-0,16	8,04	-89,59
2014	0,16	7,50	973,15
2015	0,00	12,10	37,52
2016	0,00	8,05	-28,39
2017	0,16	7,43	33,70
2018	0,16	6,91	-88,23
2019	0,16	6,47	11,79

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

Furthermore, the YoY changes in public health expenditure per capita reveal considerable volatility, especially in 2007 (29.20%) and 2008 (22.60%), reflecting instability in the allocation of healthcare resources, which can influence healthcare investment for the population in this province.

Regarding per capita income in the Northern Cape, 2014 is particularly notable for its extraordinary surge, showing a YoY change of 973.15%. While this indicates improved economic conditions, the data does not readily reveal its immediate impact on life expectancy. Further analysis may be needed to understand why this specific change in income per capita did not translate into improved health in that year or the subsequent year.

Table 6.7 illustrates the annual trends in life expectancy, public health expenditure per capita, and income per capita in Limpopo province. Similar to the patterns observed in the Northern Cape, the most notable increase occurred in 2008, with a substantial YoY change of 2.64%, implying that economic factors in that particular year, alongside historical ones, may have played a role in fostering consistent improvements in life expectancy across most of South Africa's provinces.

As corroborated by Figure 6.4, public health expenditure per capita in Limpopo remains relatively stable compared to the Northern Cape and Gauteng. However, the data also reveals extreme YoY changes in income per capita, especially in 2011, where an exceptional positive change of 797.21% was observed.

Table 6.7: Annual Trends in Life Expectancy and Public Health Expenditure in Limpopo

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,50	14,93	-28,72
2007	1,17	12,99	-39,79
2008	2,64	11,50	-29,32
2009	1,77	10,31	55,83
2010	-0,32	11,56	-80,44
2011	-0,16	11,97	797,21
2012	-0,16	8,11	-6,53
2013	-0,16	2,27	6,86
2014	0,00	8,02	-0,40
2015	0,00	4,63	42,47
2016	0,67	5,99	-24,73
2017	0,51	5,65	36,22
2018	0,50	5,35	21,05
2019	0,50	5,08	13,63

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

Interestingly, this substantial increase in income per capita did not translate into improved life expectancy, as reflected in the negative -0.16% YoY percentage change in life expectancy for that year and the subsequent one. This disconnection between a significant increase in income and its failure to translate into improved life expectancy highlights the multi-faceted nature of this relationship, warranting further examination.

Table 6.8 depicts the annual changes in life expectancy, public health expenditure per capita, and income per capita in the Eastern Cape. A key observation is the consistent increase in life expectancy, especially the significant leap in 2009, marked by a YoY increase of 3.95%. This suggests a correlation between the preceding year's investment in public health expenditure and income and positive health outcomes, underscoring the critical role of sustained healthcare financing in boosting life expectancy.

The data also shows fluctuating public health expenditure per capita trends, with a decrease of 23.29% in 2009. Interestingly, this year also saw an increase in per capita income, indicating a rise of 52.97%. Such variations in these economic factors likely affect the accessibility and quality of healthcare services, which could impact life expectancy in the Eastern Cape.

Table 6.8: Annual Trends in Life Expectancy and Public Health Expenditure in Eastern Cape

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,39	10,13	-27,92
2007	0,97	9,20	-37,49
2008	1,92	8,43	-36,38
2009	3,95	-23,29	52,97
2010	0,91	9,05	-80,46
2011	0,36	13,16	777,01
2012	0,18	4,85	-2,30
2013	0,00	8,35	6,76
2014	0,00	-0,10	1,37
2015	0,82	14,80	44,73
2016	0,81	6,30	-26,98
2017	0,81	5,93	37,72
2018	0,80	5,60	19,63
2019	0,80	5,30	13,59

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

Despite these economic shifts, the immediate impact on YoY changes in life expectancy is not consistently apparent. For instance, the drastic increase in income per capita in 2011 (777.01%) did not directly translate into an immediate improvement in life expectancy. This could imply a delayed effect of economic changes on health outcomes or the involvement of other intervening factors. Further analysis is warranted to comprehend why specific changes in economic indicators do not always result in immediate improvements in health metrics.

Table 6.9 presents YoY trends in life expectancy, public health expenditure per capita, and income per capita in the Free State. In line with the Eastern Cape, the data for this province illustrates an overall upward trajectory in life expectancy, with extreme spikes in some years (like the significant YoY growth of 2.87% in 2009. This pattern indicates that investment in public health and increased income in preceding years might have impacted the population's health outcomes, highlighting the importance of consistent healthcare funding in improving life expectancy. The table also shows an uneven public health expenditure per capita trend, with a substantial 21.56% YoY hike in 2006. There are also considerable fluctuations in income per capita, such as the enormous 954.11% rise registered in 2013. These economic changes likely impact the accessibility and quality of healthcare services, which could influence life expectancy in the Free State.

Table 6.9: Annual Trends in Life Expectancy and Public Health Expenditure in Free State

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,40	21,56	-92,53
2007	0,99	17,74	-40,39
2008	2,15	15,06	-29,81
2009	2,87	13,09	44,59
2010	2,42	15,54	92,26
2011	1,63	9,94	-13,23
2012	0,71	20,07	-90,90
2013	0,35	0,65	954,11
2014	0,35	5,99	2,15
2015	0,00	4,15	43,96
2016	1,11	6,83	-26,77
2017	0,57	6,39	38,40
2018	0,57	6,01	17,54
2019	0,57	5,67	12,51

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

It is important to note that these economic shifts do not always directly correspond with immediate changes in life expectancy for the same year, as seen in the above analysis for other provinces. For example, in this case, the significant rise in income per capita in 2013 does not reflect an immediate improvement in life expectancy.

A notable pattern emerges from the examination of Table 6.10, which demonstrates annual trends in life expectancy, public health expenditure per capita and income per capita in KwaZulu-Natal. Life expectancy appears to increase most years, with a remarkable YoY change of 3.88% in 2008. This may be linked to various factors, including public health investment and general economic conditions.

Table 6.10: Annual Trends in Life Expectancy and Public Health Expenditure in KwaZulu-Natal

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	1,05	12,77	-29,76
2007	1,45	11,32	-40,16
2008	3,88	10,17	-93,04
2009	3,54	9,23	1344,74
2010	1,33	-4,16	-81,38
2011	0,75	15,80	799,45
2012	0,19	13,27	-5,96
2013	0,19	7,78	6,52
2014	0,00	2,52	1,30
2015	0,19	8,51	43,00
2016	1,16	5,61	-26,52
2017	1,15	5,31	34,68
2018	1,14	5,04	18,80
2019	1,13	4,80	12,66

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

However, the table also reveals a dramatic spike of 1344.74% in income per capita in 2009. Although notable, this substantial economic growth does not seem to have an immediate and direct correlation with life expectancy for the same year, suggesting that the impact of economic improvements on health outcomes might have a delayed effect or be influenced by other variables. Public health expenditure per capita shows a mixed trend, with some years like 2010 experiencing a decline (-4.16%). This fluctuation might impact the accessibility and effectiveness of healthcare services, thereby affecting overall health outcomes.

Table 6.11, which focuses on Mpumalanga, showcases an oscillating pattern in life expectancy with prominent increases in certain years like 2009, where a 3.04% rise is observed. Notably, in 2008, there was a significant rise of 600.68% in income per capita, which seems to align with an increase in life expectancy, indicating that improvements in economic conditions could have a favourable impact on health outcomes.

Public health expenditure per capita in Mpumalanga exhibits variations, with some years like 2012 showing a decrease (-5.45%). These fluctuations in health investment could potentially impact the quality and reach of healthcare services, subsequently affecting life expectancy.

Table 6.11: Annual Trends in Life Expectancy and Public Health Expenditure in Mpumalanga

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,59	12,38	-92,81
2007	0,78	11,09	-37,81
2008	2,33	9,98	600,68
2009	3,04	9,07	48,61
2010	2,58	14,65	93,88
2011	1,44	7,76	-9,52
2012	0,71	-5,45	-3,59
2013	0,35	7,52	3,28
2014	0,00	6,91	0,33
2015	0,00	11,64	40,83
2016	1,74	5,55	-27,42
2017	0,57	5,26	34,14
2018	0,57	5,00	19,02
2019	0,56	4,76	12,60

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

Table 6.12 depicts trends in the North-West province and reveals a general increase in life expectancy over the years, with significant growth in certain years like 2007, when there was a 2.42% increase. The table suggests a complex relationship between economic factors and life expectancy, particularly in 2015, when there was a huge increase in income per capita (1306.74%). However, this substantial economic growth does not immediately reflect in a corresponding increase in life expectancy for the same year, indicating that the impact of economic conditions on health outcomes might be more nuanced and possibly delayed. Public health expenditure per capita also shows variability, with years like 2014 experiencing a decrease (-2.68%).

The data from the North-West province thus underscores the multi-faceted relationship between economic growth, public health expenditure, and health outcomes, emphasising the importance of balanced and strategic health policy and economic development initiatives.

Lastly, in Table 6.13, showcasing the Western Cape, gradual changes in life expectancy are observed over the years. For instance, there was a notable increase in life expectancy in 2008 (0.94%), which could be attributed to various factors, including developments in public health and economic conditions in this province. The table also highlights fluctuations in income per capita, such as the decrease of -30.60% in 2006, which may impact health outcomes. Public health expenditure per capita in the Western Cape exhibits a varying trend, with some years like 2010 experiencing a significant increase (20.41%). This can influence the quality and accessibility of healthcare services, potentially impacting life expectancy.

Table 6.12: Annual Trends in Life Expectancy and Public Health Expenditure in North-West

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	1,70	20,50	-32,22
2007	2,42	16,92	-41,59
2008	0,91	14,47	-31,68
2009	1,62	12,64	44,50
2010	1,42	21,46	90,59
2011	1,05	3,44	-10,32
2012	0,52	6,42	-12,92
2013	0,34	19,91	11,68
2014	0,17	-2,68	-90,64
2015	0,17	7,25	1306,74
2016	0,97	6,71	-27,57
2017	0,96	6,29	31,18
2018	0,96	5,91	16,26
2019	0,95	5,58	-88,79

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

In summary, economic conditions and public health investment affect longevity differently in different provinces in South Africa. In some cases, economic factors and healthcare spending are related to changes in human life. However, this trend does not manifest in every province. For example, Gauteng and the Eastern Cape show a straightforward correlation between economic factors, healthcare spending, and improvements in life expectancy, while there is no link in other provinces.

Furthermore, the relationship between these factors is not always straightforward or immediate. In some instances, substantial increases in income per capita did not result in immediate improvements in life expectancy, indicating a potential lag effect or the influence of other intervening factors. This complexity is particularly evident in cases where significant economic growth, seen in dramatic surges in income per capita, did not translate into immediate health improvements.

Table 6.13: Annual Trends in Life Expectancy and Public Health Expenditure in Western Cape

Year	YoY Change in Life Expectancy	YoY Change in Public Health Expenditure per Capita	YoY Change in Income per Capita
2005			
2006	0,47	17,99	-30,60
2007	0,31	15,25	-40,71
2008	0,94	13,23	-35,22
2009	0,62	11,69	41,44
2010	-0,46	20,41	87,28
2011	-0,15	3,28	-11,37
2012	-0,15	2,04	-7,80
2013	-0,16	7,65	5,17
2014	0,00	8,20	-2,01
2015	0,00	10,12	40,66
2016	0,00	6,43	-27,13
2017	0,14	6,04	31,25
2018	0,14	5,70	17,43
2019	0,14	5,39	11,70

*Note: The author's data was used to calculate YoY percentage changes, following the formula: percentage difference between the current and previous year's values, divided by the previous year's value, multiplied by 100.

Another notable trend is the variability in public health expenditure across provinces and over time. Such fluctuations can affect the accessibility and quality of healthcare services, potentially impacting life expectancy. For example, in years where public health expenditure per capita increased notably, there was often a corresponding improvement in life expectancy, underscoring the critical role of healthcare investment in enhancing health outcomes.

The findings underscore the importance of comprehensive and consistent healthcare funding alongside stable economic growth to improve health outcomes. They also highlight the need for a nuanced understanding of the relationship between economic factors and health, considering the potential delays and complex inter-dependencies involved. While this analysis provides valuable insights, it is essential to delve deeper into these dynamics through multivariate analysis to fully comprehend the intricate relationship between economic conditions, healthcare investment, and health outcomes in these regions. The following section examines the results of the multivariate analysis to probe such intricate interactions.

6.6.2. Results of the Provincial Index of Multiple Deprivation

Before examining the results of the multivariate analysis, it is essential to explore the outcome of the initial specification, which generated the PIMD for each province. This is crucial in understanding the variations in deprivation across South Africa's provinces. Table 6.14 presents an overview of the PIMD scores by province in South Africa from 2005 to 2019, ranging from 0 to 10. Lower scores indicate less deprivation, while higher scores denote greater deprivation. An analysis of this measure uncovers several significant findings and trends.

First, it was observed that provinces differ in their levels of deprivation. In 2005, KwaZulu-Natal had the greatest deprivation, with an index of 3.42, whereas the Western Cape only had an index of 1.60. The disparities changed over the years: The Eastern Cape became the province with the highest deprivation scores, and the Western Cape maintained its position as the least deprived province.

Table 6.14: Index of Multiple Deprivation by Province in South Africa (2005-2019)

	2005	**2006**	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**
EC	3,24	3,16	3,07	3,21	2,73	2,60	2,55	2,46	2,40	2,35	2,34	2,28	2,30	2,29	2,28
FS	2,36	2,23	2,18	2,13	1,56	1,41	1,31	1,37	1,35	1,38	1,44	1,42	1,42	1,37	1,41
GP	1,70	1,71	1,66	1,49	1,21	1,16	1,12	1,15	1,10	1,10	1,20	1,16	1,16	1,16	1,21
KZN	3,42	3,21	3,07	2,57	1,95	1,83	1,91	1,84	1,99	1,97	1,95	1,91	1,90	1,82	1,73
LP	3,29	3,19	3,11	3,19	2,51	2,40	2,30	2,27	2,42	2,36	2,28	2,28	2,28	2,26	2,22
MP	3,00	2,96	2,91	2,81	2,17	1,97	1,89	1,81	1,91	1,97	1,99	1,97	1,92	1,85	1,93
NC	2,19	2,37	2,36	2,23	1,82	1,73	1,84	1,73	1,69	1,68	1,70	1,69	1,69	1,56	1,49
NW	2,75	2,78	2,64	2,66	2,02	1,94	1,85	1,83	1,83	1,86	2,00	1,88	1,83	1,83	1,86
WC	1,60	1,58	1,56	1,36	1,04	0,95	0,90	0,81	0,86	0,84	0,90	0,90	0,89	0,86	0,80

*Note: The content presented here, including calculating deprivation scores using the first specification, is the author's original work.

Secondly, the data shows that between 2005 and 2019, there were fluctuations in deprivation levels across different provinces. For example, although the index for provinces such as Gauteng remained fairly constant, there was more variability among indices in others like KwaZulu-Natal and Limpopo. KwaZulu-Natal's index fell from 3.42 in 2005 to 1.73 in 2019.

Third, the data points to a decline in deprivation scores across provinces, suggesting overall improved living conditions. However, the rate at which the situation improves, differs. For instance, KwaZulu-Natal has the fastest annual improvement rate, at 0.100. In contrast, Gauteng has the lowest at only 0.034. This suggests that while some headway is being made, it is unequal, calling for measures specially tailored to lagging areas.

The variations in deprivation scores have significant implications for the analysis of how poverty affects the effectiveness of public health expenditure using the PIMD scores as a measure of poverty. These results are presented in the following section.

6.6.3. Two-Way Fixed Effects Regression Results: Analysis of the Base Model

The results from the two-way FE model in Table 6.15 provide insights into the relationship between public health expenditure, regional poverty levels, and life expectancy across South Africa's provinces.

As anticipated, the coefficient for the logarithm of income per capita is positive, signifying that a 1% increase in income per capita corresponds to a modest increase of 0.0523 units (years) in life expectancy. However, it is important to note that this coefficient is statistically insignificant, implying no substantial statistical relationship with the dependent variable. This suggests that income alone may not be enough to explain variations in life expectancy, as other factors may play a more critical role in determining health outcomes.

The negative coefficient for the natural logarithm of public health expenditure per capita is also of interest, as it shows that a 1% increase in per capita public health expenditure leads to a reduction in life expectancy by about 2.64 years. This surprising conclusion implies that spending more money on public health at the national level does not increase life expectancy. This variable is statistically significant at all conventional levels, showing a relationship with the dependent variable. It was thus necessary to conduct a more in-depth inquiry into this relationship.

Analysing the interaction between public health expenditure per capita, poverty, and the respective provinces produces interesting results. When regional poverty rates are accounted for, a 1% increase in per capita public health expenditure in the Free State, Gauteng, KwaZulu-Natal, Mpumalanga, and North-West is linked to an increase in life expectancy of about 0.0010, 0.0006, 0.0005, 0.0009, and 0.0007 years respectively, relative to the Eastern Cape. Although modest, these positive effects suggest that even small increases in health spending in these provinces may contribute to incremental improvements in life expectancy. These variables are statistically significant, implying a relationship with life expectancy.

The negative coefficient for the PIMD suggests that a one-unit increase in poverty levels corresponds to a decrease of approximately 3.22 units in life expectancy. The substantial magnitude of the PIMD coefficient underscores the significant and direct impact of poverty on life expectancy, indicating that higher poverty levels correlate with considerably reduced life expectancy across South Africa's provinces. This observation aligns with expectations and reinforces the well-established link between poverty and lower life expectancy. Notably, this variable is statistically significant at all conventional levels, suggesting a robust relationship with the dependent variable.

Table 6.15: Two-way Fixed Effects Model Results

Variables	Coefficients	Std. Error
Logarithm of Income per Capita	0.0523	0.0671
Logarithm of Population Growth Rate	0.0680	0.0896
Logarithm of Female Literacy Rate	-0.2172	2.1069
Logarithm of Public Health Expenditure per Capita	-2.6415 ***	0.8303
Logarithm of HIV Prevalence (Ages 15-49)	-1.1772	1.2709
PIMD	-3.2160***	0.7876
Interaction Term: Public Health Expenditure, PIMD, and Free State	0.0010***	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Gauteng	0.0006 **	0.0003
Interaction Term: Public Health Expenditure, PIMD, and KwaZulu-Natal	0.0005 **	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Limpopo	-0.0003	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Mpumalanga	0.0009 ***	0.0002
Interaction Term: Public Health Expenditure, PIMD, and North-West	0.0007 **	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Northern Cape	-0.0002	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Western Cape	-0.0011***	0.0004

*Note: The results are derived from equation (5.2). Coefficients marked with * indicate significance at the 10% level, those marked with ** denote significance at the 5% level, and coefficients with *** represent a high significance level at the 1% level.

Only the Western Cape showed a significant inverse link between per capita public health expenditure and life expectancy. In this province, a 1% increase in public health expenditure per capita lowers life expectancy by 0.0011 years compared with the Eastern Cape. However, compared to public health expenditure per capita and the PIMD, the coefficients for these interaction variables are relatively small. The implication is that these interaction term variables have little effect on life expectancy.

These results highlight the complex interplay between public health expenditure, poverty levels, and life expectancy across different provinces in South Africa and how these relationships differ from one province to another. The interaction terms between public health expenditure, PIMD, and various provinces reveal nuanced differences in this relationship across regions, with some provinces showing positive coefficients while others exhibit negative ones.

However, there is no discernible pattern in the results. For example, when comparing the least deprived province, Western Cape, to the reference category of the most deprived provinces, public expenditure per capita demonstrates a negative relationship with life expectancy. The lack of a clear pattern suggests that the factors influencing life expectancy may be complex and specific to each region, underscoring the importance of examining regional dynamics more closely. This discrepancy is further explored in the discussion section. The following section examines whether historical economic factors influence life expectancy.

6.6.4 Two-Way Fixed Effects Regression Results: Analysis of Past Economic Activities

The findings presented in Table 6.16, which include the lagged effects of past economic activities, align with those in the base model discussed in the previous section.

For the lagged variables of per capita income, the coefficient for the one-year lag is 0.0000, meaning that, in this case, income from the previous year does not greatly affect life expectancy. This coefficient is also statistically insignificant. The result indicates that income from just one year prior may not be enough to impact current life expectancy, as health outcomes might require longer-term economic improvements to show notable effects.

However, income per capita with a two-year lag reveals that a 1% increase in this variable corresponds to a decrease of 0.0001 years in average life expectancy. However, this variable is nearly zero and insignificant, which suggests that income from two years ago does not increase people’s lifespan. These findings imply that past income levels may have limited influence on immediate life expectancy outcomes, potentially because other social or health factors could overshadow the effect of past income.

The one- and two-year lagged values of public health expenditure per capita have identical magnitudes. This implies that when public health expenditure per capita increased by 1% from one and two years previously, life expectancy decreased by 0.0004 years. However, they are close to zero, and both lagged variables are not statistically significant. This result suggests that past increases in health spending may not yield immediate health benefits in terms of life expectancy, possibly due to delayed or inefficient resource allocation within the public health sector. Thus, in this context, public health expenditure per capita from one or two years ago does not relate to life expectancy.

In summary, public health spending per capita affects life expectancy. However, income per capita, its lagged values, and past public health spending per capita do not impact life expectancy. This observation suggests potential inefficiencies in South Africa's public institutions, hindering the translation of past economic factors, including public health expenditure and income, into improved life expectancy outcomes.

Table 6.16: Two-way Fixed effects model results

Variables	Coefficients	Std. Error
Logarithm of Income per Capita	0.0208	0.0731
Logarithm of Population Growth Rate	0.1587*	0.0968
Logarithm of Female Literacy Rate	-2.4690	2.5333
Logarithm of Public Health Expenditure per Capita	-2.4519*	1.1736
Logarithm of HIV Prevalence (Ages 15-49)	-3.4625*	1.4236
PIMD	-4.2100***	1.0910
Interaction Term: Public Health Expenditure, PIMD, and Free State	0.0011***	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Gauteng	0.0006*	0.0003
Interaction Term: Public Health Expenditure, PIMD, and KwaZulu-Natal	0.0007***	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Limpopo	-0.0003	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Mpumalanga	0.0009***	0.0003
Interaction Term: Public Health Expenditure, PIMD, and North-West	0.0006*	0.0003
Interaction Term: Public Health Expenditure, PIMD, and Northern Cape	-0.0001	0.0002
Interaction Term: Public Health Expenditure, PIMD, and Western Cape	-0.0003	0.0004
One-year Lag of Public Health Expenditure per Capita	-0.0004	0.0005
Two-year Lag of Public Health Expenditure per Capita	-0.0004	0.0004
One-year Lag of Income per Capita	0.0000	0.0001
Two-year Lag of Income per Capita	-0.0001	0.0001

*Note: The results are derived from equation (5.3). Coefficients marked with * indicate significance at the 10% level, those marked with ** denote significance at the 5% level, and coefficients with *** represent a high significance level at the 1% level.

6.7. Discussion

This chapter examined the intricate interplay between public health expenditure, regional poverty levels, and health outcomes across South Africa’s provinces. The findings reveal a nuanced and complex relationship significantly shaped by the varying poverty levels as measured by the PIMD.

At the outset, the PIMD for each province was established, covering 2005 to 2019. This index revealed significant variations in poverty levels across the provinces. For instance, in 2005, KwaZulu-Natal had the highest deprivation score at 3.42, contrasting with the Western Cape's lowest score of 1.60. Initially observed in 2005, these disparities persisted throughout the study period. In comparing the PIMD results, alongside the Human Development Index figures from the Global Data Lab (1990-2021) and the SAMPI from Stats SA (based on 2001 and 2011 census data), similar patterns of provincial deprivation were observed. While some shifts occurred between provinces over time, these indices consistently identified the Western Cape as having lower levels of deprivation and the Eastern Cape as one of the most deprived provinces. This convergence of findings across multiple indices lent credibility and robustness to the results.

After estimating the two-way FE model of the base model, many variables displayed the anticipated signs; however, contrary to expectations, the results indicated that for every 1% increase in public health expenditure per capita, life expectancy was projected to decrease by 2.6415 years at the national level. This unexpected outcome necessitated further exploration, as it implies that investment in healthcare services per person does not yield the expected life expectancy improvements. It may signal inefficiencies or misallocation of funds in the healthcare system, as higher spending on healthcare should ideally lead to better health outcomes and longer life expectancy.

The observed correlation suggests that despite increased financial resources being allocated to healthcare, other factors or systemic issues might be hindering the positive impact of healthcare spending on the population’s overall health and longevity. Poor governance is one such factor that can diminish the efficiency and quality of health services and the accountability and transparency of health spending. Indeed, studies by Bunyaminu et al. (2022) and Makuta and O’Hare (2015) found that government effectiveness moderated the impact of public health expenditure on health outcomes in different African contexts. Although the study did not specifically focus on government effectiveness, the well-known inefficiencies in South Africa’s government structures could significantly contribute to the findings.

Another possible explanation for these unexpected results is the principle of health persistence discussed by Miller (2019). This posits that regions with lower life expectancy often necessitate increased healthcare spending to address poor health outcomes. This scenario is particularly relevant in South Africa, where more than half the population lives in poverty. Longstanding health challenges compromise the efficacy of current public health expenditure in economically disadvantaged areas, typically inhabited by individuals who are lower on the socio-economic scale. Consequently, the observed negative correlation might not imply that higher spending leads to shorter lifespans. Rather, it could indicate that areas with lower life expectancy must invest more in public health, primarily in response to persistent health issues. This situation is pronounced in many of South Africa's provinces.

Building on these findings, the focus turned to the interaction term variables, which are crucial in understanding how poverty levels in each province influenced provincial public health expenditure and its impact on life expectancy from 2005 to 2019. The findings from the Western Cape revealed a unique pattern: a 1% increase in public health expenditure was associated with a decrease of 0.0011 years in life expectancy compared to the Eastern Cape. This finding contrasts with Hlafu et al. (2019), who reported a positive relationship between life expectancy and public health expenditure per capita in the Western Cape. However, it is important to acknowledge that Hlafu et al. (2019) did not account for regional poverty levels in their study.

A possible explanation for the findings could relate to the demographic characteristics of those relying on public healthcare in the Western Cape, mainly residents of townships and poorer regions. Alleged government neglect in developing these areas (Kulkarni et al., 2019) may exacerbate existing socio-economic disparities. Such neglect likely results in inadequate management of the hospitals and clinics serving the less privileged, and impacting overall life expectancy in these communities. Furthermore, it is important to consider the role of the private sector, which serves a significant portion of the population in this province. Since private healthcare usage is not reflected in public health spending, this could introduce bias in the results, potentially skewing the apparent relationship between public health expenditure per capita and life expectancy.

A consistent observation emerged in the analysis of historical economic factors, which were measured using one- and two-year lags for public health expenditure and income per capita. Both the lag variables for public health expenditure exhibited the same negative coefficient of 0.0004, close to zero. Moreover, these variables were statistically insignificant, implying that historical public health expenditure did not significantly influence life expectancy. Instead, only immediate health expenditure per capita appears to impact the dependent variable.

This finding is particularly intriguing when contrasted with research by Ullah et al. (2021) that identified a significant relationship between the lagged values of public health expenditure per capita and health outcomes. However, although significant, their observed effects were relatively small and tended to diminish with increased lags. This difference highlights the complexity and variability of the factors influencing health outcomes over time.

A comparable pattern was observed when considering the one- and two-year lag variables for income per capita. The coefficient for the one-year lag was zero, suggesting that it did not affect the dependent variable. The two-year lag variable also exhibited a coefficient close to zero, indicating a similarly negligible impact. Furthermore, both lagged values were found to have an insignificant effect on life expectancy. These results contradict Sharmar’s (2018) findings, suggesting a positive and significant relationship between income lags and life expectancy. It is worth noting that Sharmar's research focused on advanced economies, where efficient public institutions provide a context in which these lags can operate effectively.

In summary, the analysis demonstrates the varied ways poverty influences the effectiveness of public health expenditure in improving people's health across various provinces, confirming the validity of the first hypothesis. Furthermore, the effects of historical economic factors were insignificant, leading us to reject the second hypothesis that the lagged values of income per capita and public health expenditure per capita would impact the dependent variable.

6.8. Conclusions and Recommendations

This chapter explored the intricate dynamics among regional poverty levels, public health expenditure, and population health. Furthermore, the investigation delved into the impact of historical economic factors on health outcomes across various regions. Utilising a comprehensive dataset spanning 2005 to 2019 sourced from the GHS, the HST database, and National Treasury’s Intergovernmental Fiscal Review, we developed the PIMD. This index was analysed using a two-way FE model to thoroughly examine these complex relationships.

The findings revealed an unexpected negative correlation between life expectancy at birth and public health expenditure per capita, challenging the typical expectation that increased healthcare spending should yield better health outcomes. This suggests potential inefficiencies or misallocation of funds in South Africa's healthcare system. Another possible explanation might be the concept of health persistency, which posits that regions with historically lower life expectancy may demand higher public health expenditure to mitigate existing health challenges.

To enhance healthcare effectiveness and increase life expectancy, the South African government should consider conducting a comprehensive review of its healthcare spending to identify and address any inefficiencies or misallocation of funds. Such a review should analyse healthcare distribution and resource utilisation to ensure that funds meet the population's needs effectively, particularly in historically lower life expectancy areas. The government could also adopt a strategy focussed on health persistency by directing resources to regions facing longstanding health challenges. This may include boosting funding for preventive care and public health initiatives in the most affected areas, addressing persistent health disparities and improving life expectancy.

The study also underscored the intricate relationship between public health expenditure, regional poverty, and life expectancy across South Africa’s provinces. In those like the Free State, Gauteng, KwaZulu-Natal, Mpumalanga, and North-West, increased public health expenditure and mildly improved life expectancy was observed when adjusted for poverty. Conversely, the Western Cape exhibited a paradoxical trend, where increased health spending was linked to decreased life expectancy. This finding highlights the inadequacy of a uniform health policy across diverse socio-economic landscapes. Policymakers should adopt region-specific strategies, particularly in areas like the Western Cape, where socio-economic disparities potentially undermine the efficacy of increased health spending.

Concerning the role of historical economic factors, the analysis indicated that the lagged variables of public health expenditure and income per capita exerted minimal influence on life expectancy. This finding emphasises the importance of immediate socio-economic conditions over historical economic factors in determining health outcomes. Policy formulation should, therefore, focus on current economic and health interventions, prioritising immediate and targeted responses to contemporary socio-economic challenges. The negligible impact of historical economic variables on health outcomes further suggests the need for dynamic and adaptable policies in a rapidly evolving socio-economic context.

Future research could investigate health persistency by including lagged dependent variables of life expectancy, which could provide valuable insights into how past conditions influence current health outcomes. This would deepen understanding of the long-term effects of health policies and conditions and enhance the research's comprehensiveness. Future studies should also consider using a broader range of health measures as dependent variables such as the under-five mortality rate to validate and enrich their findings. This expansion of health metrics is especially important where data availability is a constraint, as was the case in this study, where the primary focus was on life expectancy due to missing values in other health indicators.

Furthermore, integrating measures of government effectiveness could introduce a novel perspective, revealing how governance quality impacts the relationship between public health expenditure and health outcomes. This could provide a holistic view of public health dynamics to guide the development of more efficient and impactful health policies.

6.9. Chapter Summary

This chapter analysed the relationship between public health expenditure and the population's health in the context of socio-economic inequalities. It also investigated historical economic factors that influence public health. The study utilised annual data spanning 2005 to 2019 sourced from the GHS, HST database, and National Treasury's Intergovernmental Fiscal Review. Life expectancy at birth was the primary outcome variable, and public health expenditure per capita was the main independent variable. We developed the PIMD, incorporating dimensions such as health, education, and living standards to assess poverty.

The methodology involved two-way FE models to analyse the intricate relationships between regional poverty, public health spending, and health outcomes. The influence of historical economic factors was accounted for by including lagged values of public health expenditure per capita and income per capita as independent variables. The study revealed a complex relationship between per capita public health expenditure, regional poverty, and life expectancy across South Africa's provinces. Contrary to expectations, increased public health expenditure per capita was linked to decreased life expectancy.

Furthermore, the study found that the impact of poverty on the effectiveness of public health expenditure varied across provinces. It was also established that income per capita, along with its lagged values and the lagged values of public health expenditure per capita, did not significantly affect life expectancy. The study uncovered a counterintuitive negative correlation between public health expenditure per capita and life expectancy in South Africa, implying inefficiencies in healthcare spending. A targeted review and reallocation of resources is recommended, especially in regions with persistent health challenges. Tailor-made, region-specific healthcare strategies and immediate interventions to address current socio-economic disparities are also recommended to enhance health outcomes.

The following chapter is the conclusion, which summarises and synthesises the findings from all preceding chapters to offer policy recommendations.

Chapter 7: Conclusion - Synthesis and Implications

This study explored the relationship between health inequality and healthcare policies in South Africa, focusing on areas experiencing varying degrees of deprivation. Chapters 3-5 concentrated on diverse regions, including rural formal areas, traditional authority areas, and informal and formal urban areas. Different levels of poverty and resources characterise each of these areas. Due to data limitations, Chapter 6 focused on South Africa's nine provinces. These analyses underscore the complex and persistent nature of health inequalities, setting the stage for a deeper exploration of the underlying issues.

7.1. Revisiting the Research Problem and Objectives

Despite numerous government interventions since the transition to democracy in 1994, socio-economic-related health inequalities persist in South Africa. These inequalities remain a major concern for both the population and policymakers. The expectation was that effective policies would narrow the health disparity gap, especially in the most deprived regions. However, ongoing health inequalities indicate that various unidentified mechanisms and factors continue to exacerbate these disparities.

One key issue is that policies have not been sufficiently targeted or tailored to meet the needs of impoverished populations. For policymakers to address this, deeper understanding of the interplay between health, health inequalities, and the impact of policies in different regions is required. There is a notable lack of comparative knowledge on how health inequalities vary between traditional authority areas, formal rural areas, and urban areas (both formal and informal). These regional differences potentially undermine the effectiveness of government interventions aimed at reducing inequalities.

This study aimed to fill these gaps by comprehensively analysing socio-economic-related health inequalities among adults and children and exploring how multiple deprivations impact health. It also assessed how government health spending affects populations with different levels of deprivation, emphasising the need to consider regional poverty levels in public health policy formulation.

To investigate this research problem, the study pursued four primary objectives. The first objective sought to assess the impact of multiple deprivations on adults' health inequalities within both urban and rural areas in South Africa. Secondly, the study aimed to investigate inequalities in chronic illness and disability among children across different regions. Thirdly, it focused on examining disparities in the prevalence of diabetes among adults in various geographical areas. Lastly, the research analysed the effectiveness of public health policies across different regions in South Africa. These objectives were addressed through four independent analytical chapters (Chapters 3-6), each focusing on different aspects of the research. The following section summarises the methods used in each of these analytical chapters.

7.2. Summary of Methodology

A diverse array of datasets was used to conduct the analyses. Chapter 3 utilised the NIDS Wave 5 dataset from 2017. For Chapters 4 and 5, the research also relied on the NIDS dataset, specifically leveraging its panel data feature. By combining Waves 1 and 5, a pooled dataset was created to facilitate a more comprehensive analysis. In Chapter 6, a unique dataset was constructed, encompassing annual data from 2005 to 2019. This was compiled from various sources, including the GHS, the HST database, and annual reports such as National Treasury's Intergovernmental Fiscal Reviews. These diverse data sources provided a robust foundation for the research presented in each thesis chapter.

Various empirical methods were employed to explore the themes in each chapter. These methodologies were selected and tailored to meet each unique objective, comprehensively examining the intricate relationship between health inequalities and socio-economic factors.

Chapter 3 assessed the mechanisms by which multiple deprivations influence health in the selected regions (traditional authority areas, rural formal areas, and formal and informal urban areas). The study adopted an empirical approach inspired by Noble et al. (2010) and concentrated on the adult populations. The initial phase involved constructing the SIMD for all selected regions using data from Wave 5 of the NIDS datasets. The SIMD was designed to capture various aspects of deprivation in selected South African regions, focusing on health, employment, education, the living environment, and income. Subsequently, the study utilised the SIMD for a detailed comparative analysis across each region. PCA was applied to overcome collinearity challenges, facilitating more nuanced and accurate insights.

Chapter 4 investigated the socio-economic disparities in chronic illness and disability among children in the selected regions, employing a methodology that built on the work of Wagstaff et al. (2007) through four distinct specifications. Concentration curves were first used to evaluate the distribution of chronic illnesses and disabilities among children across various levels of SES. The regression-based concentration index was then calculated for 2008 and 2017, quantitatively measuring health inequalities. A Linear Probability Model was applied for statistical analysis, specifically addressing the heteroscedasticity inherent in the model. The final stage involved decomposing the change in the concentration index from 2008 to 2017. This allowed for a detailed examination of the socio-economic factors contributing to health inequalities over time.

Chapter 5 assessed socio-economic-related inequalities in the prevalence of diabetes among adults in selected regions, employing a methodology similar to that used in Chapter 4. However, instead of using the regression-based concentration index, this chapter utilised the Erreygers (2009) concentration indices alongside concentration curves to quantify health inequalities. Like Chapter 4, this chapter included the decomposition of the concentration index that enabled a detailed analysis of the factors contributing to changes in socio-economic disparities across various geographic areas over time.

Chapter 6 examined the impact of regional poverty levels on the efficacy of public health expenditure, building on the methodologies of Hlafa et al. (2019) through three distinct specifications. The first involved developing the PIMD, incorporating data from the GHS from 2005 to 2019 across five key domains: health, education, standard of living, income, and material deprivation. This comprehensive approach enabled a quantitative assessment of poverty levels across South Africa's provinces. The chapter then analysed the relationship between regional poverty levels, public health expenditure, and health outcomes using a FE model. The final specification examined the delayed effects of public health expenditure and per capita income on health outcomes. This was achieved by employing the lagged values of these variables to understand their long-term impacts on population health.

In summary, the methodologies and datasets utilised in this study played a crucial role in examining the complex aspects of health inequalities and socio-economic factors across South Africa's diverse regions. The findings derived from these methodological approaches across the chapters are summarised in the following section.

7.3 Summary of Main Results

In Chapter 3, constructing the SIMD for selected regions in 2017 revealed varying levels of deprivation. Rural regions were more deprived than urban areas. More specifically, traditional authority areas had a SIMD score of 1.9, while rural formal areas, with a score of 3.9, were identified as the most deprived. In contrast, urban regions experienced less deprivation, with formal urban areas showing the lowest level at a SIMD score of 0.1, followed by informal urban areas with 1.4. However, a deeper analysis of the impact of multiple deprivations on individual health across these regions depicted a complex and contrasting landscape of health outcomes, revealing disparities not immediately apparent from the initial SIMD scores.

The multivariate analysis, which employed the SIMD as a dependent variable to capture multiple deprivations in each region, revealed nuanced disparities in health outcomes across the regions. The analysis focused on PCA1 and PCA2, where the SIMD variable exhibited significant loadings. It was found that informal urban areas were the most adversely affected, suffering severe health impacts stemming from extreme deprivation such as poor housing conditions and a lack of clean water. Traditional authority areas also faced considerable health challenges due to lacking basic amenities like clean water and sanitation.

Despite enjoying better access to amenities, formal urban areas were not exempt from the negative effects of deprivation. These areas ranked third in impact and showed notable declines in health, influenced by factors like socio-economic disparities and limited support networks. Conversely, formal rural areas experienced a less pronounced impact on health, potentially due to rural environments' lower pollution levels and stronger community cohesion. The differences observed in the multivariate analysis compared to the initial SIMD rankings highlight these regions' unique social and environmental factors, which could mitigate or exacerbate deprivation-related health risks.

The results from Chapter 4 provided a nuanced understanding of the changes in socio-economic-related inequalities in chronic illnesses and disabilities among children and the drivers of these inequalities across the selected regions.

In formal rural areas, there was a notable decrease in health disparities, with the concentration index shifting from a distribution favouring the affluent (0.313) to a perfectly equitable distribution between the poor and the rich (0.000). This decline in health inequalities amongst children with chronic illnesses and disabilities can be largely attributed to factors such as improved medical aid coverage and enhanced educational attainment among mothers, particularly those who did not complete secondary education, within this region. Furthermore, family dynamics, specifically parents' marital status, were pivotal in improving children's health outcomes.

A significant decrease in socio-economic-related inequalities in chronic illnesses and disabilities among children was also observed in informal urban areas. This is indicated by the concentration index moving from being concentrated among the wealthier population (0.225) to being more prevalent among the poorer segment (-0.452). It suggests that the burden of these illnesses and disabilities is now falling more heavily on poorer residents. The primary reasons include improvements in the education levels of mothers with lower educational attainment and increased access to medical aid, which have inadvertently led to a higher concentration of these health issues among the economically disadvantaged.

In traditional authority areas, there was a slight uptick in socio-economic-related inequalities in chronic illnesses and disabilities among children, with the concentration index moving from 0.008 to 0.088. Throughout both time frames, these disparities were more pronounced among the affluent. Key contributors to this growing inequality include increased disparities among children aged 11-15, variations in medical aid coverage, African ethnicity, and religious affiliation. This underscores an expanding health gap that favours wealthier individuals within these regions.

Formal urban areas recorded a noticeable increase in socio-economic-related inequalities in chronic illnesses and disabilities over time. These were initially more prevalent among the poorer segments of the population, as indicated by the concentration index value of -0.035. However, this trend reversed, with the inequalities becoming more concentrated among the affluent, evident in the latter’s concentration index value of 0.136. This growing divide in children's health is primarily attributed to disparities in maternal education levels, especially among children whose mothers did not complete secondary education.

The results from Chapter 5 revealed distinct trends and changes in the social determinants of socio-economic inequalities in the prevalence of diabetes among adults from different regions in South Africa. In traditional authority areas, there was a significant shift in diabetes-related disparities. The concentration index decreased from 0.036 to 0.014, signifying a decline in socio-economic inequalities, although diabetes remained more prevalent among the affluent. A major factor was the relative decline in diabetes prevalence among Black individuals compared to non-Blacks, indicating a narrowing racial gap. However, this positive development was counter-balanced by increased age-related disparities, especially among individuals aged 60 and older. Gender also played a crucial role, with a significant reduction in diabetes disparities among males compared to females.

Formal rural areas experienced a slight decrease in the concentration index for diabetes, moving from 0.018 to 0.0129. This indicated a marginal reduction in socio-economic inequalities, although the disease continued to be more prevalent among the affluent. In contrast to traditional authority areas, Black individuals in formal rural areas saw a significant increase in disparities compared to non-Blacks. Age dynamics also differed, with a considerable decrease in diabetes disparities among individuals aged 60 and older. Furthermore, the gender dynamics diverged as males encountered an increase in diabetes disparities compared to females.

Formal urban areas witnessed a noticeable increase in socio-economic inequalities related to diabetes, evidenced by the rise in the concentration index from 0.013 to 0.020. This points to growing disparities, predominantly among the affluent. Similar to traditional authority areas, a key factor driving this increase was the greater disparity in diabetes prevalence among individuals aged 60 and older. However, disparities among Black individuals fell, contrasting with the dynamics in formal rural areas.

A significant transformation in diabetes-related inequalities was noted in informal urban areas. The concentration index changed from 0.041 in 2008 to -0.003 in 2017, signalling a reversal in the pattern of diabetes prevalence, with the economically less privileged now more affected. Age emerged as a key factor, with individuals aged 60 and older experiencing decreased disparities. Furthermore, being Black in these areas led to an increase in disparities, mirroring the pattern in formal rural areas.

Lastly, the analysis in Chapter 6 uncovered a counter-intuitive negative correlation between life expectancy and public health expenditure per capita at the national level. Surprisingly, a 1% increase in public health expenditure per capita corresponded to a decrease of about 2.64 years in life expectancy. This suggests potential inefficiencies in healthcare resource allocation and use. The study also explored the interplay between public health expenditure per capita, regional poverty levels, and each province. This analysis reveals the varied effectiveness of healthcare spending in improving life expectancy within different poverty contexts. A positive link was noted in provinces like the Free State, Gauteng, KwaZulu-Natal, Mpumalanga, and North-West, indicating slight improvements in life expectancy with increased healthcare spending compared to the Eastern Cape. Conversely, the Western Cape exhibited a unique trend, where increased healthcare spending was inversely related to life expectancy.

The analysis of lagged income per capita variables also showed that income from the previous one or two years had no significant effect on life expectancy. Similarly, health expenditure per capita in the previous one and two years had a negligible impact on life expectancy. This suggests that historical healthcare spending levels have not significantly influenced health outcomes, underscoring the importance of current economic conditions and healthcare investment.

The following section integrates the findings from the four chapters, creating a cohesive link between them. This offers a comprehensive view of the broader implications of diverse health-related socio-economic factors.

7.4. Synthesising the Findings from Different Chapters

The synthesis of the findings from the various chapters of this analysis provides a nuanced understanding of the collective influence of multiple deprivations and socio-economic factors on health inequalities in South Africa. Contrary to the typical urban-rural dichotomy in South Africa, which often suggests better health outcomes in urban areas than rural ones (Phaswana-Mafuya et al., 2009), a more detailed examination of health outcomes across different age groups paints a different picture.

In adopting a more granular approach, the multivariate analysis presented in Chapter 3 revealed that informal urban areas exhibited the strongest negative correlation between health and multiple deprivations, closely followed by traditional authority regions. Formal urban areas ranked next, displaying a notable but less pronounced negative correlation. Formal rural areas demonstrated the weakest negative correlation in this dichotomy. The variations in basic amenities, income levels, and health outcomes within these regions substantiate this pattern. These disparities are probably the primary drivers of the marked negative relationship between health and multiple deprivations observed in these areas.

Building on these findings, Chapters 4 and 5 uncovered similar health outcome inequalities among children and adults. Although there were changes between 2008 and 2017, as outlined in the previous section, the situation in 2017 shows that the findings of Chapters 3 and 4 are closely aligned with those of Chapter 2. In 2017, informal urban areas had the largest inequalities in chronic illnesses and disabilities amongst children in absolute value. Hence, these regions require the most attention from the government. Formal rural areas had the least inequalities in children’s health outcomes during the same period.

Turning to adult health inequalities, in 2017, formal urban areas had a higher prevalence of diabetes. However, this inequality was concentrated among the affluent, who had better healthcare access. In contrast, the only negative concentration index value was found in informal urban areas. This suggests that the burden of diabetes prevalence was concentrated among people with low incomes in these regions, necessitating government intervention.

Focusing on informal urban areas is particularly important in public health policy, where reducing inequities and improving health outcomes for the most vulnerable populations is often a priority.

The main reason that health outcomes could be worse in informal urban areas compared to the other regional types may be the compounded effects of multiple deprivations, including inadequate sanitation, poor housing quality, and limited access to clean water. Combined with Chapters 4 and 5's insights, these factors underscore the complex interplay of socio-economic and environmental factors influencing health disparities in South Africa's diverse regions. This synthesis challenges the traditional urban-rural health narrative and highlights the importance of considering a range of deprivations in understanding health outcomes across different demographics.

It is crucial to acknowledge that inconsistencies in the units of analysis between Chapters 3-5 and Chapter 6 may pose challenges in synthesising and drawing comprehensive conclusions from these chapters. Despite this, it should be noted that the Western Cape was the only province with a significant negative relationship between public health expenditure and life expectancy at birth. This suggests that the Western Cape government should place emphasis on assessing its public healthcare expenditure. It is particularly relevant in informal urban areas, where disadvantaged populations are disproportionately affected by chronic illnesses and disabilities in children, as well as by the prevalence of diabetes in adults. These populations, primarily low-income people, lack the means to access quality healthcare, underlining the necessity for targeted government action in these areas.

Considering these complexities, the following section focuses on policy recommendations tailored to address the unique challenges and social determinants of health impacting adults and children in various regions. Strategies are proposed to contribute to creating a more equitable health landscape across South Africa's diverse regions.

7.5. Policy Initiatives to Address Health Inequalities

South Africa's journey to address health inequalities is characterised by diverse challenges across traditional authority areas, formal rural areas, and formal and informal urban areas. Each area has unique infrastructure challenges and social determinants that impact children's and adults' health. This section synthesises and extends the policy recommendations from each chapter, offering tailored strategies for each region. It begins with areas with the most negative relationship between health and multiple deprivations identified in Chapter 3, and ends with those showing the least negative relationship.

7.5.1. Informal Urban Areas

Addressing health disparities in South Africa's informal urban areas requires a multi-faceted approach. While these areas benefit from high levels of access to electricity (85.69%), they face significant sanitation challenges with only 53.64% of residents having access to flush toilets, and 7.10% relying on bucket toilets. The prevalence of low-quality housing (29.95%) exacerbates health risks. Policymakers should prioritise upgrading sanitation infrastructure, fostering community-led housing improvements, and ensuring consistent access to clean water.

Chapter 4 highlights the significant impact of maternal education on health inequalities among children with chronic illnesses and disabilities. The government should, therefore, focus on improving educational opportunities for mothers, particularly those with children aged 6-11, while concurrently enhancing healthcare access through subsidised medical aid programmes. The observed shift in these children's health inequalities from predominantly affecting the rich in 2008 to mainly impacting the poor by 2017 underscores the urgent need for targeted government interventions. These are essential to support vulnerable children and tackle the increasing socio-economic disparities in child health outcomes within these regions.

Chapter 5's finding that racial factors, particularly affecting Black individuals, significantly influence socio-economic-related inequalities in diabetes prevalence among adults indicates the need for targeted health education and intervention programmes. Focusing on diet management and diabetes control, these should be specifically designed for Black people to effectively address these disparities. In parallel with the initiatives for children, policies for adults must be tailored to the needs of the poorer segments of the population. This tailored approach is critical given the shift in diabetes prevalence from being predominantly among the affluent in 2008 to significantly affecting people with low incomes by 2017, highlighting the need for interventions that specifically assist these more vulnerable groups.

A comprehensive strategy to address the regional challenges and social determinants affecting children and adults in informal urban areas could include revisiting the RDP. Effective from 1994 to 2001, it played a pivotal role in constructing more than 1.1 million houses, providing shelter to about five million South Africans (Lodge, 2003). Reintroducing this programme, especially on a larger scale near city centres in all provinces, has the potential for significant benefits. Enhancing oversight measures and collaboration with reputable private sector firms are crucial to overcoming past corruption issues in RDP housing projects. This would promote the construction of higher-quality homes, effectively addressing these regions' housing needs.

This strategy could facilitate the relocation of individuals from informal urban areas to regions with better sanitation and housing while providing access to urban amenities that greatly affect inequalities in children's and adults' health outcomes. The government could further support this initiative by offering financial assistance or subsidies for education and healthcare to families relocating under the RDP. Such support is vital to ensure that all families can access essential services regardless of their financial situation, reducing health disparities linked to socio-economic factors.

7.5.2. Traditional Authority Areas

A comprehensive approach is also needed to tackle health disparities in traditional authority areas, particularly given the significant sanitation challenges and limited access to basic amenities. Although a large majority (85.90%) of residents in these areas have access to electricity, only 6.52% have access to flush toilets. This situation is further complicated by high usage of less sanitary options: 45.04% rely on unventilated pit latrines and 1.95% use bucket toilets. Furthermore, only 23.80% of residents have easy access to water, severely impacting hygiene and overall health. Upgrading sanitation facilities and improving access to clean water should be a top priority for policymakers in these areas.

Chapter 4 highlights that the 11-15-year age group makes a significant contribution to the increase in chronic illnesses and disabilities among children in these areas. Consequently, the government should intensify policies aimed at enhancing access to medical care and improving the quality of care for children within this age group who suffer from chronic diseases and disabilities. Moreover, Chapter 5 reveals that adults aged 60 and older are key to reducing socio-economic-related inequalities in diabetes prevalence in the region. Therefore, offering financial aid such as subsidies is essential to enhance healthcare for these individuals, facilitating better detection and management of diabetes and other chronic conditions common among the elderly. In this regional type, policy initiatives for both children and adults should primarily target the wealthier segment of the population, as the burden of these health inequalities remains concentrated amongst the affluent.

A holistic approach to addressing the regional challenges and social determinants contributing to health inequalities among children and adults in traditional authority areas could involve the implementation of a Community Health Worker (CHW) programme. As integral members of their communities, CHWs bridge the gap between health services and the community, facilitating access and enhancing the quality of service delivery (Rosenthal et al., 2010). In these areas, CHWs could provide crucial health education and care, particularly for children aged 11-15 with chronic diseases and disabilities and adults aged 60 and older with diabetes.

The CHW programme could also create employment opportunities in regions where jobs are scarce. The descriptive statistics in Chapter 3 indicate that in 2017, traditional authority areas had the highest percentage of people living on less than R10,000 per month, with 35% of the population in this region falling into this category. Consequently, training residents as CHWs would earn them wages higher than typical local jobs, thereby addressing both healthcare and economic challenges.

Moreover, CHWs could play a pivotal role in managing sanitation facilities and promoting good hygiene practices, directly addressing the significant sanitation issues in these areas. The government could partner with local businesses and non-profit organisations to establish community gardens or farming co-operatives. These initiatives could improve access to nutritious food, provide employment, and enhance community engagement. The produce from the gardens could be used in school feeding programmes, ensuring that children have access to healthy meals, which is vital for their overall health and academic performance. Furthermore, this produce could be sold at very low prices within communities, benefiting individuals aged 60 and above by ensuring that they have access to healthy meals.

7.5.3. Formal Urban Areas

Formal urban areas in South Africa present a considerably different deprivation landscape from traditional authority and rural formal areas. With high levels of access to electricity (92.70%) and flush toilets (90.73%), these areas demonstrate a higher standard of living and better access to essential health amenities. Proximity to water sources, with 94.25% of the population living within 100 metres of a source, significantly enhances living conditions and reduces the risk of waterborne diseases. Most housing in these urban areas is of high quality (77.53%), indicating lower exposure to environmental health risks. However, despite these advantages, health inequalities persist, influenced by factors extending beyond basic amenities such as SES, lifestyle choices, and healthcare access. To address these ongoing issues, the government could implement policy actions that include targeted financial assistance, educational and job training programmes, promotion of healthy lifestyle initiatives, and ensuring equitable access to quality healthcare services for all population segments.

The policy initiatives outlined above could significantly improve children's health in these regions, particularly considering Chapter 3's identification of maternal education as a key factor driving inequalities in chronic illnesses and disabilities among children in formal urban areas. Therefore, the government's education programmes could incorporate comprehensive strategies providing health literacy training and parenting support, catering to mothers from various socio-economic backgrounds. For the adult population, the approach recommended for traditional authority areas should also be applied in formal urban areas, especially since individuals aged 60 and above have been identified as major contributors to health inequalities in this region. Concentrating on this age group, which is central to diabetes-related health disparities, is crucial for effective management and reduction of these inequalities.

The government could direct policy initiatives towards the wealthier population segment to address regional challenges and holistically tackle health inequalities among children and adults in formal urban areas, where basic amenities and housing quality are less of a factor. This targeted approach is justified given that both the children's and adults' concentration indices are positive, indicating that the burden of these conditions is concentrated among the affluent population segment.

7.5.4. Formal Rural Areas

Lastly, in South Africa's formal rural areas, which were identified as the least affected by multiple deprivations in terms of health influence according to Chapter 3's multivariate analysis, the deprivation landscape still contrasts sharply with that of urban areas. Despite 72.47% of residents having access to electricity, a significant 27.49% lack this basic amenity, highlighting a crucial area of need that could potentially exacerbate health disparities, especially concerning food preservation and access to health services. Sanitation is also a major challenge, with only 50.29% of residents having access to flush toilets and widespread reliance on unventilated pit latrines, increasing the risk of infections. While housing quality is comparatively better, with 62.96% classified as high quality, there is still a need to address these persistent gaps in basic amenities. Enhancing electricity and sanitation access should be a primary focus for the government to improve health inequalities in this region.

Regarding children in this region, Chapter 4 identifies maternal education as the key driver of socio-economic-related inequalities in chronic illnesses and disabilities. The concentration index showed a significant shift from 0.313 in 2008 to zero in 2017, indicating equal distribution of these conditions among the rich and poor. This underscores the importance of maintaining this balance. Therefore, the strategy recommended for formal urban areas, focusing on enhancing educational opportunities and healthcare access for mothers, should also be adopted in this context. Policymakers should continue to prioritise and invest in maternal education in formal rural areas, recognising its crucial role in maintaining the equilibrium in health inequalities among children.

In terms of the adult population, Chapter 5 suggests that socio-economic-related inequalities in diabetes prevalence are significantly influenced by racial factors in this region. Therefore, mirroring the initiatives in informal urban areas, targeted health education and intervention programmes should be promoted specifically for Black individuals. More importantly, these initiatives should focus on the affluent segment of the Black population, as the study found that the burden of socio-economic-related inequalities in diabetes prevalence was concentrated amongst this group throughout the study period.

To holistically address the challenges in this regional type and enhance children's and adults' health, the CHW programme suggested for traditional authority areas should also be adopted in formal rural areas. This strategy could address healthcare needs and economic challenges by providing local employment opportunities while managing sanitation facilities and promoting good hygiene practices. Collaborating with local businesses and non-profit organisations to establish community gardens or farming cooperatives would serve multiple purposes: improving access to nutritious food for people affected by diabetes, providing employment opportunities, and fostering community engagement. Similarly, the garden produce can be utilised in school feeding programmes and sold to community members at reasonable prices.

In conclusion, addressing health inequalities in South Africa requires a multi-faceted approach tailored to different regions' unique challenges and social determinants. For informal urban areas, initiatives should focus on improving sanitation, housing, and access to clean water, while in traditional authority areas, CHW programmes and infrastructure improvements are key. Formal urban areas require policies targeting lifestyle choices and healthcare access despite better basic amenities. Lastly, in formal rural areas, the focus should be on enhancing access to electricity, sanitation and maternal education to maintain the equilibrium in health inequalities. These region-specific strategies are vital to create a more equitable health landscape across South Africa.

7.6. Policy Recommendations to Improve Efficiency in Public Health Spending

Chapter 6 identified a predominantly negative relationship between public health expenditure per capita and life expectancy at the national level. This suggests that the overall impact of public health spending on life expectancy across the country is inefficient. This crucial finding highlights an urgent need for the government to reassess and optimise its healthcare expenditure to effectively improve national health outcomes.

Further analysis highlighted variations in the effectiveness of public health expenditure across provinces, particularly when considering regional poverty levels. Notably, compared to the reference category, significant positive relationships were observed between public health expenditure and life expectancy at birth in the Free State, Gauteng, KwaZulu-Natal, Mpumalanga, and the North West provinces. These findings suggest that focusing on improving healthcare for the most vulnerable groups in these provinces, especially in informal urban areas, as inferred from Chapters 3-5's results, could enhance overall health outcomes.

Building on the brief mention in Section 7.4 of the negative correlation between public health expenditure and health outcomes in the Western Cape, it is vital for the provincial government to rigorously evaluate its public health spending, especially in informal urban areas. To optimise the effectiveness of this expenditure, it is crucial for government officials overseeing these areas to establish collaborative relationships with community members. Engagement with residents as a fundamental source of input and feedback will empower officials to more accurately address the levels of deprivation and ensure that public health spending is effectively achieving its intended objectives.

Moreover, addressing the prevailing poverty in each province is essential, as reducing poverty can significantly increase the effectiveness of public health expenditure. This holds true irrespective of whether the correlation between public health spending and life expectancy at birth is positive or negative. By alleviating poverty, the general health of the population is likely to improve (Castro-Leal, 1999), which in turn can make healthcare spending more impactful, leading to enhanced overall health outcomes. This understanding underscores the inter-connectedness between socio-economic factors and health, pointing to the need for integrated strategies to tackle poverty and improve healthcare systems.

Furthermore, the analysis in Chapter 6 revealed that historical economic factors, including the lagged values of public health expenditure per capita or income per capita, had no significant influence on life expectancy at birth. This could be attributed to delayed systemic responses, as explored by Murthy and Okunade (2016), and the time required for economic changes to translate into tangible health improvements within a population. Generally, the effects of these economic factors on health outcomes are gradual, impacting healthcare system improvements, accessibility, and overall socio-economic conditions over time. This suggests that institutions in South Africa may be encountering challenges in efficiently translating public health expenditure or income into immediate health improvements, highlighting the need for more effective and timely healthcare policies and systems.

To address this issue, policymakers must focus on enhancing the effectiveness of the institutions responsible for translating these economic factors into health improvements. This requires that their capacity be strengthened to efficiently utilise resources and implement programmes that have a more immediate and direct impact on health outcomes. Recognising that income and public health expenditure effects in South Africa are often mediated through government institutions, it is imperative to address rampant corruption, as it can significantly hinder the effectiveness of these institutions. As briefly touched on in Section 7.6.1, corruption undermines operational efficiency, transparency, and accountability within the healthcare system, obstructing proper allocation and utilisation of resources.

To combat this, the government should implement stringent anti-corruption measures, including robust monitoring and auditing systems to ensure transparency in financial transactions and resource allocation. It is also essential to strengthen legal frameworks to hold individuals and entities accountable for corrupt practices. In addition, fostering a culture of integrity and ethical behaviour within healthcare institutions, alongside public education campaigns on the impact of corruption on health outcomes, can contribute to reducing corruption.

Lastly, it is essential to recognise that investment in infrastructure, workforce training, and technology can significantly hasten the positive effects of economic factors on health. This approach ensures that resources are allocated and effectively utilised to improve life expectancy and overall health outcomes. By addressing these areas, the government can bolster the capacity of healthcare institutions to transform economic factors such as income and public health expenditure into substantial improvements in public health.

In conclusion, Chapter 6's analysis revealed a negative correlation between public health expenditure per capita and life expectancy, suggesting inefficiencies in national health spending. Notably, this inefficiency varied across provinces, emphasising the need for targeted healthcare improvements within the provinces themselves. Addressing poverty and enhancing the effectiveness of institutions in translating economic factors into health improvements are vital. Tackling corruption and investing in healthcare infrastructure and workforce training are also key to improving health outcomes.

Having outlined these policy recommendations, the following section summarises this study's contributions to public health knowledge.

7.7. Contributions to Public Health Knowledge

This study makes several significant contributions to public health knowledge. Firstly, it adopted a spatial lens to examine socio-economic health inequalities, reflecting the persistent disparities in development and economic outcomes across different regions of South Africa. This approach extends the discourse beyond traditional factors like race, gender, and SES to explicitly include geographical location as a key determinant of health inequalities.

Secondly, the study enhances the granularity in examining socio-economic health inequalities. Focusing on smaller units such as traditional authority areas, formal rural areas, and formal and informal urban areas and moving beyond the urban-rural binary classification provides a comprehensive view of the mix of social and environmental factors influencing health. This nuanced approach uncovered specific needs and barriers across different spatial scales, contributing to a more actionable understanding of health equity.

Thirdly, the study examined changes in health inequalities and their drivers over time for both children and adults, offering insights into the dynamics and causes of these disparities. This longitudinal perspective marks a significant advancement in understanding the evolving nature of health inequalities in South Africa.

Fourth, the study analysed the efficacy of public health expenditure across different provinces while controlling for regional poverty levels. This unique approach uncovered insights critical for policy formulation, particularly in identifying regions where health policies are less effective and require further intervention while controlling for regional poverty levels. In addition, the study explored the delayed effects of economic factors on health, examining whether past economic conditions shape current health outcomes.

Building on this extensive research, the following section explores the study’s limitations and future research directions, offering avenues to expand on the significant findings of this thesis and further contribute to the field of public health.

7.8. Limitations and Future Research Directions

As noted in Chapter 1, this study encountered three primary limitations, with more specific constraints outlined in the respective chapters. The first major limitation was the unavailability of data that was more detailed than what was utilised, particularly at the neighbourhood level. This impeded the ability to thoroughly analyse localised socio-economic factors like crime and environmental conditions that significantly impact health outcomes. It may have led to an underestimation or overestimation of the actual influence of these local factors, thereby impacting the study's accuracy and the precision of the findings regarding the direct effects of socio-economic factors on health. In this context, future studies could focus on obtaining and analysing more granular data such as neighbourhood-level statistics to better understand the localised socio-economic factors affecting health.

In addition, due to South Africa’s administrative framework, the analysis of public health expenditure was confined to the provincial level, as this is the only level at which expenditure data is publicly available. This affected the study's scope, particularly concerning the consistency between the units of analysis in Chapters 3-5 and Chapter 6. The variance in units of analysis introduced inconsistencies in evaluating and comparing the impacts of health policies and expenditure, potentially affecting the study's capacity to provide accurate assessments and generalisations across different regions and demographics. To address this limitation, future research should consider methods to bridge the data gaps between varying administrative levels, thereby enhancing the coherence and comparability of health expenditure analyses across diverse regions, depending on data availability. Such research could include examining the impact of provincial public health expenditure on health inequalities in different urban and rural settings.

Future studies could also explore the relationship between improvements in health disparities and specific public health spending patterns within these areas. Furthermore, an analysis of the effectiveness of health-related interventions and decisions made by public health organisations at all levels, from national government to local community groups, would be valuable. This comprehensive approach would provide insights into how these actions affect health outcomes over time in various regions.

Lastly, the chapters focusing on health inequalities and their determinants within the general population only covered children and adults, excluding older people. This hinders the understanding of health disparities across the entire age spectrum. Including an analysis of older people is crucial to comprehend their unique health challenges and ensure comprehensive healthcare planning for the entire population. The decision to exclude this age group was based on the need to focus on those with higher workforce participation rates and those enrolled at educational institutions, given their significant contribution to South Africa's current and future economy. Future researchers can also consider examining health inequalities in older people to ensure a comprehensive understanding of healthcare disparities across all age groups.

Bearing this in mind, the following section presents my final reflections on addressing health inequalities in South Africa.

7.9. Final Thoughts

This thesis ends with a clear message: going beyond simple policy and action when addressing South Africa's health inequalities is crucial to create a more just and prosperous society. It also draws attention to how important it is to close these healthcare gaps to build a future where every South African can live a long, healthy life.

Envision a South Africa where the study's recommendations have been implemented. Improved housing, abundant access to clean water, and better sanitation have completely transformed impoverished urban neighbourhoods, resulting in longer living and healthier children and adults. Community health worker initiatives have transformed healthcare in traditional authority areas by creating jobs and offering necessary services, greatly reducing health inequities. Rural areas have experienced notable advances in utilities and maternal education, fostering balanced and healthier communities. In contrast, urban areas have promoted a culture of healthy living by stressing lifestyle changes and healthcare access.

This envisioned future can be achieved. However, region-specific policy initiatives to tackle the unique difficulties confronting different areas must be diligently crafted and implemented to achieve it. Ongoing research focusing on the spatial aspects of health disparities and understanding that social determinants of health vary by region will enable more precise, location-based solutions to be crafted. Policy development should, therefore, incorporate a spatial perspective to ensure relevance and efficacy.

This is particularly pertinent as South Africa progresses towards implementing the National Health Insurance (NHI), which aims to provide all citizens and permanent residents access to quality, affordable healthcare services, irrespective of their SES (Heunis et al., 2019). The findings of this study highlight the importance of the NHI adopting a regional, multi-faceted approach that recognises the regional disparities we have identified. This should integrate healthcare with social policies, optimise resource allocation, and align with national and provincial strategies. Moreover, the counter-intuitive negative correlation between life expectancy and public health expenditure per capita at the national level suggests that, before implementing the NHI, the South African government should focus on optimising resource allocation and ensuring efficient use of funds. This will be crucial to effectively improve health services and outcomes once the initiative is implemented.

In closing, this thesis extends beyond academic exploration; it serves as a call to action to establish a healthier and more equitable South Africa. By tackling health inequalities through spatially aware strategies tailored to specific regional needs, we set the groundwork for a society where each individual, irrespective of geographical location, can lead a healthy life. This envisioned future of health equity and prosperity is attainable and begins with the transformative impact of informed, compassionate, and decisive action.

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Appendices

Appendix A

I. Rationale for Selected Income Brackets in Table 4.5

In this analysis, we consider the context of South Africa and the data on the cost of feeding a typical family of four (Ryckman et al., 2021). The income brackets were separated as follows: (1) Individuals living on less than R10,000 per month; (2) Individuals living on R10,000 to R17,500 per month; and (3) Individuals living on more than R17,500 per month.

The bracket starting with Individuals living on less than R10,000 per month is chosen to capture a significant portion of the population facing financial challenges, including difficulties in affording basic necessities such as food, housing, transportation, and healthcare expenses. This threshold reflects the socio-economic reality where many South Africans experience financial strain.

The bracket "Individuals living on R10,000 to R17,500 per month" is selected to encompass the middle-income group, representing individuals with relatively stable employment and access to basic services, but who still face financial challenges such as housing affordability, education costs, and healthcare expenses. This range reflects a segment of the population that may not qualify for social assistance programmes but still requires support and may contribute significantly to the country's consumer spending and economic activity.

The bracket "Individuals living on more than R17,500 per month" is chosen to identify the affluent segment of society, characterised by higher purchasing power, access to quality education, healthcare, and lifestyle amenities. This group represents a significant contributor to consumer spending and economic growth, and understanding their characteristics informs policies related to taxation, wealth redistribution, and social welfare.

Appendix B

Table 4.7: The decomposition of the Concentration index for the long-term disability of children in formal rural areas in South Africa

	2008			2017		
	Elasticities	Concentration indices	Contributions to CI	Elasticities	Concentration indices	Contributions to CI
6-10	0.269	-0.004	-0.001	-0.723	-0.031	0.022
11-15	0.025	-0.127	-0.003	-0.673	0.044	-0.030
Male	-0.170	-0.017	0.003	0.1780	-0.013	-0.002
African	2.061	-0.032	-0.066	3.325	-0.040	-0.132
Grant	1.501	-0.081	-0.121	-0.384	-0.076	0.029
Medical aid	-0.100	0.528	-0.053	0.535	0.654	0.350
Religious	1.092	0.060	0.065	-9.194	0.030	-0.278
Incomplete primary	-0.917	-0.119	0.109	0.242	-0.160	-0.039
Completed primary	0.299	0.070	0.021	0.240	-0.233	-0.056
Incomplete secondary	-1.158	0.144	-0.167	4.214	0.022	0.095
Completed secondary	-0.438	0.117	-0.051	0.238	0.267	0.064
More than secondary	-0.034	-0.178	0.006	-0.021	-0.110	0.002
Married parents	0.538	0.138	0.074	1.011	0.286	0.289

Total			*-0.184*			*0.314*

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (4.4) or (4.5). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 4.8: The decomposition of the Concentration index for the long-term disability of children in areas under traditional authorities in South Africa

	2008			**2017**		
	Elasticities	Concentration indices	Contributions to CI	Elasticities	Concentration indices	Contributions to CI
6-10	-0.108	-0.009	0.001	-0.050	0.025	-0.001
11-15	0.145	0.020	0.003	0.614	0.047	0.029
Male	-0.109	-0.015	0.002	0.414	0.009	0.004
African	1.570	0.000	0.000	-22.649	-0.0004	0.009
Grant	1.615	-0.006	-0.010	0.465	-0.052	-0.024
Medical aid	0.161	0.497	0.080	0.159	0.590	0.094
Religious	-1.517	0.000	0.000	0.126	0.035	0.004
Incomplete primary	0.351	-0.010	-0.004	0.254	-0.246	-0.062
Completed primary	0.181	-0.120	-0.022	0.146	-0.312	-0.046
Incomplete secondary	0.079	-0.078	-0.006	0.373	-0.067	-0.025
Completed secondary	0.076	0.257	0.020	-0.316	0.252	-0.080
More than	0.092	0.268	0.025	-0.049	0.179	-0.009

secondary						
Married parents	-0.021	0.011	0.000	-0.432	0.221	-0.096
Total			**0.089**			**-0.203**

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (4.4) or (4.5). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 4.9: The decomposition of the Concentration index for the long-term disability of children in formal urban areas in South Africa

	2008			**2017**		
	Elasticities	Concentration indices	Contributions to CI	Elasticities	Concentration indices	Contributions to CI
6-10	0.508	-0.054	-0.027	0.819	-0.007	-0.006
11-15	0.246	-0.016	-0.004	0.605	0.049	0.030
Male	0.452	0.002	0.001	1.021	0.000	0.000
African	-1.174	-0.104	0.122	-2.319	-0.056	0.130
Grant	0.783	-0.251	-0.197	1.788	-0.142	-0.254
Medical aid	0.101	0.503	0.051	0.146	0.518	0.075
Religious	0.138	0.043	0.006	0.648	0.015	0.010
Incomplete primary	-0.048	-0.243	0.012	-0.183	-0.309	0.056
Completed primary	-0.032	-0.233	0.008	-0.154	-0.337	0.052
Incomplete secondary	0.091	-0.105	-0.010	-0.922	-0.160	0.147

Completed secondary	-0.196	0.325	-0.064	-0.442	0.270	-0.119
More than secondary	0.019	-0.061	-0.001	-0.007	0.058	0.000
Married parents	0.316	0.244	0.077	0.066	0.223	0.015
Total			**-0.026**			**0.136**

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (4.4) or (4.5). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 4.10: The decomposition of the Concentration index for the long-term disability of children in informal urban areas in South Africa

	2008			**2017**		
	Elasticities	Concentration indices	Contributions to CI	Elasticities	Concentration indices	Contributions to CI
6-10	-0.285	0.033	-0.009	0.603	0.030	0.018
11-15	0.188	-0.010	-0.002	-0.167	-0.059	0.010
Male	-0.169	-0.029	0.005	0.361	-0.022	-0.008
African	-0.890	0.001	-0.001	0.866	0.000	0.000
Grant	-0.207	-0.037	0.008	0.997	-0.029	-0.029
Medical aid	0.172	-0.085	-0.015	0.181	0.531	0.096
Religious	0.260	0.000	0.000	2.229	0.020	0.044
Incomplete primary	-0.113	-0.268	0.030	-0.294	-0.532	0.156
Completed	0.000	-0.153	0.000	-0.196	-0.291	0.057

primary						
Incomplete secondary	-0.259	-0.038	0.010	-2.377	0.000	-0.001
Completed secondary	-0.221	0.199	-0.044	-1.561	0.197	-0.307
More than secondary	-0.013	0.028	0.000	-0.013	-0.578	0.008
Married parents	-0.097	-0.008	0.001	-0.094	0.096	-0.009
Total			**-0.027**			**0.035**

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (4.4) or (4.5). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 4.11: The Oaxaca-type decomposition of the changes in health for children in formal rural areas between 2008 and 2017

	Equation 6			**Equation 7**		
	Disability			**Disability**		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	Total	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	Total
Ages 6-10	0.020	0.004	**0.024**	-0.007	0.031	**0.024**
Ages 11-15	-0.115	0.089	**-0.026**	0.004	-0.030	**-0.026**
Male	0.001	-0.006	**-0.005**	-0.001	-0.005	**-0.006**
African	-0.027	-0.041	**-0.068**	-0.017	-0.051	**-0.068**
Child grant recipient	-0.002	0.153	**0.151**	0.008	0.143	**0.151**
Medical aid coverage	0.067	0.335	**0.402**	-0.013	0.415	**0.402**

Religious	0.276	-0.617	**-0.341**	-0.033	-0.309	**-0.342**
Incomplete primary	-0.010	-0.138	**-0.148**	0.038	-0.185	**-0.147**
Completed primary	-0.073	-0.004	**-0.077**	-0.091	0.014	**-0.077**
Incomplete secondary	-0.514	0.774	**0.260**	0.141	0.118	**0.259**
Completed secondary	0.036	0.079	**0.115**	-0.066	0.181	**0.115**
More than secondary	-0.001	-0.002	**-0.003**	-0.002	-0.001	**-0.003**
Married parents	0.150	0.065	**0.215**	0.080	0.135	**0.215**
Totals	**-0.192**	**0.691**	**0.499**	**0.041**	**0.456**	**0.497**

*Notes: The total is derived from the data presented in Table 4.7.

Table 4.12: The Oaxaca-type decomposition of the changes in health for children in areas under traditional authorities between 2008 and 2017

	Equation 6			**Equation 7**		
	Disability			**Disability**		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	Total	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	Total
Ages 6-10	-0.001	-0.001	**-0.002**	-0.004	0.002	**-0.002**
Ages 11-15	0.017	0.009	**0.026**	0.004	0.022	**0.026**
Male	0.010	-0.008	**0.002**	-0.003	0.005	**0.002**
African	0.009	0.000.	**0.009**	-0.001	0.010	**0.009**
Child grant recipient	-0.021	0.007	**-0.014**	-0.074	0.060	**-0.014**
Medical aid coverage	0.015	-0.001	**0.014**	0.015	-0.001	**0.014**
Religious	0.004	0.000	**0.004**	-0.053	0.058	**0.005**
Incomplete primary	-0.060	0.001	**-0.059**	-0.083	0.024	**-0.059**
Completed primary	-0.028	0.004	**-0.024**	-0.034	0.011	**-0.023**
Incomplete secondary	0.004	-0.023	**-0.019**	0.001	-0.020	**-0.019**

Completed secondary	0.002	-0.101	**-0.099**	0.000	-0.099	**-0.099**
More than secondary	0.004	-0.038	**-0.034**	-0.008	-0.025	**-0.033**
Married parents	-0.091	-0.005	**-0.096**	-0.004	-0.091	**-0.095**
Totals	**-0.136**	**-0.156**	**-0.292**	**-0.244**	**-0.044**	**-0.288**

*Notes: The total is derived from the data presented in Table 4.8.

Table 4.13: The Oaxaca-type decomposition of the changes in health for children in formal urban areas between 2008 and 2017

	Equation 6			**Equation 7**		
	Disability			**Disability**		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	Total	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	Total
Ages 6-10	0.039	-0.017	**0.022**	0.024	-0.002	**0.022**
Ages 11-15	0.039	-0.006	**0.033**	0.016	0.018	**0.034**
Male	-0.002	0.001	**-0.001**	-0.001	0.000	**-0.001**
African	-0.111	0.119	**0.008**	-0.056	0.064	**0.008**
Child grant recipient	0.195	-0.252	**-0.057**	0.085	-0.143	**-0.058**
Medical aid coverage	0.002	0.023	**0.025**	0.002	0.023	**0.025**
Religious	-0.018	0.022	**0.004**	-0.004	0.008	**0.004**
Incomplete primary	0.012	0.033	**0.045**	0.003	0.042	**0.045**
Completed primary	0.016	0.028	**0.044**	0.003	0.041	**0.044**
Incomplete secondary	0.051	0.106	**0.157**	-0.005	0.162	**0.157**
Completed secondary	0.024	-0.080	**-0.056**	0.011	-0.066	**-0.055**
More than secondary	-0.001	0.002	**0.001**	0.002	-0.002	**0.000**
Married parents	-0.001	-0.061	**-0.062**	-0.007	-0.056	**-0.063**
Totals	**0.245**	**-0.082**	**0.163**	**0.073**	**0.089**	**0.162**

*Notes: The total is derived from the data presented in Table 4.9.

Table 4.14: The Oaxaca-type decomposition of the changes in health for children in informal urban areas between 2008 and 2017

	Equation 6			**Equation 7**		
	Disability			**Disability**		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	**Total**	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	**Total**
Ages 6-10	-0.002	0.029	**0.027**	0.000	0.027	**0.027**
Ages 11-15	0.008	0.004	**0.012**	-0.009	0.021	**0.012**
Male	0.002	-0.015	**-0.013**	-0.001	-0.012	**-0.013**
African	-0.001	0.001	**0.000**	0.001	0.000	**0.001**
Child grant recipient	0.008	-0.045	**-0.037**	-0.002	-0.035	**-0.037**
Medical aid coverage	0.112	-0.001	**0.111**	0.106	0.005	**0.111**
Religious	0.045	0.000	**0.045**	0.005	0.039	**0.044**
Incomplete primary	0.078	0.049	**0.127**	0.030	0.096	**0.126**
Completed primary	0.027	0.030	**0.057**	0.000	0.057	**0.057**
Incomplete secondary	-0.090	0.081	**-0.009**	-0.010	0.000	**-0.010**
Completed secondary	0.003	-0.267	**-0.264**	0.000	-0.264	**-0.264**
More than secondary	0.008	0.000	**0.008**	0.008	0.000	**0.008**
Married parents	-0.010	0.000	**-0.010**	-0.010	0.000	**-0.010**
Totals	**0.188**	**-0.134**	**0.054**	**0.118**	**-0.066**	**0.052**

*Notes: The total is derived from the data presented in Table 4.10.

Appendix B

Table 5.8: The decomposition of the Concentration index for the prevalence of diabetes in formal rural areas in South Africa

	Wave 1			Wave 5		
	Elasticities	Concentration indices	Contributions to CI (%)	Elasticities	Concentration indices	Contributions to CI (%)
Black Individuals	0,964	-0,049	-1,361	0,856	-0,049	-3,430
Age 40-59	0,369	0,012	0,347	0,258	-0,005	-0,354
Age 60+	0,334	0,026	0,722	0,433	-0,056	-3,922
Male	0,122	-0,079	-2,213	-0,108	-0,033	-2,297
Married	0,067	0,035	0,974	0,081	-0,027	-1,890
Income less than R17,500	0,013	-0,109	-3,024	0,002	-0,036	-2,527
Income more than R17,500	-0,044	-0,019	-0,522	-0,006	-0,021	-1,504
Completed primary	-0,025	0,074	2,075	-0,013	0,056	3,969
Incomplete secondary	-0,018	-0,005	-0,128	-0,008	0,027	1,923
Completed secondary	0,020	-0,053	-1,465	-0,006	-0,012	-0,852
More than secondary	0,005	-0,029	-0,808	0,010	-0,028	-1,946
Employed	0,013	-0,017	-0,482	-0,079	-0,022	-1,565
Exercises	-0,039	-0,067	-1,858	0,050	-0,008	-0,534

regularly						
Smoker	-0,095	0,010	0,273	-0,035	0,008	0,585
Normal BMI	-0,045	-0,054	-1,514	-0,136	-0,004	-0,301
Overweight BMI	0,059	0,020	0,571	-0,022	0,003	0,243
Obese BMI	0,375	0,028	0,776	0,081	0,004	0,312
Utilised healthcare services	0,524	0,018	0,488	-0,151	0,001	0,095
Total			-7,149			-13,997

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (5.3) or (5.4). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 5.9: The decomposition of the Concentration index for the prevalence of diabetes in areas under traditional authorities in South Africa

	Wave 1			**Wave 5**		
	Elasticities	Concentration indices	Contributions to CI (%)	Elasticities	Concentration indices	Contributions to CI (%)
Black Individuals	-0,611	-0,049	-2,701	-1,433	-0,049	-3,765
Age 40-59	0,243	0,012	0,689	0,319	-0,005	-0,389
Age 60+	0,235	0,026	1,434	0,382	-0,056	-4,305
Male	0,244	-0,079	-4,394	-0,024	-0,033	-2,521
Married	0,088	0,035	1,933	-0,217	-0,027	-2,075
Income less than R17,500	0,120	-0,109	-6,002	0,259	-0,036	-2,774

Income more than R17,500	0,060	-0,019	-1,035	-0,020	-0,021	-1,651
Completed primary	0,054	0,074	4,119	0,058	0,056	4,357
Incomplete secondary	-0,219	-0,005	-0,255	0,060	0,027	2,110
Completed secondary	0,010	-0,053	-2,908	0,014	-0,012	-0,936
More than secondary	-0,018	-0,029	-1,605	-0,006	-0,028	-2,136
Employed	0,118	-0,017	-0,956	0,061	-0,022	-1,718
Exercises regularly	-0,068	-0,067	-3,689	-0,113	-0,008	-0,587
Smoker	-0,146	0,010	0,543	-0,240	0,008	0,642
Normal BMI	-0,068	-0,054	-3,005	-0,126	-0,004	-0,330
Overweight BMI	-0,145	0,020	1,133	0,190	0,003	0,266
Obese BMI	0,543	0,028	1,540	0,087	0,004	0,343
Utilised healthcare services	0,299	0,018	0,968	-0,479	0,001	0,105
Total			-14,192			-15,364

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (5.3) or (5.4). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 5.10: The decomposition of the Concentration index for the prevalence of diabetes in formal urban areas in South Africa

	Wave 1			**Wave 5**		

	Elasticities	Concentration indices	Contributions to CI (%)	Elasticities	Concentration indices	Contributions to CI (%)
Black Individuals	-0,030	-0,049	-3,904	-0,472	-0,049	-2,465
Age 40-59	0,432	0,012	0,995	0,320	-0,005	-0,255
Age 60+	0,236	0,026	2,072	0,367	-0,056	-2,819
Male	-0,018	-0,079	-6,351	0,056	-0,033	-1,650
Married	0,022	0,035	2,794	0,164	-0,027	-1,359
Income less than R17,500	-0,001	-0,109	-8,675	0,128	-0,036	-1,816
Income more than R17,500	-0,066	-0,019	-1,497	-0,004	-0,021	-1,081
Completed primary	0,030	0,074	5,953	-0,008	0,056	2,852
Incomplete secondary	0,012	-0,005	-0,368	0,044	0,027	1,382
Completed secondary	0,072	-0,053	-4,203	-0,101	-0,012	-0,612
More than secondary	-0,007	-0,029	-2,319	0,012	-0,028	-1,398
Employed	-0,030	-0,017	-1,382	-0,252	-0,022	-1,124
Exercises regularly	0,068	-0,067	-5,332	0,049	-0,008	-0,384
Smoker	-0,085	0,010	0,784	-0,093	0,008	0,420
Normal BMI	-0,184	-0,054	-4,344	-0,166	-0,004	-0,216
Overweight BMI	-0,089	0,020	1,638	-0,110	0,003	0,174

Obese BMI	0,053	0,028	2,226	0,218	0,004	0,224
Utilised healthcare services	0,313	0,018	1,399	0,218	0,004	0,224
Total			-20,512			-10,058

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (5.3) or (5.4). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 5.11: The decomposition of the Concentration index for the prevalence of diabetes in informal urban areas in South Africa

	Wave 1			**Wave 5**		
	Elasticities	Concentration indices	Contributions to CI (%)	Elasticities	Concentration indices	Contributions to CI (%)
Black Individuals	0,166	-0,049	-1,203	0,166	-0,049	-1,203
Age 40-59	-0,252	0,012	0,307	-0,252	0,012	0,307
Age 60+	0,046	0,026	0,639	0,046	0,026	0,639
Male	0,122	-0,079	-1,957	0,122	-0,079	-1,957
Married	0,168	0,035	0,861	0,168	0,035	0,861
Income less than R17,500	0,074	-0,109	-2,673	0,074	-0,109	-2,673
Income more than R17,500	-0,134	-0,019	-0,461	-0,134	-0,019	-0,461
Completed primary	0,055	0,074	1,835	0,055	0,074	1,835
Incomplete secondary	-0,229	-0,005	-0,113	-0,229	-0,005	-0,113

Completed secondary	-0,012	-0,053	-1,295	-0,012	-0,053	-1,295
More than secondary	0,000	-0,029	-0,715	0,000	-0,029	-0,715
Employed	0,146	-0,017	-0,426	0,146	-0,017	-0,426
Exercises regularly	-0,020	-0,067	-1,643	-0,020	-0,067	-1,643
Smoker	-0,140	0,010	0,242	-0,140	0,010	0,242
Normal BMI	-0,095	-0,054	-1,339	-0,095	-0,054	-1,339
Overweight BMI	-0,095	0,020	0,505	-0,095	0,020	0,505
Obese BMI	0,454	0,028	0,686	0,454	0,028	0,686
Utilised healthcare services	0,941	0,018	0,431	0,941	0,018	0,431
Total			-6,3213			67,3249

*Notes: Calculated utilising Waves 1 and 5 of the NIDS dataset. These are the individual coefficients forming part of equations (5.3) or (5.4). The calculation was performed using Stata, following the syntax outlined by O'Donnell et al. (2010, p. 161).

Table 5.12: The Oaxaca-type decomposition of the changes in health for the prevalence of diabetes in formal rural areas between 2008 and 2017

	Equation 6			**Equation 7**		
	Diabetes			**Diabetes**		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	**Total**	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	**Total**
Black Individuals	0,0002	0,0053	0,0055	0,0002	0,0053	0,0055

Age 40-59	-0,0045	-0,0014	-0,0059	-0,0045	-0,0014	-0,0059
Age 60+	-0,0353	0,0026	-0,0327	-0,0353	0,0026	-0,0327
Male	-0,0051	0,0183	0,0132	-0,0051	0,0183	0,0132
Married	-0,0050	0,0005	-0,0045	-0,0050	0,0005	-0,0045
Income less than R17,500	0,0001	0,0013	0,0014	0,0001	0,0013	0,0014
Income more than R17,500	0,0000	-0,0007	-0,0007	0,0000	-0,0007	-0,0007
Completed primary	0,0002	0,0009	0,0011	0,0002	0,0009	0,0011
Incomplete secondary	-0,0002	0,0000	-0,0003	-0,0002	0,0000	-0,0003
Completed secondary	-0,0002	0,0013	0,0011	-0,0002	0,0013	0,0011
More than secondary	0,0000	-0,0002	-0,0001	0,0000	-0,0002	-0,0001
Employed	0,0004	0,0016	0,0020	0,0004	0,0016	0,0020
Exercises regularly	0,0030	-0,0059	-0,0030	0,0030	-0,0059	-0,0030
Smoker	0,0001	0,0006	0,0006	0,0001	0,0006	0,0006
Normal BMI	-0,0068	0,0049	-0,0019	-0,0068	0,0049	-0,0019
Overweight BMI	0,0004	-0,0016	-0,0013	0,0004	-0,0016	-0,0013
Obese BMI	-0,0019	-0,0082	-0,0101	-0,0019	-0,0082	-0,0101
Utilised healthcare services	0,0024	-0,0118	-0,0094	0,0024	-0,0118	-0,0094
Totals	**-0,0523**	**0,0074**	**-0,0449**	**-0,0523**	**0,0074**	**-0,0449**

*Notes: The total is derived from the data presented in Table 5.8.

Table 5.13: The Oaxaca-type decomposition of the changes in the prevalence of diabetes in areas under traditional authorities between 2008 and 2017

	Equation 6			**Equation 7**		
	Diabetes			**Diabetes**		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	**Total**	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	**Total**

Black Individuals	-0,0003	0,0402	0,0399	-0,0001	0,0400	0,0399
Age 40-59	-0,0056	0,0009	-0,0046	-0,0043	-0,0004	-0,0046
Age 60+	-0,0312	0,0038	-0,0274	-0,0191	-0,0082	-0,0274
Male	-0,0011	0,0212	0,0201	0,0114	0,0087	0,0201
Married	0,0134	-0,0106	0,0027	-0,0054	0,0082	0,0027
Income less than R17,500	0,0188	-0,0150	0,0038	0,0087	-0,0050	0,0038
Income more than R17,500	0,0001	0,0015	0,0015	-0,0002	0,0017	0,0015
Completed primary	-0,0011	0,0002	-0,0008	-0,0010	0,0002	-0,0008
Incomplete secondary	0,0019	-0,0013	0,0006	-0,0070	0,0076	0,0006
Completed secondary	0,0006	-0,0002	0,0003	0,0004	-0,0001	0,0003
More than secondary	0,0000	-0,0003	-0,0004	0,0000	-0,0003	-0,0004
Employed	-0,0003	0,0010	0,0007	-0,0006	0,0013	0,0007
Exercises regularly	-0,0067	0,0030	-0,0037	-0,0040	0,0003	-0,0037
Smoker	0,0004	-0,0009	-0,0006	0,0002	-0,0008	-0,0006
Normal BMI	-0,0063	0,0032	-0,0031	-0,0034	0,0002	-0,0031
Overweight BMI	-0,0032	0,0069	0,0036	0,0025	0,0012	0,0036
Obese BMI	-0,0020	-0,0127	-0,0147	-0,0127	-0,0020	-0,0147
Utilised healthcare services	0,0077	-0,0136	-0,0059	-0,0048	-0,0011	-0,0059
Totals	**-0,0150**	**0,0272**	**0,0122**	**-0,03936**	**0,051558**	**0,012197**

*Notes: The total is derived from the data presented in Table 5.9.

Table 5.14: The Oaxaca-type decomposition of the changes in the prevalence of diabetes in formal urban areas between 2008 and 2017

	Equation 6	Equation 7
	Diabetes	**Diabetes**

	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	Total	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	Total
Black Individuals	-0,0001	0,0216	0,0215	0,0000	0,0215	0,0215
Age 40-59	-0,0056	-0,0014	-0,0070	-0,0075	0,0006	-0,0070
Age 60+	-0,0299	0,0034	-0,0265	-0,0193	-0,0073	-0,0265
Male	0,0026	-0,0059	-0,0032	-0,0008	-0,0024	-0,0032
Married	-0,0101	0,0050	-0,0052	-0,0013	-0,0038	-0,0052
Income less than R17,500	0,0093	-0,0140	-0,0047	-0,0001	-0,0046	-0,0047
Income more than R17,500	0,0000	-0,0012	-0,0012	0,0002	-0,0013	-0,0012
Completed primary	0,0002	-0,0028	-0,0027	-0,0005	-0,0021	-0,0027
Incomplete secondary	0,0014	-0,0001	0,0013	0,0004	0,0009	0,0013
Completed secondary	-0,0041	0,0091	0,0050	0,0029	0,0021	0,0050
More than secondary	0,0000	-0,0006	-0,0005	0,0000	-0,0005	-0,0005
Employed	0,0012	0,0038	0,0051	0,0001	0,0049	0,0051
Exercises regularly	0,0029	0,0013	0,0042	0,0040	0,0001	0,0042
Smoker	0,0001	-0,0001	0,0001	0,0001	-0,0001	0,0001
Normal BMI	-0,0083	-0,0010	-0,0093	-0,0092	-0,0001	-0,0093
Overweight BMI	0,0019	-0,0004	0,0015	0,0015	-0,0001	0,0015
Obese BMI	-0,0051	0,0046	-0,0005	-0,0012	0,0007	-0,0005
Utilised healthcare services	-0,0065	0,0015	-0,0049	-0,0051	0,0001	-0,0049
Totals	**-0,0501**	**0,0229**	**-0,0272**	**-0,0358**	**0,0087**	**-0,0272**

*Notes: The total is derived from the data presented in Table 5.10.

Table 5.15: The Oaxaca-type decomposition of the changes in the prevalence of diabetes in informal urban areas between 2008 and 2017

	Equation 6	**Equation 7**

	Diabetes			Diabetes		
	$\Delta C.\eta_{kt}$	$\Delta\eta.C_{kt-1}$	Total	$\Delta C.\eta_{kt-1}$	$\Delta\eta.C_{kt}$	Total
Black Individuals	-0,0005	0,1150	0,1145	0,0000	0,1145	0,1145
Age 40-59	-0,0079	0,0088	0,0009	0,0044	-0,0035	0,0009
Age 60+	-0,0243	0,0065	-0,0178	-0,0038	-0,0140	-0,0178
Male	-0,0173	0,0389	0,0217	0,0057	0,0160	0,0217
Married	-0,0028	-0,0043	-0,0071	-0,0104	0,0033	-0,0071
Income less than R17,500	-0,0113	0,0249	0,0136	0,0053	0,0082	0,0136
Income more than R17,500	0,0000	-0,0022	-0,0021	0,0003	-0,0025	-0,0021
Completed primary	-0,0011	0,0003	-0,0008	-0,0010	0,0002	-0,0008
Incomplete secondary	-0,0014	-0,0009	-0,0022	-0,0073	0,0051	-0,0022
Completed secondary	-0,0027	0,0029	0,0002	-0,0005	0,0007	0,0002
More than secondary	0,0001	-0,0020	-0,0019	0,0000	-0,0019	-0,0019
Employed	0,0014	0,0074	0,0088	-0,0007	0,0095	0,0088
Exercises regularly	-0,0056	0,0050	-0,0006	-0,0012	0,0006	-0,0006
Smoker	0,0001	0,0005	0,0006	0,0002	0,0004	0,0006
Normal BMI	-0,0078	0,0033	-0,0045	-0,0048	0,0003	-0,0045
Overweight BMI	-0,0025	0,0050	0,0025	0,0016	0,0008	0,0025
Obese BMI	0,0034	-0,0167	-0,0133	-0,0106	-0,0027	-0,0133
Utilised healthcare services	-0,0095	-0,0062	-0,0157	-0,0152	-0,0005	-0,0157
Totals	**-0,0897**	**0,1864**	**0,0966**	**-0,0377**	**0,1344**	**0,0966**

*Notes: The total is derived from the data presented in Table 5.11.

Appendix C

Table 6.17: Deprivation headcounts on each of the indicators (2005) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvant aged Areas	Deprived of Assets	Unemploy ment
EC	3.57	41.37	31.45	55.01	35.76	59.21	50.30	48.08	28.30
FS	4.22	36.75	11.90	32.04	13.06	33.58	13.89	32.48	32.20
GP	1.41	26.45	15.03	19.13	7.62	15.20	14.23	25.70	26.00
KZN	3.21	43.54	39.62	51.28	52.36	68.87	61.43	50.37	20.50
LP	1.57	44.20	16.86	63.27	31.96	77.12	75.50	44.25	21.90
MP	1.57	43.57	18.57	55.71	20.42	61.47	49.76	37.24	30.30
NC	3.88	38.66	10.68	23.64	17.36	34.41	15.28	31.51	24.90
NW	3.00	41.03	14.21	38.07	26.00	55.01	44.80	34.54	26.20
WC	3.84	30.26	7.66	10.41	14.39	6.42	6.57	18.90	22.80

*Note: The percentages for these indicators were calculated using the GHS data from 2005.

Table 6.18: Deprivation headcounts on each of the indicators (2006) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvant aged Areas	Deprived of Assets	Unemploy ment
EC	3.49	40.59	30.97	50.88	35.47	56.86	49.31	46.45	28.60
FS	3.38	35.10	11.87	28.94	11.52	32.94	13.97	28.60	32.90
GP	1.41	27.17	16.83	19.94	9.44	15.77	15.11	23.18	25.40
KZN	3.23	42.01	37.22	48.30	52.51	68.43	61.88	39.13	19.80
LP	1.65	43.54	15.39	57.79	35.48	76.89	75.88	39.81	20.20
MP	1.71	43.10	17.89	50.57	30.85	61.02	51.01	33.42	28.90
NC	3.56	38.55	11.99	20.95	31.62	34.92	15.38	29.09	29.90
NW	2.59	40.59	13.46	35.65	43.75	56.25	46.12	31.95	26.20
WC	3.45	29.76	8.73	10.41	16.93	5.27	6.82	17.29	23.20

*Note: The percentages for these indicators were calculated using the GHS data from 2006.

Table 6.19: Deprivation headcounts on each of the indicators (2007) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvant aged Areas	Deprived of Assets	Unemploy ment
EC	3.59	39.14	29.37	47.06	29.08	57.08	53.34	44.81	28.80
FS	4.02	35.79	11.97	27.12	12.34	30.31	13.58	24.71	32.00
GP	1.84	26.66	16.31	19.02	8.15	17.69	15.44	20.66	24.80
KZN	3.73	40.94	35.77	45.80	48.74	67.35	69.74	27.90	21.30
LP	1.90	42.14	12.79	58.88	27.22	76.20	83.20	35.38	22.20
MP	1.91	42.11	16.21	48.55	31.26	58.47	54.65	29.60	31.10
NC	4.32	38.56	9.95	20.21	26.96	33.47	17.11	26.67	30.00
NW	3.20	39.63	13.34	32.02	26.67	53.58	51.66	29.36	25.00
WC	3.72	29.36	6.80	8.71	15.50	7.47	5.87	15.68	25.40

*Note: The percentages for these indicators were calculated using the GHS data from 2007.

Table 6.20: Deprivation headcounts on each of the indicators (2008) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	3.37	40.97	31.04	46.15	39.36	59.55	58.65	43.18	30.80
FS	3.55	35.65	9.04	18.84	11.88	34.88	17.53	20.83	34.00
GP	1.62	25.47	10.75	12.96	7.96	11.46	14.35	18.13	24.30
KZN	3.38	37.47	27.69	34.33	40.07	57.79	55.31	16.67	20.90
LP	2.12	43.39	16.43	60.19	41.58	84.82	86.28	30.94	17.80
MP	1.86	41.15	14.46	43.59	35.30	64.09	58.26	25.78	26.60
NC	4.35	38.24	10.26	18.94	16.17	29.20	17.84	24.24	28.00
NW	3.38	39.80	12.47	29.33	30.12	57.21	53.31	26.77	26.60
WC	2.79	25.50	6.32	5.63	8.79	6.73	8.80	14.06	23.40

*Note: The percentages for these indicators were calculated using the GHS data from 2008.

Table 6.21: Deprivation headcounts on each of the indicators (2009) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	3.36	20.95	29.11	41.47	54.40	60.34	59.11	41.54	30.40
FS	4.32	16.90	6.96	16.79	6.12	28.64	16.87	16.95	35.00
GP	2.03	12.60	13.20	12.33	9.77	15.91	17.46	15.61	24.60
KZN	3.59	17.96	25.82	31.98	38.92	58.21	54.25	5.43	23.70
LP	2.22	18.54	13.87	58.23	51.53	84.13	84.70	26.50	15.90
MP	2.68	17.83	12.55	41.19	25.88	65.47	58.52	21.95	29.50
NC	4.63	17.50	8.38	16.30	20.36	26.68	19.16	21.82	32.30
NW	3.24	17.79	11.16	24.41	32.74	54.01	51.31	24.17	26.00
WC	3.32	12.52	8.74	6.80	8.30	6.01	8.42	12.45	23.50

*Note: The percentages for these indicators were calculated using the GHS data from 2009.

Table 6.22: Deprivation headcounts on each of the indicators (2010) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.52	19.34	26.73	42.04	53.30	57.96	57.96	39.91	29.10
FS	3.29	16.63	6.60	12.03	5.78	28.24	16.65	13.07	32.20
GP	1.33	11.27	16.99	12.68	11.21	15.91	18.89	13.09	24.60
KZN	2.78	16.75	24.63	29.18	36.94	57.19	54.08	5.90	20.80
LP	1.80	17.42	10.86	55.61	51.14	85.47	86.80	22.07	15.90
MP	1.92	16.60	11.87	35.63	23.33	62.42	56.67	18.14	26.60
NC	4.32	17.65	8.78	15.92	22.74	26.87	18.81	19.40	28.70
NW	2.74	17.95	11.11	22.84	29.50	52.25	51.19	21.58	25.20
WC	2.83	10.98	11.61	4.04	7.74	5.69	7.13	10.84	22.90

*Note: The percentages for these indicators were calculated using the GHS data from 2010.

Table 6.23: Deprivation headcounts on each of the indicators (2011) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.78	20.17	23.75	35.51	53.36	56.94	57.04	38.27	29.20
FS	3.39	16.18	5.90	9.15	5.26	25.32	16.38	9.19	31.50
GP	1.20	10.62	16.87	10.66	8.62	13.74	17.63	10.56	28.60
KZN	2.50	16.78	22.50	25.77	34.12	56.04	53.70	17.13	20.50
LP	1.88	16.70	7.89	52.06	45.73	84.56	85.95	17.63	18.80
MP	1.67	16.60	10.79	31.03	22.27	62.34	57.94	14.32	26.20
NC	4.08	17.55	6.67	13.33	19.72	27.58	19.09	16.98	34.80
NW	2.72	17.27	8.92	17.94	28.52	52.45	50.48	18.99	25.40
WC	2.79	11.09	12.49	3.66	6.63	6.83	6.97	9.23	20.60

*Note: The percentages for these indicators were calculated using the GHS data from 2011.

Table 6.24: Deprivation headcounts on each of the indicators (2012) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	3.03	19.30	16.76	32.30	52.49	56.17	56.78	36.64	29.60
FS	3.09	15.21	5.06	9.94	6.44	26.72	15.14	17.01	30.40
GP	0.95	10.99	9.70	11.13	9.37	14.08	16.20	15.79	28.40
KZN	2.79	16.39	16.75	24.59	33.70	55.49	53.85	11.51	23.60
LP	1.76	17.02	6.63	52.77	48.56	83.38	85.17	13.19	20.10
MP	1.78	16.51	7.57	28.01	21.46	59.73	56.51	10.60	28.40
NC	4.09	15.38	5.66	12.39	17.78	23.84	18.11	14.55	34.10
NW	2.60	16.39	8.81	18.94	28.16	51.86	51.59	16.40	28.40
WC	2.88	9.83	2.36	2.65	7.11	6.98	7.34	7.62	21.00

*Note: The percentages for these indicators were calculated using the GHS data from 2012.

Table 6.25: Deprivation headcounts on each of the indicators (2013) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	3.00	19.53	16.46	25.80	52.93	55.98	56.51	34.81	29.10
FS	3.27	15.93	4.45	8.42	5.99	25.84	14.24	14.33	31.40
GP	1.07	11.65	7.49	8.21	8.68	11.73	15.44	15.09	26.80
KZN	2.79	16.95	14.68	23.45	33.95	54.56	53.88	26.77	20.40
LP	1.67	17.35	5.18	48.70	48.46	82.45	85.42	28.74	18.90
MP	1.75	16.91	6.66	22.99	20.51	58.77	56.30	22.05	27.20
NC	4.40	15.73	5.11	9.11	17.89	23.66	17.96	20.84	32.70
NW	2.86	15.90	7.08	15.49	29.61	51.18	51.09	22.25	25.20
WC	2.71	10.46	2.09	2.40	7.51	7.51	7.14	11.19	21.70

*Note: The percentages for these indicators were calculated using the GHS data from 2013.

Table 6.26: Deprivation headcounts on each of the indicators (2014) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.85	19.56	12.76	22.82	54.40	56.31	56.56	33.43	28.40
FS	2.99	16.84	3.98	7.24	6.66	25.08	14.78	13.26	34.70
GP	1.11	11.55	6.07	6.70	8.15	11.61	16.05	14.43	28.60
KZN	2.75	16.72	11.97	21.58	33.55	54.09	53.80	25.07	23.90
LP	1.69	16.55	4.18	45.53	45.53	82.94	86.42	27.25	19.30
MP	1.69	17.12	6.05	22.29	20.57	59.92	57.24	22.45	31.00
NC	4.08	15.70	4.86	8.60	17.19	24.21	22.60	19.29	32.00
NW	2.80	16.66	6.83	13.38	30.81	51.29	51.25	22.23	26.50
WC	2.83	10.72	1.97	2.13	6.81	6.81	6.80	10.72	20.50

*Note: The percentages for these indicators were calculated using the GHS data from 2014.

Table 6.27: Deprivation headcounts on each of the indicators (2015) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.81	19.02	12.89	22.77	54.53	58.11	49.82	36.05	28.40
FS	2.34	17.62	6.59	8.59	8.15	27.19	16.07	15.11	33.70
GP	1.26	11.87	8.74	8.70	9.26	12.55	16.76	17.77	29.30
KZN	2.80	17.38	11.23	20.05	33.23	54.07	46.32	26.61	23.30
LP	1.52	16.36	4.44	38.49	46.13	75.83	77.61	29.36	20.00
MP	1.37	16.84	8.87	24.88	24.36	58.35	58.18	22.91	30.00
NC	4.99	15.99	4.84	8.20	20.08	27.55	27.44	20.93	29.20
NW	2.73	16.66	7.74	13.34	33.89	55.17	52.17	26.15	30.50
WC	2.84	11.33	1.77	2.14	10.30	7.18	5.31	11.46	21.70

*Note: The percentages for these indicators were calculated using the GHS data from 2015.

Table 6.28: Deprivation headcounts on each of the indicators (2016) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.65	19.10	10.99	20.14	53.79	57.66	53.12	32.80	28.20
FS	2.23	16.50	5.64	8.54	10.14	24.85	16.07	16.23	34.20
GP	1.42	11.97	7.14	7.85	7.88	11.93	17.46	15.93	29.10
KZN	2.27	16.72	9.14	18.72	34.25	54.29	46.32	26.04	23.50
LP	1.63	16.60	2.88	38.63	50.09	75.97	77.61	26.14	21.90

MP	1.44	15.76	8.42	23.59	24.28	58.65	58.18	23.53	30.40
NC	4.80	16.10	3.91	7.49	19.33	26.82	27.44	22.26	29.60
NW	2.43	16.25	6.88	11.65	32.83	52.59	52.17	22.55	28.10
WC	2.55	11.08	1.68	2.09	11.33	7.09	6.34	12.03	21.30

*Note: The percentages for these indicators were calculated using the GHS data from 2016.

Table 6.29: Deprivation headcounts on each of the indicators (2017) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.52	18.43	8.57	19.88	53.47	57.77	56.42	31.16	32.20
FS	2.10	16.59	4.54	7.61	9.68	24.64	16.07	15.95	35.50
GP	1.22	12.19	6.80	7.52	8.45	12.08	18.17	15.98	29.00
KZN	2.18	16.93	7.07	16.51	34.24	56.05	46.32	24.24	25.80
LP	1.46	16.71	3.55	36.16	47.20	75.10	77.61	28.41	21.60
MP	1.38	14.99	6.52	23.46	22.42	57.53	58.18	22.47	31.50
NC	4.98	15.84	3.80	7.11	17.26	25.73	27.44	19.87	30.70
NW	2.04	15.55	6.81	11.05	33.10	52.03	52.17	22.30	26.50
WC	2.75	11.13	1.95	1.57	10.80	6.57	6.10	11.04	21.50

*Note: The percentages for these indicators were calculated using the GHS data from 2017.

Table 6.30: Deprivation headcounts on each of the indicators (2018) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.69	18.24	6.95	18.23	51.82	56.32	59.72	29.30	35.10
FS	2.00	16.97	3.47	7.53	11.46	24.29	16.07	13.56	32.60
GP	0.97	11.64	6.20	7.95	8.11	11.37	18.88	15.45	31.10
KZN	2.14	16.13	5.51	15.67	32.04	55.08	46.32	23.07	24.10
LP	1.83	17.29	2.53	35.24	49.68	75.94	77.61	26.93	19.60
MP	1.62	14.76	5.78	23.08	21.91	57.27	58.18	20.02	28.90
NC	4.37	15.57	3.57	7.01	15.35	22.81	27.44	20.87	27.10
NW	1.86	15.44	5.69	11.52	34.20	51.90	52.17	21.91	27.70
WC	2.62	11.37	1.72	1.02	10.90	7.08	5.86	10.90	19.50

*Note: The percentages for these indicators were calculated using the GHS data from 2018.

Table 6.31: Deprivation headcounts on each of the indicators (2019) (%)

	Disability	School Years	No Electricity	Cooking Fuel	No Piped Water	No Flush Toilet	Disadvantaged Areas	Deprived of Assets	Unemployment
EC	2.00	18.57	5.98	14.96	51.68	57.62	63.02	27.5	36.10
FS	1.82	16.34	5.18	6.77	11.87	26.14	16.07	17.45	32.90
GP	0.55	11.81	8.72	7.98	9.66	15.35	19.59	18.99	28.90
KZN	1.11	15.70	5.40	11.89	31.09	54.39	46.32	19.23	25.60
LP	1.05	17.48	2.83	34.99	50.23	76.37	77.61	27.14	16.50
MP	1.02	16.44	5.92	23.99	22.04	57.30	58.18	20.53	32.00
NC	2.53	15.11	5.42	6.23	18.11	27.91	27.44	20.18	25.00
NW	1.47	15.23	8.85	11.75	34.23	49.55	52.17	24.63	28.10
WC	1.69	10.78	1.47	0.96	9.90	5.32	5.62	10.35	19.30

*Note: The percentages for these indicators were calculated using the GHS data from 2019.