Understanding Provincial Differentials in Adult Mortality in South Africa

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DECLARATION

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I declare that this dissertation contains my own work except where specifically acknowledged. This research has not been previously accepted for any degree and is not being currently considered for any other degree at any other university.

Student signature: [redacted] **Date:** 23 December 2020

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ABSTRACT

This research focuses on estimating the levels, and understanding the differentials of adult mortality (generally, between the ages 15 to 60) within South Africa, across provincial boundaries. The cross-sectional study explores indirect methods of estimation, specifically through the Orphanhood method to determine conditional survivorship probabilities which can be used to estimate conditional levels of adult mortality, taking into consideration factors such as the changing impact of HIV/AIDS. In addition to this, an exploration of household deaths data is included in the efforts to provide a robust analysis of adult mortality estimates in producing a clearer lifetable from birth to 85+. Data used to determine such estimates as well as uncovering provincial differentials are obtained from the Community Survey of 2016 (CS 2016), published by Statistics South Africa (Stats SA) (2016). The 3 main data sets utilised includes the Person/Individual file; the Household Deaths file; and the Mortality file (Statistics South Africa, 2016). Essentially, the study seeks to understand the provincial differences in adult mortality, taking into consideration contextual impacts such as sociodemographic and socioeconomic factors. Underlying these impacts is a discussion on the determinants of health framework adapted from Mosley and Chen (1984) and more recently, the dynamics of adult mortality (Sartorius *et al.*, 2013). In doing so, the study will seek to provide an understanding of the parameters of indirectly calculating adult mortality experienced in South Africa, and how these are affected by household data as opposed to individual data.

ACRONYMS AND ABBREVIATIONS

AMR	Adult Mortality Rate
ART	Anti-Retroviral Treatment
ASDR	Age-Specific Death Rate
CS	Community Survey
DU	Dwelling Unit
EC	Eastern Cape
EA	Enumeration Area
FS	Free State
GP	Gauteng province
HDI	Human Development Index
HIV/AIDS	Human Immunodeficiency Virus/ Acquired Immune Deficiency Syndrome
KZN	KwaZulu-Natal
LP	Limpopo province
MDG	Millennium Development Goals
MP	Mpumalanga
NC	Northern Cape
NW	North West
PCA	Principal Component Analysis
SA	South Africa
SDG	Sustainable Development Goals
SES	Socioeconomic status
STATA	Statistical Analysis Software
Stats SA	Statistics South Africa
UN	United Nations
VRS	Vital Registration System
WC	Western Cape
WHO	World Health Organization
YLL	Years of life lost

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CHAPTER 1: INTRODUCTION

1.1. Defining adult mortality

Demographers define adult mortality as "mortality at ages 15 or more" (Moultrie *et al.*, 2013: 191). However, in many contexts adult mortality is strictly defined as mortality between ages 15 and 60, with ages above 60 regarded as older-age mortality (Moultrie *et al.*, 2013). By limiting adult mortality between the exact ages of 15 and 60 (or even below 60 in many cases), levels of mortality can be estimated without the need for data in older-age categories which tend to be difficult to obtain and estimate (Hill, 2001). However, where this data is available it can be very useful to include as it results in a wider ranging interpretation of mortality estimates. Mortality, along with fertility and migration are the three main components that determine changes in population size, structure and distribution (United Nations, 1984). Mortality, as a population component is one of great significance as mortality measures have been defined as the second most important factor in determining population changes on a national scale (United Nations, 1984). The reasons why this is important will be subsequently discussed.

1.2. Problem statement

According to most studies, both local and international, adult mortality levels in sub-Saharan Africa tend to be extremely high and this has been largely due to HIV/AIDS, non-communicable disease, war and violence among other causes apart from biological (World Health Organization, 2000). Based on previous projection estimates on the prevalence of HIV/AIDS in South Africa, there has been a dramatic increase since 1990 (Dorrington, *et al.* 2001: 20). The projected estimates for age-specific mortality rates (ASMR) during the prevalence of HIV/AIDS indicated that the highest occurrence of infection predominantly centred around ages 15 to 34 (Dorrington, *et al.* 2001: 21). Patterns of adult mortality are typically found to be higher for men than women (Anderson and Phillips, 2006: 6). This remains to be true, where the levels of mortality for men have been shown to be consistently higher than those for women in studies examining sub-Saharan Africa (World Health Organization, 2000). Mortality rates also tend to increase after age 15 and rise at an increasing rate after age 35 for various social and biological reasons (Anderson and Phillips, 2006: 6). The level of adult mortality in any given country has huge significance on the developmental status of that country, not solely, but largely because people aged 15 to 64 comprise the labour force (Anderson and Phillips, 2006: 6; Dorrington *et al.*, 2004: 12).

Furthermore, the extreme discrepancies in socioeconomic inequality, specifically within developing nations highlights the importance of assessing mortality rates, when taking into consideration the interrelated and direct effects of development and inequality (Marmot, 2005). The persistent and historical interplay between health implications and socioeconomic status has necessitated efforts to estimate and understand adult mortality levels accurately (Palloni and Heligman, 1985). This is even more important in the face of the demographic dividend faced by youth-predominant nations such as South Africa, where a large proportion of the population is aged between 15 to 49 (Elo and Preston, 1992). The importance of understanding and obtaining an accurate representation of the level of adult mortality in South Africa cannot be understated (Bradshaw, Dorrington and Laubscher, 2012). This is particularly important with regards to the HIV/AIDS pandemic and its effect on the country's health and overall mortality pattern which has resulted in many child-headed households and the economic impacts this has had on those children as South African adults today (Anderson and Phillips, 2006; Herbst *et al*., 2009). This includes uncovering the current state of health as it relates to South Africa since the roll out of Anti-Retroviral Therapy (ART) (Herbst *et al.*, 2009). Additionally, in order to obtain an accurate representation of adult mortality, the need for efficient and effective vital registration systems (VRS) is of utmost importance (Timaeus and Jasseh, 2004: 757). Based on the situation of statistical data or lack thereof in the recent decade, it provides little certainty on the extent of robust adult mortality estimations (Timaeus and Jasseh, 2004: 757). A further examination of this concern will be looked at in greater detail in Chapter 2.

1.3. Rationale

The study of adult mortality levels is one which holds significance in the socio-political, economic and demographic arena (World Health Organization, 2008). Adult mortality measures largely influence social policy as mortality levels have been identified as the most significant factor directly related to the health of any given population (United Nations, 1984). The study of adult mortality is extremely intricate as it requires a great deal of data to arrive at plausible estimations (Blacker and Gapere, 1988). Estimations of adult mortality can be calculated directly or indirectly using various methods of estimation (Brass, 1985; Henry, 1960). Notably, the estimation of adult mortality in countries with a lack of complete vital registration of deaths has proved to be quite challenging (Hill, 2001). As such, indirect methods have often been widely used as a more accessible alternative (Bradshaw *et al.*, 2003). However, there has been no consensus on the best way to achieve such estimates as there are many indirect methods of estimation (Blacker, 1984; Hill, 2001). Due to such data constraints, the study and estimation of adult mortality becomes challenging but necessary (Brass, 1971; Foote, Hill and Martin, 1993). Understanding a country's population mortality levels and distribution can provide essential information about a country's healthcare, socioeconomic wellbeing, education levels as well as political conditioning among other mitigating factors (Luy, 2012; Moss, 2002). Thus, the collection and analysis of mortality data provides a pictorial indication of the underlying policies and programmes needed for transformation development as this has an impact on the wellbeing of a country's citizens (Moss, 2002; Setel, *et al.* 1998: 1). Furthermore, the analysis and interpretation of data facilitates efficiency in evaluating the effectiveness of such policies and the progressive status thereof through appropriate monitoring and evaluation thereof (Moss, 2002; Setel, *et al.* 1998: 1).

The importance of understanding adult mortality levels across provinces is one that focuses on two main concepts of discussion. The first being rural-urban disparities. As countries become more developed and move from rural to more urban forms of residences, this has an implication on the livelihoods of individuals and households (Menashe-Oren and Stecklov, 2016). Within South Africa, this is important because although municipal areas differ in their developmental levels, the overall analysis of adult mortality for these purposes can be seen through the differences uncovered within each province. Secondly, socioeconomic (access to resources) and demographic variables (such as sex or race) that impact the determinants of adult mortality would allow the study to inferences about such levels experienced. This coupled with the comparative advantage of such data will allow the study uncover any major extremities in the levels of adult mortality experienced within South Africa, if any at all. Provincial boundaries provide a snapshot of the level of development that can accelerate or decrease premature adult mortality and it would be beneficial to explore these theoretic concepts for discussion. The standard of living varies for different households and the data results may provide insight of the extent of this.

Mortality data uses essentially vary across different aspects of analyses depending on their intended purpose (ICSU and ISSC, 2015; UN Population Division, 2011). These include national planning, health sector planning, medical and epidemiological research, as well as population forecasting (United Nations, 1984). Mortality information allows the health sector to appropriately allocate resources in areas negatively affected the most (United Nations, 1984). Levels of mortality could also be used as measures of evaluation for general health services as it is assumed that adequate and high healthcare levels would, inevitably, be observed under a declining mortality rate (United Nations, 1984). Moreover, the amount of useful data and the access to information on adult mortality is further limited by the circumstance of poor data collection systems, incomplete data storing and other errors which prevent data accuracy and completion (Kaufman *et al*., 1997). The absence of adequate vital registration data necessitates estimates of mortality using indirect demographic techniques and mathematical assumptions based on large-scale surveys and/ or relevant census data (Bradshaw and Timaeus, 2006).

1.4. Research objectives

Taking into consideration the above-mentioned necessity for adequate data, and the need for understanding mortality levels as it relates to development and other various implications, the overall research objectives are as follows;

i) To understand the level of adult mortality in South Africa.
ii) To be able to compare adult mortality across provincial boundaries.
iii) To identify some of the methodological issues associated with the calculation and analysis of adult mortality estimates.

1.5. Research questions

The research study is therefore guided by the following core research questions as they relate the research objectives;

i) What are the levels of adult mortality in South Africa?
ii) What are the provincial differences in adult mortality in South Africa?
iii) What are some of the methodological issues to be considered when analysing adult mortality data from the South African Community Survey of 2016?

1.6. Data source

The Community Survey (CS), first introduced in 2007 by Statistics South Africa is the second (and updated) survey undertaken to provide data at a lower geographical level as well as to bridge the gap between censuses (Statistics South Africa, 2016: 8). The research will use data obtained by the CS 2016 to estimate national and provincial adult mortality levels in order to address the core research questions and objectives, which will be discussed in greater detail in Chapter 3.

1.7. Statement of hypothesis

The following study hypothesises that there are varying provincial differentials, mainly underpinned by socioeconomic determinants at an individual and household level, which have an impact on the overall level of adult mortality in South Africa. Thus, reducing levels of adult mortality often experienced in developing countries can only be done through resolutions derived from estimates at national and provincial levels and responding to those issues identified as key determinants of mortality.

1.8. Theoretical approach

For many years, the Demographic Transition Theory had been the cornerstone for the study of Demography and the dynamics of demographic processes (Kahn *et al.*, 2007). As time has progressed, however; the study of mortality levels within both developed and developing countries to a great degree, have been related to factors which have led many researchers to believe that there are predispositions of either high or low mortality rates in addition to the already known biological factors (Dorrington, *et al.* 2004: 12). Mortality has particularly been associated with the socioeconomic determinants which are directly and indirectly related to illness and wellbeing (Marmot, 2005; Masuy-Stroobant, 2001). The high correlation between mortality and socioeconomic factors to produce causal inferences about the determinants of mortality has been a focus for many prior research studies (Masuy-Stroobant, 2001; Mosley and Chen, 1984). As such, the analytic value of socioeconomic determinants serves as an appropriate indicator of mortality for population-based research (Mosley and Chen, 1984).

In essence, the socioeconomic determinants of health framework suggest that socioeconomic factors affect peoples' ability to respond to illnesses or prevent the onset of illnesses that are mostly preventable (Marmot, 2005; Masuy-Stroobant, 2001). Some of these factors include one's age, income level, living conditions, working environments and other social factors affecting behavioural responses to risk aversion (Marmot, 2005; Masuy-Stroobant, 2001). The socioeconomic determinants of health framework is best suited as an appropriate framework for understanding adult mortality because it explains the determinants that could increase or decrease the probability of surviving, particularly in developing countries like South Africa

(Marmot, 2005). The link between this theoretical approach and adult mortality assumes that as populations increase efforts in improving the quality of human life and economic development, mortality rates would decline as a result (Kahn *et al.*, 2007). Therefore, provincial socioeconomic patterns should mimic the assumed level of mortality to be expected based on these determinants (Marmot, 2005).

The socioeconomic status and health framework presented by Adler and Ostrove (1999) is another example of the vital relationship between proximal and distal factors that influence the resources of an individual or household. According to Adler and Ostrove (1999) socioeconomic status has a direct impact on the health of individuals which in turn impacts morbidity and mortality. A lower socioeconomic status is indicative of less access to adequate healthcare (Adler and Ostrove, 1999). Furthermore, those associated with a lower socioeconomic status tend to engage in more unhealthy behaviours such as smoking or consuming a diet high in fat (Adler and Ostrove, 1999). The access to adequate healthcare also plays an important role in the treatment of mental health issues and poverty exacerbates these factors (Adler and Ostrove, 1999). Interestingly, the causal direction of socioeconomic status on health can be views in two ways. The first is where socioeconomic status is largely the cause of influence of people's health, which has been the general assumption of many researchers (Adler and Ostrove, 1999). The other is the opposite, where health has a causal influence on socioeconomic status (Adler and Ostrove, 1999). Although this relationship has been found to be more prominent in individuals with long-term diseases or disabilities (Adler and Ostrove, 1999). This is known as social drift, where mental health issues are seen as having long-term determining effects on the socioeconomic status of individuals (Adler and Ostrove, 1999). The analytical frameworks will be discussed in greater detail in the subsequent chapter.

1.9. Dissertation structure

There are six chapters contained in the study. The following table summarises each chapter topic and the purpose of each topic:

Chapter	Purpose
Chapter 1: Introduction	Chapter 1 outlines an introduction of the study by outlining a brief background of the topic, its importance and the rationale of the study. In addition to this, it highlights the primary aims and objectives of the research study.
Chapter 2: Literature Review	This chapter is a reflection of past and current research and literature as it relates to adult mortality. This forms the basis of what we know and what has been empirically substantiated in the study and understanding of adult mortality. More specifically, historical levels and trends in African and South African adult mortality are reviewed. Notably, the impact of HIV/AIDS and the variations in socioeconomic status (SES) have played a significant role in the experienced levels of adult mortality in Africa. This is explored and remains a theme in the research analysis.
Chapter 3: Methodology	Chapter 3 provides the methodology involved and the data sourced which will be used for the research study. This includes a description of the study sample, estimation techniques and the statistical tools used in estimating adult mortality in South Africa. In examining the adult mortality, different variables are discussed to get a better understanding of some of the influences these may have on the levels of mortality experienced.
Chapter 4: Results	In chapter 4, detailed results and an analysis of those results are presented based on the methods of estimation used in the previous chapters. Additionally, the study explores the valuable use of household mortality data in determining survivorship probabilities and estimating life expectancy for each age category represented in the form of a lifetable.
Chapter 5: Discussion	Finally, in chapter 5, major discussion points are brought forward in an attempt to derive linkages between what has been studied in the literature review and the results of the study. Key data use limitations are stated, and final conclusions are made for any potential future research that may not have been explored.

CHAPTER 2: LITERATURE REVIEW

2.1. Introduction

Adults and children die as a result of many different diseases which stem from an array of socioeconomic predispositions and determinants (Foote, Hill and Martin, 1993). However, evidence has suggested that neither the level nor trend in adult mortality is in any way directly associated with or similar to child mortality (Foote, Hill and Martin, 1993). It is therefore necessary and important to not only investigate, but to understand the circumstantial determinants of adult mortality in Africa, in order to provide substantial information and a clear basis for population estimates (Foote, Hill and Martin, 1993). Population projections are important as they precipitate planning in any public sector (Foote, Hill and Martin, 1993).

Looking at previous and current global development goals, the MDG's have made no emphasis on adult mortality (United Nations, 2015). Of the 8 goals highlighted, the 2015 report only mentions and acknowledges the importance of child and maternal mortality, with specific emphasis on the need to reduce maternal mortality (Statistics South Africa, 2015(c); United Nations, 2015). According to the SDG's, under Goal 3, health has been emphasised as a key determinant of all aspects of life including the implications it has on mortality overall (ICSU and ISSC, 2015; United Nations, 2018). The report highlights the need to focus attention on adequate healthcare and advancement towards resilience with regards to disease incidence and prevalence (ICSU and ISSC, 2015; United Nations, 2018). Health is important especially for development because without adequate health, adults, as representatives of the active labour population, would be affected (ICSU and ISSC, 2015; United Nations, 2018). The goal also highlights the fact that a lack of life expectancy data in many countries is of growing concern as well as the consequences for the introduction of the SDG's overall (ICSU and ISSC, 2015; United Nations, 2018). This includes demographic changes in both aging populations of developed nations as well as youth-predominant developing nations (ICSU and ISSC, 2015; United Nations, 2018).

The importance of health seeks to address issues of associative concern (ICSU and ISSC, 2015; United Nations, 2018). The HDI highlights health as a core indicator for measurement and achievement of developmental goals as an analyst and policymaker (Kovacevic, 2011; United Nations, 2018(b)). Analysts believe that economic growth and technology are important to reduce diseases, leading to lower mortality rates and higher life expectancy (Kovacevic, 2011; United Nations, 2018(b)). However, the mechanism of the relationship between income, development and life expectancy is still uncertain (Kovacevic, 2011; United Nations, 2018(b)).

2.2. The demographic concept of adult mortality

Mortality, along with fertility and migration are the three main components which determine changes in population size, structure and distribution (United Nations, 1984). Mortality measures have been defined as the second most important factor in determining these changes on a national scale (United Nations, 1984). For the purpose of framework structuring and organisation, mortality can be sub-categorised into four broad bands of analysis. They are child/ infant mortality, maternal mortality, adult mortality and older-age mortality. Child/ infant mortality, defined briefly, is the number or level of mortality of newly born infants and children up to the age of 14 whilst older-aged mortality is typically above the age of 65 (Moultrie *et al.*, 2013). Adult mortality would therefore be the age categories between child and older-age mortality (i.e., 15 to 65) (Moultrie, *et al.* 2013). Maternal mortality, on the other hand, is the death of women during pregnancy or within 42 days of birth due to causes directly or indirectly associated with the pregnancy (Moultrie, *et al.* 2013). Maternal mortality pertains to women between the reproductive ages of 15 to 49, subject to contextual variances and observations, which also have an impact on adult mortality patterns due to the age category overlap (Moultrie, *et al.* 2013). Mortality levels are important as they are measures of absolute life events (United Nations, 1984). Since mortality is a definite life event, there are many implications it has on various aspects within the study and analyses of populations in general (United Nations, 1984).

2.3. Measuring adult mortality demographically

The probability of dying between ages 15 and 60 [$_{45}q_{15}$] can be interpreted as "the probability that someone who had survived childhood would die before old age if he or she went through life, subject to the age-specific death rates of the year in question" (Moultrie, *et al.* 2013: 191). This is accepted as a good measure and indicator of overall levels of adult mortality and unlike life expectancy at age 15, is not influenced by the rates of death at age 60 and above (Moultrie, *et al.* 2013). A limitation, however, of this measure is that it is indeed influenced by the upper 45-year age category death rates (Moultrie, *et al.* 2013). Therefore, estimates are not influenced as much by trends in early adulthood, as they are by later adulthood death rates (Moultrie, *et al.* 2013). Furthermore, without supplementary data or assumptions, neither sibling history data nor orphanhood data will be able to provide complete measures of adult mortality across the entire age range categories (Moultrie, *et al.* 2013).

In an attempt to determine some understanding of the level of adult mortality, the most widely used measure has been taken from the lifetable where the probability that a person aged 15 will die before their 60th birthday is used [$_nq_x$] (Moultrie, *et al.* 2013: 191). In addition to the challenges associated with estimation, the measurement of adult mortality presents itself with fundamental complexities (Moultrie, *et al.* 2013: 191). Firstly, adult mortality rates across the age categories are "an order of magnitude lower than those of children" (Moultrie, *et al.* 2013: 191). Therefore, because adult deaths are less frequent events (in comparison to the probability of infant deaths and the easier access to data for this), measuring adult mortality precisely, requires large sample sets or events occurring across a longitudinal period (Moultrie, *et al.* 2013: 191). Secondly, reliable information about deceased adults is difficult to obtain where there is no primary informant (Moultrie, *et al.* 2013: 191). Whereas data for child mortality can be collected from mothers, there is no "universally-suitable" informant for adult deaths (Moultrie, *et al.* 2013: 191). Thirdly, a problem of under reporting and multiple reporting of adult deaths tends to distort the data collection process (Moultrie, *et al.* 2013: 191). Finally, the issue of age misreporting and time-frame errors affects the data which makes it difficult to obtain adequate information and as such, age range estimates become distorted (Moultrie, *et al.* 2013: 191). The issue of age misreporting occurs for various reasons. In most developing countries older people are less likely to have birth certificates than younger people and are more likely to have a lower level of educational attainment, which is problematic during interviews (Moultrie, *et al.* 2013: 191). Also, the informant of the deceased may not know the age of the deceased, which often leads to exaggerated age estimates and incorrect reporting of age at death (Moultrie, *et al.* 2013: 191). Inevitably, raw data requires a great deal of smoothing, adjusting and rectifying before it can be used for estimations (Moultrie, *et al.* 2013: 191). With that stated, it is important to note that methods have since been refined and updated in order to remedy and circumvent the impact of these shortcomings (Moultrie, *et al.* 2013).

The importance of understanding and obtaining an accurate representation of the level of adult mortality in South Africa cannot be understated. This is particularly important with regards to the HIV/AIDS pandemic and its effect on the country's health and overall mortality pattern (Anderson and Phillips, 2006). However, in order to obtain an accurate representation of adult mortality, the need for efficient and effective vital registration systems is of utmost importance

(Timaeus and Jasseh, 2004: 757). Based on the current situation of statistical data or lack thereof, it provides little certainty on the extent of adult mortality estimations (Timaeus and Jasseh, 2004: 757). Adult mortality estimates in sub-Saharan Africa are often imputed from model lifetables because data on adult mortality are rare and insufficient with the exception of South Africa and Zimbabwe, which are primarily known as the only two countries in sub-Saharan Africa with a considerably adequate data collection system, albeit other countries have some effort of data recording (Timaeus and Jasseh, 2004: 757). However, according to reports, the estimated percentage of deaths registered has been on the decline overall, across age categories 15 to 64, from 92.2% in 1997 down to 80.2% in 2004 (Anderson and Phillips, 2006: 3). Nevertheless, this is noted as still being a remarkable improvement from the previously recorded 54% during 1990 (Dorrington *et al.*, 2001: 5).

2.4. Understanding the importance of adult mortality

As stated previously, high mortality levels are often related to key socioeconomic determinants of health as well as the extended impacts of insufficient and poor governance in the development of human life and the developmental status of a nation (Moultrie *et al.*, 2013; United Nations, 1984). This emphasis on human life relates to matters concerning health and service provision of a country (United Nations, 1984). However, the developmental status or economic growth of a country must be sufficient in order to serve as a complimentary function for overall development (United Nations, 1984). The Human Development Index (HDI), Sustainable Development Goals (SDG's), as well as the Millennium Development Goals (MDG's) across the decades have emphasised the need to redress and combat these developmental challenges (ICSU and ISSC, 2015). Although this is arguably important, measures of adult mortality, in particular, have often been neglected (Moultrie, *et al.* 2013). The need for adult mortality data collection is as significant as that for infants under 5; the elderly and women of reproductive ages, as often outlined in these policy strategies (Bradshaw and Timaeus, 2006).

Adult wellbeing encompasses the vast majority of populations globally (Moultrie, *et al.* 2013). This, to a large extent, includes the economic workforce, which is crucial for development (Bradshaw and Timaeus, 2006). Without active labour capital, development and production would inevitably decline (Bradshaw and Timaeus, 2006). The amount of adequate data and information on the matter is perpetuated by the circumstance of poor data collection systems, incomplete data storing and other errors which prevent data accuracy and completion

(Kaufman *et al.*, 1997). Without this vital information, we cannot effectively make decisions that will guide policy redress. Since measures of older-age mortality are naturally inclined to be understood as naturally expected due to the general assumptions of the life cycle, much emphasis has been placed more on the other measures of mortality with adult mortality being neglected in light of this notion, despite the importance of mortality data collection in its totality (Bradshaw and Timaeus, 2006; Kaufman, *et al.* 1997; Moultrie, *et al.* 2013). Both previous and current data have revealed very high levels of adult mortality globally (albeit more predominant in developing/ less-developed nations) (Bradshaw *et al.*, 2012).

Population estimations which have shown that adult mortality has stagnated at a relatively high level in some countries suggest that adult health should not be an issue that should be overlooked when trying to remedy the effects of socioeconomic inequalities (Foote, Hill and Martin, 1993). Efficiency in health planning requires major consideration of the experienced and contextual health problems of people throughout their lives, not just at a childhood or old-age level (Foote, Hill and Martin, 1993). Moreover, the health concerns of the poorer population highlight serious emphasis on the socioeconomic linkage to health and adult mortality as they are the primary populations directly affected by epidemics of disease and illness (Foote, Hill and Martin, 1993). Given the limited knowledge surrounding adult mortality, it is important to understand distinctive variations in adult mortality patterns which may raise issues for further investigation and estimation of other indicators (Foote, Hill and Martin, 1993).

2.5. Adult mortality data significance in developing countries

High quality data has great statistical significance for any given country, but more especially developing countries (Setel, *et al.* 1998: 1). In effect, the collection and analysis of this data provides a clear indication of the underlying policies and programmes and their impact on the wellbeing of its citizens (Setel, *et al.* 1998: 1). Also, the analysis and interpretation of data facilitates efficiency in evaluating the effectiveness of policy implications and progress status (Setel, *et al.* 1998: 1). As notoriously mentioned, the mortality levels within a country, to a great degree, are related to factors which may be a predisposition to either high or low mortality rates in addition to biological factors (Dorrington, *et al.* 2004: 12). Some of these factors include that of healthcare systems, disease prevalence, crime and poverty (United Nations, 1984). To a large extent premature adult mortality has been written off as a peculiar feature of developing countries with little research focus (Setel, *et al.* 1998: 1). Understandably so, as the rise in child and maternal mortality rates have been a highlight of concern globally (Bradshaw and Timaeus, 2006: 31; Moultrie, *et al.* 2013: 191). Yet, the effects of high adult mortality rates have severe implications for the household unit as well as the economic productivity of a country (Setel, *et al.* 1998: 1). For this reason, efficient data collection processes cannot be compromised, in order to achieve adequate analysis and interpretation of information (Department of Social Development, 1998).

Population forecasting is essential for small, medium and long-term planning as well as service provisioning (Department of Social Development, 1998). Economic development, in addition, requires population factors which largely relate to demand and supply purposes regarding the economically active population (United Nations, 1984). Mortality levels tend to also relate to the general level of wellbeing of a nation as they serve as measures of not only the quantity of life, but also the quality (United Nations, 1984). This is important for charting socioeconomic development progress and international comparison (United Nations, 1984). The sector which mortality information directly relates to is that of healthcare (United Nations, 1984). Extensive data on mortality has typically served as a surrogate for morbidity (which reflects a more accurate picture of health but is more difficult to collect and interpret) (United Nations, 1984). Mortality information allows the health sector to appropriately allocate resources in areas negatively affected the most (United Nations, 1984). Levels of mortality could also be used as measures of evaluation for general health services as it is assumed that adequate healthcare would, inevitably, be observed in a declining mortality rate (United Nations, 1984). Therefore, successes in healthcare could be weighed against previous rates of change from earlier periods or by comparing rates with other countries of a similar developmental stage (United Nations, 1984). Fundamentally, it is understood that populations have progressed through periods of high to lower levels of mortality and fertility, with migration increasing as modernity has permitted (Kahn, *et al.* 2007). These levels of high mortality had been attributable to the high levels of communicable diseases experienced in the past; and the need to have a greater number of children born in order to circumvent the probability of infant mortality had spiked fertility levels (Kahn, *et al.* 2007). As time has progressed, however, mortality levels are attributed to non-communicable diseases in addition to other causes, both natural and unnatural (Kahn, *et al.* 2007). The advancement and improvement of technology and medicine has allowed populations to thrive in many aspects of life on a global scale (Kahn, *et al.* 2007). With modernity and development increasing, in addition to inclusivity such as women empowerment and the shift from collectivist-oriented to individualistic-oriented ways of life, fertility has been on the decline overall (Moultrie *et al*., 2013).

Adult mortality is typically found to be higher for men than women (Anderson and Phillips, 2006: 6). Mortality rates also tend to increase after age 15 and rise at an increasing rate after age 35 for various reasons (Anderson and Phillips, 2006: 6). The level of adult mortality in any given country has huge significance on the developmental status of that country because people aged 15 to 64 comprise the labour force (Anderson and Phillips, 2006: 6; Dorrington, Moultrie and Timaeus, 2004: 12). Accurate mortality data is important for policy planning and research purposes (Anderson and Phillips, 2006: 1). To some degree, high levels of mortality can be associated as a characteristic of underdevelopment in the absence of adequate healthcare systems (Dorrington, *et al.* 2004: 12). However, adequate knowledge about the levels and distribution of adult mortality has been hindered for two main reasons. Firstly, for many years the core focus of mortality trends centred around child and maternal mortality, thus neglecting vital information on adult mortality as a public health issue (Bradshaw and Timaeus, 2006: 31; Moultrie, *et al.* 2013: 191). Advances within the health sector have swept the continent during the last 20 years and have allowed for primary health care prioritising in an attempt to provide easily accessible and inexpensive health care to rural communities (Bradshaw and Timaeus, 2006). However, these strategies of primary health care have largely focused on child and maternal health issues (Bradshaw and Timaeus, 2006.

Healthcare strategies have yet to overcome most challenges related to the health needs of adults such as the management of chronic conditions and HIV/AIDS treatment (Bradshaw and Timaeus, 2006). The lack of empirical-based evidence undermines the importance of such challenges and obscures strategic planning for a way forward in understanding trends and causes, as well as responding to these challenges appropriately (Bradshaw and Timaeus, 2006). Despite these challenges, which were once also associated with childhood and maternal mortality, survey-based techniques as well as indirect methods of estimation and the collection of birth histories have somewhat improved the situation (Bradshaw and Timaeus, 2006. Secondly, the neglect of adult mortality information is further perpetuated by a lack of sufficient data due to inadequate and incomplete vital registration systems (Moultrie, *et al.* 2013: 191). Apart from vital registration systems, there are other sources used within the data collection process, these include survey data, census data and Demographic and Health Surveys (Moultrie, *et al.* 2013: 191). Although knowledge of mortality overall has faced data limitations, it seems as if there is still less known about adult mortality both statistically and demographically (Moultrie, *et al.* 2013: 191).

2.6. Adult mortality in sub-Saharan Africa

According to the Global Burden of Disease studies for 1990 and 2000, sub-Saharan Africa is estimated as having the highest burden of disease and mortality rates (Timaeus and Jasseh, 2004: 765; World Health Organization, 2000). Of the 40 countries with the highest mortality rates, 37 of these are found within the sub-Saharan region (World Health Organization, 2000). The probability of surviving from age 15 to 60 in 2000 was less than 50% in half of all the countries in sub-Saharan Africa (Bradshaw and Timaeus, 2006). Increases in mortality tend to concentrate around women aged 25 to 39 and men aged 30 to 44 (World Health Organization, 2000). Adult mortality levels in sub-Saharan Africa tend to be the highest due to HIV/AIDS, non-communicable disease, war and violence among other causes (World Health Organization, 2000). HIV/AIDS have been known to cause major restructuring of the age and sex patterns of mortality (Dorrington, *et al.* 2001: 5). The projected estimates for age-specific mortality rates during the prevalence of HIV/AIDS indicated that the highest prevalence of infection centred around ages 15 to 34, thus decreasing life expectancy (Dorrington, *et al.* 2001: 21). According to the World Bank (2012), approximately 772 in 1000 Zimbabwean adults die each year from HIV/AIDS.

Adult mortality estimates in sub-Saharan Africa are often imputed from model lifetables because data on adult mortality are rare and insufficient with the exception of South Africa and Zimbabwe, which are the only two countries in sub-Saharan Africa with a considerably adequate data collection system (Timaeus and Jasseh, 2004: 757). African countries, therefore, have to compile mortality estimates from other sources of data due to the lack of sufficient data availability (Timaeus and Jasseh, 2004: 764). Sibling-history data can be evaluated; however, the severity of reporting errors remains unclear (Timaeus and Jasseh, 2004: 764). For example, mortality estimates for Senegal resulted in the overestimation in that country (Timaeus and Jasseh, 2004: 765). Adjustment of data is an important step in mortality estimates and can have huge implications for mortality results (Timaeus and Jasseh, 2004: 765). War and the HIV/AIDS epidemics have largely remained key challenges in mortality estimates for sub-Saharan Africa (Timaeus and Jasseh, 2004: 765). Mortality estimates for Rwanda had to include data 6 years prior to the population survey as a result of the genocide events which tremendously decreased the size of the population (Timaeus and Jasseh, 2004: 765). Although overall mortality levels have improved globally, sub-Saharan Africa continues to experience high levels of mortality (Timaeus and Jasseh, 2004: 765). Adult mortality estimates during the mid-1990s had become more diverse than before. By the year 1995, the probability of dying between ages 15 to 60 had increased by 55% and 64% in Zambia and Uganda, for men and women respectively (Timaeus and Jasseh, 2004: 765). By 2000 Malawi's probability of dying for women rose to approximate 59% and 70% for men in Zimbabwe (Timaeus and Jasseh, 2004: 765). In addition to the already experienced high levels of mortality, sub-Saharan Africa holds some of the highest prevalence of HIV/AIDS infections, with increases in transmission on the rise in some parts (Timaeus and Jasseh, 2004: 766). Despite medical treatment and prevention advances, age-sex distributions become distorted in the face of mortality estimates (Timaeus and Jasseh, 2004: 766).

Adult mortality levels for men are consistently higher than those for women in sub-Saharan Africa (World Health Organization, 2000). However, in Cameroon for example, the probability of dying is higher for women (estimated at 0.559) than for men (estimated at 0.488) (Bradshaw and Timaeus, 2006). This estimate is contrary to typically expected sex differentials in adult mortality. On average, mortality rates for men have risen one third more than the mortality rates for women, but due to women dying at much younger ages and population growth rising, the sex differentials remain small especially with the high number of HIV/AIDS-related deaths (World Health Organization, 2000). War and the HIV/AIDS epidemic have largely remained key challenges in mortality estimates for sub-Saharan Africa (Timaeus and Jasseh, 2004: 765). Mortality estimates for Rwanda have had to include data 6 years prior to the population survey as a result of the genocide events which tremendously decreased the size of the population (Timaeus and Jasseh, 2004: 765). Adult mortality estimates during the mid-1990s had become more diverse than before. By the year 1995, the probability of dying between ages 15 to 60 had increased by 55% and 64% in Zambia and Uganda, for men and women respectively (Timaeus and Jasseh, 2004: 765). Adult mortality levels in Southern and Eastern Africa are relatively high compared to the lower levels of mortality in Western Africa as well as the Indian Ocean Islands (Bradshaw and Timaeus, 2006). In Southern Africa, the probability of dying is estimated at 0.695 for men and 0.661 for women in Namibia (Bradshaw and Timaeus, 2006). In Western Africa, the probability of dying is estimated at 0.379 for men and 0.326 for women in Ghana (Bradshaw and Timaeus, 2006). In the year 2000, Malawi's probability of dying for women rose to approximately 59%; and 70% for men in Zimbabwe (Timaeus and Jasseh, 2004:

765). Sub-Saharan Africa remains a region plagued with relatively high levels of mortality despite efforts to change this (World Bank, 2012).

2.7. Adult mortality in South Africa

An overall picture of mortality in South Africa suggests that the rate of mortality fell prior to mid-1980, thereafter levelling off between mid-1980 and mid-1990 (Anderson and Phillips, 2006). Mortality rates also seemed to increase more in some population sub-groups than others (Anderson and Phillips, 2006). Between 1990 and 1995, the probability of dying [${}_nq_x$] increased for both men and women between the ages of 15 and 60 (Bradshaw and Timaeus, 2006). The higher probability of dying for men is expected as men have a higher overall mortality rate than women (Anderson and Phillips, 2006: 6). Data based on the probability of dying between this period also suggest that South Africa; along with Zambia, Zimbabwe, Cameroon and Uganda; had the fastest rate of increase in adult mortality (Timaeus and Jasseh, 2004). Mortality rates for both men and women in South Africa increased successively during 1997 (Anderson and Phillips, 2006: 9). In 2004, the male mortality rate showed higher estimates for ages 30-34 onward (Anderson and Phillips, 2006: 9). If one were to observe the differences between 1997 and 2004 estimates, it would be evident that mortality had increased drastically (Anderson and Phillips, 2006). For example, men aged 30 to 34 during 1997 had a mortality rate of approximately 817 deaths per 100 000, whereas the mortality rate for the same age category in 2004 was 2 118 deaths per 100 000 (Anderson and Phillips, 2006). Female mortality rates across the age categories during 2004 also tended to be more volatile than expected (Anderson and Phillips, 2006). For example, the mortality rate for ages 30 to 34 was recorded at 2 267 deaths per 100 000 which exceeded the mortality rate for subsequent age categories (with the exception of 60 to 64 at 2 360 deaths per 100 000) (Anderson and Phillips, 2006). Another notable feature in the mortality level in 2004 was that the male mortality rate remained higher than the female mortality rate across ages 15 to 19 but was suddenly superseded by a remarkably higher female mortality rate (Anderson and Phillips, 2006). Fluctuation extremities between the male and female mortality rates during 2004 highlight the impact that HIV/AIDS has had on the pattern of mortality during that period (Anderson and Phillips, 2006).

According to the statistics report in 2011, overall mortality had decreased by 7.7% between the years 2010 to 2011 (Statistics South Africa, 2015). The observed rise in median ages showed that mortality occurred later in life (Statistics South Africa, 2015). Half of the total registered deaths in 2011 were persons classified as never married (Statistics South Africa, 2015). Also, 51.7% were male, with the average age being 49 while 48.3% of the total mortality being female, with the average age being 52,5 (Statistics South Africa, 2015). Looking at population sub-groups, mortality levels tend to be highest within the Black racial classification, followed by Coloured, White and Indian, respectively (Statistics South Africa, 2015). Provincial comparisons revealed KwaZulu-Natal to have the highest level of mortality from 2010 to 2011 followed by Gauteng and Eastern Cape (Statistics South Africa, 2015). However, according to reports, despite the levels of mortality and the vital registration system challenges, South Africans are living longer (Statistics South Africa, 2015). Life expectancy at birth during 2013, for example, was 61 years as opposed to 57,1 years observed in 2009 (Statistics South Africa, 2015). Based on the current situation of statistical data or lack thereof, it provides little certainty on the extent of adult mortality estimations (Timaeus and Jasseh, 2004: 757). An overall picture of mortality in South Africa suggests that the rate of mortality fell prior to mid-1980, thereafter levelling off between mid-1980 and mid-1990 (Anderson and Phillips, 2006). Mortality rates also seemed to increase more in some population sub-groups than others (Anderson and Phillips, 2006). Between 1990 and 1995, the probability of dying [$_nq_x$] increased for both men and women between the ages of 15 and 60 (Bradshaw and Timaeus, 2006). The higher probability of dying for men is expected as men have a higher overall mortality rate than women (Anderson and Phillips, 2006: 6). Data based on the probability of dying between this period also suggest that South Africa; along with Zambia, Zimbabwe, Cameroon and Uganda; had the fastest rate of increase in adult mortality (Timaeus and Jasseh, 2004).

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2.8. Rural-urban differentials of adult mortality

Furthermore, research has shown that rural levels of mortality tend to be substantially higher than those of urban levels of mortality (Akoto *et al.*, 2002). This disadvantage stems from the rural-urban household exposure characteristics described by Mosley and Chen in the proximate determinants of mortality (Akoto *et al.*, 2002; Mosley and Chen, 1984). However, much empirical research has focused on infant and child survivorship as well as maternal mortality (Akoto *et al.*, 2002). Despite the generalised understanding and acknowledgment of lowering overall mortality levels over the decades, there is still little empirical research which focuses on the levels of adult mortality experienced across both rural and urban sectors of comparison, more prominent in developing countries (Akoto *et al.*, 2002). There has, however, been some progress towards the study of adult mortality in developing countries as resources become available. Many researchers have been interested in the interplay between adult mortality and socio-political dynamics due to the growing concern that global issues have on life expectancy (Bollyky *et al.*, 2019). This is important because such studies highlight the impact of politics and development on adult mortality (Bollyk *et al.*, 2019). Although urban mortality and fertility rates tend to decrease at a more rapid pace than rural rates, the higher prevalence of HIV/AIDS in urban populations could seemingly alter this demographic transition (Magadi, 2013). Once again, the lack of adequate population data provides little confidence in obtaining adequate estimations for rural-urban analysis and comparison (Akoto *et al.*, 2002). A recent study explored rural-urban disparities in sub-Saharan Africa (Menashe-Oren and Stecklov, 2016). The study highlights some important factors that must be taken into consideration within the context of adult mortality estimates as they relate to living standards in sub-Saharan Africa. Most notable is the finding that migration between urban and rural areas impacts the number of estimated adult mortality disproportionally even in the face of socioeconomic factors (Menashe-Oren and Stecklov, 2016). Given this understanding, it is important to analyse data with this in mind, knowing that the survivorship proportion will vary depending on the total population within each rural or urban area. This is why it is vital to take all components of estimation into consideration when interpreting the numbers. It is also worth noting that the conceptualisation of rural and urban sectors becomes a challenge as the rationale of exclusively defining each sector remains vague within developing countries (Akoto *et al.*, 2002). For the most part, sub-Saharan remains predominantly rural (Akoto *et al.*, 2002).

2.9. Understanding adult mortality dynamics in health

According to The National Burden of Disease Study in South Africa, patterns of mortality are predominantly experienced in four leading causes (Bradshaw *et al.*, 2003). Despite the increase in death registrations, leading causes of death including HIV/AIDS, poverty-related conditions, chronic diseases and injuries, continue to pose challenges for the health sector in effectively and efficiently coping the emerging burden of disease (Bradshaw *et al.*, 2003). As a result, there has been a substantial number of years of life lost (YLL) due to these leading causes (Bradshaw *et al.*, 2003). Life expectancy at birth for men was estimated to be at 52.4 years and 58.5 for women (Bradshaw *et al.*, 2003). In addition, the age distribution of deaths for men emphasised HIV/AIDS, chronic disease and injuries (intentional and unintentional) as the leading cause of death for adult men (Bradshaw *et al.*, 2003). The same applies to women; however, they are presented in varying degrees (Bradshaw *et al.*, 2003). More men die from injuries than women and women have a higher death rate with regards to HIV/AIDS prevalence (Bradshaw *et al.*, 2003). Chronic diseases are typically a feature of the mid to late adult ages, with poverty-related conditions having a much lower impact across the sex structure of the population (Bradshaw *et al.*, 2003).

The rationale for meeting human needs has always been to treat pre-existing diseases and illnesses which affect the wellbeing of a population (Marmot, 2005). However, this cannot be done with the exclusion of combating underlying health determinants and the socioeconomic causes of disease and predisposition to early adult mortality (Marmot, 2005). Wider social policy will always remain a key instrument in the reduction of social and health inequalities which might increase adult mortality prevalence both at a community and national level of a country (Marmot, 2005). In addition, consumption patterns and average income remain important measures of the reduction of such social and health inequalities (Marmot, 2005). Health will always remain a significant and direct link to the study and understanding of adult mortality levels, especially when identifying underlying determinants (Marmot, 2005).

2.9.1 HIV/AIDS and mortality estimates

HIV/AIDS have been known to cause major restructuring of the age and sex patterns of mortality (Dorrington, *et al.* 2001: 5). As such, standard indirect methods of estimation have had to be adapted to account for the age and sex structure discrepancies causes by the pandemic (Dorrington, *et al.* 2001: 5). Taking this into consideration, it is easy to understand the magnitude of data processing when trying to accommodate errors of misreporting, insufficient data collection systems as well as the HIV/AIDS pandemic (Dorrington, *et al.* 2001: 5). This is done by comparing demographic model estimates with the original statistical results after adjustments for misreporting have been made (Dorrington, *et al.* 2001: 8). The purpose for this is to assess the consistency and accuracy of empirical mortality data with model estimates (Dorrington, *et al.* 2001: 8). Based on previous projection estimates on the prevalence of HIV/AIDS in South Africa, there has been a dramatic increase since 1990 (Dorrington, *et al.* 2001: 20). The projected estimates for age-specific mortality rates during the prevalence of HIV/AIDS indicated that the highest prevalence of infection centred around ages 15 to 34 (Dorrington, *et al.* 2001: 21). Overall, projections had indicated that mortality would rise at a rapid level due to the increasing spread of infection, causing a major decline in the overall life expectancy over the subsequent years (Dorrington, *et al.* 2001: 24).

2.10. Analytical framework

The analytical framework used to understand adult mortality has been adopted from the socioeconomic determinants of health framework (Marmot, 2005; Masuy-Stroobant, 2001; Mosley and Chen, 1984). The relevance of this framework is due to the fact that levels of adult mortality have been consistently linked to the predisposed health impacts propelled by socioeconomic status of countries (Marmot, 2005; Masuy-Stroobant, 2001; Mosley and Chen, 1984).

2.10.1. Socioeconomic determinants of health

Socioeconomic status encompasses "an array of resources such as money, knowledge, prestige, power and beneficial social connections that protect health no matter what mechanisms are relevant at any given time" (Link and Phelan, 1995). As such, the associated linkage between socioeconomic status and mortality stem primarily from medicine and epidemiological studies (Link and Phelan, 1995). Socioeconomic status is presumed to be a less critical variable which highlights only the beginning of the causal chain in addition to intervening risk factors which are seen as more important (Link and Phelan, 1995). However, the general association between socioeconomic status and mortality has persisted regardless of the ever-changing diseases and risk factors used to explain them (Link and Phelan, 1995). Link and Phelan (1995) have proposed that socioeconomic status be viewed as a "fundamental cause" of mortality inequalities due to its adaptability in understanding disparities (Link and Phelan, 1995).

Some of these factors include one's age, income, education, living conditions, working environments and other social factors, somewhat similar to Mosley and Chen's model for distal determinants of infant and child mortality (Marmot, 2005; Masuy-Stroobant, 2001). These factors are important in analysing observed levels of adult mortality as they provide researchers with a precursor for understanding generalised determinants of mortality. The diagram below, adapted from Saikia and Ram (2010: 156), summarises the proximate and distal factors which contribute directly and indirectly to an individual's/ household's risk of mortality exposure.

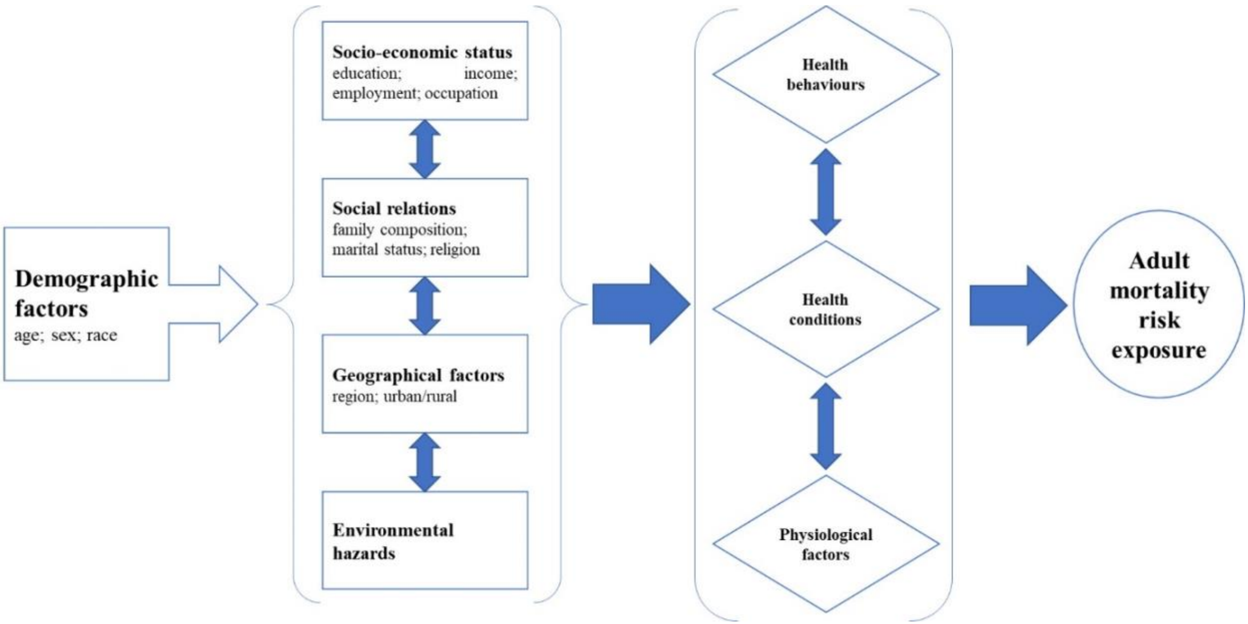

Figure 1: Socioeconomic determinants of health framework
(Adapted from Masuy-Stroobant, 2001; Mosley and Chen, 1984)

According to Moss (2002), socioeconomic factors are most consistent with predictors of health and mortality. The socioeconomic determinants of health framework are best suited as a framework for understanding adult mortality in that it explains the determinants that could increase the probability of surviving, particularly in developing countries (Marmot, 2005). As populations increase efforts in improving quality human life and economic development, mortality rates would decline as a result (Kahn *et al.*, 2007). Furthermore, the high discrepancies in socioeconomic inequalities, specifically within developing nations, highlights the importance of assessing mortality rates taking into consideration the interrelated dynamics of development and inequality (Marmot, 2005). James Riley has suggested that a combination of six factors including public health, medicine, wealth and income, nutrition, behaviour and education have influenced rising life expectancy since the 1800's (Gould, 2009). He further argues that these are all important factors, but their relative significance has varied across time and regions (Gould, 2009). This premise highlights similarities associated with the epidemiological transition and is also context-based, allowing for both private and public investment priorities to influence the general rate and magnitude of mortality improvements (Gould, 2009). These are important conclusions for policy-making as improving healthcare, addressing poverty through education, nutrition, housing, and economic opportunity issues aid in declining mortality impact rates (Gould, 2009).

Most commonly, level of education has been identified as a very important indication of underlying and predetermined behavioural effects on premature adult mortality (Lleras-Muney, 2004). In essence, education has both an indirect and direct effect on health (Lleras-Muney, 2004). Education provides individuals with critical thinking skills required for positive decision-making, which are useful for the production of healthy behaviour and response mechanisms (Lleras-Muney, 2004). It has been shown that educated people are better able to adhere to treatment regimens and are better able to manage chronic conditions (Lleras-Muney, 2004). Education therefore serves as a mechanism to lessen an individual's level of vulnerability to health-related problems because knowledge is a tool which provides informed decision-making (Lleras-Muney, 2004). More specifically, educational attainment gives women the power of choice with regards to healthcare such as with contraceptive use and knowledge about their general wellbeing (Lleras-Muney, 2004). People who are educated are also better able to adopt and adhere to newer medical technologies (Lleras-Muney, 2004).

In addition to this, educated people are more likely to adopt new forms of medical treatment especially concerning cardiovascular disease treatment; as opposed to uneducated individuals who might show a greater deal of reluctance surround medical treatment options and emerging technology (Lleras-Muney, 2004). Indirectly, education provides individuals with access to higher income and different jobs that expose people to different working environments and conditions (Lleras-Muney, 2004). Studies show that white-collar working environments have an increased benefit for peoples' health conditions in the end, with blue-collar working environments increasing peoples' susceptibility to disease and illness as well as occupational injuries (Lleras-Muney, 2004). Lastly, a lack of education increases one's vulnerability to stress, hostility, anxieties and other psychological conditions which inevitably effect an individual's heath behaviour and overall wellbeing (Lleras-Muney, 2004).

2.10.2. The dynamics of adult mortality

Adult mortality is influenced by a number of factors at an individual and household level (Sartorius *et al*., 2013). An additional conceptual framework was taken into consideration when analysing the level of adult mortality experienced across provinces. This framework can be seen below:

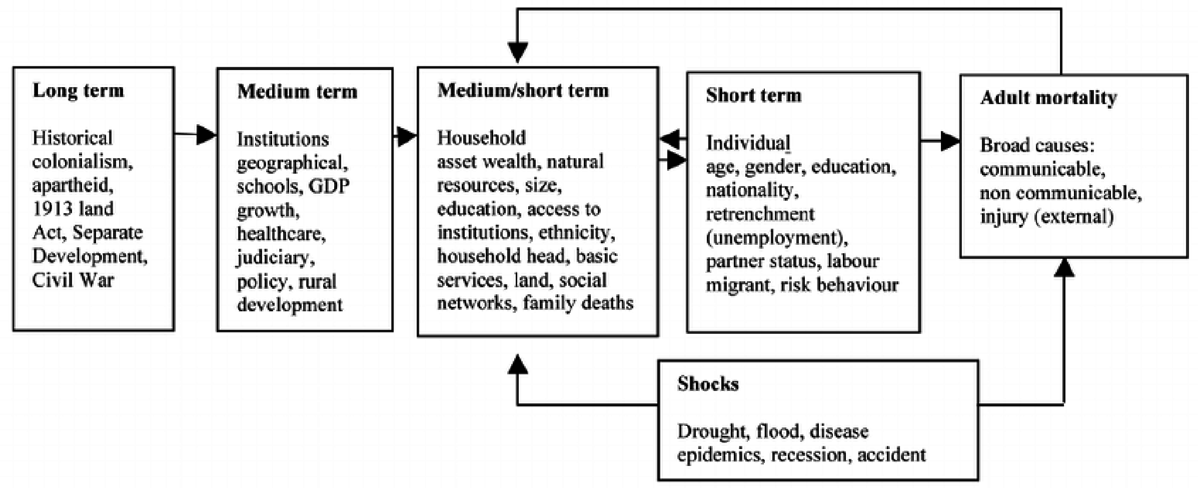

Figure 2: The dynamics of adult mortality
Sartorius *et al.* (2013)

According to Sartorius *et al.* (2013), households are a product of their environment including the social and cultural norms that influence behaviour and lifestyle. In addition to this, these factors of influence operate on a time-based continuum of short to long-term impacts that can either increase or decrease the level of adult mortality experienced (Sartorius *et al.*, 2013). Some factors are more pervasive than others, but all have an influence in some capacity (Sartorius *et al.*, 2013). Moreover, these conditions are shaped by the larger social, economic and political structures of a country (Sartorius et al., 2013). Adult mortality has often been associated with the environmental determinants (Sartorius et al., 2013). The correlation between mortality and these influencing factors to produce causal inferences about the determinants of mortality has been a focus for many prior research studies (Sartorius et al., 2013). The analytical value of environmental determinants serves as indicators as well as measures of adult mortality, both directly and indirectly, for population-based research and policy making (Sartorius et al., 2013). This conceptual framework suggests that factors influence and affect people's ability to respond to changing environments (Sartorius et al., 2013). These changes are represented across individual, house and community levels; as well as occur across time depending on the context of the country in which they operate (Sartorius et al., 2013).

2.11. Conclusion

Adult wellbeing encompasses the vast majority of populations globally which includes the economic workforce and is crucial for development (Bradshaw and Timaeus, 2006). The amount of adequate data and information on the growing number of adult deaths has been further limited by the circumstance of poor data collection systems, incomplete data storing and other errors that prevent data accuracy and completion (Kaufman *et al.*, 1997). In addition to the natural and biological implications of these demographic components, there are many socioeconomic and political implications for population health inequalities and experienced adult mortality (United Nations, 1984). Notable advances within the health sector have swept the globe during the last 20 years and have allowed for primary health care prioritising in an attempt to provide easily accessible and inexpensive health care to desolate communities (Bradshaw and Timaeus, 2006). However, these strategies of primary health care have largely focused on child and maternal health issues worldwide (Bradshaw and Timaeus, 2006).

Furthermore, research has shown that rural levels of mortality tend to be substantially higher than those of urban levels of mortality (Akoto *et al.*, 2002). This is especially relative to the growing number of adult deaths in sub-Saharan Africa, which is estimated as having one of the highest burdens of disease and mortality rates (Timaeus and Jasseh, 2004: 765; World Health Organization, 2000). Healthcare strategies have yet to overcome challenges related to the health needs of adults such as the management of chronic conditions and HIV/AIDS treatment (Bradshaw and Timaeus, 2006). The linkage between mortality and socioeconomic factors to produce causal inferences about the determinants of mortality has been, for many years, a focus for many prior research studies (Masuy-Stroobant, 2001; Mosley and Chen, 1984). The analytical value of socioeconomic determinants serves as indicators as well as measures of mortality, both directly and indirectly, for population-based research; as well as a foundation for understanding development inequalities as it relates to health and mortality levels (Mosley and Chen, 1984).

CHAPTER 3: METHODOLOGY

3.1. Introduction

This chapter discusses the overall study design and the various methodological approaches explored in order to respond to the research questions and objectives. It provides descriptions of the data and methods used, as well as the significance and limitation of data in the estimation of mortality levels. The sub-section pertaining to data includes the sampling procedures used by Stats SA in order to arrive at the given data set for the CS 2016 (Statistics South Africa, 2016). The purpose of this is to provide a basis for understanding the possible limitations and shortfalls of the research study data set. The chapter also provides a description of the study sample and variables that were investigated in the analysis of the secondary data.

3.2. Research design

The research design of this study employs a quantitative approach to estimate and evaluate the level of adult mortality experienced in SA. Due to the fact that the research study deals with data at a national and provincial level, the appropriateness of a quantitative approach is best suited to make inferences and generalisations regarding adult mortality on a large scale. The research steps include study design, sampling/target population selection for specific method requirements, estimation of mortality parameters, analysis and conclusion. The approach will make use of a cross-sectional analysis of secondary data taken from the CS 2016 for South Africa, conducted by Stats SA (2016). The level of analysis will first include national estimates, taken from survey responses to provide national adult survivorship parameters. This will be followed by the use of a demographic method to provide mathematical assumptions to indirectly estimate adult mortality by age categories of the population. Finally, the use of household deaths data will also be explored in an attempt to produce a more robust analysis of adult mortality through the use of lifetables across the provinces.

3.3. Data source

3.3.1. Community Survey (CS) 2016

Background

Secondary data has been sourced from the Stats SA database. The data sets include the Person/Individual file, the Household Deaths file, as well as the Mortality file (Statistics South

Africa, 2016). The Person/Individual file includes data collected from all individual respondents during the survey period (Statistics South Africa, 2016). The Household Deaths file contains the same data but uses a household identifier to assign individual responses to the respective household unit (Statistics South Africa, 2016). The Mortality file contains the data solely on the recorded deaths of South African households (Statistics South Africa, 2016). At the inception of CS 2016 the primary objectives were set out as follows:

- Provide an estimate of the population count by local municipality
- Provide an estimate of the household count by local municipality
- Measure demographic factors such as fertility, mortality and migration
- Measure socioeconomic factors such as employment, unemployment, and the extent of poverty in at a household level
- Measure access to facilities and services such as piped water, sanitation and electricity for lighting (Statistics South Africa, 2016)

The CS 2016 is the most recent community survey (Statistics South Africa, 2016). Stats SA has undertaken 3 population censuses since the year 1994, which have provided demographic and socioeconomic information at a national and regional level (Statistics South Africa, 2016: 8). The CS 2016 is the second survey undertaken to provide regional data as well as to bridge the gap between censuses (Statistics South Africa, 2016: 8). The following section discusses the sampling and target population chosen by Stats SA in collecting data for the survey. The research target population is therefore, not necessarily exactly the same as the CS 2016 target population, but it has been made mention of because it covers the research target population.

Geo-referenced dwelling frame

The geo-referenced dwelling frame (with indicated Global Positioning System (GPS) location points identified) was used for CS 2016 (Statistics South Africa, 2016: 11). Structures, stands or yards for surveying were assigned points on the dwelling frame depending on the type of settlement (Statistics South Africa, 2016: 11). Traditional dwelling areas as well as urban formal areas with clearly demarcated yards or stands were considered as a unit and assigned a point (Statistics South Africa, 2016: 11). However, areas where clearly demarcated stands or yards could not be identified (such as farms), structures within the area were assigned a point in order to distinguish dwelling structures from other structures (Statistics South Africa, 2016: 11). The CS 2016 is based on a single-stage sampling design whereby all eligible Census 2011 Enumeration Areas (EA) were included in the initial frame, and a selection of dwelling units

(DU's) were taken based on the sample design (Statistics South Africa, 2016: 12). EA's which do not include DU's consisting of the target population were excluded from the sampling frame, as well as EA's consisting of a small number of eligible DU's (Statistics South Africa, 2016: 12). The final DU sample for the CS 2016 was selected using a systematic sampling technique (Statistics South Africa, 2016: 12). Thus, the final DU's resulted using a fixed interval selection process from a list of units, starting at a randomly determined point (Statistics South Africa, 2016: 12). This technique ensures that sample units are spread across the geographical location (Statistics South Africa, 2016: 12). The overall sample size was around 1.37 million nationally (Statistics South Africa, 2016: 12). Thus, the final CS 2016 sample size was 1 370 809 DU's sampled from a total of 93 427 EA's within the country (Statistics South Africa, 2016: 12). The table below represents this distribution of the CS 2016 provincially (Statistics South Africa, 2016: 12).

Table 1: Total number of sampled dwelling units

Province	**Number of in-scope EA's**	**Number of sampled DU's**
Western Cape (WC)	9 851	149 100
Eastern Cape (EC)	15 742	195 301
Northern Cape (NC)	2 742	36 125
Free State (FS)	5 595	83 645
KwaZulu-Natal (KZN)	15 719	219 182
North West (NW)	6 726	102 120
Gauteng (GP)	19 022	331 125
Mpumalanga (MP)	7 197	105 058
Limpopo (LP)	10 833	149 153
South Africa	**93 427**	**1 370 809**

(Taken from Statistics South Africa, 2016: 12)

Another important factor to take into consideration is the distribution of DU's across dwelling type (Statistics South Africa, 2016). The table below highlights this. From this table, it is noticeable that the majority of household dwelling types was formal, accounting for approximately 79% of the total household dwelling types.

Table 2: Provincial distribution of household dwelling type

Province	Type of dwelling				Total
	Formal	Informal	Other	Traditional	
WC	1 593 891	320 022	10 302	9 401	1 933 616
EC	1 154 843	130 885	15 828	471 699	1 773 255
NC	295 318	45 246	4 858	8 245	353 667
FS	791 485	132 448	7 137	15 509	946 579
KZN	2 090 067	245 167	20 166	520 244	2 875 645
NW	977 031	229 544	18 799	23 146	1 248 519
GP	4 029 069	878 246	32 129	10 763	4 950 207
MP	1 048 973	135 039	14 747	39 992	1 238 751
LP	1 423 523	77 371	18 304	81 747	1 600 945
SA	**13 404 200**	**2 193 968**	**142 270**	**1 180 746**	**16 921 184**

(Taken from Statistics South Africa, 2016: 13)

Weighting of data

Most household-related surveys make use of probability sampling methods that entail probabilities of selection for each sampling unit (United Nations, 2011). Therefore, survey sampling designs typically result in unequal probabilities of selection (United Nations, 2011). For this reason, it is important that weighting factors be introduced when tabulating data outputs in order to arrive at an output that is representative of the population from which the sample ways derived (United Nations, 2011). Weights are often adjusted for non-responsiveness in a sampling unit (United Nations, 2011). The sampling weight is then multiplied by a constant factor in order to normalise the weighted outputs to that of the unweighted outputs (United Nations, 2011). In addition to this, estimations are tabulated as weighted figures in order to make generalised assumptions of the total population. All data files contain specific weights needed for the calculation and tabulation of results. These weighting commands are included alongside the description of variables included in the data set during the calculation of estimates.

3.4. Study sample

The research study uses various sub-population groups in order to arrive at indirect adult mortality estimates, as this is dependent on the data requirements for the Orphanhood method. For example, in order to calculate the level of adult mortality for men, the method requires data on the total number of male respondents who answered ‘yes’ to the question “*Is (name)’s own biological father still alive?”* Similarly, the method requires the same data asked of women for mothers' living status (Statistics South Africa, 2015: 11). Having stated that, the total number of respondents in the CS 2016 included 3 328 867 men and women across the 9 provinces of SA. In calculating conditional adult survivorship probabilities, the study makes use of purposive sampling (non-probability). Due to the specific method requirements, data is purposely selected from the data set and will be discussed subsequently.

Table 3: Total CS 2016 individuals enumerated (unweighted)

Age category	Males	Females	Total respondents
0 - 4	163 261	162 396	325 657
5 - 9	172 710	170 768	343 478
10 - 14	154 845	154 306	309 151
15 - 19	155 333	152 118	307 451
20 - 24	147 361	153 085	300 446
25 - 29	137 637	150 868	288 505
30 - 34	123 048	136 219	259 267
35 - 39	102 219	114 167	216 386
40 - 44	88 825	104 408	193 233
45 - 49	75 825	95 218	171 043
50 - 54	65 363	90 022	155 385
55 - 59	55 686	77 717	133 403
60 - 64	44 617	62 804	107 421
65+	79 077	138 964	218 041
Total	**1 565 807**	**1 763 060**	**3 328 867**

(Own calculations based on CS 2016)

The table below represents the weighted totals of respondents as they would be applied to represent the total South African population of men and women in all provinces, across the various age categories.

Table 4: Total CS 2016 individuals enumerated (weighted)

Age category	Males	Females	Total respondents
0 - 4	3 016 695	2 959 824	5 976 519
5 - 9	2 828 368	2 791 428	5 619 796
10 - 14	2 604 741	2 585 063	5 189 803
15 - 19	2 555 343	2 549 139	5 104 482
20 - 24	2 658 874	2 643 461	5 302 335
25 - 29	2 666 258	2 614 246	5 280 505
30 - 34	2 186 764	2 267 924	4 454 688
35 - 39	1 904 797	1 943 164	3 847 961
40 - 44	1 621 471	1 639 113	3 260 584

Age category	Males	Females	Total respondents
45 - 49	1 359 758	1 423 173	2 782 931
50 - 54	1 115 366	1 219 143	2 334 509
55 - 59	913 560	1 060 636	1 974 196
60 - 64	704 256	868 662	1 572 917
65+	1 110 976	1 841 453	2 952 428
Total	27 247 226	28 406 428	55 653 654

(Own calculations based on CS 2016)

Respondents who answered ‘yes’ are used, as opposed to those who answered ‘no’, because the first step of estimation is determining conditional survivorship probabilities which can then be applied to the general population (Moultrie *et al.*, 2013). Additional data needed includes the marital status of both men and women in order to determine aggregate levels of fertility based on the assumption that marriage increases the likelihood of fertility, albeit not definite every time (Moultrie *et al.*, 2013; Statistics SA, 2015). These figures are discussed further in the section 3.5 below.

In summary, the following table is a representation of the total number of men and women whose responses were used in the analysis and estimation of adult mortality.

Table 5: Parental survivorship sample

Age category	Total female respondents	Mother alive	Total male respondents	Father alive
5 - 9	2 791 428	2 672 482	2 828 368	2 525 998
10 - 14	2 585 063	2 353 586	2 604 741	2 143 618
15 - 19	2 549 139	2 188 417	2 555 343	1 889 295
20 - 24	2 643 461	2 165 287	2 658 874	1 798 822
25 - 29	2 614 246	2 073 101	2 666 258	1 658 791
30 - 34	2 267 924	1 742 116	2 186 764	1 238 301
35 - 39	1 943 164	1 418 373	1 904 797	972 887
40 - 44	1 639 113	1 065 095	1 621 471	661 340
45 - 49	1 423 173	775 893	-	-

(Own calculations based on CS 2016)

The table below describe the sample characteristics, more specifically, the population group of men and women taken from the CS 2016 (Statistics South Africa, 2016).

Table 6: Parental survival data characteristics

Age category	Black		Coloured		Indian		White	
	Female respondents whose mother is alive	**Male respondents whose father is alive**	**Female respondents whose mother is alive**	**Male respondents whose father is alive**	**Female respondents whose mother is alive**	**Male respondents whose father is alive**	**Female respondents whose mother is alive**	**Male respondents whose father is alive**
15-19	1 803 1367	1 520 414	199 360	186 618	46 667	44 935	139 253	137 328
20-24	1 779 005	1 437 462	192 846	172 856	49 782	48 065	143 655	140 439
25-29	1 719 561	1 335 228	167 779	145 601	52 276	50 726	133 485	127 235
30-34	1 411 539	954 958	150 090	117 408	51 675	49 946	128 812	115 989
35-39	1 105 485	718 906	142 054	101 566	47 148	45 200	123 686	107 214
40-44	790 996	458 124	118 862	77 594	37 632	32 901	117 605	92 721
45-49	545 171	278 416	82 374	48 252	28 610	22 589	119 737	88 155
50-54	340 419	137 395	50 239	25 913	19 599	13 072	97 916	61 887
55-59	201 343	70 623	28 113	12 843	12 356	7 640	72 296	39 136
60-64	105 027	29 554	11 708	4 800	5 831	3 938	36 973	19 224
65+	69 459	19 161	7 021	2 575	3 655	3 126	26 221	11 943

3.5. Data analysis tools

For the purpose of the study, the use of STATA was employed. STATA is a data and statistics analysis programme which allows data to be process and analysed using programmable commands. The use of such a tool allows the researcher to calculate and generate numerous outcomes based on the information trying to be obtained.

3.6. Methods

The following section provides a description of the various methods used to estimate national and provincial adult mortality levels. It also describes the various methods of adjustments made to the data, justification of adjustments as well as the models employed in order to understand provincial differentials in mortality determinants.

3.6.1. Parental survival

In order to answer the first research question (i.e., what are the levels of adult mortality in South Africa?), the Orphanhood method will be used. The Orphanhood method is a demographic method which uses information on the survival status of respondents' parents in order to indirectly estimate the level of age-specific survivorship of men and women (Moultrie, *et al.*, 2013: 222). The method requires that at least one population census or single-round survey to contain the questions "*Is (name)'s own biological mother still alive?*" and "*Is (name)'s own biological father still alive?*" (Moultrie, *et al.*, 2013: 222; Statistics South Africa, 2015). From these responses, survivorship probabilities can be estimated without information on the date/time of death of the deceased parent (Moultrie, *et al.*, 2013: 222).

It is generally assumed that the respondents' mothers were alive when the respondents were born, thus the duration of exposure to the risk of dying would equate to the respondents' age (Moultrie, *et al.*, 2013: 222). By taking into consideration the average age at which mothers in the population gave birth, the method can then predict the lifetable survivorship from age ***25*** to ***25+(n)*** based on the age category of the respondents whose mothers are still alive [$\frac{l25+(n)}{l25}$] (Moultrie, *et al.*, 2013: 222). By adjusting the average age at which fathers have children, the method can also predict the lifetable survivorship of adult men from the respondents whose fathers are still alive (Moultrie, *et al.*, 2013: 222). However, because males tend to be older than females, their survivorship is measured between ***35*** and ***35+(n)*** dependent on the age category of the respondents (Moultrie, *et al.*, 2013: 222).

As mortality changes overtime, estimated survivorship ratios will reflect the rates of experienced mortality at different age categories and dates (Moultrie, *et al.*, 2013: 222). A 'time location' method then estimates how many years prior to survey inquiry each cohort survivorship ratio equalled the period survivorship ratio, increasing with the age interval of each respondent from about 4 to 14 years prior to the data collection period (Moultrie, *et al.*, 2013: 222). Therefore, if estimated survivorship ratios obtained from respondents are then translated into a common index of adult mortality [$_{n}q_{x}$] using a *1*- parameter system of model life tables, a broad trend of adult mortality over time can be deduced from the general time location indicators (Moultrie, *et al.*, 2013: 222). An advantage of the Orphanhood method over other general questions on household deaths is that only large-scale surveys and censuses can capture enough information on household deaths prior to inquiry to estimate mortality levels that are sufficiently accurate to be useful (Moultrie, *et al.*, 2013: 222). Furthermore, the method does not assume that the population is closed to migration; however, mortality estimates would not be representative for small regions or areas where a large proportion of the population are migrants (Moultrie, *et al.* 2013: 222).

All estimates derived from the Orphanhood method are considered to be conditional survivorship probabilities (Moultrie, *et al.* 2013). This means that adult probabilities of survival across age category intervals are conditional on the survivorship at the start of the interval (Moultrie, *et al.* 2013). In order to obtain a complete life table, survivorship from birth to adulthood must be calculated using another data source containing child mortality data (Moultrie, *et al.* 2013). Realistically, parental deaths can occur any time between the respondent's birth to the time at which they were interviewed (Moultrie, *et al.* 2013). As such, this method can only produce a smoothed trend in adult mortality over time and may fail to capture short-term mortality trends, especially in times of epidemics (Moultrie, *et al.* 2013).

3.6.2. Mean age of child-bearing

The most suitable way to calculate the mean age at which men have children is to calculate the mean age of the partners of women who gave birth in a defined year (Moultrie *et al.*, 2013: 226). However, this method requires data on women to be linked to the data on their partners, which is largely impossible in many data sets (Moultrie *et al.*, 2013: 226). Therefore, the average age at which men have children is usually estimated by adding an index of the difference between the ages of men and women who are having children, to the average age of childbearing of women (Moultrie *et al.*, 2013: 226). The following formula taken from Moultrie *et al.* (2013) can be used:

$$\bar{M}^m = \bar{M}^f + d$$

Equation 1: Formula for mean age at childbearing for men

The table below indicates the marital status of men and women according to the CS 2016 responses (Statistics South Africa, 2016). These include both traditionally recognised and state instituted marriages. Although South Africa is somewhat similar to Western countries, in that the traditional emphasis on the importance of marriage are slowly declining, this still has implications for the likelihood of childbearing for those who are married or cohabitating (Hosegood, McGrath, and Moultrie, 2009).

Table 7: Median ages of married men

Age category	Married men	Married women	Cumulative % of married men	Cumulative % of married women
10-14	6 227	7 099	0,0009	0,0010
15-19	16 468	57 579	0,0033	0,0089
20-24	107 181	345 692	0,0187	0,0564
25-29	439 844	749 815	0,0818	0,1595
30-34	743 743	957 229	0,1887	0,2912
35-39	951 842	973 188	0,3254	0,4250
40-44	969 983	884 555	0,4647	0,5466
45-49	911 372	797 675	0,5956	0,6563
50-54	793 810	685 890	0,7096	0,7506
55-59	676 279	577 420	0,8068	0,8300
60-64	528 466	449 572	0,8827	0,8919
65-69	374 558	333 846	0,9365	0,9378
70-74	240 055	224 886	0,9709	0,9687
75-79	119 660	124 446	0,9881	0,9858
80+	82 594	103 265	1,0000	1,0000
Total	**6 962 081**	**7 272 157**	**43,85**	**40,58**

(Own calculations based on CS 2016)

The CS 2016 asks the question *"What is (name)'s present marital status?"* (Statistics SA, 2016). Using the total respondents who answered 'yes' to being married, the median age at childbearing can be calculated by applying the formula above. One estimate of this difference that can be readily calculated from census data is the difference between the median ages of currently married men and currently married women (Moultrie *et al.*, 2013: 226). It is more appropriate than the difference between the singulate mean ages at marriage of men and women in populations where marital dissolution or polygynous marriage is common (Hosegood, McGrath, and Moultrie, 2009; Moultrie *et al.*, 2013: 226). Therefore, the median is used rather than the mean so that differential age exaggeration by older respondents (who are typically no longer at an age of childbearing), does not distort the estimate (Moultrie *et al.*, 2013: 226). This approach to the estimation of the mean age of men at the birth of their children assumes that the average ages of the fathers of children born to unmarried women are the same as the ages of the fathers of children born to married women (Moultrie *et al.*, 2013: 226). However, they may not be, and this could introduce a significant bias into the estimate of M^m in populations where childbearing outside of marital bond is common (Hosegood, McGrath, and Moultrie, 2009; Moultrie *et al.*, 2013: 226). While it is difficult to think of an appropriate solution to the problem, fortunately the mortality estimates are not very sensitive to errors in the estimate of M^m (Moultrie *et al.*, 2013: 226).

Table 8: Marital status of respondents

Age category	Males	Females
15 - 19	16 468	57 579
20 - 24	107 181	345 692
25 - 29	439 844	749 815
30 - 34	743 743	957 229
35 - 39	951 842	973 188
40 - 44	969 983	884 555
45 - 49	911 372	797 675
50 - 54	793 810	685 890
55 - 59	676 279	577 420
60 - 64	528 466	449 572
65 - 69	374 558	333 846
70 - 74	240 055	224 886
75 - 79	119 660	124 446
80+	82 594	103 265

(Own calculations based on CS 2016)

It can be deduced that differences in the marital status of men and women are as a result of older men being married to younger women. For example, looking at the totals for men aged

30-74, we see a shift in the number of positive marital status increasing whilst decreasing for women of the same age categories. Commonalities in the way traditional ideas about marriage and/or partnerships still exist, where women are often married at younger ages than their male counterparts (Hosegood, McGrath, and Moultrie, 2009). This is in line with cultural preferences that have become the norm for many younger women (Hosegood, McGrath, and Moultrie, 2009). The use of marital status in the indirect calculation of adult mortality is significant only to obtain the probability of childbearing. While it is understood that childbearing does occur outside formal marriages, for many African countries such as South Africa, survey data does take traditional forms of marriage into consideration. Data where cohabitation is prominent can also be considered, provided it is a feature relevant to the population in question. The use of marital status is a component of the orphanhood method in estimating adult mortality. Although there have been many researchers who suggest adjusting this in light of cultural shifts in the concept of marriage globally, there are no significant alternative ways around these estimations. Thankfully, the results of adult mortality estimates using these components are not significantly distorted so as to deem the analysis unobtainable. It would be interesting for further research to explore the component of marital status in adult mortality estimates as they relate to the following component of births.

3.6.3. Births

The Orphanhood method requires an estimate of the average age at which parents had their children (Moultrie, *et al.*, 2013: 224). This is calculated in order to control for the age variation range, across which they have been exposed to the risk of dying (Moultrie, *et al.*, 2013: 224). Women's average age of childbearing is typically calculated from survey data on the most recent births at interview of the total women giving birth (Moultrie *et al.*, 2013: 224). Therefore, the measure is the general average age of women giving birth calculated without making adjustments for the biased age structure of the population (Moultrie *et al.*, 2013: 224). The following formula taken from Moultrie *et al.* (2013) is used:

$$\bar{M}^f = \frac{\sum_{x=15}^{45} {}_5B_x (x+2)}{\sum_{x=15}^{45} {}_5B_x}.$$

Equation 2: Formula for average age of childbearing of women

$_5B_x$ represents the number of births to women in the age category x to $x + 4$ (Moultrie, *et al.*, 2013: 224). The ($x + 2$) represents the mid-point of the specific age category of women with a half-year downward shift in order to take into consideration that women who gave birth during the previous year from the date of interview did so 6 months ago (Moultrie *et al.*, 2013: 224). Thus, the women were 6 months younger at that time (Moultrie *et al.*, 2013: 224). If the data used to calculate M^f are tabulated by women's age at giving birth, the mid-point of each age category would become $x + 2.5$ (Moultrie *et al.*, 2013: 224). There is, therefore, no need to make adjustments to the total births data for reference period errors before calculating M^f (Moultrie *et al.*, 2013: 224). Moreover, mortality estimates are not affected by bias in this indicator (Moultrie *et al.*, 2013: 224). However, if there is reason to believe that the age pattern of births has been severely distorted by women exaggerating their ages, the number of births by age could be recalculated from an adjusted age distribution and fertility distribution before the calculation of M^f (Moultrie *et al.*, 2013: 225). The mean age of motherhood refers to the approximate time at which the respondents were born, which may be between 5 and 45 years prior to the collection of the orphanhood data (Moultrie *et al.*, 2013: 225). The CS 2016 asks respondents *"How many children has (name) ever given birth to that were born alive?"* in order to gather data pertaining to fertility (Statistics SA, 2016).

Table 9: Mean age at childbearing for women

Age category	**Births in the last year *B*(*i*)**	**Mid-point Age *N***	***B*(*i*)****N***
15-19	122 371	17	2 080 309
20-24	266 135	22	5 854 979
25-29	260 476	27	7 032 839
30-34	201 511	32	6 448 365
35-39	115 298	37	4 266 015
40-44	42 165	42	1 770 917
45-49	6 579	47	309 227
Total	**1 014 535**	**-**	**27 762 650**

(Own calculations based on CS 2016)

An estimate based on fertility data collected in the same enquiry about orphanhood should be adequate in populations which have not yet experienced phases of substantial fertility decline (Moultrie *et al.*, 2013: 225). If levels of fertility have declined and recent census or survey data exist, M^f could be calculated using the earlier data to determine any notable changes (Moultrie *et al.*, 2013: 225). If this has occurred, then the most suitable way of determining final values of M^f for the estimation of adult mortality will depend on what data are available as well as the change in fertility (Moultrie *et al.*, 2013: 225). Additionally, M^f could be calculated from data collected around the approximate time that fertility began to decline and use that value for age categories of respondents born then or earlier and to interpolate linearly between that value and the current one to estimate M^f for younger age categories of respondents (Moultrie *et al.*, 2013: 225).

The table below is a summary of children ever born for each age category.

Table 10: Children ever born (CEB)

Age category	Frequency
15 - 19	122 371
20 - 24	266 135
25 - 29	260 476
30 - 34	201 511
35 - 39	115 298
40 - 44	42 165
45 - 49	6 579

(Own calculations based on CS 2016)

3.6.4. HIV adjustment

Due to the historic effects that HIV/AIDS has had on sub-Saharan Africa in recent years, demographic estimates have to be adjusted at some level. Estimates of adult mortality using national data has to take into consideration the impact that HIV/AIDS has on age-specific and sex-specific estimates of mortality (Shisana *et al.*, 2014). In particular, the indirect methods of adult mortality estimates are based on assumptions which are largely biased to the underestimation of the mortality experienced within a given region (Shisana *et al.*, 2014). Prior to calculating mortality, adjustments to the data must be made in order to account for the irregularities in adult mortality. According to the SA Global AIDS Response Progress Report (GARPR) (Neluheni *et al.*, 2015), South Africa has had a high level of HIV prevalence; which in the year 2012 alone, was at an estimated 12.2%. HIV prevalence seems to remain the highest for women aged 15-24 and key population groups such as sex workers and men who have sex with men (MSM) (Neluheni *et al.*, 2015). One way of adjusting for this issue is by imputing the age and sex proportion of HIV prevalence in order to adjust survivorship probabilities (Shisana *et al.*, 2014). The prevalence figures below were used in order to do this:

Table 11: Age and sex HIV prevalence in 2012

Age category	% Males	% Females
0 - 14	2.3	2.4
15 - 19	0.7	5.6
20 - 24	5.1	17.4
25 - 29	17.3	28.4
30 - 34	25.6	36.0
35 - 39	28.8	31.6
40 - 44	15.8	28.0
45 - 49	13.4	19.7
50 - 54	15.5	14.8
55 - 59	5.5	9.7
60+	4.6	2.4

(Own calculations based on CS 2016)

3.6.5. Model lifetable

The Princeton West model life table coefficients were used in the adjustment of adult survivorship figures (Coale, Demeny and Vaughan, 1983). In estimating adult survivorship, it is necessary to apply a standard lifetable model that would closely represent the pattern on mortality of men and women in SA (Coale, Demeny and Vaughan, 1983). For this reason, the Princeton West model was selected to achieve this (Coale, Demeny and Vaughan, 1983). The Princeton standard lifetables are divided into 4 main regions that describe the generalised patterns of demographic transitions (Coale, Demeny and Vaughan, 1983). The Princeton West standard lifetables are characterised by countries that generally experience intermediate patterns of fertility and mortality (Coale, Demeny and Vaughan, 1983). This group of lifetable standards tend to be the largest, encompassing many countries and therefore more generalised (Coale, Demeny and Vaughan, 1983). Of the four different model lifetables, the Princeton West model has some of the highest levels of mortality, often mimicking the overall patterns of mortality typical of African countries (Coale, Demeny and Vaughan, 1983).

The Princeton West model life table was selected as the most appropriate pattern of mortality representative of South African levels. Most demographers have opted to use this model in the estimation of adult mortality for South African estimates (Dorrington, 1998: 104). However, it is worth noting that although the Princeton West model is not an exact representation, of the other models, it is the best fit (Dorrington, 1998: 105). Researchers such as Dorrington (1998) have also highlighted this in comparisons with other models. Due to the stark differences in adult mortality patterns within regions of Africa, models that assume uniformity of contextual factors often overlook unique patterns which may occur in countries such as South Africa. Unfortunately, with all model lifetables there will be some compromise in the variance of mortality levels. The study has taken these margins of inconsistency into consideration.

3.6.6. Household deaths

The data used in the estimation of adult mortality includes the number of household deaths per province. The CS 2016 asks respondents "*How many members of this household have passed away in the last 12 months (between 07 March 2015 and 06 March 2016)?"* The table below indicates the total number of reported deaths per province.

Table 12: Total number of Household deaths in South Africa, 2016

Province	**Household deaths**		
	Yes	**No**	**Total**
WC	33 212	1 900 665	1 933 876
EC	66 596	1 706 798	1 773 395
NC	12 140	341 570	353 709
FS	28 307	918 332	946 638
KZN	87 778	2 788 065	2 875 843
NW	40 201	1 208 565	1 248 766
GP	84 299	4 866 868	4 951 137
MP	34 827	1 204 034	1 238 861
LP	41 624	1 599 460	1 601 083
Total (SA)	**428 983**	**16 490 000**	**16 920 000**

(Adapted from Statistics South Africa, 2016)

3.7. Differentials in adult mortality

The following section describes the variables used to understand provincial factors associated with mortality risks based on the previously discussed socioeconomic determinants of health framework.

3.7.1. Dependent variable

Household deaths

The total number of household deaths is considered to be the dependant variable because the study is trying to understand differentials that have a direct and indirect effect on the levels of mortality experienced within a household. For this reason, the total number of deaths in a household then becomes our dependent variable. The occurrence of this life event is dependent on the environmental predisposing factors. The CS 2016 asks respondents "*How many members of this household have passed away in the last 12 months (between 07 March 2015 and 06 March 2016)?"* in order to record the total number of deaths occurring in the last 12 months for each household (Statistics South Africa, 2016). The rationale for the selection of household deaths as the dependent variable is because adult mortality which indirectly estimated using the Orphanhood method cannot be directly linked to household factors since they are only aggregate estimates of mortality. On the other hand, household deaths provide a clearer and direct link to the levels of mortality experienced within a household.

3.7.2. Independent variables

The expectation is that the probability of someone dying at age ***x*** can be attributed to the proximal and distal determinants of mortality, relative to the environment in which they are exposed (Statistics South Africa, 2017). For this reason, the following socioeconomic status calculations and variables are presented. The Principal Component Analysis method (or PCA) is a technique that is used to determine the correlation between living standards and household variables, depending on the independent variable selected (Montgomery *et al.*, 2000). The PCA technique analyses the link between identifiable variables as they relate to the level of household living conditions or standards (Montgomery *et al.*, 2000). This is based on studies that have shown the positive links associated with the relationship between household income and assets as a valuable determinant of SES (Montgomery *et al.*, 2000). The PCA transforms multiple variables from a large data set into a measure or factor score, used as a proxy in determining the SES index of relatedness (Montgomery *et al.*, 2000). It does this without losing the original information associated with the variable (Montgomery *et al.*, 2000). The objective is to deduce important information from a table of indices in order to represent a new set of variables known as the principal components (Montgomery *et al.*, 2000). These components are then used to observe patterns of similarity (Montgomery *et al.*, 2000). The calculation is explained as follows;

$$y1 = a11\ x1j + a12\ x2j + ... + a1k\ xk = \sum a1n\ xni$$

Equation 3: Calculation of PCA

Where ***x1i*** is the variable ***i*** for household ***j***, and are coefficients for ***n*** and variable ***i*** (Montgomery *et al.*, 2000). The PCA deduces coefficients (or factor loadings) from ***n*** components and generates them into weights (or scoring factors) applied to the variables normalized by their means and standard deviations (Montgomery *et al.*, 2000). The component index created included 5 SES variables. These included a household's access to piped water, electricity, possession of a refrigerator, a flushing toilet, and a motor vehicle (Statistics South Africa, 2016).

In order to establish which variables load highly on which factors, a component matrix was restricted to loading factors above 0.5. All indicators ended up loading sufficiently to the factor. The indicated factor scores operate to increase the index, and because all variables are binary in nature, a single unit increase in each variable can be interpreted as an increase in index by scoring factor divided by the standard deviation of the variable [**FS/SD**] (Montgomery *et al.*, 2000). Looking at an example, a household with a flushing toilet has an index that is 0,6618 times higher than a household without one. The sample means and standard deviation are presented in the table below.

Table 13: Factor scoring from a PCA

SES Variables	Factor Loadings (*FL*)	Factor Scores (*FS*)	Mean	Standard Deviation (*SD*)	SES Index (*FS/SD*)
Access to piped water	0,5233	0,24708	0,8747	0,3311	0,7463
Access to electricity	0,72503	0,34233	0,9116	0,2839	1,2058
Possession of a refrigerator	0,76013	0,3589	0,8075	0,3942	0,9104
Possession of a flushing toilet	0,69423	0,32778	0,5683	0,4953	0,6618
Possession of a motor vehicle	0,5086	0,24014	0,8087	0,4494	0,5343

(Own calculation based on CS 2016)

Access to piped water

A Household's access to clean and fresh water is a key indicator of their SES in SA (Mayosi *et al.*, 2012). Studies have shown that the lack of clean water for consumption within a household has a negative impact on the health of that household (Mayosi *et al*., 2012; Statistics South Africa, 2017). The CS 2016 asks household respondents "*What is the household's main source of water for drinking?*" (Statistics South Africa, 2016). Other sources of water included boreholes, rain-water tanks, using the neighbour's tap, communal taps, water carriers, natural flowing streams of water such as rivers, and other (South Africa, 2016).

Access to electricity

Electricity is an important indicator of SES as SA has 78% of the poor using unsustainable alternatives for household cooking (such as wood or coal) (Davidson and Mwakasonda, 2004). This is not an ideal situation, which sees many households exposed to the risk of harmful pollutants and hazardous fires (Davidson and Mwakasonda, 2004). The CS 2016 asks "*Does the household use the following energy sources?*", listing various items for selection (Statistics South Africa, 2016). For the purposes of analysing electricity, variables are divided into either electricity or other.

Possession of a refrigerator

A working refrigerator within a household has been indicated as an important variable in determining level of SES (Mayosi *et al*., 2012; Statistics South Africa, 2017). Within lower and middle-income households, the possession of a refrigerator, television or motor vehicle has been identified as an indication of lower SES (Statistics South Africa, 2015). A household able to afford these items typically have a higher SES than those which cannot (Statistics South Africa, 2015). The CS 2016 asks "*Does the household own any of the following in working order?*", listing various items (Statistics South Africa, 2016). For the purpose of analysing the possession of a refrigerator, variables were divided into refrigerator, television and a motor vehicle.

Possession of a flushing toilet

The possession of a flushing toilet in a household is indicative of a higher level of SES as many South Africans still lack efficient and sanitary toilet facilities (Mayosi *et al*., 2012; Statistics South Africa, 2017). Even in instances where there are communal or shared ablution facilities, these are often not efficiently maintained and can pose huge risks to the communities that need them (Mayosi *et al*., 2012; Statistics South Africa, 2017). The spread of disease and bacteria has a negative impact on the health of such communities and is an indication of poor development and Human Rights efforts (Mayosi *et al*., 2012; World Health Organization, 2008). The CS 2016 asks "*What is the main type of toilet facility used by this household?*"

(Statistics South Africa, 2016). For the purpose of analysis this variable, items were divided into flushing toilets, chemical toilets, pit latrines, ecological and bucket toilets. Where there were no responses to any of the above, this indicated either no toilet facilities or other (with both being classified as bad) (Statistics South Africa, 2016).

Possession of a motor vehicle

For similar reasons indicated for the possession of a refrigerator, motor vehicle possession is indicative as a higher level of SES. The CS 2016 asks "*Does the household own any of the following in working order?*", listing various items (Statistics South Africa, 2016). For the purpose of analysing the possession of a motor vehicle, variables were divided into refrigerator, television and a motor vehicle.

Age

Although the analysis of age-specific estimates encompasses 15 to 60 in adult mortality, there are many instances where the methodology only permitted a certain level of estimation based on the parameters and assumptions made by the method. For example, the Orphanhood method limits the estimation of adult mortality for men to the ages between 15 to 39. However, the importance of age is never disputed, as survivorship is directly linked to age-specific levels of mortality or survivorship (Moultrie *et al.*, 2013).

Sex

The study will make use of estimated figures for both men and women in the analysis of adult mortality. In addition to the biological factors such as fertility, the life expectancy of females often presents itself as being very different to that of males (Kallan, 1997). This is an important variable in understanding patterns of mortality. The use of sex in estimating levels of adult mortality is important for maternal mortality and understanding how differences between males and females vary across provinces. Demographic estimates posit that on average females have a higher life expectancy than males. By estimating each sex separately, the extent of these differences can be analysed.

Province

The level of development in South Africa hugely impacts a person's ability to effectively access resources that will afford them a better lifestyle (Sahn and Stifel, 2003). For this reason, the environment in which a person lives can influence this (Sahn and Stifel, 2003). One way that we can measure this lies in the difference between urban and rural living (Sahn and Stifel, 2003). Province of residence can have a significant impact on the health and wellbeing of individuals and households (Sahn and Stifel, 2003). This affects living conditions and the circumstances that expose people to the risk of dying (Kuate-Defo, 2006; Sahn and Stifel, 2003). Urban areas are typically associated with better economic opportunities and higher levels of development in comparison to rural regions (Hallman, 2005; Sahn and Stifel, 2003). Not without substance, levels of health and the social development outcomes tends to be better in urban regions in developing countries (Van de Poel *et al.*, 2008). In South Africa this is divided between rural, metropolitan and urban as well as non-metropolitan areas, disaggregated by province (Statistics South Africa, 2016). Province is, therefore, a key independent variable within the context of this study (Sahn and Stifel, 2003).

Population group

There are four formally categorised population groups (i.e., racial classifications) in South Africa. They are African, Coloured, Indian/Asian and White (Statistics South Africa, 2016). According to Chitiga *et al.* (2010), the inclusion of population groups for analysis is important as there are generally observed differences in the estimates of mortality for different population groups. The CS 2016 specifically records this variable through the question *"What population group does (name) belong to?"* (Statistics South Africa, 2016).

3.8. Methodological concerns

The limitations of the data include issues pertaining to survey response. The use of survey-based data inherently poses challenges to data processing and analysis (Statistics South Africa, 2015). Over-count as well as under-count errors in survey data create a challenge in understanding the extent of sub-population estimates, such as age-specific estimates (Dobbie, 2009). However, weighting the data as well as statistical adjustments which Stats SA would have already taken into consideration will lessen the likelihood of such limitations. Age misreporting and incorrect data capturing further perpetuates the challenge of providing reliable and accurate estimations as this tends to distort age category estimates for both men and women (Dobbie, 2009). The same can be said with regard other variables analysed. Data omissions and misreporting, to a large extent can be dealt with through mathematical adjustments based on assumptions inferred. By smoothing and adjusting the raw data, many of these issues were adequately addressed without distorting the results of the data. Generally, both administrative as well as technical errors tend to be the key challenges affecting methodological processes (Dobbie, 2009). With that said, mortality estimation methods used made provision for such issues as these are inherent limitations where survey responses were used.

Although the Orphanhood method is widely used, there are inherent limitations due to the assumptions made by the method (Moultrie, *et al.*, 2013: 223). Data on parental survival is collected from respondents who are alive (Moultrie, *et al.*, 2013: 223). Parental survival of adults with no children or deceased children are slightly underrepresented; as opposed to adults who have more than one surviving child are slightly overrepresented in the data (Moultrie, *et al.*, 2013: 223). The method can only produce unbiased results if the parental mortality is unrelated to the number of children alive at the time of data collection (Moultrie *et al.*, 2013: 223). However, the bias resulting from this assumption generally tends to be small and will not affect the final outcome as the estimation of parental survival probability is unrelated to the number of biological siblings a respondent has (Moultrie *et al.*, 2013: 223). Populations that are highly affected by HIV/AIDS epidemics will more likely experience much higher biased results (Moultrie *et al.*, 2013: 223). Prior to calculating mortality, adjustments to the data must be made for HIV/AIDS, at least at some level, in order to account for the irregularities in adult mortality (Shisana *et al.*, 2014). In order to circumvent this bias, an adjustment can be made for HIV/AIDS. Age-specific HIV/AIDS prevalence levels will be imputed in the estimation of survivorship probabilities, therefore balancing out any possible estimation distortions in the data (Neluheni *et al.*, 2015; Shisana *et al.*, 2014). The adjustment derives from the assumption that adult mortality estimates would be much higher given the age category prevalence of HIV (Neluheni *et al.*, 2015; Shisana *et al.*, 2014).

The adoption effect refers to the underreporting of orphanhood for those whose parents died when they were very young (Moultrie *et al*., 2013). Children orphaned at a young age are often raised by other family members who assume the role of guardian; thus, these children tend to be enumerated as being their biological children (Moultrie *et al*., 2013). This causes the data to be skewed, in that it results in an estimation of low/declining mortality rates (Moultrie *et al*., 2013). Misreporting also tends to be common when a mother dies (Moultrie *et al*., 2013). As the ages of the respondents' increase, the more likely that their biological as well as adoptive or foster parent/guardian has died (Moultrie *et al*., 2013). This would then imply that the bias is most distinct for younger children whose adoptive or foster parent/guardian is still alive (Moultrie *et al*., 2013). Therefore, if not taken into consideration, the adoption effect may lead to an underestimation of recent adult mortality but overestimate the rate of declining mortality

(Moultrie *et al.*, 2013). This would not affect the research study as the data set categorises parenthood as biological or guardianship. Respondents who have been adopted or part of the foster care system are clearly identified as such (Statistics South Africa, 2016).

Lastly, the Orphanhood method disregards the assumption of closed migration to the studied population (Moultrie *et al.*, 2013). General migration patterns may result in many respondents living in different places from their reported parents. However, survey data does take into consideration place of residence from birth to current location, providing researchers with an understanding of typical migration patterns. This component of adult mortality estimates is still yet to be explored. With that stated, the method is only used to understand conditional survivorship proportions relative to parental survivorship. The significance of provincial impacts on mortality will later be explored using household deaths data to establish that aspect. For this purpose, the issue of migration will not necessarily distort the findings from an indirect estimation analysis.

3.9. Summary

The purpose of this chapter was to present the research study design and the various methodological approaches explored in order to calculate adult mortality. A quantitative approach was used to estimate and evaluate the level of adult mortality experienced in SA. Due to the fact that the research study deals with data at a national and provincial level, the appropriateness of a quantitative approach was best suited to make inferences and generalisations on a large scale. A sample of the CS 2016 was used in the data analysis of the research study. The key characteristics of the study sample unweighted (**N** = 226 538) based on specific methodological requirements were provided. In assessing some of the SES as it related to the probability of adult mortality in SA, the variables used included access to piped water, electricity, a refrigerator, a flushing toilet and the possession of a motor vehicle. The specific methods of analysis were also discussed in the chapter.

Chapter 4: Results

4.1. Introduction

In this chapter, the results of the data analysis are presented. Provincial estimates on the observed levels of adult mortality in SA were derived using the CS 2016. The Princeton West model life table was used in order to standardise the general pattern of adult mortality observed from the calculation of Orphanhood survivorship. The use of household deaths data allowed for the tabulation of life tables for South African men and women across different provinces.

A lifetable is a tool used for estimating patterns and levels of mortality based a set of standard or generalised observations of population trends (Coale, Demeny and Vaughan, 1983). More specifically, a period life table describes possible levels of mortality in the future, depending on the observed levels of mortality within a given population (Coale, Demeny and Vaughan, 1983). The lifetable assumes the levels and patterns of mortality of people subject to the exposure to the risk of dying based from birth onwards (Coale, Demeny and Vaughan, 1983). Thus, the factors associated with dying at each age interval will have an impact on the resulting estimations of life expectance (Coale, Demeny and Vaughan, 1983). These estimations are important as they give a researcher insight into the state of wellbeing of any population (Coale, Demeny and Vaughan, 1983). This is linked to health, socioeconomic wellbeing and other mitigating factors in addition to biological factors (Coale, Demeny and Vaughan, 1983). The data derived from the CS 2016 were used to estimate the life expectancy of South African men and women.

4.2. Orphanhood method

Parental survival questions such as "*Is (name)'s own biological mother still alive?*" and "*Is (name)'s own biological father still alive?*" are used to indirectly estimate adult survivorship (Moultrie, *et al.*, 2013: 222; Statistics South Africa, 2015). The method for estimating adult mortality in this manner was first developed by Brass (1975). Over the years, the original methodology of calculation has undergone numerous revisions but is still based on the same premise, as long as exposure time can be assessed through the age of the respondent at the time of the survey questioning (Bradshaw, Dorrington and Laubscher, 2012). As such, the proportion with parents who are alive at the time of the survey are closely related to the life table probability of surviving for a number of years equal to the age of the respondent and starting from the mean age at childbearing at the time of the respondent's birth (Bradshaw, Dorrington and Laubscher, 2012). Adjustments can then be made for the age difference between men and women (Bradshaw, Dorrington and Laubscher, 2012). Survival proportions can then be used estimate life expectancy (Bradshaw, Dorrington and Laubscher, 2012). The tables below highlight the differences between life expectancy derived from the parental survival and those derived from household deaths.

In the table below, the probability of dying for women aged 15-49 remain to be higher than that of other age categories. The introduction of HIV prevalence in the estimation increases these factors by a margin. Looking at women aged 30-34, the proportion alive drops from 0,7682 to 0,5662 once the impact of HIV is taken into consideration. From this age onwards, the adjusted proportion alive seem do decrease. The table that follows indicates the approximate time of death of those parents had died, giving a general indication of the timeframe of parental survivorship.

Table 14: Estimation of adult mortality of South African women

Age category	Total respondents	Mother alive	Proportion alive	M^f	Age n	$\frac{l(25+n)}{l(25)}$	Standard $l_s(25+n)$	Level α	Probability of dying *45q15*	Date
10-14	2 585 063	2 353 586	0,9105	27,36	15	0,9017	0,8094	0,315	0,381	2010,4
15-19	2 549 139	2 188 417	0,8585	27,36	20	0,8541	0,7845	0,336	0,389	2008,2
20-24	2 643 461	2 165 287	0,8191	27,36	25	0,8205	0,7527	0,247	0,356	2006,3
25-29	2 614 246	2 073 101	0,7930	27,36	30	0,8014	0,7096	0,083	0,295	2004,8
30-34	2 267 924	1 742 116	0,7682	27,36	35	0,7851	0,6515	-0,095	0,233	2003,8
35-39	1 943 164	1 418 373	0,7299	27,36	40	0,7580	0,5724	-0,259	0,184	2003,3
40-44	1 639 113	1 065 095	0,6498	27,36	45	0,6856	0,4700	-0,334	0,164	-
45-49	1 423 173	775 893	0,5452	27,36	50	0,5759	0,3443	-0,396	0,148	-
Age category	**Proportion $S(n)$**	**Estimated HIV prevalence**	**Adjusted proportion alive**	**M^f**	**Age n**	**$\frac{l(25+n)}{l(25)}$**	**Standard $l_s(25+n)$**	**Level α**	**Probability of dying *45q15***	**Date**
10-14	0,9105	0,0240	0,8964	27,36	15	0,8860	0,6913	-0,206	0,335	2010,3
15-19	0,8585	0,0560	0,8178	27,36	20	0,8174	0,6645	-0,017	0,415	2008,1
20-24	0,8191	0,1740	0,7055	27,36	25	0,7068	0,6281	0,204	0,510	2005,8
25-29	0,7930	0,2840	0,6227	27,36	30	0,6275	0,5783	0,233	0,522	2003,7
30-34	0,7682	0,3600	0,5662	27,36	35	0,5755	0,5110	0,130	0,478	2002,1
35-39	0,7299	0,3160	0,5581	27,36	40	0,5732	0,4225	-0,136	0,364	2001,6
40-44	0,6498	0,2800	0,5120	27,36	45	0,5302	0,3149	-0,341	0,282	-
45-49	0,5452	0,1970	0,4605	27,36	50	0,4770	0,2012	-0,581	0,199	-

(Own calculation based on CS 2016)

Table 15: Time location of maternal orphanhood estimates

Age category	Central age N	Proportion Surviving $S(n)$	Standard proportion alive ${}_np_m$	Correction for non-linearity $C(n)$	Mid-point of exposure $N/2$	Time Location T	Date
10-14	12,5	0,9105	0,7625	0,0591	6,25	5,881	2010,36
15-19	17,5	0,8585	0,6675	0,0839	8,75	8,016	2008,23
20-24	22,5	0,8191	0,5725	0,1194	11,25	9,907	2006,34
25-29	27,5	0,7930	0,4775	0,1691	13,75	11,425	2004,82
30-34	32,5	0,7682	0,3825	0,2324	16,25	12,474	2003,77
35-39	37,5	0,7299	0,2875	0,3105	18,75	12,928	2003,32
40-44	42,5	0,6498	0,1926	0,4054	21,25	12,635	2003,61
45-49	47,5	0,5452	0,0976	0,5736	23,75	10,128	2006,12
Age category	**Central Age N**	**Proportion Surviving $S(n)$**	**Standard proportion alive ${}_np_m$**	**Correction for non-linearity $C(N)$**	**Mid-point of exposure $N/2$**	**Time Location T**	**Date**
10-14	12,5	0,8964	0,7625	0,0539	6,25	5,913	2010,33
15-19	17,5	0,8178	0,6675	0,0677	8,75	8,158	2008,09
20-24	22,5	0,7055	0,5725	0,0696	11,25	10,467	2005,78
25-29	27,5	0,6227	0,4775	0,0885	13,75	12,533	2003,71
30-34	32,5	0,5662	0,3825	0,1307	16,25	14,126	2002,12
35-39	37,5	0,5581	0,2875	0,2210	18,75	14,606	2001,64
40-44	42,5	0,5120	0,1926	0,3260	21,25	14,323	2001,92
45-49	47,5	0,4605	0,0976	0,5173	23,75	11,464	2004,78

(Own calculation based on CS 2016)

The tables below indicate the estimated level of adult mortality for men. Unlike women, whom have a much higher probability of dying between the ages of 15-49, men typically display more consistent mortality rates from age group to another. This is noted even with HIV prevalence taken into consideration. However, it is important to note that infant mortality remains a concern as these rates seem to be as high as men in their teenage years. The same was noted in the estimation of female mortality, albeit a lower rate in comparison.

Table 16: Estimation of adult mortality of South African men

Age category	**Total respondents**	**Father alive**	**Proportion alive**	M^f	**Age *n***	**l(35+n) / l(35)**	**Standard $l_s(35+n)$**	**Level α**	**Probability of dying *45q15***	**Date**
10-14	2 604 741	2 143 618	0,8230	30,63	15	0,7987	0,7527	0,632	0,498	2008,7
15-19	2 555 343	1 889 295	0,7394	30,63	20	0,7063	0,7096	0,628	0,497	2006,5
20-24	2 658 874	1 798 822	0,6765	30,63	25	0,6424	0,6515	0,476	0,442	2004,6
25-29	2 666 258	1 658 791	0,6221	30,63	30	0,5679	0,5724	0,340	0,391	2003,1
30-34	2 186 764	1 238 301	0,5663	30,63	35	0,4864	0,4700	0,202	0,338	2002,1
35-39	1 904 797	972 887	0,5108	30,63	40	0,3672	0,3443	0,124	0,310	2001,9
40-44	1 621 471	661 340	0,4079	-	-	-	-	-	-	-
Age category	**Proportion *S*(*n*)**	**Estimated HIV prevalence**	**Adjusted proportion alive**	M^f	**Age *n***	**l(35+n) / l(35)**	**Standard $l_s(35+n)$**	**Level α**	**Probability of dying *45q15***	**Date**
10-14	0,8230	0,0230	0,8189	30,63	15	0,7930	0,5614	-0,011	0,412	2008,7
15-19	0,7394	0,0070	0,7379	30,63	20	0,7020	0,5189	0,102	0,456	2006,5
20-24	0,6765	0,0510	0,6668	30,63	25	0,6162	0,4700	0,146	0,472	2004,5
25-29	0,6221	0,1730	0,5916	30,63	30	0,5246	0,4048	0,135	0,468	2002,7
30-34	0,5663	0,2560	0,5252	30,63	35	0,4361	0,3230	0,054	0,437	2001,6
35-39	0,5108	0,2880	0,4691	30,63	40	0,3343	0,2309	-0,029	0,405	2001,5
40-44	0,4079	0,1580	0,3896	-	-	-	-	-	-	-

(Own calculation based on CS 2016)

Table 17: Time location of paternal orphanhood estimates

Age category	Central age N	Proportion surviving $S(n)$	Standard proportion alive $_np_m$	Correction for non-linearity $C(N)$	Mid-point of exposure $(N+0.75)/2$	Time Location T	Date
10-14	15	0,7800	0,6858	0,0429	7,875	7,537	2008,71
15-19	20	0,7072	0,5860	0,0627	10,375	9,725	2006,52
20-24	25	0,6488	0,4862	0,0961	12,875	11,637	2004,61
25-29	30	0,5935	0,3865	0,1430	15,375	13,176	2003,07
30-34	35	0,5378	0,2867	0,2097	17,875	14,127	2002,12
35-39	40	0,4564	0,1870	0,2975	20,375	14,313	2001,93
Age category	**Central age N**	**Proportion surviving $S(n)$**	**Standard proportion alive $_np_m$**	**Correction for non-linearity $C(N)$**	**Mid-point of exposure $(N+0.75)/2$**	**Time location T**	**Date**
10-14	15	0,7774	0,6858	0,0418	7,875	7,546	2008,70
15-19	20	0,7014	0,5860	0,0599	10,375	9,753	2006,49
20-24	25	0,6281	0,4862	0,0853	12,875	11,776	2004,47
25-29	30	0,5574	0,3865	0,1221	15,375	13,498	2002,75
30-34	35	0,4963	0,2867	0,1829	17,875	14,605	2001,64
35-39	40	0,4275	0,1870	0,2757	20,375	14,758	2001,49

(Own calculation based on CS 2016)

4.3. Household deaths

During the CS 2016, households are surveyed on information including the number of deaths which have occurred in the last 12 months prior to the survey, as well as the age and sex of the deceased (Statistics South Africa, 2016). This provided vital information which was then used to formulate a lifetable for men and women, as well as estimates for each province (Statistics South Africa, 2016). In the tables presented below, we can see the differences in life expectancy experienced by the average person in the population, if they are exposed to the similar risks of mortality. The question on the number of deaths occurring within a household in the last 12 months directly relates to the number of deaths used in the calculation and estimation of adult survivorship "*How many members of this household have passed away in the last 12 months (between 07 March 2015 and 06 March 2016)?"* (Statistics South Africa, 2016). In addition, information can be found on the age and sex of the deceased through the survey questions "*Was (name) male or female?*" *"What was (name)'s age in completed years at the time of death?"* (Statistics South Africa, 2016). The age of the deceased was used to calculate age-specific deaths in general and to allow for the estimation of mortality for specific indicators: IMR, under-5 mortality rate, life expectancy at birth and at age 60, probabilities of dying in adulthood etc.

The following lifetable indicates the total life expectancy for South African men and women from birth to age 85+.

Table 18: Lifetable of South Africans

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	1 126 132,8	28 526	0,0253	0,068	0,02475	0,97525	100 000	2 475	97 694	6 584 058	65,8
1 - 4	4	4 850 386,2	11 714	0,0024	1,626	0,00961	0,99039	97 525	937	387 877	6 486 364	66,5
5 - 9	5	5 619 795,8	3 582	0,0006	2,5	0,00318	0,99682	96 589	307	482 175	6 098 487	63,1
10 - 14	5	5 189 803,3	3 500	0,0007	3,143	0,00337	0,99663	96 281	324	480 804	5 616 312	58,3
15 - 19	5	5 104 481,7	8 096	0,0016	2,724	0,00790	0,99210	95 957	758	478 059	5 135 508	53,5
20 - 24	5	5 302 334,9	14 712	0,0028	2,52	0,01378	0,98622	95 199	1 312	472 741	4 657 449	48,9
25 - 29	5	5 280 504,5	24 578	0,0047	2,481	0,02300	0,97700	93 887	2 160	463 995	4 184 708	44,6
30 - 34	5	4 454 688,2	28 856	0,0065	2,601	0,03189	0,96811	91 727	2 925	451 619	3 720 713	40,6
35 - 39	5	3 847 961,3	31 276	0,0081	2,701	0,03989	0,96011	88 802	3 543	435 865	3 269 094	36,8
40 - 44	5	3 260 583,9	30 864	0,0095	2,663	0,04630	0,95370	85 259	3 948	417 070	2 833 228	33,2
45 - 49	5	2 782 930,5	30 754	0,0111	2,698	0,05388	0,94612	81 311	4 381	396 471	2 416 158	29,7
50 - 54	5	2 334 509,2	31 611	0,0135	2,676	0,06564	0,93436	76 930	5 050	372 915	2 019 687	26,3
55 - 59	5	1 974 196,4	34 451	0,0175	2,645	0,08381	0,91619	71 880	6 024	345 215	1 646 772	22,9
60 - 64	5	1 572 917,4	34 479	0,0219	2,624	0,10418	0,89582	65 856	6 861	312 980	1 301 557	19,8
65 - 69	5	1 179 287,2	31 609	0,0268	2,619	0,12598	0,87402	58 996	7 432	277 282	988 576	16,8
70 - 74	5	824 733,2	28 172	0,0342	2,593	0,15782	0,84218	51 563	8 138	238 230	711 294	13,8
75 - 79	5	486 336,8	26 889	0,0553	2,518	0,24309	0,75691	43 426	10 556	190 928	473 064	10,9
80 - 84	5	251 006,6	20 067	0,0799	2,423	0,33145	0,66855	32 870	10 894	136 273	282 136	8,6
85 +		211 064,4	31 798	0,1507	5,247	0,00000	1,00000	21 975	21 975	145 863	145 863	6,6

(Own calculation based on CS 2016)

The results of life expectancy of South Africans based on the data suggests that, on average, adults are expected to live up to 65.8 years. More specifically, South African men are expected to live to the age of 63, on average, from the time of birth. On the other hand, women are expected to live until the age of 68,4. These differences are represented in detail in the life tables below. Additionally, provincial estimates of life expectancy are represented subsequently. From this life tables, it is also important to note the number of infant and child deaths per province. A lifetable allows us to see the overall lifespan of an average South African man or women, and how this differs depending on the province of residence for each person. The table that follows, indicates the life expectancy of South African within each of the provinces, from birth to age 85+.

Table 19: Life expectancy (e_x) of males

x	*n*	WC	EC	NC	FS	KZN	NW	GP	MP	LP	**South Africa**
0	1	42,0	20,6	22,8	29,5	24,6	22,7	42,0	26,9	32,2	63,0
1 - 4	4	42,0	20,6	22,9	29,5	24,8	22,7	42,0	26,9	32,3	63,8
5 - 9	5	42,1	21,1	22,8	29,4	25,6	23,2	41,9	27,4	32,8	60,4
10 - 14	5	42,1	21,8	23,6	30,3	26,6	23,9	42,3	27,9	33,3	55,6
15 - 19	5	42,4	22,5	24,0	31,1	28,0	24,8	42,9	28,5	33,9	50,8
20 - 24	5	43,5	23,5	24,9	32,6	29,9	26,4	43,8	29,8	34,7	46,3
25 - 29	5	44,4	24,5	25,6	34,8	32,0	27,7	44,2	30,8	36,3	42,0
30 - 34	5	44,8	25,6	25,8	36,3	33,1	29,0	43,7	31,7	37,1	38,0
35 - 39	5	44,1	26,2	25,8	37,1	34,0	29,4	42,4	30,6	37,9	34,3
40 - 44	5	42,8	26,1	24,7	36,5	33,5	28,7	40,6	30,5	37,3	30,8
45 - 49	5	41,0	25,7	24,0	36,0	33,3	27,5	38,8	29,0	36,3	27,3
50 - 54	5	40,2	24,7	22,5	35,1	32,8	25,8	36,9	28,2	35,1	23,8
55 - 59	5	38,0	23,9	21,9	33,9	31,5	24,1	35,0	27,2	33,7	20,5
60 - 64	5	37,5	22,6	21,1	32,4	31,1	22,2	33,0	25,3	32,3	17,5
65 - 69	5	36,3	21,4	19,8	33,0	31,2	21,5	31,1	23,5	31,9	14,5
70 - 74	5	32,8	20,2	18,4	31,9	30,7	20,7	29,3	21,9	30,8	11,7
75 - 79	5	30,3	19,4	18,8	32,1	29,6	20,1	27,3	21,5	30,3	8,9
80 - 84	5	26,3	18,5	17,8	33,5	28,8	19,8	26,2	21,3	29,9	6,8
85 +		23,9	17,6	18,3	38,1	28,8	19,8	24,4	20,4	29,9	5,0

The table indicates the general life expectancy of men in South Africa. As research has shown in previous studies, it is expected that the average life expectancy of men will be lower than the average life expectancy of women. Although the total number of males born is higher than females, as the next table will indicate, the number of deaths that occur in the lifetable of South African men is higher. There are many factors that contribute to this number. The highest number of deaths occur during adulthood, apart from child mortality. This number then starts to decrease the closer men get to older ages, as there are now a fewer total number of men moving along this cohort

Table 20: Life expectancy (e_x) of females

x	*n*	WC	EC	NC	FS	KZN	NW	GP	MP	LP	**South Africa**
0	1	46,7	20,2	21,6	28,4	22,9	21,8	42,4	25,9	30,8	68,4
1 - 4	4	46,6	20,4	21,6	28,2	23,1	21,8	42,4	25,9	30,9	69,0
5 - 9	5	47,3	20,6	21,5	28,3	23,7	21,6	42,0	26,0	31,3	65,6
10 - 14	5	47,8	20,9	21,7	28,4	24,4	21,9	42,2	26,7	31,9	60,8
15 - 19	5	48,5	21,4	22,2	29,1	24,9	22,3	42,9	26,7	32,4	55,9
20 - 24	5	49,9	22,0	22,9	30,9	26,0	23,3	43,7	28,0	33,2	51,3
25 - 29	5	50,6	23,2	24,2	32,1	27,2	24,4	43,9	29,1	34,1	46,9
30 - 34	5	51,8	23,6	24,1	33,1	27,8	24,5	43,5	29,1	35,4	42,8
35 - 39	5	51,9	24,2	23,9	32,6	28,1	24,2	42,5	28,5	35,5	39,0
40 - 44	5	52,4	23,4	23,0	32,2	27,5	23,0	41,2	27,6	35,1	35,3
45 - 49	5	52,5	22,9	22,7	31,9	26,7	22,0	38,6	26,8	33,9	31,7
50 - 54	5	52,7	22,2	21,2	31,7	26,2	20,7	37,2	25,2	32,7	28,2
55 - 59	5	54,3	21,2	20,6	31,1	25,6	20,1	36,4	23,6	31,8	24,8
60 - 64	5	55,8	20,8	19,8	31,8	25,3	19,3	35,4	22,8	31,9	21,5
65 - 69	5	56,6	20,6	19,2	32,8	24,8	18,4	35,3	22,3	31,9	18,3
70 - 74	5	57,8	20,5	18,3	33,7	24,1	18,4	34,7	22,0	32,7	15,1
75 - 79	5	59,1	19,9	19,2	36,4	22,9	18,5	35,2	21,9	33,2	12,1
80 - 84	5	60,4	20,0	18,2	39,9	22,9	18,8	34,3	22,6	33,5	9,6
85 +		64,6	19,5	15,9	41,5	22,9	21,8	42,4	25,9	30,8	7,6

(Own calculation based on CS 2016)

The total number of deaths for South African women tend to be the highest around the ages of 15-49, apart from the high number of child mortality. This is largely associated with the persisting degree of maternal mortality as women reach the age of fertility. Complications in childbirth have been a common factor in adult mortality within these age groups. Furthermore, the life expectancy of women at around the age 10-14 seems to decrease drastically. It is also interesting to note how life expectancy for both men and women within this age category seem to reach similar levels. These tables provide a general understanding of the estimated lifetable for men and women within South Africa.

4.4. Population estimates

Population estimates produced by the research study calculations yielded sufficient estimates of indirect adult mortality within SA, for both men and women. The use of the Orphanhood method as well as estimated derived from household deaths proved to be significantly valuable in the efforts to arrive at plausible probabilities. Notwithstanding the various challenges that this undertaking entails, the analysis of adult mortality reveals levels that not only can be expected, but has a pattern closely resembling the socioeconomic determinants framework of understanding adult mortality within South Africa. Population estimates were based on the total population number as at 2016 (Statistics South Africa, 2016).

4.4.1. Provincial estimates

When analysing the levels of provincial estimates, coefficients that tended to be province specific were applied. The compromise of using this approach was that in some cases, provincial estimates may not have entirely represented age categories differentially. However, as the objective was to analyse the differentials in provincial survivorship proportions, any minor differences between age categories was not relevant. Aligning to the overall estimates experienced within each province yielded results that were expected based on the understanding of rural and urban differences in mortality. Many of these estimates have slight differences but still noticeable overall. This was true for both men and women.

4.5. Data quality assessment

4.5.1. Assessing the completeness of reported orphanhood

The questions asked by the CS 2016 are generally simple and can be used in relatively small sample sizes (Statistics South Africa, 2015). However, the application of the Orphanhood method has its challenges. One such challenge is the absenteeism effect, whereby men who are absent parents tend to be reported as deceased (Moultrie *et al.*, 2013: 223). This exaggerates the level of male mortality where this may not be the case (Moultrie *et al.*, 2013: 223). Another challenge is the well-known adoption effect where fostered children report their foster parents (particularly mothers) as their biological parents, and is likely to result in understatement of adult mortality levels (Moultrie *et al.*, 2013: 223). In order to establish plausible orphanhood status, the data is analysed according to response levels (Moultrie *et al.*, 2013: 223). The number of respondents whose mother's survival status was unspecified was 171, whereas the number of respondents whose father's survival status was unspecified was 1114 (Statistics South Africa, 2016).

Parental survival overall has slight variance between male and female respondents, which indicates a good quality of data for age and sex in 2016 (Statistics South Africa, 2016). As discussed previously, we know that men are predicted to experience significantly lower survival levels than that of women, and this has been consistent across ages as expected. On average, it is noted that the older the respondent, the longer ago the death of their parent took place (Moultrie *et al.*, 2013: 223; Statistics South Africa, 2016). In order to convert measures of adult mortality measures into single comparable indicators overtime, it has to be assumed that adult age patterns of mortality are represented by a chosen standard lifetable (Moultrie *et al.*, 2013: 223). Furthermore, in order to estimate time location of mortality measures, it can be assumed that mortality declined linearly over time in terms of the Princeton West lifetable (Moultrie *et al.*, 2013: 223). It is important to note that all assumptions made in indirectly estimating adult mortality will be problematic with populations experiencing high HIV epidemics (Moultrie *et al.*, 2013: 223).

Furthermore, adult mortality levels derived from this method have proven to be only aggregate estimates as they cannot directly be linked to household factors of influence in adult mortality. The CS 2016 records information of those with surviving parents in order to understand survivorship probabilities. It cannot provide a detailed understanding of the household influences on mortality for those parents who have died. For this reason. Lifetables are constructed to identify patterns of mortality that can be attributed to the effects of other variables in adult mortality. This allows the study to analyse provincial differences that may arise in the levels of mortality.

When comparing the survivorship probability estimates from both data methods, the following can be seen:

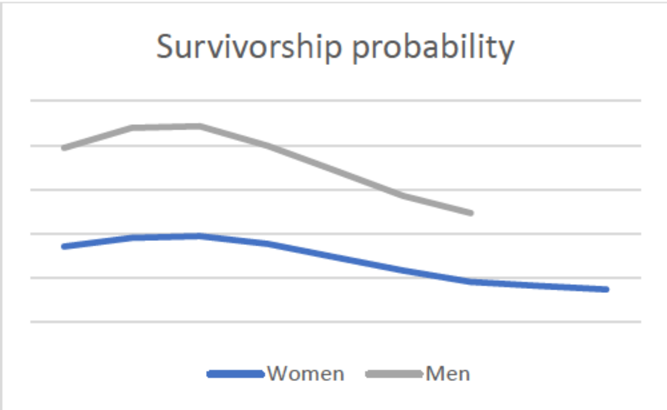

Figure 3: Survivorship probability using Orphanhood method

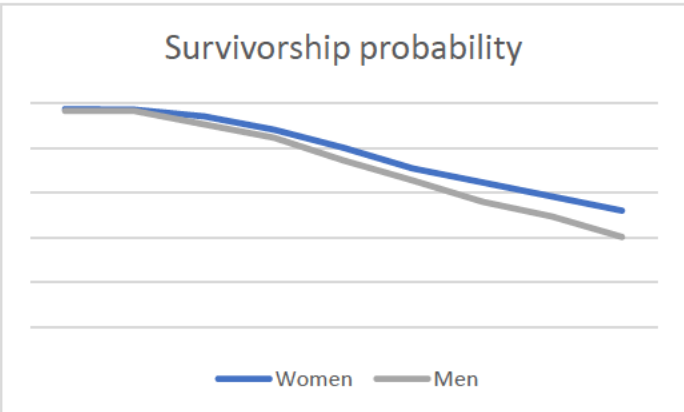

Figure 4: Survivorship probability using Household Deaths

Both estimated survivorship probabilities represent ages 5-49. This provides an indication of the discrepancies between the two different methods.

4.5.2. Assessing the completeness of reported household deaths

The CS 2016 included a total of 456 612 registered household deaths in SA (Statistics South Africa, 2016). The exploration of household deaths yielded a positive result in the estimation of life expectance as the data allowed for a more robust calculation of adult survivorship in the study. Furthermore, household death data is easier to access as it can be found in a separate data set from the Individual/Person data set (Statistics South Africa, 2016). The separation of these datasets is useful to run various estimations separately as well as merged when required on STATA. Due to the inclusion of a unique household identifier number, the data on individual respondents can be directly linked to the data on household factors (Statistics South Africa, 2016). This is especially useful when estimating adult survivorship using the Individual/Person file for the Orphanhood method; followed by the calculation of a lifetable using the household deaths file, for example. By creating a dummy variable on STATA, a wider age-ranging table of estimates could be produced for ages from birth to 85+. This is especially useful for a level of comparison of the Orphanhood method and the use of household deaths. Both methods are useful, but the household deaths file proved to have more usable information for a realistic calculation of adult life expectancy across all ages. This indicates the completeness and quality of household deaths data which can be used for other similar estimates.

Based on the Household deaths data, on average, the life expectancy from birth in 2016 would be 65,8. According to an online data base, the estimated life expectancy of South Africa was 62,5 (Macrotrends, n.d.). The World Bank indicated 63,2 (The World Bank, n.d.) and Statistics South Africa indicated 61 years (Stats SA, 2016). These discrepancies indicate that life expectancy may have been inflated in the calculation of estimates.

4.5.3. Assessing the completeness of deaths 12 months prior to the survey

The most noted caveat relates to the number of deaths recorded at age 0. It is often assumed that these recorded deaths are complete but can be misleading (Statistics South Africa, 2015). The failure to report stillbirths as a death in the household is often the case (Statistics South Africa, 2015). Many respondents may not see this as being significant in their response to the survey (Statistics South Africa, 2015). Not only is this incorrect, but it distorts the number of deaths 12 months prior to the survey (Statistics South Africa, 2015). Studies have shown that this is common, however, this discrepancy often affects direct estimations of child mortality (Statistics South Africa, 2015).

4.5. Adult mortality indicators

The closer we get to complete vital registration systems, the closer we get to accurately estimate and assess the levels of adult mortality (Statistics South Africa, 2015). Much of this concern lends itself to the indirect estimation of adult mortality (Statistics South Africa, 2015). Methods that, through statistical and mathematical calculation, allow us to arrive at plausible estimates. It is not forgotten that South Africa, is among the very few African countries that have available and useable data sets recorded (Timaeus and Jasseh, 2004: 757). Even so, it would still be beneficial to estimate levels of adult mortality against necessary and relative methods that allow us to not only assess the levels of deviation but make inferences where the data set might be limiting in this regard (Statistics South Africa, 2015). Furthermore, the levels of adult mortality estimated through the Orphanhood method as well as the household deaths file provide us with clear indications of such variances, if any. Noteworthy, are the distinct differences in the estimates for age and sex. These can be expected as the number of deaths reported per household provide an account of mortality experienced, whereas the Orphanhood methods provides estimates of survivorship and the conditional patterns of mortality that can be expected for that cohort.

4.6. Survivorship proportions

Mortality estimates based on the Orphanhood method requires the age-specific survivorship proportions (Moultrie, *et al.*, 2013). These are obtained from the information given by survey respondents on parental survivorship (Moultrie, *et al.*, 2013). The CS 2016 asks respondents the survivorship status of their parents (Statistics South Africa, 2016). This information is then used to tabulate the proportion of those whose mother or father (depending on the corresponding sex of the respondent) is still surviving (Moultrie, *et al.*, 2013). By calculating the proportion of those surviving, it provides a benchmark by which the probability of survival can be calculated given the age-specific and sex-specific patterns of survival in the country or more specifically, the province. Inversely, the probability of dying can also be represented (Moultrie, *et al.*, 2013). The graph below indicates the survivorship proportions or likelihood of survival for each age category based on that information.

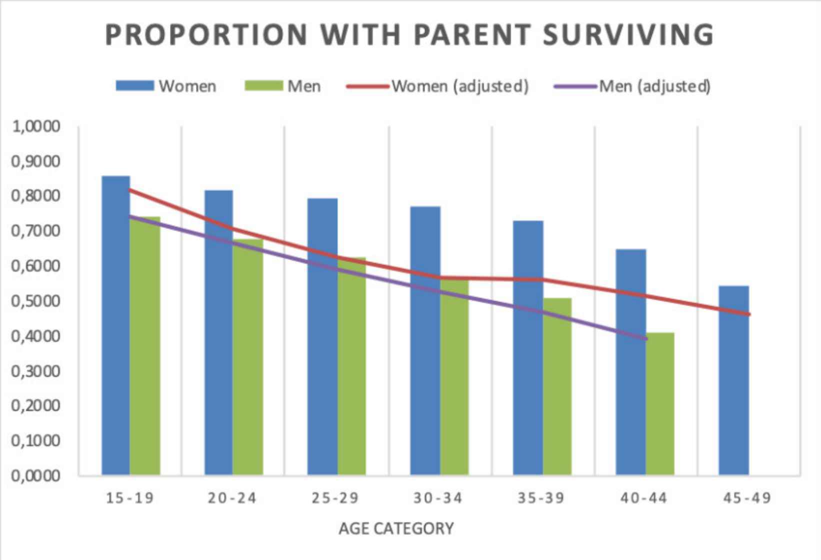

Figure 5: Proportion with parent surviving
(Own calculation based on CS 2016)

Here, we see that the number of people with a surviving parent decreases with each age group. Taking into considerations the various factors that could impact these numbers, the adjusted levels for men and women have been recorded. According to the adjusted figures, it is noted that there has been an inflated estimation in the proportion of parents. This overestimation has an impact on the survivorship levels of adults when calculating the probability that an adult will survive to age x.

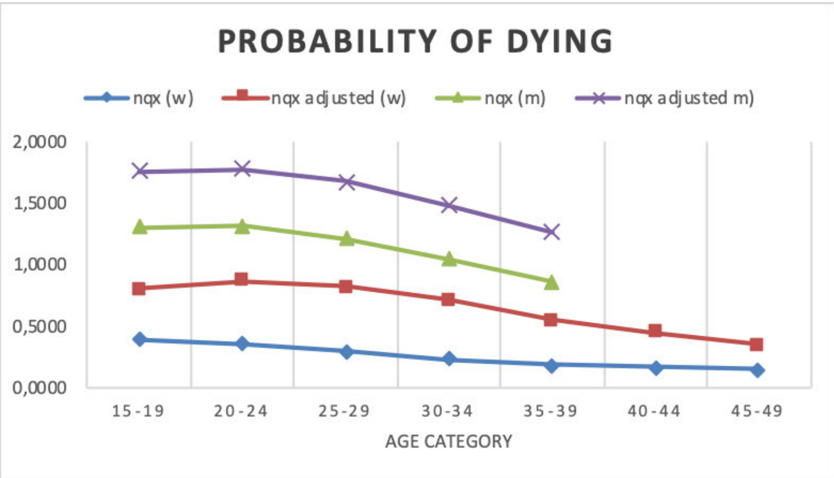

Figure 6: Probability of dying
(Own calculation based on CS 2016)

In the graphs above, we see that for both men and women, the probability of survival decreases with each incremental age category. The highest probability of survival being the age category

5-9 and the lowest being 45+. It is important to note the 'adjusted proportions' for both men and women as these figures take into account the level of HIV prevalence per age category. Estimates, as expected will thereafter vary, most notably due to increases in the number of people living with/dying from HIV/AIDS. The most notable drop in survivorship proportion is among women from the age of 20-24 onwards. The adjusted proportion of men surviving decreases slightly by a generally constant level. However, the adjusted proportion of women dying at ages 20-24 onwards is a substantial increase.

4.6.1. National adult mortality estimates

The probability of surviving ranges from between 0 to 1 (Moultrie, *et al.*, 2013). This means that the closer an estimate is to reaching 1, the higher the probability of survival (Moultrie, *et al.*, 2013). The graph below for South African men shows a steady and gradual decline from ages 15-19 onwards. For women, this survival probability is not only much higher, but varies across the age categories. According to the estimated survivorship, women aged 30-39 have almost the same probability of surviving, as opposed to the gradual declining rate across other ages.

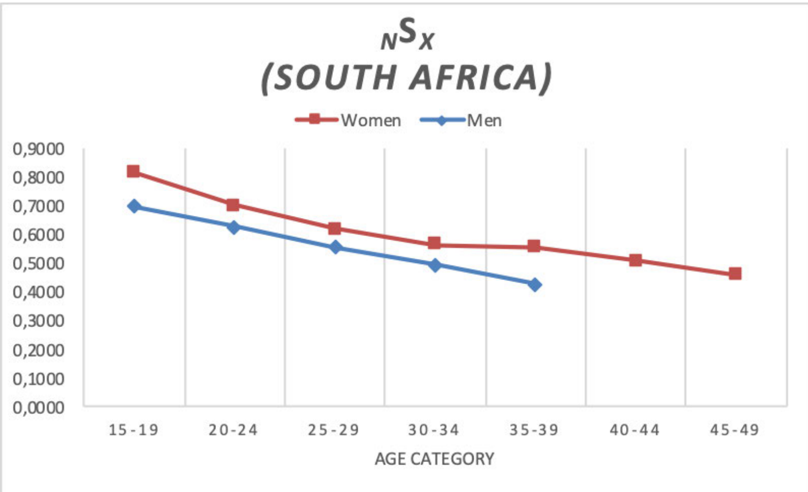

Figure 7: Graph of survivorship proportions of men and women in SA
(Own calculation based on CS 2016)

As can be expected, the survivorship probabilities of men are much lower to that of women. The most notable shift in levels occurs for women aged 30-34, followed but a steady decline into older ages. There are many factors that could have resulted in these levels being lower. This includes sexual and reproductive health factors.

4.6.2. Provincial adult mortality estimates

Within in each provincial region, the level of adult mortality will vary depending on the experienced survivorship proportions. The tables and graphs below represent the estimated levels of survivorship for each province, taking into consideration estimated levels of HIV prevalence.

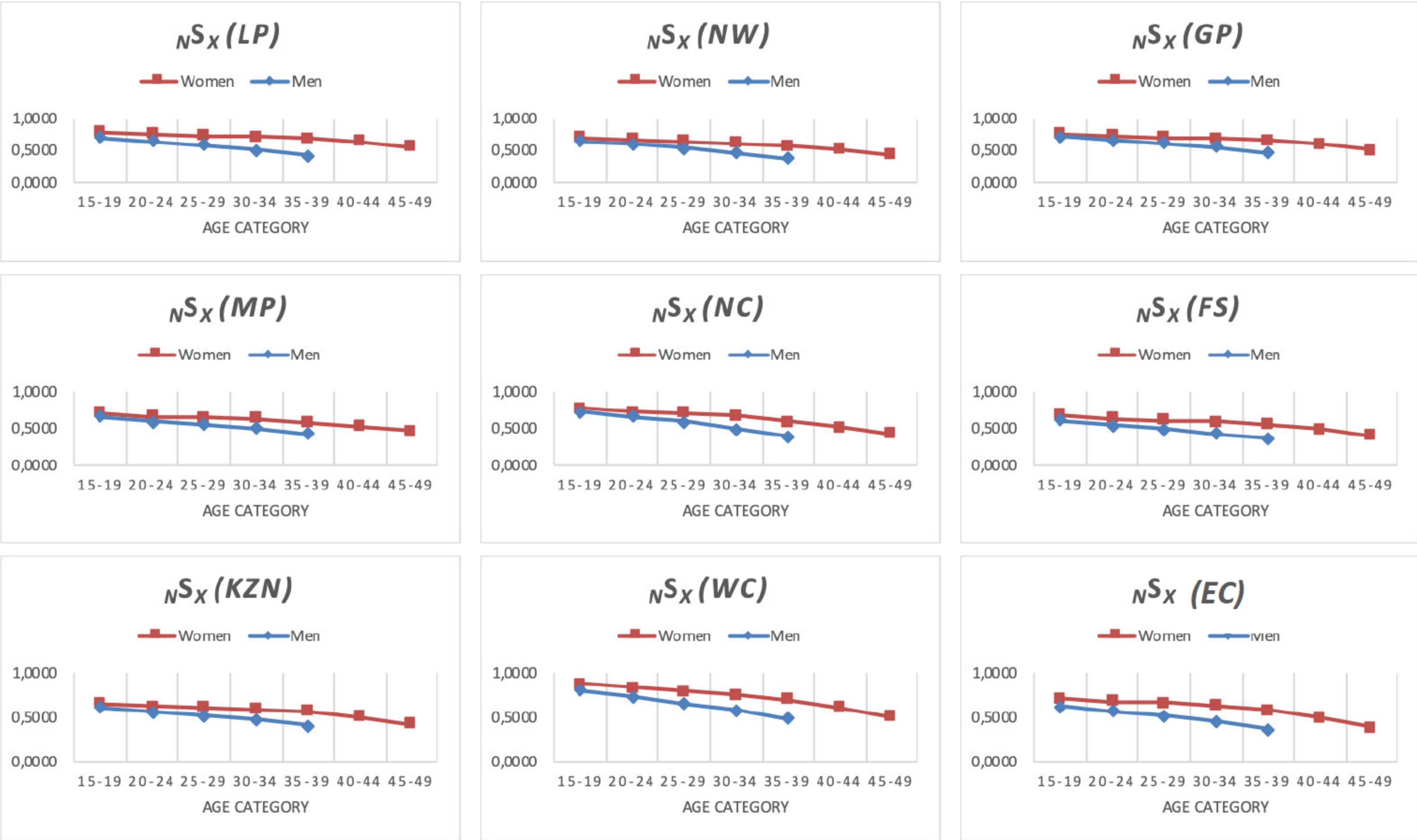

Figure 8: Provincial survivorship proportions of men and women

The figure above indicates the aggregate survivorship proportions of South African men and women. Western cape has the highest level of survivorship, with the lowest being Eastern Cape. Much of the differences between these provinces are as a result of the infrastructure in healthcare and other resources. It has been known that levels of health and development tends to be better in urban regions than in rural (Van de Poel *et al.*, 2008)

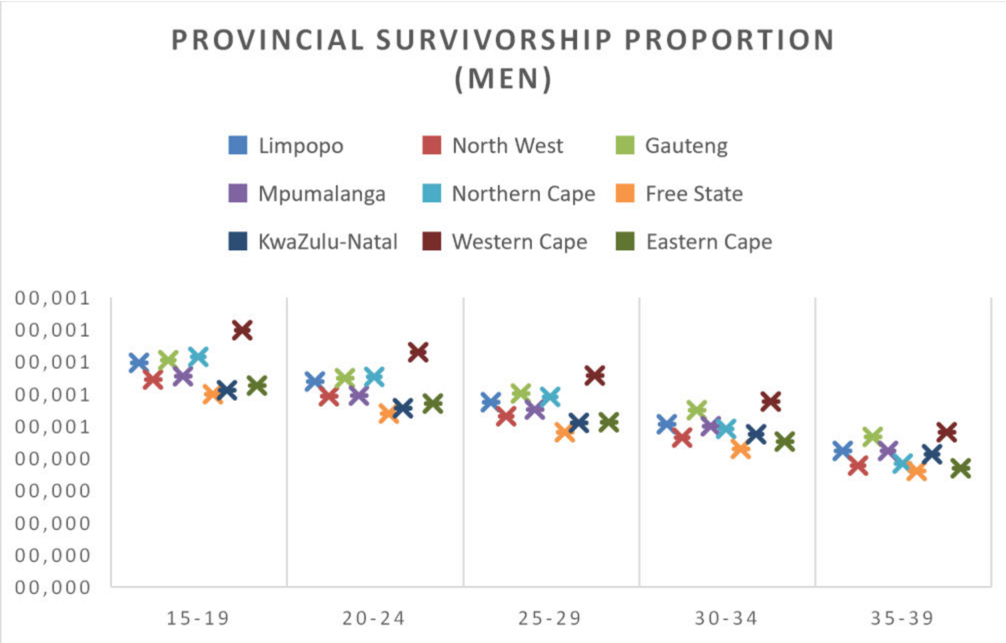

Figure 9: Graph of total survivorship proportion of men
(Own calculation based on CS 2016)

Taking a closer look at the differences, Free State has the lowest level of survivorship for men, followed by KwaZulu-Natal and Eastern Cape. The highest province remains the Western Cape across all age categories. The development of urban regions provides better healthcare and opportunities for employment and ultimately a higher standard of living. The survivorship of women, in the figure below, indicates that the standard of living within the Western Cape is also favourable. The Northern Cape, Eastern Cape and Free State consistently prove to have the lowest survivorship levels.

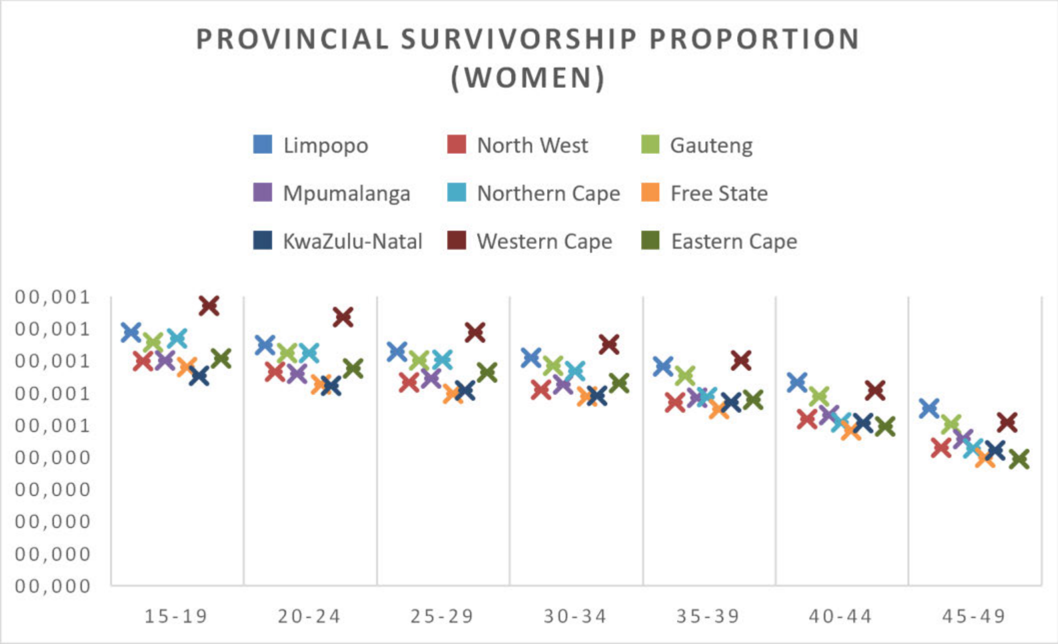

Figure 10: Graph of total survivorship proportion of women
(Own calculation based on CS 2016)

CHAPTER 5: DISCUSSION

5.1. Introduction

The following chapter is a discussion of the state of adult mortality given the observed levels of estimation, provincial differentials and socioeconomic determinants. The study drew on the understanding of adult mortality based on previous studies that suggested the overall pattern of mortality one would likely uncover in an analysis. Based on such assumptions, it is noted that the orphanhood to a great degree aligns with those assumptions outlined in Chapter 3. However, when comparing the results with the data produced by household deaths, a different picture emerges. The differences in these findings shed light on the methods used in arriving at the results rather than suggesting inconsistency. It is important to remember that the methodological assumptions made do not negate each finding, rather they complement each other in the perspectives of understanding adult survivorship or mortality. Where one ends, the other seeks to expand understand from a different viewpoint.

5.2. Data usefulness

The importance of adult mortality as an indicator has major socioeconomic and policy implications (United Nations, 1984). There are a number of characteristics of the structure and pattern of mortality, with levels of premature adult mortality still remaining high in many different parts of South Africa, most notably, rural provinces. Comparisons with previous studies indicate that this has been slowly changing with the onset of effective ART and lifestyle changes in the pursuit of a better life in urban regions, but still remains a common feature with sub-Saharan African experiencing the highest rates of adult mortality (Zaba *et al.*, 2007). With life expectancy being lower in less-developed regions, the probability of dying before the age of 60 is high (Statistics South Africa, 2017). In addition to this, there are stark differences within and amongst populations from either rural or urban areas due to the availability of resources (Barro and Lee, 2000). For this purpose, increasing the demographic information base is of utmost importance as adequate and sufficient data is required in order to fully understand the level and degree of mortality in SA (Statistics South Africa, 2017).

5.3. Adult mortality levels in South Africa

According to Dorrington *et al.* (2018), SA has made much progress with the improvement of life expectancy. Although these improves are slow, there is indication that on average, individuals seem to be living longer than previous estimations (Dorrington *et al.*, 2018). The table below is taken from the 2016 mortality report presented by Dorrington *et al.* (2018). It indicates the adult mortality patterns observed overtime, for both men and women. This information provides a clear understanding of life expectancy within South Africa as it relates to the 2019 targets.

Table 21: Adult mortality indicators overtime

Indicator	**Target 2019**	**2012**	**2013**	**2014**	**2015**	**2016**
Life expectancy (*Total*)	64.2	61.2	62.2	62.9	63.3	63.8
Life expectancy (*Men*)	61.5	58.5	59.4	60.0	60.3	60.8
Life expectancy (*Women*)	67.0	64.0	65.1	65.8	66.4	66.9
Adult mortality (*Total*)	34%	38%	36%	34%	34%	33%
Adult mortality (*Men*)	40%	44%	42%	40%	40%	39%
Adult mortality (*Women*)	28%	32%	30%	28%	28%	27%

The life expectancy of women remains higher than that of men (Dorrington *et al.*, 2018). Unfortunately, case of death still seems to remain largely missing in adult mortality enquiries (Dorrington *et al.*, 2018). The data that is available indicate that adult mortality is largely related to unnatural rather than natural causes of death (Dorrington *et al.*, 2018). It is interesting that the degree of emphasis placed on quantifying life expectancy does not shed light on the quality thereof. Looking at a table of figures may show progressive advancement when in reality, the experience of that life expectancy may be a different problem entirely. Based on the orphanhood method, survivorship levels seem to indicate that on average South African males have a higher life expectancy than females. In contrast, the household deaths data indicates that there is a steady decline in life expectancy for both males and females, with females being at a slightly higher level than males. This seems to be the most consistent with the theory of adult survivorship presented in Chapter 2 and 3 of the study. Arguably, household deaths data remains at an advantage over the indirect method as it deals directly with adult mortality experienced at a household unit. As such, the accuracy of these estimates is expected. Additionally, life expectancy to age 80+ is limited when looking at indirect estimates derived from the orphanhood method as much of these levels do not exceed the ages above 49 due to child-bearing parameters in the formulae of the orphanhood method. The life expectancy of the average South African was 65.8 in 2016 based on the calculations of the study. This is higher than the estimated 63.8 provided by Dorrington *et al.* (2018). Based on literature review, most researchers in previous studies had found that KwaZulu-Natal, Gauteng and Eastern Cape had the highest number of deaths recorded for adult men and women. The results from the lifetables produced using the household deaths data shows the same pattern of adult mortality that has been shown in the recent years. Household data seems to be more robust in formulating a total picture of the experienced levels of adult mortality across provinces. Although the orphanhood has been a tried and trusted indirect estimator of adult mortality, the shift in landscape of development and demographic characteristics in South Africa necessitates the use of mortality data that is already available. The reliability of this data gives much hope for further investigation.

5.4. Provincial differentials in adult mortality

In SA, provincial differentials are noticeable due to the divide of resources across provincial boundaries (Statistics South Africa, 2017). As such, the standard of living varies across provinces depending on rural and urban differences, with rural regions have little to no sufficient resources to sustain a healthy lifestyle (Statistics South Africa, 2017). As outlined previously, in Chapter 2, there are noticeable differences between rural and urban predispositions to the exposure of adult mortality based on the assumption that people tend to have a higher SES once households migrate to urban areas (Statistics South Africa, 2017). However, it is important to mention that the level of mortality is proportionally represented by the total number of people within a given province. By this, an urban region may present as having a higher mortality rate than a rural region because the population there is much larger to begin with. If we look at the proportion per population, estimates indicate the poor level of survival for men and women in rural SA (Statistics South Africa, 2017). Due to the higher level of completeness in the reporting and recording of household deaths, the data used proved to be of great value and robust in terms of estimating adult survivorship in South Africa. Moreover, the analysis of provincial differentials becomes a complex task when looking at the factors of socioeconomic determinants linked to household deaths. The fact that the data provided gives a clear indication of the level of household deaths across provinces, lowers the biases that one might expect to uncover when deducing the relationship between socioeconomic factors and adult mortality. With that stated, the household deaths produced sufficient estimates in life expectancy and levels of survivorship probabilities across various age categories. Household deaths data was best suited to construct a lifetable of South Africans given the general socioeconomic factors that impact the livelihood of a household in different provinces.

The findings indicate that on average, for both males and females, life expectancy tends to be the lowest in the Eastern Cape, Northern Cape and North West. This is somewhat consistent with the idea of more rural areas having lower levels of development. However, it is important to reiterate that the total population in these provinces are relatively lower than more urban provinces. Interestingly, Menashe-Oren and Stecklov (2016) suggest that estimates of rural-urban disparities are based on child mortality estimates rather than adult mortality. The study also found that within South Africa, the rural-urban disparity disproportionately affects more females that males (Menashe-Oren and Stecklov, 2016). Increases in life expectancy appear to be located in the provinces of Gauteng and Western. The lifetables produced from the household data indicate that females are expected to live longer that males in Gauteng and Western Cape, except in the rest of the provinces, which are predominated by rural areas. This would seem to align with the findings of Menashe-Oren and Stecklov (2016). Analysis of rural-urban disparities are complex in the context of South Africa because provinces have aspects or urban development and rural residences. For this reason, further estimates at a municipal or zone level may prove more substantial in understanding the differences in adult mortality.

5.5. Influences on the level of adult mortality

Many studies have highlighted the direct link associated with the standard of living and the impact that this has on a household's ability to access valuable resources for better health and wellbeing (Barro and Lee, 2000; Statistics South Africa, 2017). This includes the influence and impact of SES on an individual or household's capacity to access better resources for health-related decision-making (Barro and Lee, 2000; Statistics South Africa, 2017). The socioeconomic status of a household does indeed provide us with a rationale for the varying levels of adult mortality experienced within each province (Adler and Ostrove, 1999). Similarly, the dynamics of adult mortality presented by Sartorius *et al*., (2013) have been useful in showing how environmental factors play an important role in the livelihood of a household. In addition, HIV/AIDS has been known to impact the level of adult mortality experienced in sub-Saharan Africa. From the results produced by the orphanhood method, the prevalence of HIV/AIDS has been taken into consideration in estimating adult mortality. It is interesting that with this adjustment females are disproportionately affected by this. The drastic decrease in life expectancy shown in Figure 3 is indicative of this.

5.6. Study limitations

The study used indirect estimations of adult survivorship proportions and life expectancy estimates from household data to provide a comprehensive look at the adult mortality levels in South Africa. The use of both sets of data makes analysis more robust when looking at how these differentials compare across provincial boundaries. What the study has been limited in, is showing how certain household factors directly impact the number of household deaths. It has been shown in theory that socioeconomic factors impact these levels, but the extent of this has not been explored. It would be interesting to further the understanding of these factors by exploring the level of significance each variable might have when analysing household deaths within each province. Furthermore, the study is limited in the estimation of socioeconomic impacts as data on parental survivorship does not necessarily correlate to the household respondents who have taken part in the survey. In order to establish significance, there must be comprehensive modelling that does not take into account parental survivorship. The study has not extensively explored these determinants.

5.7. Recommendations

The exploration of household deaths data, collected by CS 2016, can serve as a good measure of comparison to arrive at more feasible estimates of adult mortality in future. Household level estimates allowed for a more complete tabulation of life expectancy for SA, a task which other indirect estimation methods may limit. The changing landscape of South Africa requires a shift in the methodology and the parameters by which we measure mortality overall. It would be useful to explore this further. In addition, drawing from the limitations of the results, it would be interesting to explore the determinants of adult mortality across provinces. This could uncover interesting results given the socio-political landscape of South Africa and how urban-rural disparities present themselves.

5.8. Conclusion

Adult mortality, although a 'grey area' focus, proves to be one of significance for development and forecasting the state of wellbeing of a country. Sufficient adult mortality data, as well as a more updated measure of its calculation is needed overall. Although there are many intricate methods of calculation, the assumptions based on contextual factors are largely ignored. As a result, estimates often end up conforming to standardised patterns of mortality largely rooted in historic trends. This is especially worth noting for underdeveloped nations such as Africa, in which actual adult mortality estimates do not align with the current patterns of mortality previously assumed for each population. The need for sufficient and complete data collection further perpetuates this problem. The fast-changing pace of development and migration globally has necessitated that we look towards improved methods of estimation and understanding adult mortality. Unfortunately, we may still be analysing mortality through an outdated lens, where population indicators may be taking on a different dynamic. With that stated, the study has managed to produce valuable estimates levels of adult mortality across provincial boundaries. By providing face-value comparisons between the results from the orphanhood method and household deaths, a more robust analysis can be done. Household deaths data has proven to be a significant source of data when trying to understand adult mortality at a household level. The production of complete lifetables from this data has been evidence of this. Overall, the study has managed to answer each of the research questions and provide recommendations for further investigation given the study limitations. The shift towards analysing mortality in its totality within the scope of development is something that must be prioritised.

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APPENDIX

Table 22: Coefficients for the estimation of survivorship for men

n	*a(n)*	*b(n)*	*c(n)*	*d(n)*
10	-0,5578	0,00040	1,4708	0,0698
15	-0,4013	0,00576	1,5602	-0,3522
20	-0,3329	0,01031	0,6656	0,3419
25	-0,4726	0,01559	0,2161	0,7896
30	-0,7056	0,02076	0,1997	0,9066
35	-0,9153	0,02493	0,3484	0,8631
40	-0,9950	0,02635	0,4269	0,8263

Table 23: Coefficients for the estimation of survivorship for women

n	*a(n)*	*b(n)*	*c(n)*
10	-0,3611	0,00125	1,2974
15	-0,4030	0,00222	1,3732
20	-0,2120	0,00372	1,1342
25	-0,2389	0,00586	1,1131
30	-0,2513	0,00885	1,0223
35	-0,3644	0,01287	1,0380
40	-0,5181	0,01795	1,0753
45	-0,6880	0,02342	1,1276
50	-0,8054	0,02721	1,1678

Table 24: Survivorship proportions of men and women in SA

Age	**Men**	**Women**	**Central age**	
			Men	**Women**
15-19	0.7014	0.8178	15	12.5
20-24	0.6281	0.7055	20	17.5
25-29	0.5574	0.6227	25	22.5
30-34	0.4963	0.5662	30	27.5
35-39	0.4275	0.5581	35	32.5
40-44	-	0.5120	40	37.5
45-49	-	0.4605	-	42.5

Table 25: Survivorship proportions of men and women (LP)

Age	Men	Women	Central age	
			Men	Women
15-19	0.6959	0.7882	20	17.5
20-24	0.6377	0.7487	25	22.5
25-29	0.5754	0.7269	30	27.5
30-34	0.5069	0.7083	35	32.5
35-39	0.4240	0.6829	40	37.5
40-44	-	0.6327	-	42.5
45-49	-	0.5511	-	47.5

Table 26: Survivorship proportions of men and women (NW)

Age	Men	Women	Central age	
			Men	Women
15-19	0.6448	0.6989	20	17.5
20-24	0.5924	0.6647	25	22.5
25-29	0.5318	0.6329	30	27.5
30-34	0.4651	0.6097	35	32.5
35-39	0.3785	0.5707	40	37.5
40-44	-	0.5179	-	42.5
45-49	-	0.4291	-	47.5

Table 27: Survivorship proportions of men and women (GP)

Age	Men	Women	Central age	
			Men	Women
15-19	0.7060	0.7562	20	17.5
20-24	0.6486	0.7237	25	22.5
25-29	0.6018	0.7008	30	27.5
30-34	0.5494	0.6842	35	32.5
35-39	0.4675	0.6537	40	37.5
40-44	-	0.5882	-	42.5
45-49	-	0.5011	-	47.5

Table 28: Survivorship proportions of men and women (MP)

Age	Men	Women	Central age	
			Men	Women
15-19	0.6550	0.7007	20	17.5
20-24	0.5953	0.6599	25	22.5
25-29	0.5510	0.6448	30	27.5
30-34	0.5005	0.6266	35	32.5
35-39	0.4225	0.5840	40	37.5
40-44	-	0.5303	-	42.5
45-49	-	0.4567	-	47.5

Table 29: Survivorship proportions of men and women (NC)

Age	Men	Women	Central age	
			Men	Women
15-19	0.7160	0.7692	20	17.5
20-24	0.6535	0.7245	25	22.5
25-29	0.5900	0.7021	30	27.5
30-34	0.4913	0.6677	35	32.5
35-39	0.3838	0.5869	40	37.5
40-44	-	0.5072	-	42.5
45-49	-	0.4266	-	47.5

Table 30: Survivorship proportions of men and women (FS)

Age	Men	Women	Central age	
			Men	Women
15-19	0.5996	0.6799	20	17.5
20-24	0.5386	0.6252	25	22.5
25-29	0.4821	0.5978	30	27.5
30-34	0.4283	0.5887	35	32.5
35-39	0.3607	0.5493	40	37.5
40-44	-	0.4827	-	42.5
45-49	-	0.3975	-	47.5

Table 31: Survivorship proportions of men and women (KZN)

Age	Men	Women	Central age	
			Men	Women
15-19	0.6116	0.6536	20	17.5
20-24	0.5557	0.6228	25	22.5
25-29	0.5099	0.6076	30	27.5
30-34	0.4748	0.5914	35	32.5
35-39	0.4137	0.5696	40	37.5
40-44	-	0.5058	-	42.5
45-49	-	0.4208	-	47.5

Table 32: Survivorship proportions of men and women (WC)

Age	Men	Women	Central age	
			Men	Women
15-19	0.7989	0.8706	20	17.5
20-24	0.7307	0.8357	25	22.5
25-29	0.6563	0.7878	30	27.5
30-34	0.5758	0.7508	35	32.5
35-39	0.4815	0.7006	40	37.5
40-44	-	0.6069	-	42.5
45-49	-	0.5068	-	47.5

Table 33: Survivorship proportions of men and women (EC)

Age	Men	Women	Central age	
			Men	Women
15-19	0.6255	0.7067	20	17.5
20-24	0.5712	0.6762	25	22.5
25-29	0.5123	0.6631	30	27.5
30-34	0.4521	0.6291	35	32.5
35-39	0.3684	0.5784	40	37.5
40-44	-	0.4945	-	42.5
45-49	-	0.3932	-	47.5

Table 34: Life expectancy of South African women

x	*n*	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	555 397,8	12 489	0,0225	0,068	0,02202	0,97798	100 000	2 202	97 947	6 841 284	68,4
1 - 4	4	2 404 426,0	5 686	0,0024	1,626	0,00941	0,99059	97 798	920	389 006	6 743 337	69,0
5 - 9	5	2 791 428,0	1 546	0,0006	2,500	0,00277	0,99723	96 878	268	483 718	6 354 331	65,6
10 - 14	5	2 585 062,7	1 517	0,0006	3,143	0,00293	0,99707	96 610	283	482 523	5 870 613	60,8
15 - 19	5	2 549 138,7	3 119	0,0012	2,724	0,00610	0,99390	96 327	588	480 295	5 388 090	55,9
20 - 24	5	2 643 461,4	6 364	0,0024	2,520	0,01197	0,98803	95 739	1 146	475 853	4 907 795	51,3
25 - 29	5	2 614 246,0	10 620	0,0041	2,481	0,02011	0,97989	94 593	1 902	468 175	4 431 942	46,9
30 - 34	5	2 267 923,7	13 500	0,0060	2,601	0,02934	0,97066	92 691	2 720	456 932	3 963 767	42,8
35 - 39	5	1 943 164,3	14 032	0,0072	2,701	0,03552	0,96448	89 971	3 195	442 511	3 506 835	39,0
40 - 44	5	1 639 113,3	14 000	0,0085	2,663	0,04187	0,95813	86 776	3 633	425 389	3 064 324	35,3
45 - 49	5	1 423 173,0	14 004	0,0098	2,698	0,04811	0,95189	83 143	4 000	406 505	2 638 935	31,7
50 - 54	5	1 219 142,8	14 832	0,0122	2,676	0,05916	0,94084	79 143	4 682	384 833	2 232 430	28,2
55 - 59	5	1 060 636,2	15 605	0,0147	2,645	0,07110	0,92890	74 461	5 294	359 836	1 847 598	24,8
60 - 64	5	868 661,6	16 089	0,0185	2,624	0,08870	0,91130	69 167	6 135	331 255	1 487 761	21,5
65 - 69	5	678 968,6	14 614	0,0215	2,619	0,10237	0,89763	63 031	6 453	299 792	1 156 506	18,3
70 - 74	5	504 526,5	14 758	0,0293	2,593	0,13664	0,86336	56 579	7 731	264 285	856 714	15,1
75 - 79	5	323 142,2	14 822	0,0459	2,518	0,20590	0,79410	48 848	10 058	219 276	592 429	12,1
80 - 84	5	176 900,2	12 036	0,0680	2,423	0,28944	0,71056	38 790	11 227	165 017	373 153	9,6
85 +		157 915,1	20 912	0,1324	5,247	0,00000	1,00000	27 563	27 563	208 136	208 136	7,6

(Own calculation based on CS 2016)

Table 35: Lifetable of South African men

x	*n*	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	570 735,0	15 977	0,0280	0,068	0,02728	0,97272	100 000	2 728	97 457	6 304 912	63,0
1 - 4	4	2 445 960,3	6 028	0,0025	1,626	0,00980	0,99020	97 272	953	386 824	6 207 454	63,8
5 - 9	5	2 828 367,8	2 035	0,0007	2,500	0,00359	0,99641	96 318	346	480 728	5 820 630	60,4
10 - 14	5	2 604 740,7	1 982	0,0008	3,143	0,00380	0,99620	95 973	365	479 186	5 339 902	55,6
15 - 19	5	2 555 343,0	4 965	0,0019	2,724	0,00967	0,99033	95 608	925	475 935	4 860 716	50,8
20 - 24	5	2 658 873,5	8 348	0,0031	2,520	0,01558	0,98442	94 683	1 475	469 759	4 384 781	46,3
25 - 29	5	2 666 258,4	13 935	0,0052	2,481	0,02579	0,97421	93 208	2 404	459 986	3 915 023	42,0
30 - 34	5	2 186 764,4	15 341	0,0070	2,601	0,03450	0,96550	90 804	3 132	446 507	3 455 037	38,0
35 - 39	5	1 904 797,0	17 229	0,0090	2,701	0,04430	0,95570	87 672	3 884	429 429	3 008 530	34,3
40 - 44	5	1 621 470,6	16 852	0,0104	2,663	0,05073	0,94927	83 788	4 251	409 004	2 579 101	30,8
45 - 49	5	1 359 757,5	16 735	0,0123	2,698	0,05984	0,94016	79 537	4 760	386 728	2 170 096	27,3
50 - 54	5	1 115 366,4	16 758	0,0150	2,676	0,07259	0,92741	74 777	5 428	361 272	1 783 369	23,8
55 - 59	5	913 560,1	18 813	0,0206	2,645	0,09820	0,90180	69 349	6 810	330 708	1 422 097	20,5
60 - 64	5	704 255,8	18 360	0,0261	2,624	0,12275	0,87725	62 539	7 676	294 456	1 091 389	17,5
65 - 69	5	500 318,6	16 976	0,0339	2,619	0,15697	0,84303	54 863	8 612	253 808	796 933	14,5
70 - 74	5	320 206,7	13 414	0,0419	2,593	0,19027	0,80973	46 251	8 800	210 071	543 126	11,7
75 - 79	5	163 194,5	12 049	0,0738	2,518	0,31199	0,68801	37 450	11 684	158 252	333 054	8,9
80 - 84	5	74 106,4	8 031	0,1084	2,423	0,42357	0,57643	25 766	10 914	100 707	174 802	6,8
85 +		53 149,3	10 654	0,2005	5,247	0,00000	1,00000	14 853	14 853	74 095	74 095	5,0

Table 36: Lifetable of WC

x	*n*	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	112 560,7	1 446	0,0128	0,068	0,01269	0,98731	100 000	1 269	98 817	7 535 639	75,4
1 - 4	4	457 810,1	413	0,0009	1,626	0,00360	0,99640	98 731	356	394 078	7 436 822	75,3
5 - 9	5	546 409,9	187	0,0003	2,500	0,00171	0,99829	98 375	168	491 455	7 042 744	71,6
10 - 14	5	517 934,4	114	0,0002	3,143	0,00110	0,99890	98 207	108	490 834	6 551 289	66,7
15 - 19	5	495 982,5	781	0,0016	2,724	0,00785	0,99215	98 099	770	488 743	6 060 455	61,8
20 - 24	5	566 934,3	1 524	0,0027	2,520	0,01335	0,98665	97 329	1 300	483 423	5 571 713	57,2
25 - 29	5	556 794,2	1 703	0,0031	2,481	0,01518	0,98482	96 030	1 457	476 478	5 088 290	53,0
30 - 34	5	511 330,4	1 411	0,0028	2,601	0,01371	0,98629	94 572	1 296	469 752	4 611 812	48,8
35 - 39	5	484 911,3	1 739	0,0036	2,701	0,01778	0,98222	93 276	1 659	462 567	4 142 060	44,4
40 - 44	5	455 015,8	1 694	0,0037	2,663	0,01845	0,98155	91 617	1 691	454 135	3 679 493	40,2
45 - 49	5	385 833,0	2 212	0,0057	2,698	0,02829	0,97171	89 927	2 544	443 776	3 225 358	35,9
50 - 54	5	324 282,2	2 805	0,0086	2,676	0,04240	0,95760	87 382	3 705	428 302	2 781 582	31,8
55 - 59	5	269 665,5	3 172	0,0118	2,645	0,05723	0,94277	83 678	4 789	407 110	2 353 281	28,1
60 - 64	5	205 197,0	3 630	0,0177	2,624	0,08488	0,91512	78 889	6 696	378 534	1 946 170	24,7
65 - 69	5	155 009,5	2 711	0,0175	2,619	0,08395	0,91605	72 192	6 061	346 532	1 567 636	21,7
70 - 74	5	105 273,4	2 963	0,0281	2,593	0,13180	0,86820	66 132	8 716	309 680	1 221 104	18,5
75 - 79	5	73 022,7	2 506	0,0343	2,518	0,15812	0,84188	57 416	9 079	264 545	911 425	15,9
80 - 84	5	34 390,6	1 691	0,0492	2,423	0,21820	0,78180	48 337	10 547	214 505	646 880	13,4
85 +		21 372,9	1 868	0,0874	5,247	0,00000	1,00000	37 790	37 790	432 375	432 375	11,4

(Own calculation based on CS 2016)

Table 37: Life expectancy of WC men

x	**n**	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	58 205	1 352	0,0232	0,068	0,02274	0,97726	100 000	2 274	97 881	4 204 032	42,0
1 - 4	4	231 414	5 572	0,0241	1,626	0,09110	0,90890	97 726	8 903	369 769	4 106 151	42,0
5 - 9	5	277 785	6 699	0,0241	2,5	0,11372	0,88628	88 823	10 101	418 862	3 736 382	42,1
10 - 14	5	258 093	6 389	0,0248	3,143	0,11833	0,88167	78 722	9 315	376 311	3 317 520	42,1
15 - 19	5	246 956	7 054	0,0286	2,724	0,13410	0,86590	69 406	9 307	325 848	2 941 209	42,4
20 - 24	5	286 020	7 694	0,0269	2,52	0,12609	0,87391	60 099	7 578	281 702	2 615 361	43,5
25 - 29	5	281 211	6 722	0,0239	2,481	0,11273	0,88727	52 521	5 921	247 691	2 333 659	44,4
30 - 34	5	256 613	5 054	0,0197	2,601	0,09403	0,90597	46 600	4 382	222 490	2 085 967	44,8
35 - 39	5	240 520	4 073	0,0169	2,701	0,08150	0,91850	42 218	3 441	203 182	1 863 478	44,1
40 - 44	5	225 955	3 427	0,0152	2,663	0,07324	0,92676	38 778	2 840	187 252	1 660 296	42,8
45 - 49	5	190 410	3 961	0,0208	2,698	0,09926	0,90074	35 938	3 567	171 477	1 473 044	41,0
50 - 54	5	157 190	2 283	0,0145	2,676	0,07025	0,92975	32 371	2 274	156 568	1 301 567	40,2
55 - 59	5	126 488	2 991	0,0236	2,645	0,11200	0,88800	30 097	3 371	142 545	1 144 999	38,0
60 - 64	5	94 405	1 943	0,0206	2,624	0,09811	0,90189	26 726	2 622	127 400	1 002 454	37,5
65 - 69	5	73 162	949	0,0086	2,619	0,04219	0,95781	24 104	1 017	118 098	875 054	36,3
70 - 74	5	45 056	630	0,0157	2,593	0,07560	0,92440	23 087	1 745	111 233	756 956	32,8
75 - 79	5	27 713	707	0,0071	2,518	0,03510	0,96490	21 341	749	104 848	645 723	30,3
80 - 84	5	12 805	198	0,0211	2,423	0,09999	0,90001	20 592	2 059	97 656	540 875	26,3
85 +		6 457	270	0,0418	5,247	0,00000	1,00000	18 533	18 533	443 219	443 219	23,9

Table 38: Life expectancy of WC women

x	**n**	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	54 355	1 056	0,0194	0,068	0,01908	0,98092	100 000	1 908	98 222	4 667 533	46,7
1 - 4	4	226 396	5 706	0,0252	1,626	0,09512	0,90488	98 092	9 331	370 216	4 569 311	46,6
5 - 9	5	268 625	6 169	0,0230	2,5	0,10859	0,89141	88 761	9 639	419 708	4 199 095	47,3
10 - 14	5	259 841	6 221	0,0239	3,143	0,11461	0,88539	79 122	9 068	378 772	3 779 387	47,8
15 - 19	5	249 027	6 402	0,0257	2,724	0,12143	0,87857	70 054	8 507	330 908	3 400 615	48,5
20 - 24	5	280 915	6 386	0,0227	2,52	0,10760	0,89240	61 547	6 622	291 311	3 069 708	49,9
25 - 29	5	275 583	6 682	0,0242	2,481	0,11426	0,88574	54 925	6 275	258 815	2 778 396	50,6
30 - 34	5	254 717	5 023	0,0197	2,601	0,09415	0,90585	48 649	4 580	232 258	2 519 581	51,8
35 - 39	5	244 391	5 140	0,0210	2,701	0,10031	0,89969	44 069	4 421	210 183	2 287 323	51,9
40 - 44	5	229 061	4 476	0,0195	2,663	0,09344	0,90656	39 649	3 705	189 585	2 077 140	52,4
45 - 49	5	195 423	3 869	0,0198	2,698	0,09468	0,90532	35 944	3 403	171 886	1 887 555	52,5
50 - 54	5	167 093	4 112	0,0246	2,676	0,11639	0,88361	32 541	3 787	153 903	1 715 669	52,7
55 - 59	5	143 177	3 385	0,0236	2,645	0,11198	0,88802	28 754	3 220	136 185	1 561 767	54,3
60 - 64	5	110 792	2 278	0,0206	2,624	0,09802	0,90198	25 534	2 503	121 723	1 425 581	55,8
65 - 69	5	81 847	1 782	0,0218	2,619	0,10350	0,89650	23 031	2 384	109 480	1 303 859	56,6
70 - 74	5	60 218	1 286	0,0214	2,593	0,10156	0,89844	20 647	2 097	98 190	1 194 379	57,8
75 - 79	5	45 309	963	0,0213	2,518	0,10095	0,89905	18 551	1 873	88 105	1 096 189	59,1
80 - 84	5	21 585	631	0,0292	2,423	0,13593	0,86407	16 678	2 267	77 548	1 008 084	60,4
85 +		14 916	231	0,0155	5,247	0,00000	1,00000	14 411	14 411	930 536	930 536	64,6

Table 39: Life expectancy of Eastern Cape

x	*n*	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	144 153,7	3 125	0,0217	0,068	0,02125	0,97875	100 000	2 125	98 020	6 047 398	60,5
1 - 4	4	671 730,9	1 643	0,0024	1,626	0,00973	0,99027	97 875	952	389 240	5 949 378	60,8
5 - 9	5	848 301,8	472	0,0006	2,500	0,00278	0,99722	96 923	269	483 942	5 560 138	57,4
10 - 14	5	795 211,8	427	0,0005	3,143	0,00268	0,99732	96 654	259	482 788	5 076 196	52,5
15 - 19	5	789 606,7	1 464	0,0019	2,724	0,00923	0,99077	96 395	890	479 947	4 593 408	47,7
20 - 24	5	699 765,0	2 562	0,0037	2,520	0,01814	0,98186	95 505	1 733	473 227	4 113 461	43,1
25 - 29	5	623 583,8	4 409	0,0071	2,481	0,03473	0,96527	93 772	3 257	460 656	3 640 234	38,8
30 - 34	5	511 477,4	5 021	0,0098	2,601	0,04795	0,95205	90 515	4 341	442 162	3 179 578	35,1
35 - 39	5	322 991,2	4 908	0,0152	2,701	0,07341	0,92659	86 175	6 326	416 328	2 737 416	31,8
40 - 44	5	291 894,3	4 608	0,0158	2,663	0,07612	0,92388	79 848	6 078	385 036	2 321 087	29,1
45 - 49	5	265 189,2	4 519	0,0170	2,698	0,08199	0,91801	73 770	6 048	354 926	1 936 052	26,2
50 - 54	5	237 944,5	4 739	0,0199	2,676	0,09518	0,90482	67 722	6 446	323 629	1 581 125	23,3
55 - 59	5	231 679,1	5 151	0,0222	2,645	0,10564	0,89436	61 276	6 473	291 137	1 257 497	20,5
60 - 64	5	190 883,6	4 772	0,0250	2,624	0,11799	0,88201	54 803	6 466	258 652	966 360	17,6
65 - 69	5	141 317,2	5 491	0,0389	2,619	0,17783	0,82217	48 337	8 596	221 219	707 708	14,6
70 - 74	5	100 433,1	4 671	0,0465	2,593	0,20913	0,79087	39 741	8 311	178 702	486 489	12,2
75 - 79	5	65 306,1	4 229	0,0648	2,518	0,27895	0,72105	31 430	8 767	135 390	307 787	9,8
80 - 84	5	34 792,4	3 296	0,0947	2,423	0,38072	0,61928	22 663	8 628	91 079	172 397	7,6
85 +		30 715,0	5 301	0,1726	5,247	0,00000	1,00000	14 035	14 035	81 318	81 318	5,8

(Own calculation based on CS 2016)

Table 40: Life expectancy of EC men

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	73 530	3 515	0,0478	0,068	0,04576	0,95424	100 000	4 576	95 735	2 064 270	20,6
1 - 4	4	341 602	18 160	0,0532	1,626	0,18882	0,81118	95 424	18 017	338 921	1 968 535	20,6
5 – 9	5	428 600	22 823	0,0533	2,5	0,23497	0,76503	77 406	18 188	341 560	1 629 614	21,1
10 - 14	5	398 151	20 625	0,0518	3,143	0,23628	0,76372	59 218	13 992	270 107	1 288 054	21,8
15 - 19	5	398 490	20 832	0,0523	2,724	0,23359	0,76641	45 226	10 564	202 085	1 017 948	22,5
20 - 24	5	347 488	17 294	0,0498	2,52	0,22150	0,77850	34 661	7 678	154 267	815 863	23,5
25 - 29	5	310 780	15 004	0,0483	2,481	0,21522	0,78478	26 984	5 807	120 290	661596	24,5
30 - 34	5	241 274	10 494	0,0435	2,601	0,19692	0,80308	21 176	4 170	95 878	541 306	25,6
35 - 39	5	149 696	5 639	0,0377	2,701	0,17334	0,82666	17 006	2 948	78 254	445 428	26,2
40 - 44	5	132 673	4 692	0,0354	2,663	0,16333	0,83667	14 058	2 296	64 926	367 174	26,1
45 - 49	5	114 768	3 667	0,0320	2,698	0,14881	0,85119	11 762	1 750	54 782	302 248	25,7
50 - 54	5	100 528	3 467	0,0345	2,676	0,15964	0,84036	10 012	1 598	46 345	247 465	24,7
55 - 59	5	96 193	3 084	0,0321	2,645	0,14905	0,85095	8 414	1 254	39 115	201 120	23,9
60 - 64	5	79 336	2 708	0,0341	2,624	0,15786	0,84214	7 160	1 130	33 112	162 005	22,6
65 - 69	5	49 031	1 794	0,0366	2,619	0,16828	0,83172	6 029	1 015	27 731	128 893	21,4
70 - 74	5	32 800	1 401	0,0427	2,593	0,19366	0,80634	5 015	971	22 736	101 162	20,2
75 - 79	5	17 911	772	0,0431	2,518	0,19468	0,80532	4 044	787	18 264	78 426	19,4
80 - 84	5	7987	362	0,0453	2,423	0,20292	0,79708	3256	661	14579	60 162	18,5
85 +		6 656	379	0,0569	5,247	0,00000	1,00000	2596	2596	45583	45 583	17,6

Table 41: Life expectancy of EC women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	70 624	4 332	0,0613	0,068	0,05802	0,94198	100 000	5 802	94 592	2 016 224	20,2
1 - 4	4	330 129	16 867	0,0511	1,626	0,18226	0,81774	94 198	17 169	336 033	1 921 632	20,4
5 - 9	5	419 702	21 614	0,0515	2,5	0,22812	0,77188	77 029	17 572	341 216	1 585 599	20,6
10 - 14	5	397 061	20 459	0,0515	3,143	0,23513	0,76487	59 457	13 980	271 324	1 244 383	20,9
15 - 19	5	391 116	20 194	0,0516	2,724	0,23101	0,76899	45 477	10 506	203 473	973 059	21,4
20 - 24	5	352 277	19 416	0,0551	2,52	0,24244	0,75756	34 971	8 478	153 829	769 586	22,0
25 - 29	5	312 803	14 402	0,0460	2,481	0,20628	0,79372	26 493	5 465	118 697	615 757	23,2
30 - 34	5	270 204	12 479	0,0462	2,601	0,20789	0,79211	21 028	4 371	94 652	497 059	23,6
35 - 39	5	173 295	6 193	0,0357	2,701	0,16512	0,83488	16 656	2 750	76 959	402 408	24,2
40 - 44	5	159 221	6 165	0,0387	2,663	0,17753	0,82247	13 906	2 469	63 761	325 449	23,4
45 - 49	5	150 421	5 763	0,0383	2,698	0,17604	0,82396	11 437	2 013	52 552	261 688	22,9
50 - 54	5	137 416	5 075	0,0369	2,676	0,17006	0,82994	9 424	1 603	43 395	209 137	22,2
55 - 59	5	135 486	5 949	0,0439	2,645	0,19897	0,80103	7 821	1 556	35 441	165 742	21,2
60 - 64	5	111 548	5 222	0,0468	2,624	0,21064	0,78936	6 265	1 320	28 190	130 300	20,8
65 - 69	5	92 286	4 385	0,0475	2,619	0,21343	0,78657	4 945	1 055	22 214	102 110	20,6
70 - 74	5	67 633	2 916	0,0431	2,593	0,19531	0,80469	3 890	760	17 621	79 896	20,5
75 - 79	5	47 395	2 408	0,0508	2,518	0,22559	0,77441	3 130	706	13 898	62 276	19,9
80 - 84	5	26 805	1 233	0,0460	2,423	0,20562	0,79438	2 424	498	10 836	48 377	20,0
85 +		24 058	1 234	0,0513	5,247	0,00000	1,00000	1 926	1 926	37 542	37 542	19,5

Table 42: Life expectancy of Northern Cape

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	22 959,9	847	0,0369	0,068	0,03566	0,96434	100 000	3 566	96 676	6 197 840	62,0
1 - 4	4	94 703,5	228	0,0024	1,626	0,00958	0,99042	96 434	923	383 542	6 101 164	63,3
5 - 9	5	107 674,0	76	0,0007	2,500	0,00352	0,99648	95 510	336	476 710	5 717 621	59,9
10 - 14	5	106 210,1	69	0,0006	3,143	0,00324	0,99676	95 174	309	475 295	5 240 912	55,1
15 - 19	5	117 027,2	125	0,0011	2,724	0,00533	0,99467	94 865	505	473 174	4 765 616	50,2
20 - 24	5	111 376,7	273	0,0025	2,520	0,01218	0,98782	94 360	1 149	468 947	4 292 442	45,5
25 - 29	5	108 958,4	570	0,0052	2,481	0,02582	0,97418	93 210	2 406	459 989	3 823 495	41,0
30 - 34	5	97 841,8	830	0,0085	2,601	0,04157	0,95843	90 804	3 775	444 963	3 363 506	37,0
35 - 39	5	83 019,5	925	0,0111	2,701	0,05432	0,94568	87 029	4 727	424 277	2 918 543	33,5
40 - 44	5	71 690,5	881	0,0123	2,663	0,05973	0,94027	82 302	4 916	400 021	2 494 266	30,3
45 - 49	5	61 764,1	1 074	0,0174	2,698	0,08360	0,91640	77 386	6 469	372 037	2 094 245	27,1
50 - 54	5	52 372,9	1 010	0,0193	2,676	0,09229	0,90771	70 917	6 545	339 373	1 722 208	24,3
55 - 59	5	44 161,3	988	0,0224	2,645	0,10626	0,89374	64 372	6 840	305 751	1 382 834	21,5
60 - 64	5	35 261,0	895	0,0254	2,624	0,11969	0,88031	57 532	6 886	271 296	1 077 084	18,7
65 - 69	5	30 803,5	745	0,0242	2,619	0,11434	0,88566	50 645	5 791	239 439	805 788	15,9
70 - 74	5	22 085,9	1 073	0,0486	2,593	0,21748	0,78252	44 854	9 755	200 792	566 349	12,6
75 - 79	5	13 102,0	719	0,0549	2,518	0,24149	0,75851	35 099	8 476	154 459	365 557	10,4
80 - 84	5	7 596,6	542	0,0713	2,423	0,30133	0,69867	26 623	8 022	112 442	211 098	7,9
85 +		5 171	975	0,1885	5,247	0,00000	1,00000	18 601	18 601	98 656	98 656	5,3

(Own calculation based on CS 2016)

Table 43: Life expectancy of NC men

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	11 697	565	0,0483	0,068	0,04622	0,95378	100 000	4 622	95 692	2 275 653	22,8
1 - 4	4	46 878	2 025	0,0432	1,626	0,15672	0,84328	95 378	14 947	3 46 026	2 179 961	22,9
5 - 9	5	53 535	2 683	0,0501	2,5	0,22268	0,77732	80 430	17 911	3 57 376	1 833 935	22,8
10 - 14	5	55 042	2 476	0,0450	3,143	0,20758	0,79242	62 520	12 978	2 88 500	1 476 559	23,6
15 - 19	5	59 767	2 902	0,0486	2,724	0,21862	0,78138	49 542	10 831	2 23 060	1 188 059	24,0
20 - 24	5	58 306	2 628	0,0451	2,52	0,20270	0,79730	38 711	7 847	1 74 096	965 000	24,9
25 - 29	5	56 547	2 285	0,0404	2,481	0,18338	0,81662	30 864	5 660	1 40 065	790 903	25,6
30 - 34	5	49 368	1 898	0,0384	2,601	0,17600	0,82400	25 205	4 436	1 15 381	650 838	25,8
35 - 39	5	42 090	1 307	0,0311	2,701	0,14492	0,85508	20 769	3 010	96 924	535 458	25,8
40 - 44	5	36 568	1 305	0,0357	2,663	0,16470	0,83530	17 759	2 925	81 959	438 534	24,7
45 - 49	5	31 627	953	0,0301	2,698	0,14089	0,85911	14 834	2 090	69 359	356 575	24,0
50 - 54	5	25 790	1 010	0,0392	2,676	0,17948	0,82052	12 744	2 287	58 405	287 216	22,5
55 - 59	5	21 406	845	0,0395	2,645	0,18059	0,81941	10 457	1 888	47 837	228 811	21,9
60 - 64	5	16 528	590	0,0357	2,624	0,16453	0,83547	8 568	1 410	39 493	180 974	21,1
65 - 69	5	13 854	528	0,0381	2,619	0,17471	0,82529	7 159	1 251	32 816	141 482	19,8
70 - 74	5	8 962	521	0,0581	2,593	0,25499	0,74501	5 908	1 506	25 914	108 666	18,4
75 - 79	5	4 642	203	0,0437	2,518	0,19725	0,80275	4 402	868	19 853	82 752	18,8
80 - 84	5	2 553	155	0,0607	2,423	0,26250	0,73750	3 533	927	15 277	62 899	17,8
85 +		1 261	69	0,0547	5,247	0,00000	1,00000	2 606	2 606	47 623	47 623	18,3

Table 44: Life expectancy of NC women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	11 263	537	0,0477	0,068	0,04565	0,95435	100 000	4 565	95 745	2 161 842	21,6
1 - 4	4	47 826	2 142	0,0448	1,626	0,16193	0,83807	95 435	15 454	345 052	2 066 097	21,6
5 - 9	5	54 139	2 577	0,0476	2,5	0,21269	0,78731	79 981	17 011	357 378	1 721 044	21,5
10 - 14	5	51 168	2 582	0,0505	3,143	0,23069	0,76931	62 970	14 526	287 874	1 363 667	21,7
15 - 19	5	57 261	2 884	0,0504	2,724	0,22593	0,77407	48 443	10 945	217 307	1 075 792	22,2
20 - 24	5	53 071	2 828	0,0533	2,52	0,23534	0,76466	37 499	8 825	165 608	858 485	22,9
25 - 29	5	52 412	2 149	0,0410	2,481	0,18582	0,81418	28 674	5 328	129 948	692 878	24,2
30 - 34	5	48 474	1 936	0,0399	2,601	0,18223	0,81777	23 346	4 254	106 522	562 930	24,1
35 - 39	5	40 929	1 446	0,0353	2,701	0,16338	0,83662	19 091	3 119	88 286	456 407	23,9
40 - 44	5	35 123	1 439	0,0410	2,663	0,18695	0,81305	15 972	2 986	72 883	368 121	23,0
45 - 49	5	30 137	949	0,0315	2,698	0,14681	0,85319	12 986	1 906	60 542	295 238	22,7
50 - 54	5	26 583	1 127	0,0424	2,676	0,19297	0,80703	11 080	2 138	50 430	234 696	21,2
55 - 59	5	22 755	955	0,0420	2,645	0,19097	0,80903	8 942	1 708	40 687	184 266	20,6
60 - 64	5	18 733	830	0,0443	2,624	0,20043	0,79957	7 234	1 450	32 726	143 578	19,8
65 - 69	5	16 949	754	0,0445	2,619	0,20113	0,79887	5 784	1 163	26 151	110 853	19,2
70 - 74	5	13 123	819	0,0624	2,593	0,27129	0,72871	4 621	1 254	20 087	84 702	18,3
75 - 79	5	8 460	366	0,0433	2,518	0,19534	0,80466	3 367	658	15 204	64 615	19,2
80 - 84	5	5 044	157	0,0311	2,423	0,14407	0,85593	2 709	390	12 541	49 412	18,2
85 +		3 911	246	0,0629	5,247	0,00000	1,00000	2 319	2 319	36 870	36 870	15,9

Table 45: Life expectancy of Free State

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	51 272,2	1 867	0,0364	0,068	0,03522	0,96478	100 000	3 522	96 718	6 141 950	61,4
1 - 4	4	222 057,0	494	0,0022	1,626	0,00885	0,99115	96 478	854	383 885	6 045 232	62,7
5 - 9	5	269 094,4	224	0,0008	2,500	0,00415	0,99585	95 624	397	477 128	5 661 347	59,2
10 - 14	5	254 841,4	237	0,0009	3,143	0,00464	0,99536	95 227	442	475 314	5 184 219	54,4
15 - 19	5	270 246,8	556	0,0021	2,724	0,01024	0,98976	94 785	970	471 716	4 708 905	49,7
20 - 24	5	275 982,2	894	0,0032	2,520	0,01607	0,98393	93 814	1 507	465 334	4 237 189	45,2
25 - 29	5	276 707,9	1 452	0,0052	2,481	0,02589	0,97411	92 307	2 390	455 514	3 771 855	40,9
30 - 34	5	236 010,5	1 654	0,0070	2,601	0,03446	0,96554	89 917	3 099	442 150	3 316 340	36,9
35 - 39	5	191 327,5	2 125	0,0111	2,701	0,05415	0,94585	86 818	4 701	423 283	2 874 190	33,1
40 - 44	5	160 489,0	2 263	0,0141	2,663	0,06825	0,93175	82 117	5 605	397 486	2 450 908	29,8
45 - 49	5	146 282,9	1 964	0,0134	2,698	0,06512	0,93488	76 512	4 982	371 091	2 053 421	26,8
50 - 54	5	126 883,6	2 131	0,0168	2,676	0,08082	0,91918	71 530	5 781	344214	1 682 330	23,5
55 - 59	5	107 879,8	2 594	0,0240	2,645	0,11378	0,88622	65 749	7 481	311 126	1 338 116	20,4
60 - 64	5	87 281,7	2 705	0,0310	2,624	0,14433	0,85567	58 268	8 410	271 357	1 026 990	17,6
65 - 69	5	64 548,7	2 087	0,0323	2,619	0,15011	0,84989	49 858	7 484	231 470	755 634	15,2
70 - 74	5	45 800,3	1 615	0,0353	2,593	0,16252	0,83748	42 374	6 886	195 294	524 164	12,4
75 - 79	5	24 261,2	1 708	0,0704	2,518	0,29964	0,70036	35 488	10 634	151 045	328 870	9,3
80 - 84	5	14 285,9	1 405	0,0983	2,423	0,39231	0,60769	24 854	9 751	99 142	177 825	7,2
85 +		9 461	1 816	0,1920	5,247	0,00000	1,00000	15 103	15 103	78 682	78 682	5,2

(Own calculation based on CS 2016)

Table 46: Life expectancy of FS men

x	**n**	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	25 187	907	0,0360	0,068	0,03484	0,96516	100 000	3 484	96 753	2 948 557	29,5
1 - 4	4	111 537	3 627	0,0325	1,626	0,12075	0,87925	96 516	11 654	358 396	2 851 804	29,5
5 - 9	5	133 778	5 299	0,0396	2,5	0,18021	0,81979	84 861	15 293	386 076	2 493 408	29,4
10 - 14	5	126 999	4 825	0,0380	3,143	0,17744	0,82256	69 569	12 345	324 920	2 107 333	30,3
15 - 19	5	135 271	5 469	0,0404	2,724	0,18512	0,81488	57 224	10 593	262012	1 782 413	31,1
20 - 24	5	140 995	6 051	0,0429	2,52	0,19394	0,80606	46 631	9 044	210 728	1 520 401	32,6
25 - 29	5	139 695	5 103	0,0365	2,481	0,16726	0,83274	37 588	6 287	172 101	1 309 673	34,8
30 - 34	5	114 781	3 619	0,0315	2,601	0,14656	0,85344	31 301	4 588	145 498	1 137 572	36,3
35 - 39	5	93 799	2 210	0,0236	2,701	0,11175	0,88825	26 713	2 985	126 703	992 074	37,1
40 - 44	5	78 829	1 960	0,0249	2,663	0,11749	0,88251	23 728	2 788	112 125	865 371	36,5
45 - 49	5	70 945	1 651	0,0233	2,698	0,11044	0,88956	20 940	2 313	99 377	753 246	36,0
50 - 54	5	61 678	1 352	0,0219	2,676	0,10429	0,89571	18 627	1 943	88 623	653 869	35,1
55 - 59	5	50 428	1 059	0,0210	2,645	0,10005	0,89995	16 685	1 669	79 493	565 247	33,9
60 - 64	5	38 405	1 319	0,0343	2,624	0,15877	0,84123	15 015	2 384	69 413	485 754	32,4
65 - 69	5	25 775	627	0,0243	2,619	0,11497	0,88503	12 632	1452	59 700	416 341	33,0
70 - 74	5	17 007	557	0,0328	2,593	0,15179	0,84821	11 179	1 697	51 812	356 641	31,9
75 - 79	5	8 119	316	0,0389	2,518	0,17746	0,82254	9 482	1 683	43 235	304 829	32,1
80 - 84	5	4 413	236	0,0535	2,423	0,23500	0,76500	7 800	1 833	34 274	261 594	33,5
85 +		2 324	61	0,0262	5,247	0,00000	1,00000	5 967	5 967	227 320	227 320	38,1

Table 47: Life expectancy of FS women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	26 085	797	0,0306	0,068	0,02971	0,97029	100 000	2 971	97 231	2 836 511	28,4
1 - 4	4	110 520	4 004	0,0362	1,626	0,13344	0,86656	97 029	12 947	357 380	2 739 279	28,2
5 - 9	5	135 316	4 851	0,0358	2,5	0,16450	0,83550	84 082	13 832	385 830	2 381 900	28,3
10 - 14	5	127 842	5 012	0,0392	3,143	0,18272	0,81728	70 250	12 836	327 413	1 996 070	28,4
15 - 19	5	134 975	6 108	0,0453	2,724	0,20514	0,79486	57 414	11 778	260 264	1 668 657	29,1
20 - 24	5	134 987	5 367	0,0398	2,52	0,18095	0,81905	45 636	8 258	207 701	1 408 393	30,9
25 - 29	5	137 013	4 997	0,0365	2,481	0,16701	0,83299	37 378	6 243	171 166	1 200 692	32,1
30 - 34	5	121 229	3 382	0,0279	2,601	0,13074	0,86926	31 136	4 071	145 913	1 029 526	33,1
35 - 39	5	97 529	2 752	0,0282	2,701	0,13249	0,86751	27 065	3 586	127 081	883 614	32,6
40 - 44	5	81 660	2 377	0,0291	2,663	0,13627	0,86373	23 479	3 200	109 918	756 533	32,2
45 - 49	5	75 338	2 296	0,0305	2,698	0,14239	0,85761	20 280	2 888	94 750	646 615	31,9
50 - 54	5	65 206	1 815	0,0278	2,676	0,13072	0,86928	17 392	2 273	81 676	551 864	31,7
55 - 59	5	57 452	2 083	0,0363	2,645	0,16702	0,83298	15 118	2 525	69 646	470 188	31,1
60 - 64	5	48 877	1 805	0,0369	2,624	0,16975	0,83025	12 593	2 138	57 888	400 542	31,8
65 - 69	5	38 774	1 389	0,0358	2,619	0,16504	0,83496	10 456	1 726	48 170	342 655	32,8
70 - 74	5	28 793	1 257	0,0437	2,593	0,19753	0,80247	8 730	1 724	39 500	294 485	33,7
75 - 79	5	16 143	721	0,0447	2,518	0,20103	0,79897	7 006	1 408	31 533	254 986	36,4
80 - 84	5	9 873	319	0,0323	2,423	0,14913	0,85087	5 597	835	25 835	223 453	39,9
85 +		7 137	172	0,0241	5,247	0,00000	1,00000	4 763	4 763	197 618	197 618	41,5

Table 48: Life expectancy of KwaZulu-Natal

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	243 054,4	5 647	0,0232	0,068	0,02274	0,97726	100 000	2 274	97 881	6 338 829	63,4
1 - 4	4	1 100 477,8	2 922	0,0027	1,626	0,01055	0,98945	97 726	1 031	388 455	6 240 948	63,9
5 - 9	5	1 291 699,8	965	0,0007	2,500	0,00373	0,99627	96 694	361	482 571	5 852 493	60,5
10 - 14	5	1 213 715,7	1 127	0,0009	3,143	0,00463	0,99537	96 334	446	480 841	5 369 922	55,7
15 - 19	5	1 079 257,2	2 015	0,0019	2,724	0,00930	0,99070	95 887	891	477 409	4 889 081	51,0
20 - 24	5	1 071 892,7	3 818	0,0036	2,520	0,01765	0,98235	94 996	1 677	470 822	4 411 673	46,4
25 - 29	5	1 044 783,9	6 279	0,0060	2,481	0,02960	0,97040	93 319	2 762	459 637	3 940 851	42,2
30 - 34	5	853 251,3	6 787	0,0080	2,601	0,03903	0,96097	90 557	3 534	444 305	3 481 214	38,4
35 - 39	5	665 735,9	6 597	0,0099	2,701	0,04844	0,95156	87 023	4 216	425 421	3 036 909	34,9
40 - 44	5	538 151,7	6 251	0,0116	2,663	0,05654	0,94346	82 807	4 682	403 093	2 611 487	31,5
45 - 49	5	446 144,3	6 239	0,0140	2,698	0,06774	0,93226	78 125	5 292	378 441	2 208 395	28,3
50 - 54	5	383 580,6	5 924	0,0154	2,676	0,07454	0,92546	72 833	5 429	351 545	1 829 954	25,1
55 - 59	5	327 522,4	6 193	0,0189	2,645	0,09051	0,90949	67 403	6 101	322 649	1 478 408	21,9
60 - 64	5	278 360,9	6 573	0,0236	2,624	0,11179	0,88821	61 302	6 853	290 229	1 155 759	18,9
65 - 69	5	220 261,3	6 069	0,0276	2,619	0,12929	0,87071	54 449	7 040	255 485	865 530	15,9
70 - 74	5	144 852,4	5 121	0,0354	2,593	0,16290	0,83710	47 410	7 723	218 459	610 045	12,9
75 - 79	5	84 492,5	5 221	0,0618	2,518	0,26788	0,73212	39 686	10 631	172 046	391 587	9,9
80 - 84	5	41 355,4	4 281	0,1035	2,423	0,40859	0,59141	29 055	11 872	114 683	219 541	7,6
85 +		36 650,0	6 006	0,1639	5,247	0,00000	1,00000	17 184	17 184	104 858	104 858	6,1

(Own calculation based on CS 2016)

Table 49: Life expectancy of KZN men

x	**n**	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	122 859	6 119	0,0498	0,068	0,04760	0,95240	100 000	4 760	95 564	2 458 668	24,6
1 - 4	4	557 973	26 660	0,0478	1,626	0,17165	0,82835	95 240	16 348	342 151	2 363 104	24,8
5 - 9	5	648 687	29 884	0,0461	2,5	0,20655	0,79345	78 892	16 295	353 723	2 020 953	25,6
10 - 14	5	609 752	28 126	0,0461	3,143	0,21244	0,78756	62 597	13 298	288 290	1 667 230	26,6
15 - 19	5	540 992	25 760	0,0476	2,724	0,21480	0,78520	49 299	10 590	222 393	1 378 939	28,0
20 - 24	5	528 247	24 211	0,0458	2,52	0,20577	0,79423	38 709	7 965	173 793	1 156 546	29,9
25 - 29	5	514 962	19 390	0,0377	2,481	0,17196	0,82804	30 744	5 287	140 403	982 753	32,0
30 - 34	5	406 337	14 265	0,0351	2,601	0,16190	0,83810	25 457	4 121	117 400	842 350	33,1
35 - 39	5	317 233	8 595	0,0271	2,701	0,12752	0,87248	21 336	2 721	100 424	724 951	34,0
40 - 44	5	255 802	7 253	0,0284	2,663	0,13296	0,86704	18 615	2 475	87 291	624 526	33,5
45 - 49	5	202 155	5 556	0,0275	2,698	0,12924	0,87076	16 140	2 086	75 898	537 235	33,3
50 - 54	5	167 228	3 797	0,0227	2,676	0,10784	0,89216	14 054	1 516	66 748	461 337	32,8
55 - 59	5	138 034	4 100	0,0297	2,645	0,13880	0,86120	12 538	1 740	58 594	394 589	31,5
60 - 64	5	114 545	3 714	0,0324	2,624	0,15052	0,84948	10 798	1 625	50 129	335 995	31,1
65 - 69	5	85 529	2 519	0,0295	2,619	0,13761	0,86239	9 173	1 262	42 858	285 866	31,2
70 - 74	5	51 250	1 329	0,0259	2,593	0,12204	0,87796	7 910	965	37 229	243 008	30,7
75 - 79	5	26 062	738	0,0283	2,518	0,13229	0,86771	6 945	919	32 445	205 780	29,6
80 - 84	5	10 596	368	0,0347	2,423	0,15939	0,84061	6 026	961	27 656	173 335	28,8
85 +		8 052	280	0,0348	5,247	0,00000	1,00000	5 066	5 066	145 678	145 678	28,8

Table 50: Life expectancy of KZN women

x	**n**	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	120 195	6 204	0,0516	0,068	0,04925	0,95075	100 000	4 925	95 410	2 294 751	22,9
1 - 4	4	542 505	26 373	0,0486	1,626	0,17433	0,82567	95 075	16 575	340 952	2 199 340	23,1
5 - 9	5	643 013	30 471	0,0474	2,5	0,21184	0,78816	78 500	16 630	350 928	1 858 388	23,7
10 - 14	5	603 964	27 216	0,0451	3,143	0,20791	0,79209	61 871	12 864	285 466	1 507 460	24,4
15 - 19	5	538 265	25 749	0,0478	2,724	0,21570	0,78430	49 007	10 571	220 976	1 221 994	24,9
20 - 24	5	543 645	25 087	0,0461	2,52	0,20704	0,79296	38 436	7 958	172 446	1 001 019	26,0
25 - 29	5	529 822	21 621	0,0408	2,481	0,18502	0,81498	30 478	5 639	138 187	828 573	27,2
30 - 34	5	446 915	17 106	0,0383	2,601	0,17528	0,82472	24 839	4 354	113 752	690 385	27,8
35 - 39	5	348 503	10 874	0,0312	2,701	0,14557	0,85443	20 485	2 982	95 571	576 634	28,1
40 - 44	5	282 350	8 851	0,0313	2,663	0,14604	0,85396	17 503	2 556	81 543	481 062	27,5
45 - 49	5	243 989	8 171	0,0335	2,698	0,15546	0,84454	14 947	2 324	69 387	399 519	26,7
50 - 54	5	216 352	7 387	0,0341	2,676	0,15817	0,84183	12 623	1 997	58 477	330 132	26,2
55 - 59	5	189 489	7 005	0,0370	2,645	0,17004	0,82996	10 627	1 807	48 879	271 655	25,6
60 - 64	5	163 816	5 901	0,0360	2,624	0,16591	0,83409	8 820	1 463	40 623	222 776	25,3
65 - 69	5	134 732	4 768	0,0354	2,619	0,16319	0,83681	7 357	1 201	33 925	182 153	24,8
70 - 74	5	93 602	3 065	0,0327	2,593	0,15176	0,84824	6 156	934	28 532	148 229	24,1
75 - 79	5	58 431	2 543	0,0435	2,518	0,19639	0,80361	5 222	1 026	23 564	119 697	22,9
80 - 84	5	30 759	1 065	0,0346	2,423	0,15894	0,84106	4 196	667	19 263	96 134	22,9
85 +		28 598	1 313	0,0459	5,247	0,00000	1,00000	3 529	3 529	76 871	76 871	21,8

Table 51: Life expectancy of North West

x	*n*	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	78 573,3	3 514	0,0447	0,068	0,04293	0,95707	100 000	4 293	95 999	5 963 781	59,6
1 - 4	4	328 935,9	1 045	0,0032	1,626	0,01261	0,98739	95 707	1 207	379 961	5 867 782	61,3
5 - 9	5	373 184,4	296	0,0008	2,500	0,00396	0,99604	94 500	374	471 563	5 487 821	58,1
10 - 14	5	335 658,2	401	0,0012	3,143	0,00596	0,99404	94 126	561	469 586	5 016 258	53,3
15 - 19	5	347 520,4	473	0,0014	2,724	0,00678	0,99322	93 565	635	466 378	4 546 672	48,6
20 - 24	5	348 713,8	1 208	0,0035	2,520	0,01717	0,98283	92 930	1 596	460 691	4 080 294	43,9
25 - 29	5	352 737,2	1 780	0,0050	2,481	0,02491	0,97509	91 334	2 276	450 937	3 619 603	39,6
30 - 34	5	300 579,1	2 651	0,0088	2,601	0,04318	0,95682	89 058	3 846	436 065	3 168 665	35,6
35 - 39	5	256 732,4	3 053	0,0119	2,701	0,05788	0,94212	85 212	4 932	414 724	2 732 600	32,1
40 - 44	5	220 116,6	2 833	0,0129	2,663	0,06247	0,93753	80 281	5 015	389 682	2 317 876	28,9
45 - 49	5	195 484,8	2 808	0,0144	2,698	0,06952	0,93048	75 265	5 233	364 281	1 928 194	25,6
50 - 54	5	165 036,7	3 368	0,0204	2,676	0,09742	0,90258	70 033	6 822	334 308	1 563 914	22,3
55 - 59	5	144 338,3	3 381	0,0234	2,645	0,11100	0,88900	63 210	7 016	299 528	1 229 606	19,5
60 - 64	5	111 108,5	3 303	0,0297	2,624	0,13883	0,86117	56 194	7 802	262 434	930 078	16,6
65 - 69	5	74 293,7	2 810	0,0378	2,619	0,17349	0,82651	48 392	8 396	221 972	667 645	13,8
70 - 74	5	55 497,6	2 349	0,0423	2,593	0,19206	0,80794	39 997	7 682	181 494	445 672	11,1
75 - 79	5	29 086,6	2 427	0,0834	2,518	0,34562	0,65438	32 315	11 169	133 854	264 179	8,2
80 - 84	5	17 100,1	2 024	0,1184	2,423	0,45349	0,54651	21 146	9 589	81 018	130 325	6,2
85 +		13 738,0	3 220	0,2344	5,247	0,00000	1,00000	11 557	11 557	49 307	49 307	4,3

(Own calculation based on CS 2016)

Table 52: Life expectancy of NW men

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	39 984	1 788	0,0447	0,068	0,04293	0,95707	100 000	4 293	95 999	2 272 446	22,7
1 - 4	4	164 908	7 951	0,0482	1,626	0,17305	0,82695	95 707	16 562	343 510	2 176 447	22,7
5 - 9	5	186 564	9 048	0,0485	2,5	0,21627	0,78373	79 145	17 117	352 933	1 832 938	23,2
10 - 14	5	167 772	8 112	0,0484	3,143	0,22184	0,77816	62 028	13 760	284 589	1 480 005	23,9
15 - 19	5	177 002	9 114	0,0515	2,724	0,23045	0,76955	48 268	11 123	216 024	1 195 416	24,8
20 - 24	5	181 188	8 472	0,0468	2,52	0,20950	0,79050	37 145	7 782	166 425	979 392	26,4
25 - 29	5	185 584	8 276	0,0446	2,481	0,20045	0,79955	29 363	5 886	131 989	812 967	27,7
30 - 34	5	152 110	5 590	0,0367	2,601	0,16886	0,83114	23 477	3 964	107 875	680 978	29,0
35 - 39	5	137 857	4 143	0,0301	2,701	0,14055	0,85945	19 513	2 743	91 259	573 103	29,4
40 - 44	5	118 389	3 191	0,0270	2,663	0,12678	0,87322	16 770	2 126	78 882	481 845	28,7
45 - 49	5	105 011	2 568	0,0245	2,698	0,11576	0,88424	14 644	1 695	69 318	402 963	27,5
50 - 54	5	89 123	2 378	0,0267	2,676	0,12562	0,87438	12 949	1 627	60 964	333 645	25,8
55 - 59	5	75 844	2 073	0,0273	2,645	0,12840	0,87160	11 322	1 454	53 188	272 681	24,1
60 - 64	5	54 441	2 132	0,0392	2,624	0,17914	0,82086	9 868	1 768	45 142	219 493	22,2
65 - 69	5	31 612	1 258	0,0398	2,619	0,18175	0,81825	8 101	1 472	36 998	174 351	21,5
70 - 74	5	22 466	968	0,0431	2,593	0,19519	0,80481	6 628	1 294	30 027	137 354	20,7
75 - 79	5	10 421	487	0,0467	2,518	0,20938	0,79062	5 335	1 117	23 900	107 326	20,1
80 - 84	5	5 339	269	0,0504	2,423	0,22297	0,77703	4 218	940	18 665	83 426	19,8
85 +		3 972	201	0,0506	5,247	0,00000	1,00000	3 277	3 277	64 761	64 761	19,8

Table 53: Life expectancy of NW women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	38 589	1 716	0,0445	0,068	0,04270	0,95730	100 000	4 270	96 020	2 179 274	21,8
1 - 4	4	164 028	7 301	0,0445	1,626	0,16103	0,83897	95 730	15 415	346 325	2 083 253	21,8
5 - 9	5	186 620	9 116	0,0488	2,5	0,21766	0,78234	80 315	17 481	357 872	1 736 929	21,6
10 - 14	5	167 887	8 129	0,0484	3,143	0,22213	0,77787	62 834	13 957	288 250	1 379 057	21,9
15 - 19	5	170 518	8 890	0,0521	2,724	0,23303	0,76697	48 877	11 390	218 461	1 090 807	22,3
20 - 24	5	167 525	8 585	0,0512	2,52	0,22734	0,77266	37 487	8 522	166 301	872 346	23,3
25 - 29	5	167 153	7 017	0,0420	2,481	0,18982	0,81018	28 965	5 498	130 975	706 045	24,4
30 - 34	5	148 469	5 734	0,0386	2,601	0,17673	0,82327	23 467	4 147	107 384	575 070	24,5
35 - 39	5	118 875	3 844	0,0323	2,701	0,15049	0,84951	19 319	2 907	89 913	467 686	24,2
40 - 44	5	101 728	3 610	0,0355	2,663	0,16385	0,83615	16 412	2 689	75 776	377 773	23,0
45 - 49	5	90 474	3 144	0,0348	2,698	0,16088	0,83912	13 723	2 208	63 532	301 998	22,0
50 - 54	5	75 913	3 248	0,0428	2,676	0,19458	0,80542	11 515	2 241	52 369	238 465	20,7
55 - 59	5	68 494	2 934	0,0428	2,645	0,19455	0,80545	9 275	1 804	42 123	186 097	20,1
60 - 64	5	56 667	2 498	0,0441	2,624	0,19951	0,80049	7 470	1 490	33 810	143 973	19,3
65 - 69	5	42 682	2 323	0,0544	2,619	0,24091	0,75909	5 980	1 441	26 469	110 164	18,4
70 - 74	5	33 031	1 822	0,0552	2,593	0,24348	0,75652	4 539	1 105	20 036	83 695	18,4
75 - 79	5	18 665	1 059	0,0567	2,518	0,24867	0,75133	3 434	854	15 051	63 659	18,5
80 - 84	5	11 761	678	0,0576	2,423	0,25096	0,74904	2 580	647	11 232	48 609	18,8
85 +		9 767	505	0,0517	5,247	0,00000	1,00000	1 933	1 933	37 377	37 377	19,3

Table 54: Life expectancy of Gauteng

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	247 148,4	5 511	0,0223	0,068	0,02184	0,97816	100 000	2 184	97 964	7 043 005	70,4
1 - 4	4	994 891,5	2 432	0,0024	1,626	0,00972	0,99028	97 816	951	389 005	6 945 040	71,0
5 - 9	5	1 094 378,9	597	0,0005	2,500	0,00272	0,99728	96 865	264	483 664	6 556 036	67,7
10 - 14	5	979 789,8	548	0,0006	3,143	0,00279	0,99721	96 601	270	482 503	6 072 372	62,9
15 - 19	5	912 156,8	1 511	0,0017	2,724	0,00825	0,99175	96 331	795	479 846	5 589 869	58,0
20 - 24	5	1 192 598,1	2 215	0,0019	2,520	0,00924	0,99076	95 536	883	475 490	5 110 024	53,5
25 - 29	5	1 325 151,0	4 194	0,0032	2,481	0,01570	0,98430	94 653	1 486	469 521	4 634 533	49,0
30 - 34	5	1 153 242,6	5 094	0,0044	2,601	0,02185	0,97815	93 167	2 036	460 950	4 165 012	44,7
35 - 39	5	1 244 171,0	5 945	0,0048	2,701	0,02363	0,97637	91 131	2 154	450 703	3 704 062	40,6
40 - 44	5	1 020 566,0	6 664	0,0065	2,663	0,03216	0,96784	88 977	2 861	438 200	3 253 359	36,6
45 - 49	5	843 470,2	6 351	0,0075	2,698	0,03701	0,96299	86 116	3 187	423 244	2 815 159	32,7
50 - 54	5	67 397,2	6 212	0,0092	2,676	0,04512	0,95488	82 929	3 742	405 949	2 391 915	28,8
55 - 59	5	551 165,5	7 316	0,0133	2,645	0,06436	0,93564	79 187	5 096	383 935	1 985 966	25,1
60 - 64	5	414 856,8	7 161	0,0173	2,624	0,08291	0,91709	74 091	6 143	355 860	1 602 031	21,6
65 - 69	5	319 548,0	6 859	0,0215	2,619	0,10211	0,89789	67 948	6 938	323 223	1 246 171	18,3
70 - 74	5	217 666 ,6	6 074	0,0279	2,593	0,13074	0,86926	61 010	7 977	285 852	922 949	15,1
75 - 79	5	117 527,7	5 692	0,0484	2,518	0,21617	0,78383	53 034	11 464	236 714	637 096	12,0
80 - 84	5	56 355,5	3 785	0,0672	2,423	0,28627	0,71373	41 569	11 900	177 181	400 382	9,6
85 +		41 113,0	5 465	0,1329	5,247	0,00000	1,00000	29 669	29 669	223 201	223 201	7,5

(Own calculation based on CS 2016)

Table 55: Life expectancy of GP men

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	125 640	2 923	0,0233	0,068	0,02277	0,97723	100 000	2 277	97 878	4 204 452	42,0
1 - 4	4	496 822	11 446	0,0230	1,626	0,08737	0,91263	97 723	8 539	370 621	4 106 574	42,0
5 - 9	5	554 956	14 258	0,0257	2,5	0,12071	0,87929	89 184	10 765	419 009	3 735 953	41,9
10 - 14	5	490 714	12 808	0,0261	3,143	0,12447	0,87553	78 419	9 761	373 970	3 316 944	42,3
15 - 19	5	441 812	12 128	0,0275	2,724	0,12918	0,87082	68 658	8 869	323 104	2 942 974	42,9
20 - 24	5	591 177	14 498	0,0245	2,52	0,11559	0,88441	59 789	6 911	281 805	2 619 870	43,8
25 - 29	5	679 978	13 983	0,0206	2,481	0,09776	0,90224	52 878	5 169	251 368	2 338 065	44,2
30 - 34	5	588 934	9 904	0,0168	2,601	0,08082	0,91918	47 709	3 856	229 293	2 086 697	43,7
35 - 39	5	647 694	10 165	0,0157	2,701	0,07574	0,92426	43 853	3 321	211 628	1 857 403	42,4
40 - 44	5	542 708	8 823	0,0163	2,663	0,07831	0,92169	40 531	3 174	195 239	1 645 775	40,6
45 - 49	5	444 108	7 308	0,0165	2,698	0,07927	0,92073	37 357	2 961	179 970	1 450 536	38,8
50 - 54	5	346 851	5 827	0,0168	2,676	0,08084	0,91916	34 396	2 781	165 517	1 270 566	36,9
55 - 59	5	270 753	4 821	0,0178	2,645	0,08545	0,91455	31 615	2 701	151 714	1 105 049	35,0
60 - 64	5	198 006	3 911	0,0198	2,624	0,09433	0,90567	28 914	2 728	138 089	953 335	33,0
65 - 69	5	155 763	3 259	0,0209	2,619	0,09965	0,90035	26 186	2 609	124 718	815 246	31,1
70 - 74	5	98 631	2 099	0,0213	2,593	0,10122	0,89878	23 577	2 386	112 140	690 528	29,3
75 - 79	5	45 147	1 313	0,0291	2,518	0,13562	0,86438	21 190	2 874	98 819	578 388	27,3
80 - 84	5	19 904	508	0,0255	2,423	0,11974	0,88026	18 316	2 193	85 930	479 569	26,2
85 +		13 672	560	0,0410	5,247	0,00000	1,00000	16 123	16 123	393 638	393 638	24,4

Table 56: Life expectancy of GP women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	121 509	2 697	0,0222	0,068	0,02175	0,97825	100 000	2 175	97 973	4 243 330	42,4
1 - 4	4	498 069	10 759	0,0216	1,626	0,08219	0,91781	97 825	8 040	372 214	4 145 357	42,4
5 - 9	5	539 423	13 314	0,0247	2,5	0,11624	0,88376	89 785	10 436	422 834	3 773 143	42,0
10 - 14	5	489 075	13 029	0,0266	3,143	0,12692	0,87308	79 349	10 071	378 041	3 350 309	42,2
15 - 19	5	470 345	12 650	0,0269	2,724	0,12672	0,87328	69 278	8 779	326 408	2 972 267	42,9
20 - 24	5	601 421	14 094	0,0234	2,52	0,11074	0,88926	60 499	6 699	285 880	2 645 860	43,7
25 - 29	5	645 173	13 547	0,0210	2,481	0,09971	0,90029	53 799	5 365	255 484	2 359 980	43,9
30 - 34	5	564 309	10 638	0,0189	2,601	0,09018	0,90982	48 435	4 368	231 696	2 104 496	43,5
35 - 39	5	596 477	10 537	0,0177	2,701	0,08488	0,91512	44 067	3 740	211 736	1 872 800	42,5
40 - 44	5	477 858	5 817	0,0122	2,663	0,05918	0,94082	40 327	2 387	196 056	1 661 064	41,2
45 - 49	5	399 363	7 644	0,0191	2,698	0,09166	0,90834	37 940	3 478	181 695	1 465 008	38,6
50 - 54	5	327 076	7 329	0,0224	2,676	0,10649	0,89351	34 462	3 670	163 783	1 283 313	37,2
55 - 59	5	280 413	6 342	0,0226	2,645	0,10736	0,89264	30 792	3 306	146 176	1 119 531	36,4
60 - 64	5	216 851	6 009	0,0277	2,624	0,12999	0,87001	27 486	3 573	128 942	973 354	35,4
65 - 69	5	163 785	4 141	0,0253	2,619	0,11924	0,88076	23 913	2 851	112 778	844 412	35,3
70 - 74	5	119 036	3 739	0,0314	2,593	0,14601	0,85399	21 062	3 075	97 907	731 634	34,7
75 - 79	5	72 381	1 698	0,0235	2,518	0,11084	0,88916	17 987	1 994	84 985	633 727	35,2
80 - 84	5	36 452	1 035	0,0284	2,423	0,13229	0,86771	15 993	2 116	74 513	548 742	34,3
85 +		27 441	803	0,0293	5,247	0,00000	1,00000	13 877	13 877	474 230	474 230	34,2

Table 57: Life expectancy of Mpumalanga

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	91 552,8	2 663	0,0291	0,068	0,02832	0,97168	100 000	2 832	97 361	6 363 416	63,6
1 - 4	4	400 238,4	1 113	0,0028	1,626	0,01105	0,98895	97 168	1 074	386 123	6 266 056	64,5
5 - 9	5	446 983,1	293	0,0007	2,500	0,00327	0,99673	96 094	314	479 686	5 879 933	61,2
10 - 14	5	415 968,2	296	0,0007	3,143	0,00355	0,99645	95 780	340	478 267	5 400 247	56,4
15 - 19	5	421 879,6	589	0,0014	2,724	0,00696	0,99304	95 440	664	475 686	4 921 980	51,6
20 - 24	5	434 019,7	1 307	0,0030	2,520	0,01495	0,98505	94 775	1 416	470 364	4 446 293	46,9
25 - 29	5	451 165,0	2 267	0,0050	2,481	0,02481	0,97519	93 359	2 316	460 960	3 975 929	42,6
30 - 34	5	357 593,5	2 969	0,0083	2,601	0,04070	0,95930	91 043	3 706	446 324	3 514 969	38,6
35 - 39	5	284 528,5	3 163	0,0111	2,701	0,05420	0,94580	87 337	4 733	425 803	3 068 645	35,1
40 - 44	5	234 844,9	2 820	0,0120	2,663	0,05840	0,94160	82 604	4 824	401 744	2 642 842	32,0
45 - 49	5	201 311,2	2 785	0,0138	2,698	0,06704	0,93296	77 779	5 214	376 894	2 241 098	28,8
50 - 54	5	167 972,5	2 790	0,0166	2,676	0,07996	0,92004	72 565	5 803	349 342	1 864 204	25,7
55 - 59	5	132 456,2	2 544	0,0192	2,645	0,09188	0,90812	66 763	6 134	319 369	1 514 862	22,7
60 - 64	5	107 682,6	2 483	0,0231	2,624	0,10930	0,89070	60 629	6 627	287 399	1 195 493	19,7
65 - 69	5	73 782,4	1 802	0,0244	2,619	0,11540	0,88460	54 002	6 232	255 171	908 094	16,8
70 - 74	5	52 192,2	1 892	0,0363	2,593	0,16671	0,83329	47 770	7 964	219 681	652 923	13,7
75 - 79	5	29 404,7	1 783	0,0606	2,518	0,26352	0,73648	39 806	10 490	172 996	433 242	10,9
80 - 84	5	16 000,3	876	0,0547	2,423	0,23990	0,76010	29 316	7 033	128 458	260 246	8,9
85 +		16 388,0	2 771	0,1691	5,247	0,00000	1,00000	22 283	22 283	131 788	131 788	5,9

(Own calculation based on CS 2016)

Table 58: Life expectancy of MP men

x	**n**	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	44 695	1 735	0,0388	0,068	0,03746	0,96254	100 000	3 746	96 508	2 689 327	26,9
1 - 4	4	202 430	8 400	0,0415	1,626	0,15110	0,84890	96 254	14 544	350 488	2 592 819	26,9
5 - 9	5	224 786	8 914	0,0397	2,5	0,18039	0,81961	81 710	14 740	371 700	2 242 331	27,4
10 - 14	5	208 776	8 197	0,0393	3,143	0,18297	0,81703	66 970	12 254	312 095	1 870 632	27,9
15 - 19	5	211 838	9 192	0,0434	2,724	0,19746	0,80254	54 716	10 804	248 992	1 558 537	28,5
20 - 24	5	219 656	8 678	0,0395	2,52	0,17991	0,82009	43 912	7 900	199 969	1 309 545	29,8
25 - 29	5	232 396	8 739	0,0376	2,481	0,17175	0,82825	36 012	6 185	164 480	1 109 576	30,8
30 - 34	5	178 794	4 541	0,0254	2,601	0,11970	0,88030	29 827	3 570	140 570	945 096	31,7
35 - 39	5	140 693	4 465	0,0317	2,701	0,14789	0,85211	26 257	3 883	122 357	804 526	30,6
40 - 44	5	113 811	2 695	0,0237	2,663	0,11219	0,88781	22 374	2 510	106 002	682 169	30,5
45 - 49	5	95 970	2 805	0,0292	2,698	0,13693	0,86307	19 864	2 720	93 057	576 167	29,0
50 - 54	5	81 621	2 374	0,0291	2,676	0,13622	0,86378	17 144	2 335	80 291	483 110	28,2
55 - 59	5	64 960	1 532	0,0236	2,645	0,11171	0,88829	14 808	1 654	70 146	402 819	27,2
60 - 64	5	48 950	1 289	0,0263	2,624	0,12391	0,87609	13 154	1 630	61 898	332 673	25,3
65 - 69	5	31 072	935	0,0301	2,619	0,14040	0,85960	11 524	1 618	53 768	270 775	23,5
70 - 74	5	19 942	852	0,0427	2,593	0,19370	0,80630	9 906	1 919	44 912	217 006	21,9
75 - 79	5	9 660	432	0,0447	2,518	0,20126	0,79874	7 987	1 608	35 947	172 094	21,5
80 - 84	5	4 519	177	0,0392	2,423	0,17788	0,82212	6 380	1 135	28 974	136 147	21,3
85 +		4 618	226	0,0489	5,247	0,00000	1,00000	5 245	5 245	107 173	107 173	20,4

Table 59: Life expectancy of MP women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	46 857	1 721	0,0367	0,068	0,03551	0,96449	100 000	3 551	96 690	2 590 144	25,9
1 - 4	4	197 808	8 000	0,0404	1,626	0,14760	0,85240	96 449	14 236	351 999	2 493 454	25,9
5 - 9	5	222 197	9 489	0,0427	2,5	0,19293	0,80707	82 213	15 861	371 411	2 141 455	26,0
10 - 14	5	207 192	7 841	0,0378	3,143	0,17680	0,82320	66 352	11 731	309 974	1 770 045	26,7
15 - 19	5	210 042	9 667	0,0460	2,724	0,20830	0,79170	54 621	11 378	247 209	1 460 071	26,7
20 - 24	5	214 364	9 068	0,0423	2,52	0,19143	0,80857	43 243	8 278	195 687	1 212 862	28,0
25 - 29	5	218 769	7 465	0,0341	2,481	0,15711	0,84289	34 965	5 493	160 989	1 017 175	29,1
30 - 34	5	178 800	5 506	0,0308	2,601	0,14338	0,85662	29 472	4 226	137 222	856 186	29,1
35 - 39	5	143 836	4 260	0,0296	2,701	0,13865	0,86135	25 246	3 500	118 184	718 964	28,5
40 - 44	5	121 034	3 718	0,0307	2,663	0,14331	0,85669	21 746	3 116	101 447	600 780	27,6
45 - 49	5	105 341	2 732	0,0259	2,698	0,12237	0,87763	18 630	2 280	87 901	499 332	26,8
50 - 54	5	86 352	2 461	0,0285	2,676	0,13365	0,86635	16 350	2 185	76 672	411 432	25,2
55 - 59	5	67 496	2 404	0,0356	2,645	0,16430	0,83570	14 165	2 327	65 344	334 760	23,6
60 - 64	5	58 733	2 360	0,0402	2,624	0,18340	0,81660	11 838	2 171	54 029	269 416	22,8
65 - 69	5	42 710	1 830	0,0428	2,619	0,19440	0,80560	9 667	1 879	43 858	215 387	22,3
70 - 74	5	32 250	1 443	0,0447	2,593	0,20197	0,79803	7 787	1 573	35 151	171 528	22,0
75 - 79	5	19 745	995	0,0504	2,518	0,22395	0,77605	6 215	1 392	27 618	136 377	21,9
80 - 84	5	11 482	451	0,0393	2,423	0,17834	0,82166	4 823	860	21 897	108 759	22,6
85 +		11 771	537	0,0456	5,247	0,00000	1,00000	3 963	3 963	86 862	86 862	21,9

Table 60: Life expectancy of Limpopo

x	*n*	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	134 857,5	3 905	0,0290	0,068	0,02820	0,97180	100 000	2 820	97 372	6 657 521	66,6
1 - 4	4	579 541,1	1 424	0,0025	1,626	0,00977	0,99023	97 180	950	386 467	6 560 149	67,5
5 - 9	5	642 069,4	472	0,0007	2,500	0,00367	0,99633	96 231	353	480 272	6 173 681	64,2
10 - 14	5	570 473,8	280	0,0005	3,143	0,00245	0,99755	95 878	235	478 952	5 693 410	59,4
15 - 19	5	670 804,5	581	0,0009	2,724	0,00432	0,99568	95 643	413	477 273	5 214 457	54,5
20 - 24	5	601 052,5	911	0,0015	2,520	0,00755	0,99245	95 229	719	474 364	4 737 184	49,7
25 - 29	5	540 623,0	1 925	0,0036	2,481	0,01765	0,98235	94 510	1 668	468 351	4 262 821	45,1
30 - 34	5	433 361,6	2 439	0,0056	2,601	0,02777	0,97223	92 843	2 578	458 029	3 794 470	40,9
35 - 39	5	314 544,1	2 821	0,0090	2,701	0,04394	0,95606	90 265	3 966	442 207	3 336 441	37,0
40 - 44	5	267 815,0	2 850	0,0106	2,663	0,05192	0,94808	86 299	4 480	421 024	2 894 234	33,5
45 - 49	5	237 450,8	2 802	0,0118	2,698	0,05744	0,94256	81 819	4 700	398 274	2 473 210	30,2
50 - 54	5	202 509,1	2 632	0,0130	2,676	0,06308	0,93692	77 119	4 865	374 288	2 074 937	26,9
55 - 59	5	165 328,2	3 113	0,0188	2,645	0,09015	0,90985	72 254	6 514	345 931	1 700 648	23,5
60 - 64	5	142 285,4	2 956	0,0208	2,624	0,09899	0,90101	65 741	6 508	313 241	1 354 717	20,6
65 - 69	5	99 723,1	3 035	0,0304	2,619	0,14189	0,85811	59 233	8 405	276 153	1 041 476	17,6
70 - 74	5	80 931,8	2 413	0,0298	2,593	0,13909	0,86091	50 828	7 070	237 125	765 323	15,1
75 - 79	5	50 133,4	2 604	0,0519	2,518	0,23005	0,76995	43 758	10 067	193 807	528 198	12,1
80 - 84	5	29 129,8	2 167	0,0744	2,423	0,31212	0,68788	33 692	10 516	141 360	334 391	9,9
85 +		36 456,0	4 377	0,1201	5,247	0,00000	1,00000	23 176	23 176	193 032	193 032	8,3

(Own calculation based on CS 2016)

Table 61: Life expectancy of LP men

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	68 937	2 386	0,0346	0,068	0,03353	0,96647	100 000	3 353	96 875	3 218 311	32,2
1 - 4	4	292 397	10 054	0,0344	1,626	0,12716	0,87284	96 647	12 290	357 413	3 121 436	32,3
5 - 9	5	319 676	10 665	0,0334	2,5	0,15397	0,84603	84 357	12 988	389 317	2 764 023	32,8
10 - 14	5	289 441	9 740	0,0337	3,143	0,15836	0,84164	71 369	11 302	335 858	2 374 707	33,3
15 - 19	5	343 215	11 524	0,0336	2,724	0,15596	0,84404	60 067	9 368	279 013	2 038 849	33,9
20 - 24	5	305 797	11 403	0,0373	2,52	0,17066	0,82934	50 699	8 652	232 036	1 759 835	34,7
25 - 29	5	265 105	8 371	0,0316	2,481	0,14625	0,85375	42 046	6 149	194 742	1 527 799	36,3
30 - 34	5	198 554	6 146	0,0310	2,601	0,14407	0,85593	35 897	5 172	167 079	1 333 057	37,1
35 - 39	5	135 214	3 103	0,0229	2,701	0,10899	0,89101	30 725	3 349	145 928	1 165 979	37,9
40 - 44	5	116 736	2 571	0,0220	2,663	0,10473	0,89527	27 377	2 867	130 182	1 020 051	37,3
45 - 49	5	104 765	2 240	0,0214	2,698	0,10189	0,89811	24 509	2 497	116 798	889 868	36,3
50 - 54	5	85 357	1 756	0,0206	2,676	0,09817	0,90183	22 012	2 161	105 039	773 070	35,1
55 - 59	5	69 453	1 545	0,0222	2,645	0,10569	0,89431	19 851	2 098	94 315	668 032	33,7
60 - 64	5	59 639	1 700	0,0285	2,624	0,13348	0,86652	17 753	2 370	83 135	573 716	32,3
65 - 69	5	34 519	855	0,0248	2,619	0,11695	0,88305	15 383	1 799	72 633	490 581	31,9
70 - 74	5	24 092	722	0,0300	2,593	0,13976	0,86024	13 584	1 899	63 352	417 948	30,8
75 - 79	5	13 519	411	0,0304	2,518	0,14134	0,85866	11 686	1 652	54 329	354 596	30,3
80 - 84	5	5 991	201	0,0336	2,423	0,15440	0,84560	10 034	1 549	46 178	300 267	29,9
85 +		6 139	205	0,0334	5,247	0,00000	1,00000	8 485	8 485	254 089	254 089	29,9

Table 62: Life expectancy of LP women

x	n	$_nN_x$	$_nD_x$	$_nM_x$	$_na_x$	$_nq_x$	$_nP_x$	l_x	$_nd_x$	$_nL_x$	T_x	e_x
0	1	65 920	2 167	0,0329	0,068	0,03190	0,96810	100 000	3 190	97 027	3 084 388	30,8
1 - 4	4	287 144	10 256	0,0357	1,626	0,13170	0,86830	96 810	12 750	356 973	2 987 361	30,9
5 - 9	5	322 393	11 412	0,0354	2,5	0,16260	0,83740	84 060	13 668	386 131	2 630 388	31,3
10 - 14	5	281 033	9 679	0,0344	3,143	0,16185	0,83815	70 392	11 393	330 804	2 244 257	31,9
15 - 19	5	327 589	11 443	0,0349	2,724	0,16179	0,83821	58 999	9 546	273 269	1 913 454	32,4
20 - 24	5	295 256	10 493	0,0355	2,52	0,16330	0,83670	49 453	8 076	227 239	1 640 184	33,2
25 - 29	5	275 518	9 889	0,0359	2,481	0,16458	0,83542	41 378	6 810	189 734	1 412 945	34,1
30 - 34	5	234 807	6 806	0,0290	2,601	0,13551	0,86449	34 568	4 684	161 601	1 223 211	35,4
35 - 39	5	179 330	4 619	0,0258	2,701	0,12159	0,87841	29 884	3 633	141 065	1 061 610	35,5
40 - 44	5	151 079	3 376	0,0223	2,663	0,10618	0,89382	26 250	2 787	124 737	920 546	35,1
45 - 49	5	132 686	3 037	0,0229	2,698	0,10871	0,89129	23 463	2 551	111 442	795 809	33,9
50 - 54	5	117 152	2 942	0,0251	2,676	0,11864	0,88136	20 912	2 481	98 794	684 367	32,7
55 - 59	5	95 875	3 076	0,0321	2,645	0,14915	0,85085	18 431	2 749	85 681	585 572	31,8
60 - 64	5	82 646	2 597	0,0314	2,624	0,14620	0,85380	15 682	2 293	72 963	499 891	31,9
65 - 69	5	65 204	2 352	0,0361	2,619	0,16609	0,83391	13 389	2 224	61 652	426 928	31,9
70 - 74	5	56 840	1 891	0,0333	2,593	0,15401	0,84599	11 166	1 720	51 688	365 276	32,7
75 - 79	5	36 614	1 171	0,0320	2,518	0,14815	0,85185	9 446	1 399	43 756	313 588	33,2
80 - 84	5	23 139	767	0,0331	2,423	0,15269	0,84731	8 046	1 229	37 066	269 832	33,5
85 +		30 317	888	0,0293	5,247	0,00000	1,00000	6 818	6 818	232 766	232 766	34,1