Determinants of under-Five Mortality in Lesotho

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Preface and acknowledgements

This study began in 2017 when I first registered for my Master's degree. The intention was to complete by end of academic year 2019. I could not complete as anticipated due to dropping out because of financial constraints and other personal factors. Despite the struggles, I managed to reach the conclusion and finally submit.

I would like to thank my supervisor, Prof M. E Palamuleni who has been with me since the beginning of this study.

I also want to acknowledge the contribution of Dr Natal Ayiga and Dr Karabo Mhele. When I first registered for this program, I was working with Dr Natal and then later worked with Dr Mhele. After I re-registered, I was co-supervised by Dr Mhele and Prof Palamuleni.

Furthermore, I want to thank my fellow students, friends and family for the emotional support.

Lastly, I would like to thank the North-West University, Mafikeng campus, particularly the Faculty of Humanities for awarding me a bursary which assisted me to register.

Abstract

Although the social and economic conditions in Lesotho have improved, under-five mortality has remained one of the major problems in the country. Documentation of the factors influencing under-five mortality is an important problem that needs to be addressed. This study aimed to estimate the effect of social, economic, demographic health and environmental factors on under-five mortality in Lesotho.

Data source

The study used data extracted from the 2004, 2009 and 2014, Lesotho Demographic and Health Survey to investigate the levels and trends in under-five mortality whereas the 2014 Lesotho Demographic and Health Survey was used to explore the factors influencing under-five mortality in the country. The outcome variable was the child's survival status i.e. the child being either alive or dead. The explanatory variables were the socio-economic and demographic factors for mother and child, respectively. Variables were selected through conceptualised Mosley and Chen model and relevant literature.

Results

Linear regression analysis suggests that Lesotho will fail to achieve goal 3 of the sustainable development goals, should rates of under-5 mortality continue to decline in slower rates as observed in previous years.

The chi-square test shows that higher under-5 mortalities were recorded from children residing in rural areas, who were never breastfed, born to uneducated mothers, delivered at home, born to mothers who never attended ante-natal care classes or went for check-up after delivery, residing in a household that access water from a borehole and whose main source of cooking fuel is gas or smoke emitting fuel.

The association of under-five mortality and selected variables was further investigated through four binary logistic regression models. First three models were performed to test association between under-five mortality and socio-economic, bio-demographic and environmental factors respectively. In the last model all variables which presented a strong relationship and higher significance level were included. Among all the variables

that were tested, parity and breast-feeding status were significant at 1% while Ante Natal Care visit, check-up after delivery, maternal age, maternal education, type of cooking fuel and source of drinking water were significant at 10%.

Conclusion

The study therefore concluded that significant socio-economic and demographic factors in Lesotho are maternal education and type of residences while bio-demographic and health factors are breast feeding status, parity, maternal age, ante-natal visit and checks after delivery and environmental factors include type of cooking fuel and toilet facility. Insignificant factors include the child's sex, birth order, source of drinking water and wealth index.

Key words: Under-five mortality, childcare, maternal age, maternal education, Ante-natal care, parity and breast feeding.

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ANC	Antenatal Care
AIDS	Acquired Immunodeficiency Syndrome
DHS	Demographic and Health Survey
GDP	Gross Domestic Products
HIV	Human Immune Virus
HDI	Human Development Index
IRB	Institutional Review Board
LDHS	Lesotho Demographic and Health Survey
MDG's	Millennium Development Goals
SDG's	Sustainable Development Goals
UN	Unites Nations
UN-DESA	United Nations Department of economic and social Affairs
UNICEF	United Nations International Children's Emergency Fund
UN-GA	United Nations General Assembly
UN-IGME	The United Nations Inter-Agency Group for Child Mortality Estimation
WHO	World Health Organisation

Chapter 1

Introduction

1.1 Background of the study

Reducing under-five mortality has been a public health target for different countries and has been prioritised by public health policies worldwide (Sanyang, 2019). Child mortality is an indicator of mortality and to some extent, it can be used as an indicator of development, health and socio-economic status of a population (Oduse 2021). Recognition of child mortality as a priority can be viewed from its inclusion in the Millennium Development Goal 4 (MDG: 4) which aimed to reduce child mortality by two thirds by 2015, and also the Sustainable Development goal number 3 which continues from the MDGs. Goal number 3 of the Sustainable Development aims to ensure and promote healthy life and wellbeing for all at all ages. With specific to under-5 mortality, target 3.2 is to reduce deaths of children under the age of five to at least 25 per 1000 births by 2030.

The year 2015 marked the end of the millennium development goals (MDGs) era, goals were targeted to be achieved within a period of 15 years (2000-2015). Evidence from various publications shows an impressive decline; however, there is a short fall in achieving goal 4. Most Sub-Saharan countries in particular have failed to achieve this goal. Lesotho is one of the countries that missed to achieve this goal. The 2016 United Nations general assembly (UNGA) and You, Hug, Ejdemyr, Idele, Hogan, Mathers, Gerland, New, & Alkema (2015) showed that the global reduction of under 5 mortality was 53%. Comparing what have been achieved and the target suggest that MDG: 4 was indeed missed. UN general assembly further highlighted that although the remarkable improvement, 16 000 children under the age of five die every day (UN General Assembly, 2016).

UN-IGME, The United Nations Inter-Agency Group for Child Mortality Estimation report identified a global decline in child mortality since the year 2000. Almost all countries have experienced a decline irrespective of their initial rate and demographic and socio-economic characteristics, however, the decline differs from region to region. The rate

of decline is lower in least developed countries, particularly sub-Saharan region (You et. al, 2015). World Health Organisation (WHO) in analysis of various research and other publications, added that children in sub-Saharan countries are 14 times more likely to die before age five compared to children in developed countries, and more than half of the main cause of death are preventable (Liu, Oza, Hogan, Perin, Rudan, Lawn, Cousens, Mathers, & Black, 2015). Global trends show that between 1990 and 2000 the rate of child mortality decline was 1,8 percent per year and increased to 3,2 percent between 2000 and 2011 signifying an improvement in life expectancy of children under 5. Conversely the sub-Saharan region remains critically high where 1 in 9 children dies before age 5 (Liu et. al, 2015).

UN-IGEM (2012) & United Nation Children's Fund, UNICEF (2012) cited by Liu et. al (2015) identified the main causes of child death such as pneumonia, diarrhoea and malaria. Almost half of all child deaths are caused by malnutrition, making children more vulnerable to severe diseases. Furthermore, death of children who die within 28 days are the most due to of preterm birth, intrapartum related complications (birth asphyxia or lack of breathing at birth), and infections such as tuberculosis and HIV/AIDS.

According to Lie et al (2015) Lesotho among the countries in Sub-Saharan African region is identified as one of the countries with highest infant and child mortality rates worldwide. Infant mortality rate in Lesotho increased from 79 deaths per 1000 live birth in 2000 to 94 death per 1000 in 2011 (Liu et al, 2015). Deaths of children under-5 in Lesotho increased from 85 per 1000 birth in 1990 to 100 in 2012 UNICEF (2015). These findings raised a question as to whether the goal to reduce child mortality by two thirds will be achieved. This question was answered at the end of millennium development goal era in 2015. Lesotho failed to reach goal 4 of the MDGs which was to reduce child mortality by two third.

Under-five mortality results from various factors. Black, Morris & Bryce (2003) argued that factors influencing child mortality differ by demographic and the socio-economic status of a society. It also is reported by UNICEF (2012) that children from poor families, rural areas and those born to a mother with no basic education have high

chances of dying before reaching age 5. This paper therefore notes investigating factors associated with child mortality in Lesotho as a paramount important activity. This study will therefore adopt Mosley and Chen (1984) model to study covariates of infant and child mortality in Lesotho. This is a useful framework to view the effects of different determinants on infant and child mortality. The model identifies proximate determinants (biological and social factors) through which indirect (other social, environmental, and cultural factors) work to influence child mortality and survival.

1.2 Problem statement

In the year 2000 United Nations developed the millennium development goals which aimed to halve poverty, halting the spread of HIV/AIDS and providing universal primary education by 2015. Among others, one of the goals was to reduce child mortality by two third (goal 4). At the end of MDGs time frame, Lesotho and most Sub-Saharan African countries failed to achieve this goal. Recent statistics have reported that Lesotho remain among countries with highest infant and child mortality, irrespective of the interventions by government and other organisations. Victora, Requejo, Barros, Berman, Bhutta, Boerma, Chopra, De Francisco, Daelmans, Hazel & Lawn (2016) reported that Lesotho rank number 16 in the whole world in terms of highest under-five mortality. Surprisingly, according to a UNICEF (2012) report, Infant mortality rate in Lesotho increased from 79 deaths per 1000 live birth in 2000 to 94 death per 1000 in 2011. Victora et. al citing UNICEF (2015) highlighted that deaths of children under 5 in Lesotho increased from 85 per 1000 birth in 1990 to 100 in 2012.

The rise in child mortality in Lesotho can be attributed to poor demographic, socio-economic and environmental condition of the country since they are associated with mortality as according to Black, Morris and Bryce 2003). Infant and child mortality are associated with the well-being of the population.

Looking into the health situation in Lesotho, the country falls in a list of countries hardest hit by HIV/AIDS hence the quality of health is low. Life expectancy was estimated at 52 years for both men and women in 2018. The HIV prevalence rate was recorded at 23% which saw Lesotho to be the second highest in the world after Swaziland. TB on the other hand remains to be a greater challenge. The country

records the highest statistics in the whole world. Other social issues faced by Lesotho include child labour, disability, and sexual violence among others as according to Kamaleri & Eide (2011). The above mentioned social issues in one way or the other may have an impact on child mortality and under-five mortality in particular. It is therefore key to highlight these issues and study further their association to under-five mortality.

1.3 Rationale of the study

Identifying determinants of infant and child mortality is essential for formulating appropriate health programmes and policies. As cited in Lemani (2013), Mustafa & Odimegwu (2008) assert that significant pace of decline in infant and child mortality can only be achieved if the strategies and policies against mortality are directed towards those factors associated with high mortality rates.

Finding from this study will therefore help the government of Lesotho, health organisations, policy makers and other decision makers in terms of formulating policies and programs that will ensure that.

The study will also add to the growing body of literature on child mortality in Lesotho. In addition, findings from this study will reflect information that will be useful for demographic assessment and evaluation of health policies and programmes that aimed to reduce child mortality. In particular child mortality defines the wellbeing of the population, the results therefore will provide detailed information on the health status together with the effectiveness of health systems in Lesotho.

According to the UN Human Development report of 2005, there is no other source that captures and describes best the variations in human development than infant and child mortality research. It is therefore expected that findings from this study will not only assist Lesotho policy makers but also to academicians and others whose research interest are linked to studies of child health and survival in Lesotho.

1.4 Objective of the study

1.4.1 Main Objective

The main objective of this study is to identify determinants of Under-5 mortality in Lesotho.

1.4.2 Specific Objectives

The specific objectives are:

- To establish trends and levels of under-5 mortality in Lesotho.
- To examine the distribution of under-5 mortality by selected covariates of under-5 mortality in Lesotho.
- To investigate bio-demographic and health factors, socio-economic and demographic and environmental factors associated with under-5 in Lesotho.

1.5 Research outline

This study is organized into five chapters. Chapter one is the introduction and it describes the background, problem statement, objectives and significance of the study. Chapter two presents the literature review which describe theoretical framework, trends and levels of child mortality from a global and regional perspective and Lesotho respectively. Chapter three presents the methods of the study focusing on source of data and methods of data analysis. Chapter four presents the results of the study at the univariate, bivariate and multivariate levels and chapter five presents the summary of main findings, conclusion and recommendations from the study.

Chapter 2

Literature review

2.1 Introduction

This chapter presents review of literature related to under-five mortality. The study also finds it key to study the socio-economic background of Lesotho for a clear understanding of development situation because early child mortality is an indicator of development. The review of literature focused on the levels and trends in under-five mortality and present the demographic and socio-economic factors that have been found to be associated with under-five mortality.

2.2 Socio-economic background of Lesotho

Lesotho falls under the category of poor and developing countries and is found among countries with low human development. According to the UNDP report of 2020 which was reflecting on human development in Lesotho, the country's HDI value was 0.527 and it was ranking no 165 out of 189 countries in the world. Despite being a poor country, Lesotho is ranked high in terms of literacy. About 85% of woman and 68% of women can read and write. About 12% of Lesotho's GDP is directed to education (UNDP, 2021).

Looking into the health situation in Lesotho, the country falls in a list of countries hardest hit by HIV/AIDS hence the quality of health is low. Life expectancy was estimated at 52 years for both men and women in 2018. The HIV prevalence rate was recorded at 23% which saw Lesotho to be the second highest in the world after Swaziland. TB on the other hand remains to be a greater challenge. The country records the highest statistics in the whole world. Other social issues faced by Lesotho include child labour, disability, and sexual violence among others as according to Kamaleri & Eide (2011).

2.3 Levels and Trends of under-five mortality

It is however key to have a global and a general view of the child and infant mortality movements. The study's section will review trends from the year 2000 since the launch of the millennium development goals. Section 2.3.1 reviews trends from a global and regional perspective while section 2.3.2 focus on Lesotho as an area of study.

2.3.1 Global and regional trends and levels of child and infant mortality

Liu et. al (2015) reflect a notable improvement in child survival from a global perspective. Promoting child survival has shown fruitful results by far. According to the recent report, under-5 mortality has seen a remarkable declined from 78 to 47 deaths per 1000 between the year 2000 and 2016. About 50million lives of children under-five years were saved. This constitutes of majority from least developed countries which include sub-Saharan countries in particular. The report further added that despite the decline, under 5 mortality remains to be high. In 2016 alone 5.6 million children died and mostly from preventable causes. These deaths are not evenly distributed; new-born mortality contributed largely since improvement in neonatal mortality has been slow. In addition, more deaths occur in poorer regions which include countries in the least developed regions and sub-Saharan countries in particular (Liu et. Al, 2015). According to Liu et. al (2015) compliment trends identified by the UNICEF, WHO, World Bank, UN-DESA Population Division reports in 2017 were based on 2016 data. The reports noted that the world has made substantial progress in reducing child mortality in the past several decades. The total number of under-five deaths dropped to 5.6 million in 2016 from 12.6 million in 1990 – 15 000 every day compared with 35 000 in 1990. Globally, 2.6 million new-borns died in 2016 – or 7000 every day. Neonatal deaths accounted for 46% of all under-five deaths, increasing from 41% in 2000.

The decline in child and infant mortality is not universal, disparities across regions and countries exist. There is a remarkable average decline in child and infant mortality in most developed countries than least developed regions. Statistics show that southern Asia account for 39% of total deaths followed by sub-Saharan region with 38%. This

suggests that least developed countries still lack behind although the decline is evident.

The Sub-Saharan African region in particular, approximately 1 child in 13 dies before age 5, while in most developed countries the ratio is 1 in 189. Among new-borns in the same region, about 1 child in 36 dies in the first month, while in the world's high-income countries the ratio is 1 in 333.

Should the current trends remain the same or worsen, the dream of achieving goal 3 of the sustainable development goals will not be realised.

As noted above, mortality trends vary by region and country, the following subsection will discuss child mortality trends of countries in sub-Saharan countries, however much attention will be directed to Lesotho since is the area of study in hand.

2.3.2 Trends and level of child and infant mortality in Lesotho

Lesotho among countries in Sub-Saharan African region is identified as one of the countries with highest infant and child mortality rates worldwide. With reference to UNICEF 2015 report, Lie et al (2014) state that infant mortality rate increased from 79 deaths per 1000 live birth in 2000 to 94 death per 1000 in 2011 (Lesotho Demographic and health Survey, 2014). Deaths of children under-5 in Lesotho increased from 85 per 1000 birth in 1990 to 100 in 2012 UNICEF (2015). These findings raised a question as to whether the goal to reduce child mortality by two third will be achieved. The question was answered at the end of millennium development goal era in 2015. Lesotho failed to goal 4 of the MDGs which was to reduce child mortality by two thirds.

Figure 2.1 below presents under-5 mortality trends from 2000 to 2017. In general, a significant decline was witnessed from 2004, where under-5 mortality was at its highest point. The graph shows a rise which began from 2000 to 2004 and therefore declined to the lowest point in 2017.

Figure 2. 1 Under-five mortality in Lesotho Source: UN IGME (2012)

2.4 Theoretical framework

The survival of a child is a global public health issue; it defines the quality life. Research has shown child death occur from highly preventable causes. Although child death occurs globally, the most affected countries are in the third world. It is argued that child mortality is escalated by inadequate and uneven distribution of resource and unmet needs of mothers and their children that affect such countries. Frey and Field (2000) demonstrate that causes of child death are complex and have a great variation among less developed nations. These variations of child mortality are detailed in the modernization theory by Fred and Field (2000).

The modernisation theory states that industrialization reduces infant mortality. Modernization is characterised with an improved quality of life and increased economic output which will bring up improvements in all dimensions of development i.e. improved education, housing, nutrition, health care and various health services which will escalate child survival (Frey & Field, 2000). A better economy is stimulated a well monitored distribution of health resources and therefore improve the health of both the child and the mother. Moreover, the current study adopted by Mosley & Chen's (1984) model which argues a similar observation. Mosley & Chen's (1984) model will

therefore be used with a consideration of redefined models such as Frey & Field (2000) which were developed from the model.

In the following sub-section Mosley and Chen's (1984) model on infant and child mortality in developing countries will be discussed and employed in selection of variables for analysis.

2.4.1 Mosley and Chen's (1984) model

The Mosley and Chen model was developed in 1984 to explain the mechanism through which various determinants influence child morbidity and mortality. For this study, the model will be used as a guide to develop and inform variables in the analysis. The framework categorises co-variates of infant and child mortality into two groups namely proximate determinants/ direct determinates and indirect determinants. Direct determinants include: biological and behavioural causes of death such as: sex, maternal age, parity, birth spacing, birth weight and breast-feeding status while indirect determinants include: socio-economic factors, environmental factors and some cultural factors. The model further describes how some indirect determinants can operate through proximate determinants to influence mortality. Figure 2.2 below describe a flow chat of how socio-economic factors operate through proximate determinants to lead to death.

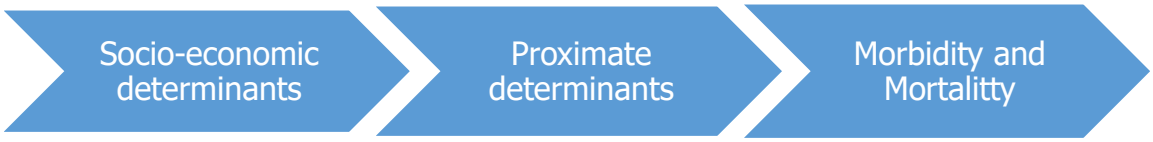

Figure 2. 2 Summarised Mosley and Chen model (Source: Mosley & Chen (1984))

Socio-economic determinants are "distant" to mortality as elaborated in the flow chat but can contribute to influencing mortality through proximate determinants.

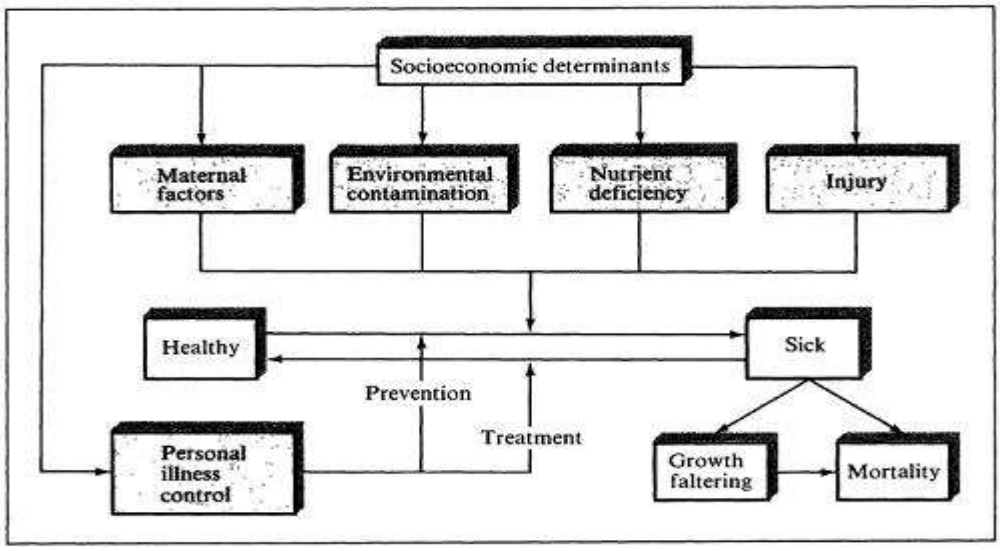

Figure 2. 3 Mosley and Chen framework, 1984 (determinants of under-five mortality in developing countries) (Source: Mosley and Chen (1984))

Observed from figure 2.3 above, Mosley & Chen (1984) proximate determinants of child mortality are: Maternal factors, Environmental factors, feeding practices and Injuries. Socio-economic determinants that do not directly cause but may lead to child morbidity and mortality include: individual factors, household factors and cultural factors.

In addition, Mosley & Chen (1984) emphasise that, co-variates of child mortality in least developed countries differs from those in most developed countries. Children from least developed countries die from mostly communicable and poverty illnesses.

2.4.2 Conceptualized Mosley and Chen model

The study will adopt and modify the Mosley and Chen model based on factors found in the literature and on the availability of data from the most recent Lesotho demographic and health survey.

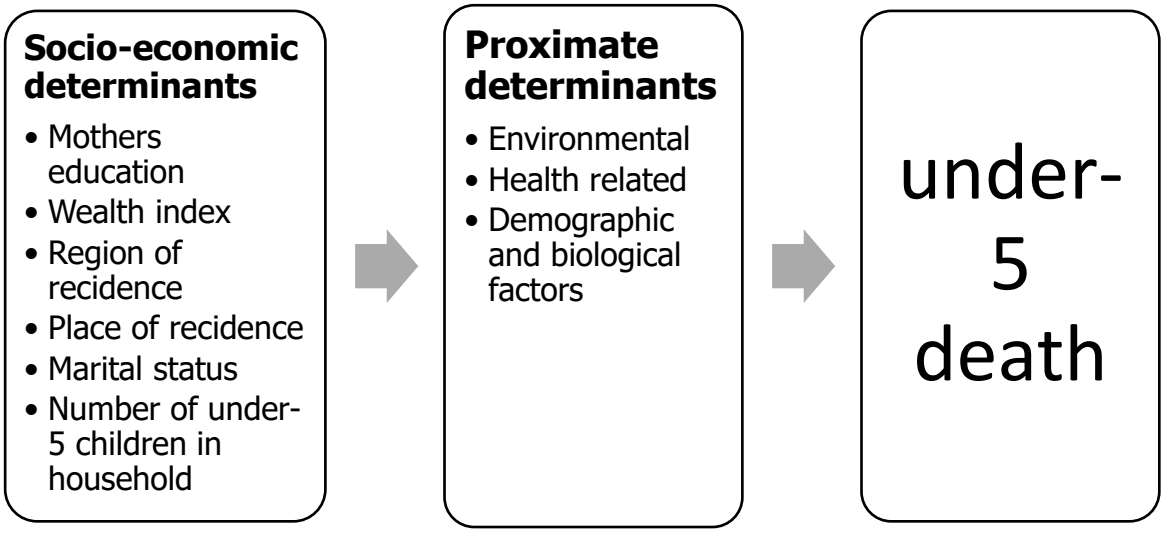

Figure 2. 4 Conceptualised Mosley and Chen model

2.5 Factors associated with under-5 mortality

Recent studies in their various nature have identified some of the factors associated with child mortality. This section presents some of the factors that were identified from recent studies conceptualised from the Mosley and Chen model.

2.5.1 Socio-demographic factors

Research has shown that a mother's education plays a critical role in child development, child survival and individual reproductive and health behaviour among others. A study in Northern Ghana found that maternal education is a significant predictor of under-five mortality (Edmund et al,2014). Kibet (2013) in a paper related to the study in hand found that literacy and mother's educational attainment among others are important determinants of child survival. A literate and educated mother up to at least primary education has more capacity to sustain the survival of the child since they are more likely to marry and engage in child bearing at a later age. Furthermore, children who are more likely to die before age five are born to mothers with little or no education (Kibet, 2013). A similar finding was reflected by Aheto (2019) that maternal education reduces the odds of under-5 mortality. Rademeyer

(2019) in a study looking into levels and determinants of under-five mortality in south Africa also revealed that maternal education is an important determinant of under-five infant and under-five mortality. It was observed from the results that under-five children born to mothers who have obtained secondary or higher, were most luckily to survive to age five.

Another study in Ghana found that wealth index is associated with child mortality. A child born from a poor family has more risk of dying than one that comes from a richer family (Lartey, Khanam & Takahashi, 2016). Another study found similar results, children from poorer household have higher survival difficulties. Lower socio-economic status was associated with a high risk of dying before age five (Rademeyer, 2019).

Amouzou and Hill (2004) looking into under-5 mortality and place of residence found that children born to mothers who reside in non-urban areas have higher risk of not surviving to age 5 than those born to mothers residing in urban areas. Another study by Machado and Hill (2005) found that children born in rural areas are 2.5 more likely to die before age one than those residing in urban areas. The results therefore suggest that place of residence can be associated with under-5 mortality. Of recent (Forde & Tripathi, 2018) however found that an increase in number of under-five children residing in rural areas will result in a slight increase in under-five mortality although the association was insignificant.

Household demography defines marriage as an important component in the definition of a family. Although there are children who are born and raised outside marriage, it plays role in child care. From various research it is argued that married men live longer than males who have never been married (Lillard & Panis, 1996). It may be expected that child mortality may be high among children born to unmarried parents than those that were ever married or with an understanding that single parenting is more prevalent among unmarried woman therefore access to child care is compromised particularly in poor countries and therefore child mortality result. This may not necessarily reflect reality based on Clark & Hamplova (2013) who found that the relationship between marital status of a mother and child mortality differ from one country to another. It was found that children of never married mothers experienced significantly higher mortality in Malawi, Tanzania, and Zimbabwe and children of

formerly married mothers are significantly more likely to die in Ethiopia, Kenya, Malawi, and Tanzania.

2.5.2 Bio-demographic and health related factors

Age at first birth is an important determinant mortality among children and mothers (Mirrowsky, 2005). Due to biological incapability of caring for a child to full term, mortality may result for both the mother as a results of pregnancy complication and the child as a result of disturbed foetus development. Medical research advices that fertility be postponed to until at least after completion of puberty stage. It suggests that better health and survival come from delaying motherhood as long as possible. Similarly, recommendations were made by Finlay, Özaltin & Canning (2011) where they found that first-born children of adolescent mothers are the more likely to die before age-5 and most vulnerable to poor child health outcomes. Furthermore, first time mothers up to the age of 27 have a higher risk of having a child who has stunted growth, diarrhoea and moderate or severe anaemia.

Breast milk is a globally recommended feeding practice that is key for the health and development of a child. Biological substances found in breast milk have a major impact on the immune system of a child, hence it is recommended by WHO and UNICEF that mothers should breastfeed their infants for at least six months. In relation to mortality, children who are never breastfed are more likely to die during infancy or before age 5. In a study Maiwashe (2014) found a significant association between child and infant mortality.

Visiting a health facility during and after pregnancy is an important factor for both maternal and child health. Attending antenatal care and going for check-up after delivery can reduce risks of contracting preventable death causing infections for both the mother and the child (Arund, Emmelin & Asamoah, 2017).

Child mortality by sex has shown that sons are more likely to die than daughters although the relationship may not necessarily be significant. This is explained by the biological differences that exist between boys and girls. According to Maiwashe (2014) citing Bhuiya and Streatfeid (1991), differences in child death by sex is brought about child sex preferences.

A study conducted in Tanzania looking into the impact of place of delivery on neonatal mortality proved that children delivered outside authorised heath facilities have more risks of dying than those delivered in authorised health facilities. Ajaari, Masanja, Weiner, Abokyi & and Owusu-Agyei (2012) found that place of delivery is a significant predictor of neonatal mortality. Mothers who delivered outside a health facility experienced 1.85 times higher odds of experiencing neonatal deaths than those who delivered in a health facility.

The study of under-5 mortality and birth order and parity have received serious attention over time. It dates back to Mosley and Chen theory which was developed in 1984. The model states that birth order and parity are highly associated to infant and child mortality. Kibet (2013) argues that first born are more likely to die before age 5 due to age of mother at birth, birth complications and mother's inexperience of looking after an under-5 children. Sonneveldt et. al (2013) also found that a number of times a woman has given birth is associated with maternal and child mortality. A logistic regression analysis of Rademeyer (2019) conversely presented hat higher parity is associated with higher child mortality.

According to Rutstein (2005) birth spacing is associated with child mortality and infant mortality, the risk of dying decreases with increasing birth interval lengths up to 36 months. In another study Winikoff (1983) found a similar relationship and further added that the evidence on child mortality suggests very short intervals (conceptions less than six months after a birth) are detrimental to the survival of the second child, but these results must be viewed in light of the methodological difficulties of studies of this subject. In another study, Aheto (2019) suggests that multiple births and increasing number of times a woman has given birth is highly associated with under-5 mortalities. Children of age under-5 were more likely to die if they were born to mothers who gave birth multiple times or had at least more than one birth in the last five years.

2.5.3 Environmental factors

Rutstein (2000) identified environmental health as one factor associated with infant and child mortality in developing countries. A decline in mortality and specifically child

mortality declined during 1990-2000 following various intervention to combat environmental contamination as according to WHO (2000) cited by (Rutstein, 2000). Rutstein (2000) further added that keeping a child away from contaminated environment guarantees a healthy childhood life. Availability of clean water, proper working garbage collection and sewage services can heighten the chance of surviving infancy and childhood. In brief they described the environmental factors related to child death were source of drinking water, type of toilet facility and flooring.

Naz, Page, & Agho (2017) in a study looking at household air pollution from cooking fuel and under-5 mortality found that the use of smoke emitting fuel is the main cause of respiratory illness which leads to mortality. The use of smoke emitting fuel as source of cooking and under-5 mortality was significant at 95%. A similar finding was observed by Owili, Wuga, Pan & Kuo (2017) where they found that using solid fuel in a household is associated with higher chances of under-5 mortality.

2.6 Literature matrix

The literature matrix below, presents a list of studies with the same title as the current study. These studies were conducted in various countries. These studies were reviewed to find out various methods and data sources that have been used on the same topic. The logistic regression method was observed to be the most common method for this kind of topic. In this study, we therefore decided to use the logistic regression method for the current study in.

Title	Author(s)	Year published	Method of analysis	Data source	Main findings
Socio-economic and demographic determinants of under-five mortality in rural northern Ghana	Edmund Wedam Kanmiki, Ayaga A Bawah, Isaiah Agorinya, Fabian S Achana, John Koku Awoonor-williams, Abraham R	2014	Logistic regression	Ghana essential health intervention project data (2011)	Maternal education, presence of co-wife, age and marital status were found to be significant predictors of under-five mortality.

	Oduro, James F Phillips and James Akazili				
The determinants of under-five mortality in Malawi: evidence based on demographic and Health survey 2010	Maiwashe Khathutshelo Valencia	Unpublished (masters dissertation submitted at NWU in 2014)	The Kaplan-Meier survival analysis and multivariate hazard analysis	Malawi demographic and health survey (2010)	The results showed that birth order, mother's education, place of residence. region and exclusive breastfeeding were significantly associated with under-five mortality
Levels and determinants of under-five mortality in South Africa	Shanaaz Redemeyer	2019	Indirect method methods of estimation (Brass method)	Community survey (2016)	The study revealed a significant deference in provincial infant and under-five mortality rates. It was also found that under-five mortality is higher among those with lower socio-economic status and lower educational attainment. the study also found that under-five, mortality differ by province and race.
Predictive model and	Justice Moses K. Aheto	2019	Ghana DHS 2014	Logistic regression	Contraception use, Parity

determinants of under-five child mortality: evidence from the 2014 Ghana demographic and health 2survey					and number of children ever born were significant factors associated with under-five mortality.
Modelling covariates of infant and child mortality in Malawi	Lemani Clara	Unpublished (masters dissertation submitted in 2013)	Logistic regression and survival analysis	Malawi DHS 2004 and 2010	HIV status, birth interval, birth interval, maternal age, maternal education and wealth index.
Socioeconomic Determinants of Infant Mortality in Kenya: Analysis of Kenya DHS 2003.	Hisham Elmahdi Mustafa and Clifford Odimegwu	2008	Logistic regression model	Khenya DHS (2003)	Findings indicated that adequate use of antenatal care services reduced risk of neonatal and under-five mortality. Similarly, use of skilled delivery care services was associated with reduced risk of neonatal and under-five mortality.
Determinants of under-five mortality in South Africa: A logistic regression.	Yanelisa Bija	Unpublished (masters dissertation submitted at WITS in 2019)	Logistic regression model	SA vital registration survey (200-2015) and SA DHS (1998)	The study showed that mothers age at birth and maternal education were significant predictors of under-five mortality.

Determinants of Under-Five Mortality in High Mortality Regions of Ethiopia: An Analysis of the 2011 Ethiopia Demographic and Health Survey Data	Solomon Gebretsadik and Emmanuel Gabreyohannes	2016	Cox proportional regression model.	Ethiopia DHS (2011)	The model revealed that under-five mortality significantly associated with preceding birth interval, family size, birth type, breastfeeding status, source of drinking water, and income of mother.
Determinants of under-five mortality in south africa: A logistic regression	Yanelisa Biya	2019	Logistic regression	1998 SADHS	Mothers occupation, birth interval, region, age at first birth and mothers highest education

2.7 Summary

In this chapter we reviewed literature from various studies. We continued with the selection of methods and variables that will be used and applied in the study to fulfil the objective of the study. The following chapter will explain how selected variables and methods will be employed.

Chapter 3

Methodology

3.1 Introduction

This is the third chapter of the study. The chapter will give emphasis to research methodology. It will cover the research design, source of data, data collection methods, study measures and data analysis methods. The limitation of the study will be presented as well. In this chapter we discuss how the main objective of the study was achieved and how the conclusions were reached.

3.2 Study setting

In this sub-section, we describe the geographic description, brief socio-economic and demographic setting of Lesotho.

Figure 2. 5 Geographic location of Lesotho

Lesotho is a small country located in the southern part of Africa. It is found within the borders of South Africa (figure3:1). The country covers an area of 30 355 km^2 with a landscape dominated by mountains and hills and only 12% is arable (Crbriwsky, 2013). According to UN-DESA (2019), the population of Lesotho was estimated to be 2 108 328 with a domination of 75% rural residents. The countries youth population was estimated to be 34.8%.

Lesotho is among countries with higher literacy levels among people of age 15 and above. 85% of women and 68% of men of age 15 and above can read and write. This may be because Lesotho invests 12% of its GDP in education (Mosia, 2013).

Looking into the health situation in Lesotho, the country falls in a list of countries hardest hit by HIV/AIDS hence the quality of health is low. Life expectancy was estimated at 52 years for both men and women in 2018. HIV prevalence rate was recorded at 23% which saw Lesotho to be the second highest in the world after Swaziland. TB on the other hand remains to be a greater challenge. The country records the highest statistics in the whole world. Other social issues faced by Lesotho include child labour, disability and sexual violence among others as according to Kamaleri & Eide (2011).

3.3 Data Source

The study used data obtained from the 2004, 2009 and 2014 Lesotho Demographic and Health Surveys. The 2014 survey data was used as the main data source to respond to the main objective of this study. Whereas the 2004 and 2009 LDHS were employed in to respond to the specific objective which was to study levels and trends of under-five mortality in Lesotho.

Demographic and Health Survey (DHS) remains to be the world's biggest survey that provides reliable information on child health status, health service indicators and child and infant mortality among others. For purpose of this study, the Demographic and Health Survey of Lesotho conducted in 2014 (LDHS 2014) will be employed as the main data source to draw results that will inform conclusions and recommendation of this study. LDHS 2004 and 2009 will only be used for purpose of analysing trends and levels. This study will use the child file to fulfil the objective of the study.

In addition, the United Nations Inter-Agency group for child mortality estimates (UN IGME) for Lesotho will be used to analyse trends from 2000 to 2019 and therefore project under-5 mortality rates to 2030 which is the end of the Sustainable Development Goals timeframe. UN IGME is led by the United Nations Children's Fund

(UNICEF). Data is drawn from most recent mortality data collected in each county across the globe and it is updated yearly.

3.4 Study sample

The LDHS 2014 focused on female reproductive ages (15-49) and men aged 15-54. In this study, we will utilise the child file, extracted from a total sample of 6621 mothers who were interviewed. The sample was selected to include only 3138 children who were extracted from the individual female sample. The focus was only on woman who responded to child mortality questions since the main focus of this study is child mortality. Information on children who died was recorded based on information about all births that occurred to women for a period of five years preceding the survey. In the entire sample, cases were selected to include only a sample of woman who reported to ever given birth in the last five years preceding the survey (3138 participants). In the child file, responses were ordered in reverse such that last birth comes first. The models fitted to the data were therefore based on 3138 children.

The 2004 LDHS had a total of 7095 interviews with woman of reproductive ages. In this study, we selected 3598 participants who responded to the child question in the survey. Relatively, from the 2009 LDHS we selected a sample of 3880 participants out of 7624 of the total sample.

3.5 Measurement of results

3.5.1 Dependent variable

The dependent variable is under-5 mortality. All deaths reported to have occurred before exact age 5 were regarded as under-5 mortality. The question in the survey was "whether the child is still alive?" and the response was "0=no for child is not alive and 1=yes for child is alive".

3.5.2 Independent variables

This study draws explanatory variables from the Mosley & Chen (1984) model which was developed to explain determinates of mortality among children in less developed countries. Not all variables identified by Mosley & Chen 1984 are available in the LDHS

2014. The survey considered variable/factors that are of greatest for public policy and there are identified among on-going interventions that aim to reduce mortality.

This study therefore, conceptualised dependent variable into 5 themes that are found in LDHS 2014. These themes are as follow:

- Bio-demographic factors and Health related factors: *(Birth order, birth interval, maternal age, sex of the child, Pre and Post-natal care, place of birth and child vaccination, period of breast-feeding type of birth and type of feeding)*
- Environmental health factors: *(Source of drinking water, toilet facility and energy for preparation of food)*
- Socio-economic and demographic factors: *(Maternal education, Wealth index, region of residence, marital status and type of residence)*

3.6 Definition of terms

Variable	**Definition**
Fertility behaviour	
Birth order	Whether a child is a first born, second born, thirds born etc.in a family
Children ever born	Number of times a woman has given birth.
Maternal age	Current age of mother.
Type of delivery	Whether a child was delivered through caesarean.
Maternal and child health	
Pre and post-natal care	This variable was measured by number of ante natal visit during and after pregnancy.
Sex of the child	Whether the child is male or female.
Place of delivery	A place where a child was delivered.
Smokes cigarette	Whether the mother smokes cigarette.
Environmental factors	
Type of toilet facility	Whether a household uses flush, pit toilet or no toilet.

Source of drinking water	A place where drinking water is accessed.
Type of energy used for preparation of food	Whether the respondent uses liquid fuel, solid fuel or electricity.
Demographic and socio-economic factors	
Type of residence	Whether the respondent lives in a rural or urban residence.
Maternal education	The level of mother's education.
Region	A region where the respondent resides.
Wealth index	Whether the respondent falls under a category of poorest, poor, middle, rich or richest.
Number of under-5 children in a household	Total number of under-5 children living in a household.
Marital Status	Whether the respondent is in a union, not in a union or separated with their partner.

3.7 Method of analysis

3.7.1 Statistical analysis

Using the latest version of Statistical Package for the Social Sciences (SPSS), data from the univariate, bivariate and multivariate levels were analyzed. To study the relationship between dependant variable and explanatory variables, chi-square test and binary logistic regression were employed.

3.7.2 Trends and levels of under-5 mortality

To evaluate the trends and levels of under-five mortality, we compared proportions of under-5 deaths from three DHS data sets which are LDHS 2004, LDHS 2009 and LDHS 2014 respectively. We also calculated absolute changes from selected variables known to be associated with under-5 mortality. We used a formula:

$$Absolute\ change = X_{n+1} - X_n$$

Where $X_n$is the initial calculated percentage of under-5 deaths and X_{n+1} is the calculated percentage of under-5 deaths for the next identified period.

A linear regression was employed to interpret trends and to project under-5 mortality rates from 2020 to 2030. A linear regression is a widely used tool of analysis which looks at the relationship between two sets of data. It can also be used to predict future linear trends. A linear regression formula is given by $Y = a + bx$, where ''y'' is the independent variable (Under-5 mortality), ''x'' being the dependent variable (year), ''b'' is the slope and a is the ''y-intercept''.

3.7.3 Chi-square test

Chi-square test is a statistical tool used to test the relationship between two variables. The null hypothesis of the model is that there is no relationship between two variables. In this regard the, the model will test the relationship between child death and selected predictor variables selected for the study at hand.

To compute chi-square test statistics, the following equation can be used:

$$X^2 = \sum \frac{(f_0 - f_e)^2}{f_e}$$

Where f_0 represents the observed counts and f_e represents the expected frequency if no relationship exists.

3.7.4 Logistic regression

Logistic regression is a statistical tool that is widely used to model the probability of an even to occur. There are three types of logistic regressions namely: binary, multinomial and ordinal logistic regression. The dependent variable in this study has two possible outcomes which allows for the application of binary logistic regression model to understand the likelihood of child and infant mortality to occur. The modelling of whether a child has died or is still alive is as follows:

$$y_t = \{0 = child\ is\ not\ alive : 1 = child\ is\ alive\}$$

The logistic regression model is given by the equation:

$$y_t = \frac{exp\ (\beta_0 + \beta_i x_i)}{1 + exp\ (\beta_0 + \beta_i x_i)}$$

Where:

y_t is the probability that death will occur for the t^{th}individual.

β_0 is the intercept.

$\beta_0$is the coefficient for the explanatory variable x_i.

And x_i is the vector of explanatory variable.

Since the model use the log transformation of the odds, the formula can be written as: $logit(y_t) = log\ log\ \left(\frac{y_t}{1-y_t}\right) = \beta_0 + \beta_t x_t$

Where $\frac{y_t}{1-y_t}$ is the odds of child death to occur.

In the analysis, variables will be grouped into three main categories namely: bio-demographic factors, environmental factors and socio-economic and demographic factors. The three logistic regression model will exclude variables that were insignificant from the chi-square test.

3.8 Ethical consideration

The data was requested from the Measure DHS website in 2018 where a registration was required. The registration required personal details (email address, names, country of residence, contact number etc.), institution type and most importantly a research topic and legitimated research purpose. Approval was subsequently given to download the data (Appendix one). The ethical issues have been originally catered for by the Institutional Review Board (IRB) who carried out the survey, and the rights of the participants protected by Measure-DHS in the management of the data. The study was also granted ethics clearance certificate from North West University (Appendix two).

3.9 Limitations of the study

The study uses survey data that was collected in 2004, 2009, 2014, there may be possible changes in demographic and socio-economic dynamics of Lesotho. The results may present outcomes that do not necessarily reflect the current child and infant mortality situation.

Another limitation is that; mortality is a sensitive topic. Not all questions related to mortality could be answered correctly, since not everyone was comfortable to talk about events surrounding death.

The study employed secondary data which limited the researcher to use only information that is available. For instance, the dependent variable only tells us whether the child is alive or not. Further information on details of death was unavailable. We therefore had to work with what was available to respond to the objectives of the study.

Chapter 4

Presentation of results

4.1 Introduction

This chapter presents the results of the analysis described in the previous chapter. The chapter is divided into three section. In the following subsection (4.2), a brief description of the sample will be presented. Bivariate analysis and multivariate analysis will be presented in sub-sections 4.3 and 4.4 respectively.

4.2 Sample description

Table 4.1 describes a total sample of 3138 participants distributed according to mother's socio-economic characteristics as described in section 3. It is shown in the table that majority children born five years before the 2014 demographic health survey in Lesotho were born to mother of age group 20-24 and 25-29. Only 1.1% were born to mothers of age groups 45-49 and 7.6% were born to mothers of age group 15-19. The proportion of mothers by region of residence was evenly distributed, on average and 10% was selected from each region. About 75% of the study population was residing in rural areas while 25% were residing in urban areas. The results also show that majority of participants were married or living together with a partner. About 78.5% of participants were in a union while only 11.1% were in a union and 10.5% were separated.

Table 4.1 further shows that about half (48.9%) the population had only primary education, followed by 43.8% that reported to have completed second education. Only 6.6% of mothers had higher than secondary education and only 1.1% had no education. The majority of participants were poor. About 25.4% fell within a category of poorest while 21.1% were poorer. More than half (57.3%) of the sample were using pit toilet compared to on 1.5% who had flush toilets and 33.5% had no toilet facility. As far as access to source of drinking water is concerned, majority of respondents had access to clean water. About 63.2% of respondents had access to pipe water. Only 14% were accessing water from a well or a bore hole while 14.2% were accessing drinking water from spring water.

Table 4. 1 Sample description

	Frequency	Percent
Age in 5-year groups		
15-19	240	7.6
20-24	967	30.8
25-29	857	27.3
30-34	537	17.1
35-39	331	10.5
40-44	171	5.4
45-49	35	1.1
Total	**3138**	**100.0**
Region		
Botha-bothe	298	9.5
Leribe	351	11.2
Berea	323	10.3
Maseru	391	12.5
Mafeteng	272	8.7
Mohale's hoek	307	9.8
Quthing	296	9.4
Qacha's-nek	236	7.5
Mokhotlong	336	10.7
Thaba tseka	328	10.5
Total	**3138**	**100.0**
Type of place of residence		
Urban	786	25.0
Rural	2352	75.0
Total	**3138**	**100.0**
Marital status		
Not in a union	347	11.1
In a union	2462	78,5
Separated	329	10.5
Total	**3038**	**100**
Highest educational level		
No education	36	1.1
Primary	1522	48.5
Secondary	1373	43.8
Higher	207	6.6
Total	**3138**	**100.0**
Type of toilet facility		
Flush toilet	48	1.5
Pit toilet	1797	57.3
No facility	1050	33.5
Other	243	7.7
Total	**3138**	**100.0**

Wealth index		
Poorest	798	25.4
Poorer	663	21.1
Middle	636	20.3
Richer	554	17.7
Richest	487	15.5
Total	**3138**	**100.0**
Source of drinking water		
Pipe water	1982	63.2
Borehole/well	438	14.0
Spring water	445	14.2
Other	273	8.7
Total	**3138**	**100.0**

Source: LDHS 2014

4.3 Trends and levels analysis

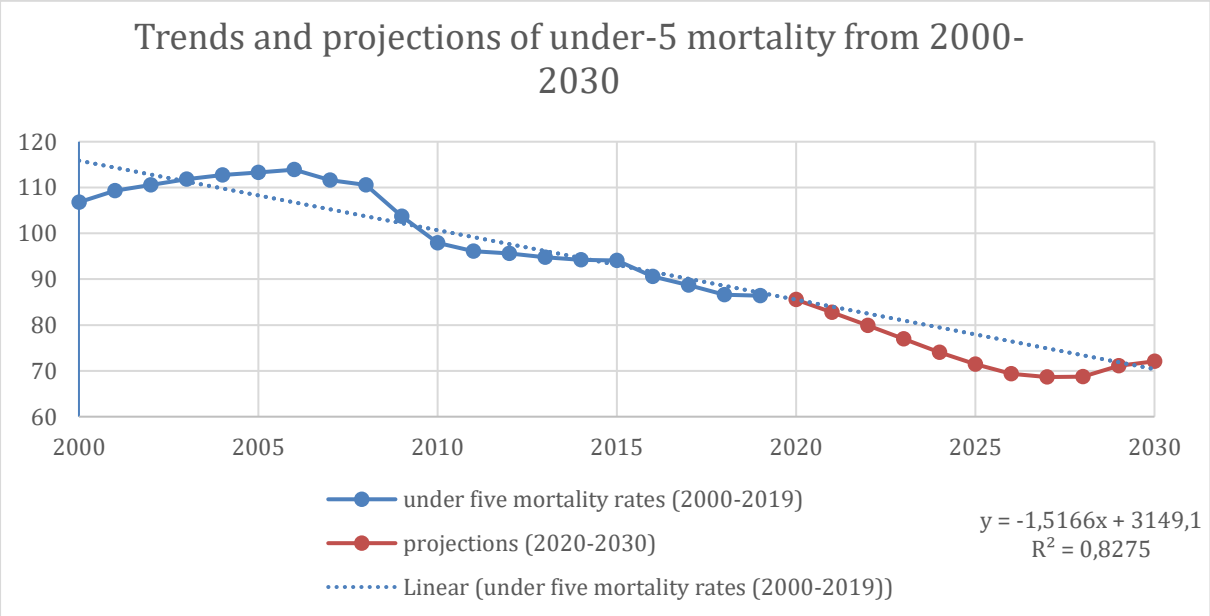

Figure 4. 1 Trends and projection of under-five mortality in Lesotho (2000-2030)

Figure 4.1 presents under-5 mortality trends from 2000 to 2019 and projected trends from 2020 to 2030. It is observed that under-5 mortality has been declining. The decline was initially observed from 2006 at 113.9 deaths per 1000, which was the

highest rate to 86.4 deaths per 1000 in 2019. Projections made from 2020 suggest that there will be a further decline to 72.1 in 2030. Although the pace of decline is relatively low, there is an observed general decline in under-5 mortality. The decline is further being observed, as according to the projections made from 2020 to 2030.

Table 4.2 below in addition to trend analysis, presents percentage distribution of under-5 mortality by selected variables and absolute changes thereof for a period between 2004 and 2014. It is observed from the table that most variables recorded a percentage decline in under-five mortality from 2004 to 2009. The decline was however barely maintained and therefore a slight increase was observed in 2014. The reproductive age group 15-19 for example, recorded 7.4% of total deaths that occurred in 2004 then slightly declined to 7.1% in 2009. In 2014, the percentage of total deaths recorded in that age group, increased to 8.5%. Similarly, households that used pit toilets recorded 38.4% of total under-5 deaths which was the second highest. An increase was observed to 42.4% and 55.6% in 2009 and 2014 respectively. A proportion of under-5 deaths among woman who gave birth for the second time also increased. In 2004, a category of mothers who gave birth for the second time recorded 24.8% of total under-5 mortality. The percentage increased to 33.2% and 34.1% in 2009 and 2014 respectively.

Moreover, some variables show a gradual decline in under-5 mortality over time. In 2004 for example, 55.4% of total deaths were recorded among households that have no toilet facility. Percentages declined to 49.7% and 34.5% in 2009 and 2014 respectively. A decline in percentages of under-5 deaths was also observed for children who were delivered at home by 13%. In 2004, 45.7% of under-5 deaths were recorded from mothers who delivered from their homes. The percentage declined to 32.7% in 2014. Under -5 deaths also declined among mothers who had more than five antenatal care visits. The percentage of total deaths changed from 56.7% in 2004 and 45.6% in 2014. Households that source water from borehole or well, has a decline in percentage of death by 13.3% for a period between 2004 and 2014. This was also observed for level maternal education. A percentage of deaths among mothers with primary education declined by 4.2% while deaths among mothers with secondary education declined by 8.6%.

Table 4. 2 Percentage distribution of under-5 mortality by selected variables and absolute changes (2004-2014).

Selected variables	Percentage died			Absolute change (%)		
Maternal age						
	2004	**2009**	**2014**	**2004-2009**	**2009-2014**	**2004-2014**
15-19	7,4	7,1	8,5	-0,3	1,4	1,1
20-24	30,3	27,6	23,3	-2,7	-4,3	-7
25-29	27,6	27,8	33,2	0,2	5,4	5,6
30-34	14,9	14,8	17,5	-0,1	2,7	2,6
35-39	9	10,8	9,4	1,8	-1,4	0,4
40-44	6,5	8,5	5,8	2	-2,7	-0,7
45-49	4,3	3,4	2,2	-0,9	-1,2	-2,1
Region						
Botha-bothe	8,6	8	9,4	-0,6	1,4	0,8
Leribe	14,6	12,5	13	-2,1	0,5	-1,6
Berea	9,9	8,2	8,1	-1,7	-0,1	-1,8
Maseru	11,5	11,6	12,1	0,1	0,5	0,6
Mafeteng	6,5	10,2	10,8	3,7	0,6	4,3
Mohale's hoek	13	9,9	11,7	-3,1	1,8	-1,3
Quthing	9	9,1	9,4	0,1	0,3	0,4
Qacha's-nek	6,5	8,2	5,8	1,7	-2,4	-0,7
Mokhotlong	9,9	10,2	11,7	0,3	1,5	1,8
Thaba tseka	10,5	11,9	8,1	1,4	-3,8	-2,4
Type of place of residence						
Urban	19,2	13,9	22	-5,3	8,1	2,8
Rural	80,8	86,1	78	5,3	-8,1	-2,8
Breastfeeding status						
Never breastfed	34,5	32	34,5	-2,5	2,5	0
Breastfed	65,5	68	65,5	2,5	-2,5	0
Type of cooking fuel						
Electricity	0,9	2,8	6,3	1,9	3,5	5,4
Biomas or clean fuel	27,5	20,4	21,1	-7,1	0,7	-6,4
Smoke emitting fuel	66,6	71,7	63,2	5,1	-8,5	-3,4
Other	5	5,1	9,4	0,1	4,3	4,4
Highest educational level						
No education	4,6	2,6	0,4	-2	-2,2	-4,2
Primary	63,8	64,8	55,2	1	-9,6	-8,6
Secondary	31	30,1	41,7	-0,9	11,6	10,7
Higher	0,6	2,6	2,7	2	0,1	2,1
Respondent's check-up after delivery						
No	55,2	74,6	41,2	19,4	-33,4	-14
Yes	44,8	25,4	58,8	-19,4	33,4	14

Table 4.2 continues…

Wealth index						
Poorest	21,1	27,8	23,8	6,7	-4	2,7
Poorer	24,5	27,6	21,1	3,1	-6,5	-3,4
Middle	18	15,6	21,5	-2,4	5,9	3,5
Richer	18,6	18,5	21,5	-0,1	3	2,9
Richest	17,8	10,5	12,1	-7,3	1,6	-5,7
Sex of child						
Male	54,5	58	53,4	3,5	-4,6	-1,1
Female	45,5	42	46,6	-3,5	4,6	1,1
Source of drinking water						
Piped water	57,7	54,5	57,8	-3,2	3,3	0,1
Borehole or well	31,2	25	17,9	-6,2	-7,1	-13,3
Spring water	4,3	14,3	14,8	10	0,5	10,5
Other water source	6,8	6,2	9,4	-0,6	3,2	2,6
Number of antenatal visits						
No visits	9,9	14	11	4,1	-3	1,1
Less than five	30	34,8	42,7	4,8	7,9	12,7
More than five	56,7	49,3	45,6	-7,4	-3,7	-11,1
Don't remember	3,4	1,9	0,7	-1,5	-1,2	-2,7
Birth order number						
One	36,8	34,1	34,1	-2,7	0	-2,7
Two	23,5	25,9	28,3	2,4	2,4	4,8
Three	16,7	13,9	14,3	-2,8	0,4	-2,4
Four	5,3	9,1	8,5	3,8	-0,6	3,2
Five or more	17,7	17	14,8	-0,7	-2,2	-2,9
Number of children ever born						
One	23,2	16,2	17,5	-7	1,3	-5,7
Two	24,8	33,2	34,1	8,4	0,9	9,3
Three	21,7	18,2	20,6	-3,5	2,4	-1,1
Four	11,5	12,5	9	1	-3,5	-2,5
Five or more	18,8	19,9	18,8	1,1	-1,1	0
Place of delivery						
Home	45,7	48,5	32,7	2,8	-15,8	-13
Recognised health centre (inclusive of Chal)	53,97	51,1	57,8	-2,87	6,7	3,83
Outside Lesotho	0	0	1,8	0	1,8	1,8
Others	0,33	1,4	7,6	1,07	6,2	7,27
Type of toilet facility						
Flush toilet	1,2	2,8	0,4	1,6	-2,4	-0,8
Pit toilet	38,4	42,4	55,6	4	13,2	17,2
No facility	55,4	49,7	34,5	-5,7	-15,2	-20,9
Other	5	5,1	9,4	0,1	4,3	4,4

4.4 Bivariate analysis

Chi-square test of association between under-5 mortality and selected covariates is presented in table 4.3 This includes distribution of under-5 mortality by selected variable and percentage of death per category. In the tables, variables are divided into four groups namely bio-demographic variables, Health related variables, environmental variables and socio-economic variables.

Distribution of under-5 mortality by maternal age shows that more deaths occurred in the middle ages of 20-34 where a majority of births were recorded. On the other hand, death rates are high among older ages. About 14 children died for every 100 children born to mothers of age group 45-49 as compared to only 8% death rate among under-5 children born to mothers of age group 15-19 and 5.4% among mothers in age group 20-24. However, the relationship was not significant. The ratio of sons to daughters born five years before the survey was almost the same. Total birth by sex was recorded to be 50.4% and 49.6% respectively. More deaths occurred among males accounting to 53.4% of total deaths with a death rate of 7.7% compared to 6.6% death rate among females. The relationship was also not significant. Chi-square test results also show a negative relationship between under-5 mortality and child order of birth. More deaths occur among first children and reduces with higher birth order however, there are higher deaths among order number five and above. Distribution of deaths declined from 34.1% in the first birth order to 28.3% in the second order and 14.3% in the third order. Percentage of deaths further increased from the lowest 8.5% at the fourth order to 14.8% for order number five and above. Death rates in contrary were increasing with birth order number. The relationship was however not significant. Distribution of under-5 mortality by number children ever born was fluctuating. On the other hand, a positive relationship is witnessed between death rates and number of children ever. Death rates increases as the number of children ever born increases. The relationship is highly significant at 1% significance level.

Table 4.3 also shows that mothers who never went for check-up after delivery of the child accounts for 41.2% of death that occurred five years before the 2014 survey. It is also shown that 8 out of 100 children born to mothers who never went for check-

up after delivery have died compared to on 2% who survived. The relationship between check-up after delivery and under-5 deaths is significant at 1% significant level. Children who were never breastfed account for 7% of the total children born five years before the survey. Out of the total number of under-5 deaths that occurred 34.5% were never breastfed. Death rate for children who were not breastfed was 35.5% compared to only 5% of children who were breastfed. The relationship was significant at 1% level of significance. As place of delivery goes, most births took place at a recognised health facility although almost a quarter (24.9%) were delivered at home. Of all deaths that occurred, children delivered at home contributed 32.7%. Under-5 mortality rates were the highest at 9.4% among children who were delivered at home. The relationship between under-5 mortality and place of delivery was highly significance at 1% significance level.

It is shown again in table 4.3 below that more under-5 deaths occurred among households of mothers who used solid fuel to prepare food. 63.2% of deaths occurred among households that used solid fuel to prepared food as compared to the 6.3% that died in households that use electricity. Under-5 mortality rates further show that higher rates are among households that use solid fuel at 7.1%. The relationship is however not significant. Source of water distribution shows that more under-5 deaths occurred among households that use piped water since it is the main source of water. Under-5 mortality rates however show that more deaths occur among participants who access water from a bore hole or well. For every 100 deaths in these category 9 children were reported to have died. This relationship is however not significant. As far as toilet facility is concerned, most under-5 deaths occurred among participants who use pit toilet or have no access at all. About 55.6% of under-5 mortality occurred from participants who uses pit toilets followed by 34.5% who do not have any facility. The relationship was also not significant.

Table 4. 3 Distribution of under-5 mortality by selected variables

Selected variables	Child is alive			percentage of death	Chi-square (X^2)
	No	Yes	Total		
Age in 5-year groups					
15-19	19 (8.5)	221 (7.6)	240 (7.6)	7,9	10.757
20-24	52 (23.3)	915 (31.4)	967 (30.8)	5,4	
25-29	74 (33.2)	783 (26.9)	857 (27.3)	8,6	
30-34	39 (17.5)	498 (17.1)	537 (17.1)	7,3	
35-39	21 (9.4)	310 (10.6)	331 (10.5)	6,3	
40-44	13 (5.8)	158 (5.4)	171 (5.4)	7,6	
45-49	5 (2.2)	30 (1.0)	35 (1.1)	14,3	
Total	223 100	2915 100	3138 100	7,1	
Region					
Botha-bothe	21 (9.4)	277 (9.5)	298 (9.5)	7,0	6.383
Leribe	29 (13.0)	322 (11.0)	351 (11.2)	8,3	
Berea	18 (8.1)	305 (10.5)	323 (10.3)	5,6	
Maseru	27 (12.1)	364 (12.5)	391 (12.5)	6,9	
Mafeteng	24 (10.8)	248 (8.5)	272 (8.7)	8,8	
Mohale's hoek	26 (11.7)	281 (9.6)	307 (9.8)	8,5	
Quthing	21 (9.4)	275 (9.4)	296 (9.4)	7,1	
Qacha's-nek	13 (5.8)	223 (7.7)	236 (7.5)	5,5	
Mokhotlong	26 (11.7)	310 (10.6)	336 (10.7)	7,7	
Thaba Tseka	18 (8.1)	310 (10.6)	328 (10.5)	5,5	
Total	223 100	2915 100	3138 100	7,1	
Type of place of residence					
Urban	49 (22.0)	737 (25.3)	786 (25.0)	6,2	1.209
Rural	174 (78.0)	2178 (74.7)	2352 (75.0)	7,4	
Total	223 100	2915 100	3138 100	7,1	

Table 4.3: continues…

Ever breastfed					
never breastfed	77 (34.5)	140 (4.8)	217 (6.9)	35,5	284.374***
Breastfed	146 (65.5)	2775 (95.2)	2921 (93.1)	5,0	
Total	223	2915	3138		
	100	100	100	7,1	
Type of cooking fuel					
electricity	14 (6.3)	223 (7.7)	237 (7.6)	5,9	1.494
Biomas or clean fuel	47 (21.1)	639 (21.9)	686 (21.9)	6,9	
smoke emitting fuel	141 (63.2)	1832 (62.8)	1973 (62.9)	7,1	
other	21 (9.4)	221 (7.6)	242 (7.7)	8,7	
	223	2915	3138		
Total	100	100	100	7,1	
Highest educational level					
No education	1 (0.4)	35 (1.2)	36 (1.1)	2,8	8.996**
Primary	123 (55.2)	1399 (48.0)	1522 (48.5)	8,1	
Secondary	93 (41.7)	1280 (43.9)	1373 (43.8)	6,8	
Higher	6 (2.7)	201 (6.9)	207 (6.6)	2,9	
Total	223	2915	3138		
	100	100	100	7,1	
Respondent's check-up after delivery					
No	56 (41.2)	633 (25.7)	689 (26.5)	8,1	150.768***
Yes	80 (58.8)	1827 (74.3)	1907 (73.5)	4,2	
	136	2460	2596		
Total	100	100	100	5,2	
Wealth index					
Poorest	53 (23.8)	745 (25.6)	798 (25.4)	6,6	4.286
Poorer	47 (21.1)	616 (21.1)	663 (21.1)	7,1	
Middle	48 (21.5)	588 (20.2)	636 (20.3)	7,5	
Richer	48 (21.5)	506 (17.4)	554 (17.7)	8,7	
Richest	27 (12.1)	460 (15.8)	487 (15.5)	5,5	
Total	223	2915	3138		
	100	100	100	7,1	

Table 4.3 Continues

Sex of child					
Male	119 (53.4)	1436 (49.3)	1555 (49.6)	7,7	1.394
Female	104 (46.6)	1479 (50.7)	1583 (50.4)	6,6	
Total	223	2915	3138		
	100	100	100	7,1	
Source of drinking water					
Piped water	129 (57.8)	1853 (63.6)	1982 (63.2)	6,5	4.003
Borehole or well	40 (17.9)	398 (13.7)	438 (14.0)	9,1	
Spring water	33 (14.8)	412 (14.1)	445 (14.2)	7,4	
Other water source	21 (9.4)	252 (8.6)	273 (8.7)	7,7	
	223	2915	3138		
Total	100	100	100	7,1	
Number of antenatal visits					
No visits	15 (11.0)	105 (4.3)	120 (4.6)	12,5	25.223***
One	6 (4.4)	35 (1.4)	41 (1.6)	14,6	
Two	10 (7.4)	122 (5.0)	132 (5.1	7,6	
Three	18 (13.2)	339 (13.8)	357 (13.8)	5,0	
Four	24 (17.6)	515 (20.9)	539 (20.8)	4,5	
Five	22 (16.2)	416 (16.9)	438 (16.9)	5,0	
Six	15 (11.0)	388 (15.8)	403 (15.5)	3,7	
Seven	9 (6.6)	233 (9.5)	242 (9.3)	3,7	
Eight or more	16 (11.8)	288 (11.7)	304 (11.7)	5,3	
Don’t remember	1 (0.7)	19 (0.8)	20 (0.8)	5,0	
	136	2460	2596		
Total	100	100	100	5,2	

Table 4.3 continues…

Birth order number					
One	76 (34.1)	1148 (39.4)	1224 (39.0)	6,2	4.509
Two	63 (28.3)	757 (26.0)	820 (26.1)	7,7	
Three	32 (14.3)	457 (15.7)	489 (15.6)	6,5	
Four	19 (8.5)	223 (7.7)	242 (7.70	7,9	
Five or more	33 (14.8)	330 (11.3)	363 (11.6)	9,1	
Total	223	2915	3138		
	100	100	100	7,1	
Number of children ever born					
One	39 (17.5)	948 (32.5)	987 (31.5)	4,0	23.996***
Two	76 (34.1)	825 (28.3)	901 (28.7)	8,4	
Three	46 (20.6)	540 (18.5)	586 (18.7)	7,8	
Four	20 (9.0)	232 (8.0)	252 (8.0)	7,9	
Five or more	42 (18.8)	370 (12.7)	412 (13.1)	10,2	
Total	223	2915	3138		
	100	100	100	7,1	
Place of delivery					
Home	73 (32.7)	707 (24.3)	780 (24.9)	9,4	13.040***
Recognised health centre	129	1735	1864		
	(57.8)	(59.5)	(59.4)	6,9	
Outside Lesotho	4 (1.8)	147 (5.0)	151 (4.8)	2,6	
Other	17 (7.6)	326 (11.2)	343 (10.9)	5,0	
Total	223	2915	3138		
	100	100	100	7,1	
Type of toilet facility					
Flush toilet	1 (0.4)	47 (1.6)	48 (1.5)	2,1	2.9
Pit toilet	124 (55.6)	1673 (57.4)	1797 (57.3)	6,9	
No facility	77 (34.5)	973 (33.4)	1050 (33.5)	7,3	
Other	21 (9.4)	222 (7.6)	243 (7.7)	8,6	
Total	223	2915	3138		
	100	100	100	7,1	

***: significant at 10%; **: significant at 5%; ***: significant at 1%**

4.5 Logistic regression

The association between under-five mortality and background variables was also investigated using logistic regressions. The results of Binary logistic regression are presented in this section. The model included variables that were found to be significant from the chi-square test and those that showed higher mortality rates.

Table 4.4 shows the results of logistic regression between under-five mortality and socio-economic characteristics of the women.

The results show no significant association between region of residence and under-5 mortality however, Berea region and Qacha's-neh shows a higher probability of child not being alive than the reference region (Botha-Bothe). The probabilities are 74% and 38% likelihood of child not being alive respectively.

Under-5 mortality was associated with type of residence at 10% significance level. Children under-5 born to mothers who reside in urban areas were about 31% less likely to die compared to those of mothers who reside in rural areas.

Maternal education was a significant factor associated with under-5 mortality at 5% significance level for secondary and higher education. Although under-five children born to mothers who obtained primary education were 4.5% more luckily to die before age five as compared to children born to mothers who are not educated, a significant decline was observed with secondary education and higher. It is observed that children born to mothers who have acquired secondary education were 76% less likely to die than those born to mothers who are have no education while those born to mothers who have more than secondary education were 59% less likely to die.

Wealth index was an insignificant factor associated with under-5 mortality however, children born to mothers who categorised as richest were 13% less likely to die than the poorest.

Table 4. 4 Binary logistic regression of under-5 mortality for selected socio-economic variables.

Variables in the Equation	Sig.	Exp(B)
Socio-Economic Variables		
Region		
Botha-bothe®		1.000
Leribe	0.568	1.202
Berea	0.117	1.743
Maseru	0.866	1.057
Mafeteng	0.905	0.961
Mohale's hoek	0.823	1.075
Quthing	0.883	1.051
Qacha's-nek	0.402	1.378
Mokhotlong	0.953	1.020
Thaba Tseka	0.395	1.347
Type of place of residence		
Rural®		1.000
Urban	0.091	.687*
Highest educational level		
No education®		1.000
Primary	0.968	1.045
Secondary	0.011	0.340**
Higher	0.038	0.411**
Wealth index		
Poorest®		1.000
Poorer	0.962	1.011
Middle	0.790	0.938
Richer	0.492	0.834
Richest	0.889	1.047

®: Reference category; *: significant at 10%; **: significant at 5%; *: significant at 1%**

Bio-demographic and health related factors were mostly associated with under-5 mortality. Shown in table 4.5 below, place of delivery had no association with under-5 mortality. However, children born outside of Lesotho were three time more likely to die than those delivered at home within Lesotho. Number of antenatal visits was associated at 5% significance level for four or more visits. Mothers who went for antenatal visits for more than three occasions were 48% less likely to witness the loss of their child. Male children were 1.3 times more likely to die than female children although the association was insignificant.

Birth order was only significant at 10% for children born second child. Second born children were 1.5 times more likely to die than first born child. Breastfeeding was highly significant, children who were breastfed were 90% less likely to die than those who were never breastfed. Visits after delivery was also significant at 5%. Mothers who never visited any health facility were 1.7 time more likely to witness child death than those that reported to have visited. Children born to mother between ages 15-19 were less likely to die. Maternal age at birth was only significant at age 20-20 and 30-39. The significant level was at 5%. The results suggest that under-5 mortality is associated with higher ages.

Table 4. 5 Binary logistic regression of under-5 mortality for selected Bio-demographic and health factors

Bio-demographic and health factors		
Place of delivery		
Home®		1.000
Hospital/Clinic/Health Centre	0.868	0.959
Outside Lesotho	0.137	3.054
Other	0.234	1.623
Number of antenatal visits		
None®		1.000
One to Three	0.051	0.708
Four or More	0.036	.516**
Sex of child		
Female®		1.000
Male	0.145	1.299
Respondent's check-up after delivery		
Yes®		1.000
No	0.024	1.695**
breast feeding status		
No®		1.000
Yes	0.000	0.096***
Birth order number		
One®		1.000
Two	0.058	1.511*
Three	0.414	1.202
Four	0.168	1.428
Five and more	0.594	1.174

Number of children ever born		
1®		1.000
2	0.000	0.205***
3	0.000	0.093***
4	0.000	0.033***
5	0.000	0.010***
Age in 5-year groups		
15-19®		1.000
20-24	0.004	2.367**
25-29	0.133	1.600
30-34	0.044	2.043**
35-39	0.026	2.484**
40-44	0.108	2.119
45-49	0.823	1.150

®: Reference category; *: significant at 10%; **: significant at 5%; *: significant at 1%**

Table 4.6 shows logistic regression results of association of under-5 mortality and selected environmental factors. It is presented that households that use gas and solid fuel pose as a threat on the survival of the child. Under-5 children living in a household that use solid fuel were 23% more likely to die than those residing in households that uses electricity. The use of gas fuel poses 12% more likely chances of death among under-5 death. The association was significant at 5%. The results further show a significant association between type of toilet facility and under-5 mortality. Households that use pit toilet were 69% less likely to witness under-5 mortality while those that use flush toilets were 70% less likely to witness under-5 mortality. The significance levels were 10% and 5% for a pit toilet and flush toilet respectively.

Table 4.6 Binary logistic regression of under-5 mortality for selected environmental factors

Environmental factors		
Type of cooking fuel		
Electricity®		1.000
Biomas or clean fuel	0.049	1.117**
Smoke emitting	0.021	1.231**
Other	0.999	0.981

Type of toilet facility		
No facility®		1.000
Pit toilet	0.052	0.308*
Flush	0.040	0.295**
Bucket on other	0.583	1.086
Source of drinking water		
Piped water®		1.000
Borehole	0.071	0.706
Spring	0.580	0.890
Other	Omitted	Omitted

®: Reference category; *: significant at 10%; **: significant at 5%; *: significant at 1%**

In the last model presented in table 4.7 below, we combine all the significant variables into one model without categories. It can be observed that the inclusion of selected variables into the same model without categories has introduced some changes in the significant levels of most variables. The model included maternal age, children ever born, birth order number, type of place of residence, educational level, breast feeding status, check up after delivery, antenatal visits, type of toilet facility and source of drinking water.

It is observed from the table that breast feeding and going for check-up after delivery remains to be highly significant factors contributing to the survival of the child. It is observed that mortality is higher among children who were never breastfed. Children who were never breastfed were 14 times more likely to die before age five. Again, it is observed that mothers who never went for check-up after delivery were almost 2 time more at risk of losing their children. The association for both variables was at 1% significance level.

Table 4. 7 Binary logistic regression of under-5 mortality for combined significant variables selected from previous three models.

Variables in the Equation	Sig.	Exp(B)
Type of place of residence		
Rural®		1.000
urban	0.088	1.040*
Highest educational level		
No education®		1.000
Primary	0.078	1.118*
Secondary	0.030	1.573**
Higher	1.000	3.389
Antenatal visits		
None®		1.000
One to Three	0.038	0.614**
Four or More	0.043	1.444**
Check-ups after delivery		
Yes®		1.000
No	0.001	1.990***
Breast feeding status		
Yes®		1.000
No	0.000	13.936***
Birth order number		
One®		1.000
Two	0.006	0.596**
Three	0.082	0.922*
Four	0.067	1.216*
Five and more	0.049	0.737*

Number of children ever born		
1®		1.000
2	0.058	0.557*
3	0.069	0.651*
4	1.000	0.263
5	0.058	0.557*
Age in 5-year groups		
15-19®		1.000
20-24	0.007	1.947**
25-29	0.051	1.305*
30-34	0.048	1.362**
35-39	0.065	1.251*
40-44	0.064	1.300*
45-49	0.097	1.026*

Type of cooking fuel		
Electricity®		1.000
Biomas or clean fuel	0.078	1.118*
Smoke emitting	0.030	1.573**
Other	1.000	3.389
Type of toilet facility		
No facility®		1.000
Pit toilet	0.058	0.557*
Flush	0.069	0.651*
Bucket on other	1.000	0.263

®: Reference category; *: significant at 10%; **: significant at 5%; *: significant at 1%**

4.6 Summary

The chapter set out to present the findings of the study. Trend analysis revealed a declining trend. The pace of decline is however slow. The results also indicate that there is a relationship between under-five mortality and breastfeeding status, maternal education, check up after delivery, antenatal visits children ever born and place of delivery. The results of the multivariate analysis showed maternal age, type of residence, type of cooking fuel, children ever born, birth order number, type of place of residence, educational level, breast feeding status, check up after delivery, antenatal visits, type of toilet facility and source of drinking water.

Chapter 5

Conclusion and recommendations

5.1 Introduction

This is the concluding chapter. The discussion of results is presented. The discussion will be based on findings from the previous chapter in comparison to the reviewed literature. Based on the results, recommendations for possible interventions and research recommendations will follow later in the chapter.

5.2 Discussion of results

Analysis of trends and projections of under-5 mortality in the previous chapter presents current and expected future declines. Findings therefore agree with a popular finding that under-5 mortality has been declining in sub-Saharan Africa and particularly in Lesotho since 2000. It is however evident that the rate of decline is relatively slow. Projections suggest that by 2030, under-5 mortality rate will be 72.1 deaths per 1000 births. This is far beyond the anticipated goal 3 of the sustainable development goals which is to reduce under-5 five mortality to at least 25 deaths per 1000 births.

Distribution of deaths by selected variables have been changing over time. For example, there had been a decline in percentage of deaths among households that use smoke emitting fuel, households that source water from a borehole or a well, mothers who have primary and secondary education and households that do not have access to toilet facility. These declines can be explained by or associated with improved public service delivery such as the reduced use of buckets as toilet facilities, increased distribution of piped water, electricity and other public services. Again, reduced deaths among mothers with primary and secondary education can be explained as the improved quality of education and reduced number of births among school age going population over time.

Although variables like Region, wealth, place of delivery, sex of the child and type of toilet facility were hypothesized to be significantly associated with under-five mortality, the study findings did not find any significant association with under-five mortality in

Lesotho. There is a possibility that these factors have indirect effects because they operate through other mechanisms to affect child survival.

A significant variation of under-5 mortalities by place of residence was shown in the results. Under-5 children born to mothers residing in urban areas had higher chances of survival than those residing in rural areas. A similar finding from the literature was seen by Amouzou & Hill (2004) and Machado & Hill (2005). This can be explained by poor or no health services associated with rural areas. Better health facilities are most likely to be found in urban areas, hence higher under-5 survival rates. As stated in the literature that Lesotho is dominated by rural areas, it is therefore not a coincidence to observe higher under-five mortalities in rural areas. This can be explained by poor health services associated with rural areas in Lesotho.

The study also found that under-5 mortalities were higher among mothers with primary education level than those who are not educated. Children born to mothers who obtained at least primary education were 4.5% more likely to die before reaching age-5 as compared to those born to undereducated mothers. A significant decline in chances of dying was however observed with secondary or higher education levels. Indicated in the review of literature that very few females are with no education (only 15%) and observation from distribution of births by level of literacy which shows that very few births were observed among uneducated mothers, it can be explained that this was because of fewer records of births and death among uneducated mothers. A similar observation of reduced chances of under-five mortality with higher maternal education was found in a study by Kibet (2013) and also by Aheto (2019) who both found that maternal education reduces the odds of under-five mortalities. It was also highlighted by Liliana & Christian (2019) that for an additional year of maternal education, there was a 10% and 16.6% reduction in chances of under-five death in Malawi and Uganda respectively.

An educated mother is more likely to be concerned about their child's health. In cases of sickness, an educated mother is more likely to take immediate action rather than later unlike an uneducated mother who would assume that the doctor's judgements are always correct or prefer to take action when the sickness become severe.

The current study found out that mothers who had more than three antenatal visits at any health facility after delivery of the child were more likely to see their children surviving to age five. A similar finding was discovered by (Arund, Emmelin & Asamoah, 2017).

Frequent visit and check-up during and after pregnancy allows for early detections infections and unusual child development and therefore gives time to immediate attention to prevent death.

Recommended by WHO that breast feeding must be prioritised since it plays a critical role in child development and survival, this was found true from the results. Children who were breastfed were more likely to survive to age-5. A similar study by Maiwashe (2014) found similar results that breastfed children experience higher survival chances. It is true that under-5 and infants in particular have a lower immune system, the contents of breast milk therefore are highly protective against death causing infections (Kibet, 2013).

Results shows that the risk of under-5 mortality reduces with increasing number of times a woman has given birth. This contradicts findings from Sonneveldt et. al (2013) that higher parity poses a threat on survival of children under-5. Both findings suggest variations in factors associated with under-5 mortalities among countries. Higher child survival associated with increasing number of times a woman has given birth can be explained by woman's child rearing experience accumulated from one surviving child to another. Assuming that all children were raised and taken care of by biological mothers. Maternal age was also associated with under-5 mortality, children born to mothers in the older ages (20-39) were more likely to die before age-5. Children born to mothers in age group (15-19) showed lower probabilities of dying, this may be the results of fewer births recorded in the same age group. A majority of births were recorded in the middle age groups. Mirrowsky (2005) found similar results they were inconsistent to age group (15-19). They found that under-5 mortality is associated with lower maternal age due to the biological incapability of caring a child for full term.

5.3 Conclusions

The objective of the study was to investigate determinants of under-5 mortality in Lesotho. The objective was aimed to be achieved through investigating bio-demographic and health factors, socio-economic and demographic and environmental factors associated with under-5 and infant mortality and looking at the distribution of under-5 mortality by selected covariates of under-5 mortality. Variables were selected through conceptualised Mosley and Chen model and relevant literature.

From this study's findings, Linear regression analysis suggests that Lesotho will fail to achieve goal 3 of the sustainable development goals should rates of under-5 mortality continues to decline in slower rates as observed from previous years.

The chi-square test has shown that higher under-5 mortalities were recorded from children residing in rural areas, who were never breastfed, born to uneducated mothers, delivered at home, born to mothers who never attended ante-natal care classes or went for check-up after delivery, residing in a household that access water from a borehole and whose main source of cooking fuel is gas or smoke emitting fuel.

The association of under-five mortality and selected variables was investigated through four binary logistic regression models. The first three models were performed to test association between under-five mortality and socio-economic, bio-demographic and environmental factors respectively. In the last model all variables which presented a strong relationship and higher significance level were included. Among all the variables that were tested, parity and breast-feeding status were significant at 1% while ANC visit, check-up after delivery, maternal age, maternal education, type of cooking fuel and source of drinking water were significant at 10%.

The study therefore concludes that significant socio-economic and demographic factors in Lesotho are maternal education and type of residences while bio-demographic and health factors are breast feeding status, parity, maternal age, ante-natal visit and checks after delivery and environmental factors include type of cooking fuel and toilet facility. Insignificant factors include child's sex, birth order, source of drinking water and wealth index.

5.4 Recommendations

The study has identified factors associated with under-5 mortality which can be used to inform policies that seek to reduce child mortality and under-5 mortality in particular. Based on the findings in this study, the following recommendations are made:

- Woman empowerment through education must be prioritised and therefore be supported through political will and the financial means because maternal education was seen to have influence on under-5 mortality.
- Rural development through enhancement of primary health care must be a priority. Public health services should be made more accessible to rural residents.
- Mothers should be encouraged to breastfeed their babies.
- Pre and post-natal services should be encouraged and made easy to access by mothers and pregnant woman because more visits to health services during and after pregnancy reduces the risk of under-5 mortality.
- Contraceptive use especially among teenage girls should be encouraged to postpone birth and reduce parity.
- Provision of electricity and proper sanitation is encouraged. Most under-5 deaths occur among residents who reside in households that use smoke emitting source of fuel and who have use pit toilet or have no access to toilet.

Although place of delivery was not highly a significant factor in determining under-5 mortalities, it is recommended that public health service delivery be enhanced and made available to all to reduce or eliminate an alarming number of births delivered at home.

The study also recommends a study which seeks to understand why some mothers prefer to deliver their infants at home while there are available health facilities which provides such services should be conducted.

The results suggest a lack of access of health services, it is therefore recommended that a health program that encourages breast feeding, attending ante-natal classes and provision of health care to older mothers.

Lastly, woman empowerment through provision of quality education to at least secondary level should also be encourage.

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Appendix

1. PERMISSION TO USE LESOTHO DHS DATA

Oct 08, 2018

Kopano Pitsoyame
North West University
South Africa
Phone: 0796739047
Email: pitsoyamek@gmail.com
Request Date: 10/08/2018

Dear Kopano Pitsoyame:

This is to confirm that you are approved to use the following Survey Datasets for your registered research paper titled: "co-variates of infant mortality in Lesotho":

Lesotho

To access the datasets, please login at: https://www.dhsprogram.com/data/dataset_admin/login_main.cfm. The user name is the registered email address, and the password is the one selected during registration.

The IRB-approved procedures for DHS public-use datasets do not in any way allow respondents, households, or sample communities to be identified. There are no names of individuals or household addresses in the data files. The geographic identifiers only go down to the regional level (where regions are typically very large geographical areas encompassing several states/provinces). Each enumeration area (Primary Sampling Unit) has a PSU number in the data file, but the PSU numbers do not have any labels to indicate their names or locations. In surveys that collect GIS coordinates in the field, the coordinates are only for the enumeration area (EA) as a whole, and not for individual households, and the measured coordinates are randomly displaced within a large geographic area so that specific enumeration areas cannot be identified.

The DHS Data may be used only for the purpose of statistical reporting and analysis, and only for your registered research. To use the data for another purpose, a new research project must be registered. All DHS data should be treated as confidential, and no effort should be made to identify any household or individual respondent interviewed in the survey. Please reference the complete terms of use at: https://dhsprogram.com/Data/terms-of-use.cfm.

The data must not be passed on to other researchers without the written consent of DHS. Users are required to submit an electronic copy (pdf) of any reports/publications resulting from using the DHS data files to: archive@dhsprogram.com.

Sincerely,

Bridgette Wellington

Bridgette Wellington
Data Archivist
The Demographic and Health Surveys (DHS) Program

2. ETHICS CLEARANCE CERTIFICATE FROM NORTH WEST UNIVERSITY

PO Box 1174, Vanderbijlpark
South Africa 1900

Tel: 016 910-3111
Fax: 016 910-3116
Web: http://www.nwu.ac.za

Faculty of Humanities
Tel: 016-91003441
Email: Chrizanne.vaneeden@nwu.ac.za

6 August 2020

Dear Mr Pitsoyame and Dr Mhele,

ETHIC CLEARANCE GRANTED

This letter serves to inform you that ethics clearance was granted for your study by the Basic and Social Sciences Research Ethics Committee (BaSSREC)

ETHICS APPLICATION NUMBER:	NWU-02032-20-S7
PROJECT LEADER:	Dr K Mhele
APPLICANT:	Mr K Pitsoyame
PROJECT TITLE:	Determinants for under-five mortality in Lesotho.
DURATION:	August 2020 to August 2021
ETHICS CLEARANCE DATE:	5 August 2020

Your research is of low ethical risk since it does not involve human participants and therefore a complete ethics review process was not necessary. The BaSSREC wishes you well with your project.

Yours sincerely

C. Van Eeden

Prof C Van Eeden
BaSSREC Chair