Socio-Economic Factors Influencing Under-Five Mortality and Survival in Tanzania, 2010

by

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Declaration

I, Ntoayiphatwa Nimrod Mhambi hereby declare that this mini-dissertation for the degree of Master of Social Sciences in Population Studies and Sustainable Development at the North-West University (Mafikeng Campus) submitted by me, is my original work and has not been previously submitted for a master's degree at this or any other university. I would like to declare here that any inaccuracy or omission that may be contained herein is entirely mine. Therefore, where other people's work has been used, has been duly acknowledged.

Student signature. Date.....

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Abstract

Aim of the study: The study of the study was to examine the socio-economic factors influencing under-five mortality using the 2010 Tanzania Demographic Health Survey (TDHS). This study aimed to determine which maternal, child and environmental factors that are associated with under-five mortality and child survival in Tanzania.

Methods: This study involved a secondary data analysis of the 2010 Tanzania Demographic Health Survey (TDHS) data set of children under-five years of age and women who had experienced the death of children who were under-five years. The Cox proportional hazard analysis was used to examine the relationship between under-five mortality and maternal, child and environmental factors and child survival in Tanzania. The survival prospects for the children were projected and compared through maternal, child and environmental factors.

Results: In the multivariate Cox proportional hazard regression, child factor variables which are positively associated with under-five mortality in this study include breastfeeding and multiple births. In view of environmental factors, the variables which showed significant association with under-five mortality in this study included type of place of residence, household size and regional zones. Children born to women who are married or living together with their partners have shown to survive longer than those born to those women who have never married or formerly married (4.725). Consistent with other findings of demography studies, the mean survival time analysis in this study indicated a higher survival time for female children (4.740) than their male counterparts (4.675). The results further showed that children of mothers residing in the Lake region [H.R =1.27, P=0.25, 95% C.I (0.56 – 1.41)] were having significantly higher risks of under-five mortality compared to children in the Western region.

Conclusion: In view of the analysis done on the maternal, child and environmental factors of this study, it can be justifiably concluded that breastfeeding, household size, child is twin/multiple births, type of bednet(s) slept under last night, type of place of residence and regional zones were some of the variables which showed significant association with under-five mortality and greater influence on child survival in this study. A surprising and strange finding was the increased survival time of households of 8+. In view of this finding, a reasonable inference that can be drawn is the fact that in such households, there may be more people who contribute to the household keeping and resources necessary for both the mother and the child.

The most outstanding and interesting finding of this study was that breastfeeding until 13 months and more showed the highest survival time at 4.873 months whilst not breastfeeding "correctly" showed the least survival time of 2.170 months. The multivariate regression of this study showed a highly significant relationship between the duration of breastfeeding and child mortality (p-value=0.000). Given the fact that breastfeeding had the highest impact on reducing child mortality, the study recommends that awareness campaigns for breastfeeding be intensified and a conducive environment for breast-feeding should be encouraged in all facets of society.

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Acronyms

ANC - Antenatal care

BA - Birth Asphyxia

Birth Asphyxia - BA

Child Survival Call to Action - CSCA

Demographic Transition Theory - DTT

DFID - Department for International Development

Early Neonatal Mortality - ENM

ENM - Early Neonatal Mortality

GCCA - Global Campaign on Children and AIDS

GDP- Growth Domestic Product

HBB - Helping Babies Breathe

HIV/AIDS – Human Immune Virus/Acquired Immune Deficiency Syndrome

ICPD - International Conference on Population and Development

IMF - International Monetary Fund

IMR - Infant Mortality Rate

IMR – Infant Mortality Rate

ITN - Insecticide-Treated Bed-Net

MDG – Millennium Development Goal

MDG – Millennium Development Goal

MMR – Maternal Mortality Rate

MoHSW - Ministry of Health and Social Welfare

MoHSW- Ministry of Health and Social Welfare

NBS - National Bureau of Statistics

NGO-Non-Governmental Organisation

Nigerian Demographic Health Survey - NDHS

Non-Governmental Organisations - NGOs

NSGRP- National Strategy for Growth and Reduction of Poverty

NSGRP-MKUKUTA - National Strategy for Growth and Reduction of Poverty

OCGS- Office of the Chief Government Statistician

Office of the Chief Government Statistician - OCGS

PHSDP- Primary Health Services Development Program

PoA – Programme of Action

Primary Health Services Development Program - PHSDP-MMAM)

RCHS- Reproductive and Child Health Section

SADHS - South Africa Demographic Health Survey

SPSS - Statistical Package for Social Scientist

SSA – Sub-Saharan Africa

TDHS - Tanzania Demographic Health Survey

TDHS- Tanzanian Demographic Health Survey

TFNC - Tanzania Food and Nutrition Centre

TFNC- Tanzania Food and Nutrition Centre

UN - United Nations

UN – United Nations

UNDP - United Nations Development Programme

UNFPA - United Nations Fund for Population Activities

UNFPA- United Nations Fund for Population Activities

UNICEF – United Nations Children's Fund

WFP- World Food Programme

WHO – World Health Organization

WFP – World Food Programme

WHO – World Health Organisation

WHO/GMP - World Health Organization Global Malaria Programme

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CHAPTER 1

INTRODUCTION

1.1. Background of the Study

The survival and well-being of children is the most crucial objective of communities, countries and nations of the world (Bornstein *et al.*, 2012). Infant mortality and under-five mortality have been given priority in the field of demography because among others, it mirrors the overall level of socio-economic settings in a population and thus, it is viewed as an exceptionally delicate measure of population health (Turnock, 2016).

When unprotected against unfavourable conditions and environments they live in, children are the most vulnerable to diseases (Ianni, 1975). The mortality risks of children are also determined by their ages. For example, in the neonatal stage, the immune systems are most delicate and susceptible to diseases than it is in the case of post-natal infants. However, the risk of mortality among children is attenuated as they move from infant to childhood stage (Omran, 2005). Research findings have revealed that a substantial number of deaths among children occur to children under the age of five. Thus, under-five mortality can be used as a good index of overall level of child mortality (O'Reilly, 2012).

In an effort to reduce under-five mortality by 2/3 in 2015, the United Nations Member States adopted the Millennium Development Goals (MDGs) in 2000. Though the turn of the 21st century experienced an unparalleled decrease in both infant and child mortality, the level of decline differs across countries and regions. However, the pace of decline in developing countries has been very slow compared to that of developed countries (National Research Council, 1998). For example, developing regions experienced a sluggish decline from 106 to 83 per 1,000 live births between 1990 and 2005 (World Bank, 2014).

Most developing countries, especially those in the Sub-Saharan Africa (SSA) region are poor and still in the "early" stages of demographic transition (Losch, 2012). This situation can arguably be lucidly interpreted by the demographic transition status of the SSA countries. The theory advocates for the reduction in mortality through the processes of modernisation effected by industrialisation, urbanization, empowerment of women, improved levels of education and

overall socio-economic development which results in low fertility and mortality rates (Dudley *et al*, 2010). The transition propels a decline in mortality through improvements in hygiene and economic growth and enhances fertility decline as life expectancy rises considerably (Brym & Lie, 2010).

The demographic transition theory implies that countries which are at a lower level of development are likely to experience high mortality rates, especially among infants, which is the case with most developing countries in the SSA region (Baumle, 2006). Furthermore, the demographic transition difference between the third world and first world countries epitomise the development gap between these two regions. It is further in this context that the socio-economic development of these regions differs considerably and therefore explains the impact it has on the mortality differentials in both worlds.

1.2. Trends and Levels of Child Mortality

In Africa, there exist an empirical evidence of the relationship between maternal mortality and child mortality where 25% of under-five deaths occur within the first month and 75% occur within the first week (UN Chronicle, 2007). This incidence has been revealed by several studies on the impact of socio-economic factors of child survival on health in developing countries (Wagstaff *et al*., 2004). Variations in child mortality are ostensibly premised on the unequal socio-economic conditions existing in locations and regions (Asthana & Halliday, 2006). Globally, there is a substantial quantity of literature on the determinants of infant and child mortality. Infant mortality, which is a component of under-five mortality, is high in low-income countries such as those in the developing Sub-Saharan Africa and Asia than in high income countries which include those in North America and Europe (Wesley *et al*., 2009). This statement therefore means that there is a strong connection between child mortality and socio-economic development. From the above statement, it is evident that socio-economic development determines child mortality disparities between countries of the world.

1.2.1. Childhood and Under-Five Mortality in the World

Since the world embarked on a progress to reduce infant mortality, mortality and child survival rates have improved considerably in most developing countries. Evidence corroborating this

lies in the under-five mortality which has fallen by more than half since 1990 (UNICEF, 2008). As a consequence of the nations of the world's undertaking, the under-five mortality rate fell from 90 deaths per 1,000 live births between 2000 to 43 deaths per 1 000 live births in 2013 (The Millennium Development Goals Report, 2015). In addition, in 2015, neonatal deaths dropped from 5.1 million in 1990 to 2.7 million (Josh; 2015).

In addition, the World Summit for Children held in 1990 set goals for the decrease of infant and under-five child mortality rates by one-third. Among the goals agreed upon was a commitment to promote child health and survival by eradicating child death caused by preventable diseases. Furthermore, the policy of promoting breast-feeding in order to expand child survival was adopted by the summit. As a consequence of this strategy, there were improvements in the global under-five mortality rate. Developed regions experienced under-five mortality of 9 per 1000 against 153 per 1000 in the least developed countries during the period 2000 to 2005 (United Nations, 2007).

1.2.2. Childhood and Under-Five Mortality in SSA

Despite a considerable decline in infant and under-five mortality rates in the world, there still exist disparities between countries and regions. Political and economic instability characterises many SSA countries and contribute to the poor economic status of these countries. In addition, neonatal death from these countries accounts for 38% of overall global neonatal deaths and for about a third of global under-five mortality (WHO, 2005). On the other hand, in Southern Asia, about 1 child in 19 dies before the age of five and this region is rated as the second highest in under-five mortality in the world (Mahbub ul Haq Human Development Centre, 2007). However, as time went by, decrease in mortality and a consequent surge of life expectancy at birth were evident in these regions. Much of this decline in the SSA has been attributed to the marginal social and economic transformation which took place in the region which includes the growth of the economy and the concomitant increase in access to health care (Adentunji & Bos, 2006).

However, childhood mortality reduction in Sub-Saharan Africa has been muted by epidemics of HIV/AIDS and malaria which have been touted as the leading causes of death among young children in Sub-Saharan Africa (United Nations, 2007). On the other hand, the scourge of malaria accounted for almost 500 000 lives of children under-five in the world and most of

these deaths occurred in Sub-Saharan Africa. For example, 1 child in 12 in Sub-Saharan Africa dies before his or her fifth birthday compared to developed countries' average ratio of 1 in 147 (Josh, 2012). Although Tanzania faces similar challenges, the situation is slowly improving.

According to Garcia *et al.* (2008), the Sub-Saharan Africa (SSA) region experienced a high infant mortality rate (IMR) at the beginning of the 20th century. Close to a quarter of neonatal deaths in the world come from Sub-Saharan Africa and Asia (Lawn *et al.*, 2005). For example, the main infectious diseases, including sepsis, pneumonia, diarrhoea and tetanus are found in this region. Neonatal sepsis is one of the leading contributors to under-five mortality and was responsible for 15% of new-born deaths in Africa.

1.2.3. Childhood and Under-Five Mortality in Tanzania

The health problems of Tanzania do not differ much from the problems of other developing countries. A profound deficit of development in developing countries in general is c0rroborated by poor living conditions where provision of basic services is inadequate (Nies and McEwen, 2013). According to Chuhan-Pole and Angwafo (2011), Tanzania's infant mortality rate (IMR) declined from 115 per 1000 live births in 1990 to 38 per 1000 in 2015. This is evidently a remarkable feat to achieve but still the highest number by world standards (Chuhan-Pole & Angwafo, 2011).

Furthermore, with the aim of improving the standard of living and quality of life of the population the government of Tanzania adopted the National Population Policy in 1999. In its quest to minimise IMR, the Tanzanian government partnered with United Nations (UN) and various Non-Governmental Organisations (NGOs) to enhance maternal and child health in the country. Manifestly, the above statement reflects the government's solemn intention to reduce maternal, new-born and child deaths in the gamut of the objectives of the Tanzania Vision 2025, the National Strategy for Growth and Reduction of Poverty (NSGRP-MKUKUTA) as well as the Primary Health Services Development Program (PHSDP-MMAM) in general. The advance of this strategy was clearly consistent with the doctrines of the New Delhi Declaration of 2005.

Due to high under-five mortality rate, Tanzania is globally positioned 27. However, Susuman (2012) apprise us that in the period between 1996 and 2000 under-five mortality was reduced

from 143 to 81 in Tanzania. As a consequence, Tanzania is counted among the 12 low-income countries which have reached the MDG 4 target of reducing under-five mortality by 2/3 in 2015 (Susuman, 2012). Others include Cambodia, Ethiopia, Eritrea, Liberia, Madagascar, Malawi, Mozambique, Nepal, Niger, Rwanda and Uganda. Manji (2009) conducted a study in a Special Care Baby Unit in the Kilimanjaro Christian Medical Centre. The results of his study revealed that 31 new-borns died within 24 hours after being born in this centre alone (Manji, 2009). Clearly, this number is high if we consider the fact that this number may be amplified over 59 months.

Furthermore, Mmbaga's study of 2013 showed that Tanzania was able to reduce child mortality. However, at 32 per 1,000 live births neonatal mortality contributed 47% of the infant mortality rate (The National Road Map Strategic Plan to Accelerate Reduction of Maternal, Newborn and Child Deaths in Tanzania, 2008). Congruently, other scholars observed that neonatal and post-neonatal mortality exceeded half of less than under-five mortality rates in Tanzania. Quite evidently, this occurrence reflects a high number of neonate's mortality and it is not yet comparable to developed countries and a need for the investigation of the socio-economic impact of under-five mortality in Tanzania arises.

Manji (2012) also noted that Tanzania was able to substantially reduce child mortality. Nonetheless, neonatal mortality still remained high in Tanzania. Msemo *et al.* (2013) highlights an effort by the government of Tanzania to reach the MDG 4 which called for a 2/3 reduction in under-five mortality in 2015. As a result of this initiative, there was a 4.4% reduction of under-five year's deaths in Tanzania. Nevertheless, it was found that birth asphyxia (BA), which is a failure to start breathing at birth contributed to approximately 27% to 30% of neonate deaths. It is important to note that although efforts were made to reduce the mortality of new-borns, early neonatal mortality (ENM) and birth asphyxia (BA) remained unchanged over 15 years in Tanzania. Msemo *et al.* (2013) further apprise us that neonatal mortality rate is approximately at 32/1000 live births in Tanzania, which amounts to 40 000 infants' deaths annually. Quite evidently, this is a large number by any measure for the loss of human lives.

A study conducted by Ntimba and Mbago (2005) on the socio-economic and demographic determinants of infant and child mortality in Tanzania, Karagwe District, has shown that although Tanzania had made a great effort to reduce infant and child mortality through various means, infant and child mortality has remained high. Ntimba and Mbago found variations

between regions and districts which recognised existence of disparities in child deaths between rural and urban areas. Their study revealed that more children were dying in rural areas than urban areas. However, in contrast to some common findings of the demographic literature, the study revealed that age of the mother was found to have insignificant effect on child mortality.

1.3. Problem Statement

Child mortality is recognized globally as an important development indicator and therefore reducing child mortality remains a global priority (WHO, 2005). Under-five mortality trends constitute a leading indicator of the level of child health and overall development of countries. Sub-Saharan Africa is ranked second after South Asia in terms of child mortality and most child deaths are from preventable causes. Although significant progress was made in reducing under-five mortality, the current mortality levels remain very high in Sub-Saharan Africa compared to the developed countries.

Tanzanian health problems reflect those of other developing countries where the standard of living is low and housing and sanitation are inadequate (Nies & McEwen, 2013). Despite some improvements, close to 400 children less than five years die every day of preventable and treatable conditions in Tanzania (Kamagi, 2016). Moreover, diseases that affect children at an early vulnerable stage of life are premised on the ability of the mothers to protect children from such diseases and the environment they are born in. If then these diseases are easily preventable and curable, the question which can be asked is: how then is under-five mortality so high in SSA countries, Tanzania included.

However, it is important to note that although efforts were made to reduce mortality of new-borns, early neonatal mortality (ENM) and BA remained unchanged over 15 years in Tanzania (Msemo *et al*, 2013). Msemo *et al* (2013) further appraise us that neonatal mortality rate, which is a component of under-5 mortality was approximately at 32/1000 live births in Tanzania and this was aggregated to 40 000 infants' deaths annually. Quite evidently, this is a large number by any measure for the loss of human lives. It is in this context that this research study attempts to examine the socio-economic determinants prompting under-5 mortality in Tanzania.

DataMarket (2018) shows that although mortality rate of under-five children (per 1000 births) has been declining between 1960 and 1990 in Tanzania, however, the decline has not been

constant. For example, under-five mortality rate in Tanzania had increased constantly from 179.4 in 1980 to 180.4, 182.3, 184.4, 185.8 to 186.2 in 1982, 1983, 1984, 1985 and 1986 respectively. However, a decline was experienced from 185.5 (1987) to 183.8 (1988), 181.4 (1989) to 178.7 in 1990 (DataMarket, 2018). Equally, the above data from DataMarket (2018) shows that mortality rate was higher in 1988 (183.8) compared to 1982 (180.4), 1987 (185.4) and 1984 (184.4). The fluctuating mortality rate over the years in Tanzania and any other country mandates a constant meticulous investigation of the factors influencing mortality. The socio-economic conditions existing within communities are not stable but mutable. These conditions are controlled by the socio-economic and political circumstances existing at that time and are inadvertently changing.

The challenge that is brought by such socio-economic and geo-political factors still needs to be identified and given more consideration and priority to reduce under-five mortality to "acceptable" levels. Although Tanzania might have reduced infant and under-five mortality, but the challenge that is brought about by some socio-economic factors which affect child mortality still need to be identified and given more consideration and priority if child mortality is to be eradicated. The aim, therefore, should be to identify those socio-economic factors that are responsible for the escalation of mortality and pledge more resources to them. There exists a need to distribute both human and capital resources equitably among those underachieving regions. Appreciating the factors liable for high prevalence of child mortality is, therefore, imperative and judicious. It is in this context that factors influencing mortality in the population should be continuously investigated in order to evaluate existing policies and adapt them to the fluctuating socio-economic conditions.

Child mortality disparities provide the level of child health and overall development in countries (UNICEF, 2015). On average, the Sub-Saharan countries' under-five mortality is estimated at 78 deaths per 1000 live births and the overall under-five mortality in the world is estimated 41 deaths per 1000 live births. According to the UNICEF (2016), in 1960 Tanzania's under-5 mortality stood at 242.80 and 56.70 in 2016 (UNICEF, 2016). Even at this rate, Tanzania's under-five mortality rate is still 1.7 times more than the world average (UNICEF, 2015). High under-5 mortality rates are experienced in Sub-Saharan African countries such as Angola, Chad, Somalia and Central African Republic at 157, 139, 137 and 130 deaths per 1,000 live births respectively. Other Sub-Saharan countries whose under-five mortality was estimated below that of Tanzania in 2016 include among others South Africa (43), Senegal (47), Gabon

(47), Eritrea (45) and Kenya at 49 per 1000 live births in 2016. Developed countries' such as Sweden, United Kingdom, Switzerland and North America's under-five mortality per 1000 live births was estimated in 2016 at 3, 4, 4 and 6 respectively (World Health Statistics, 2010). In Tanzania, one in seven children born perishes before reaching the age of five (The DHS Program, 2010). Parenthetically, almost one child in 13 dies before his or her fifth birthday in Sub-Saharan Africa while the world's high-income countries experience approximately 1 in 189 (The DHS Program, 2010).

Although Tanzania has made some remarkable effort in child health and has attained its millennium development goal (MDG 4) target, preventable diseases such as malaria, pneumonia and diarrhoea are prevalent in Tanzania and predominantly responsible for the death of 250 children under-five years of age (UNICEF, 2015). Manifestly, these are environment related diseases that can be avoided. Notwithstanding the great efforts undertaken to reduce child mortality, regional and economic disproportions in the country are sources of imbalances in child deaths and survival. There exists mortality variations between regions and districts premised on their performances, human resource, inadequate medical infrastructure and the quality of health services rendered (Kibele, 2012). The under-five mortality proportion before the 2010 survey reached 58 deaths per 1,000 live births in Northern Zone and 109 in Lake Zone (Kruk and Mbaruku, 2015). Clearly, this incidence shows that although overall child mortality has declined in Tanzania, some regions are still experiencing high mortality which is profoundly premised on the socio-economic conditions existing in some parts of the country.

The fact that mortality has been reduced in any society or country is not a victory for that particular country. The loss of one child is one too many. Children epitomise the future we wish for and convey our dreams and visions of how we would like life to be. The survival of children from infant stage and them maturing to adulthood is imperative for any society since their survival past this juncture increases their prospect of becoming productive members of society. Therefore, reproduction is imperative for both the replacement of generations and long term implication of development goals within societies. Quite evidently, high child mortality has undesirable developmental repercussions for both the family and society at large. If children die, this means that a country's future workforce is reduced and underdevelopment is ascertained. Therefore, the global battle for ending infant and child mortality is an incessant resolve.

As mentioned above, infant and child mortality are premised on the socio-economic factors at play in the realm of development, the egregious consequences posed by the lack of socio-economic development cannot be ignored (Gebretsadik and Gabreyohannes, 2016; Basiago, 1999). In spite of substantial natural resources that the country is endowed with, the economic condition of Tanzania is still not adequate to address the abject poverty of the population. Moreover, the increasing population of Tanzania is also a cause for concern since it burdens the healthcare system and other social services (Cincotta & Engelman, 1997). It is in this context that high rate of child mortality is a major problem for low and middle income countries, including Tanzania.

1.4. Objectives

1.4.1. Main objective

The over-all objective of this study was to investigate the socio-economic factors influencing under-five mortality in Tanzania using the 2010 Tanzania Demographic Health Survey (TDHS).

1.4.2 Specific Objectives

Specifically, the aim of this research study is to:

- Identify the socio-economic factors that affect under-five mortality and child survival in Tanzania;
- Determine whether and which maternal factors are associated with under-five mortality and child survival in Tanzania;
- Determine whether child factors are associated with under-five mortality and child survival in Tanzania and
- Identify the environmental factors which influence under-five mortality and child survival in Tanzania.

1.5. Significance of the Study

Available literature reveals that socio-economic, demographic and health related variables are the most important factors used to gauge neonatal, post-neonatal, infant and child mortality levels in a country (Kamal, 2012). The results of this study will therefore offer valuable insight into unexplored characteristics of maternal, child and environmental factors influencing under-five mortality in Tanzania. In essence, new-borns' lives can be saved by implementing apposite policies and programmes for child survival. Furthermore, countries with similar challenges, as is the case with most SSA countries, can only borrow these strategies and programmes and adapt them in their own countries' policies and strategies for reducing under-five mortality.

Additionally, a study of under-five mortality is imperative for the understanding of population dynamics and can positively contribute to the planning, evaluation and formulation of pertinent health policies or strategies and also to review existing policies on child mortality with the aim of improving them. From the trends, records and information on under-five mortality; appropriate estimates of child mortality rates can be used to project population growth. This study, therefore, also considers the lessons from the failures and successes of child mortality in Tanzania. In addition, information on under-five mortality can also point out where interventions and resources could be directed. The results of this study may further help donors and the government of Tanzania to understand risk factors associated with survival and the death of children. This will eventually provide base-line data for detail and further studies in future.

As a measure to build on the successes of the Millennium Development Goals and hasten progress attained, in 2015 the United Nations (UN) adopted the Sustainable Development Goals (SDGs) where the target among others was to end preventable deaths of new-borns and children under-five years of age. Furthermore, the aim was to reduce neonatal mortality to below 12 per 1000 live births and under-five mortality to at least 25 per 1000 live births by 2030 (Armstrong-Mensah, 2017). Though three of the SDG's targets are similar to the earlier MDG goals on health and mortality, goal No. 3's intentions are to ensure healthy lives and promote well-being for everyone at all ages. The target includes among others new areas such as climate change, economic inequality, innovation, sustainable consumption, peace and justice, among other priorities.

Furthermore, the Child Survival Call to Action (CSCA) set up by the governments of Ethiopia, India and the United States of America in 2012 in Washington D.C. called for rejuvenated

determination to propel global child survival. The convention culminated in 178 governments including a considerable number of civil society and faith-based organizations signing a determination to do everything possible to stop the death of women and children from easily avoidable diseases. The aim of the CSCA was to support Millennium Development Goal (MDG) 4 which called for the reduction of the under-five mortality rate by two thirds between 1990 and 2015 and also the acceleration of maternal survival contained in MDG 5. The commitment was later called A Promise Renewed. The most important objective of the CSCA for this study was to continue with the promise beyond 2015, until mother and child deaths are stopped (MDG, 2014). Hence, this research study resonates with the objectives of the CSCA commitment and the SDGs in that the ultimate goals should not be to reduce child mortality, but to end it.

1.6. The Synoptic History of Tanzania

Figure 1. Map of regions of Tanzania.

The United Republic of Tanzania was formed from the union of Tanganyika with Zanzibar in April 1964. The name of this country originates from the two states of Zanzibar and Tanganyika to form what is today known as the United Republic of Tanzania (Mwakikagile, 2008). Julius Nyerere, popularly known to Tanzanians as *Mwalimu* (the teacher) was the first president of the United Republic of Tanzania which got its independence from Britain in 1964 (Kwame & Gates Jr., 2005). Despite its poor economic status, Tanzania remains rather peaceful and stable except for inconsequential and sporadic isolated public strikes (Ndulu & Mutalemwa, 2002).

1.6.1. Geography of Tanzania

Tanzania, a country of 947,300 square kilometres of land is found in East Africa along the Indian coast (Luschei & Chudgar, 2017). To the north are Uganda and Kenya; to the west, Burundi, Rwanda and Congo and to the south, Mozambique, Zambia, and Malawi. Three of Africa's best-known lakes are found in Tanzania and these are; Victoria in the north, Tanganyika in the west and Nyasa in the south. The island of Zanzibar is also part of Tanzania. Additionally, the renowned Mount Kilimanjaro which is the highest point above sea level in the continent (5,895 m) is also found in Tanzania (Marshall, 2010).

1.6.2 Demographic Context of Tanzania

In 2016, the population of Tanzania was estimated at 51.04 million and 80% of it lived in rural areas (Francoeur & Noonan, 2004). There are 120 different ethnic groups in Tanzania and the official languages are Kiswahili and English. With a population growth of over 3% per annum, Tanzania's population is estimated to reach 95.5 million by 2050 (Gray, 2017). The age distribution of Tanzania shows that 44% of the population is under the age of 15 and the total fertility rate is 5.01 children born per woman. Currently, the crude birth rate of Tanzania stands at 37.631 births per thousand; one of the highest birth rates in the world (Ciment & Ness, 1999).

1.6.3 Socio-economic Background of Tanzania

The most prominent effort of "radical" economic transformation in Tanzania was initiated by President Julius Nyerere in 1967. Through the Arusha Declaration, President Nyerere came up with a socio-economic development policy based on African socialism which among others discouraged personal wealth accumulation amidst pervasive poverty. President Nyerere promoted Tanzanian self-reliance where everyone would work for both the group and for him/herself to construct a culture based on reciprocated support, economic as well as political equality (Lawrence, 2009). However, this ideology was received with some repugnance by the West and some donors. The International Monetary Fund (IMF) and aid donors called for rigorous economic reform by advocating for some structural adjustment of the economic system.

Although Tanzania is rated as one of the world's poorest economies in terms of *per capita* income, recent economic overview of Tanzania has revealed that real GDP growth for 2016 was estimated at nearly 7% and the inflation rate has remained low (Gray, 2017). The economy of Tanzania depends on agriculture, which accounts for more than one-quarter of GDP, provides 85% of exports and employs about 65% of the work force. Despite the fact that poverty rate fell from 60% in 2007 to 47% in 2016, about 12 million Tanzanians still live in extreme poverty (Biermann & Moshi. 1997). However, during the tenure of President Julius Nyerere, Tanzania's education and healthcare improved and primary and secondary school enrolment increased (Adedeji *et al.*, 2013).

1.7 Definition of Major Terms

In order to deliver an inclusive conceptual framework for the analysis of under-five mortality, it is indispensable to consider the terminology which is usually used in this arena as follows:

a) ***Neonates mortality*:** defined as mortality that occurs within the first month of life. A neonate is also called a new-born. Neonatal mortality therefore describes the probability of dying within the first month of life.

b) ***Post-neonates mortality*:** is the death of new-borns that takes place between the first month of life and 12 months of a new-born.

c) ***Infant Mortality*:** mortality that occurs before the child reaches 12 months. It is evident from this statement that infant mortality incorporates both the neonates and post-neonates mortality.

d) ***Child Mortality*:** refers to death of a child between its first and fifth birthday.

e) ***Under-five Mortality:*** It is further important to note that the explanation of the above terms add up to what under-five mortality is because they all happen to children who are under the age five. Under-five mortality is therefore explained as the probability of death among children under age of five.

1.8 Chapter Summary

This chapter outlined the foundations upon which the entire research will be constructed. The chapter focused on the background and rationale of the study, objectives of the study, keywords and the problem statement. The purpose and significance of the study is also stated in this chapter. The next chapter will review the literature, theoretical and conceptual frameworks required to provide guidance for the research topic under investigation

CHAPTER 2: Theoretical, Conceptual Frameworks and Literature Review

2.1 Introduction

Universally, there is vast literature that expounds the determinants of infant and child mortality. These studies and their findings have shown significant relationship between socio-economic,

demographic and environmental factors and, child mortality. Emanating from above is the purpose of this chapter which is to present the conceptual and theoretical frameworks and, literature review used to explore socio-economic factors related to under-five mortality such as maternal, environmental and child determinants. This study, therefore, adopted the framework from Mosley and Chen (1984) and uses: maternal factors, child factors and environmental factors as socio-economic factors that may influence child survival.

As mentioned above, child mortality causes distress to both the society and the family (Shehan, 2016). Locations where child mortality levels are high display a lack of or inadequate basic health infrastructure (Kyei, 1999). Besides, high child mortality levels reveal that other basic facilities are absent or are in a poor state; for example, toilet facilities, water, sewerage and the rest. Where high child mortality is prevalent, there is equally a display of infectious and parasitic diseases and recurrent occurrences of widespread diseases (National Research Council, 1993).

2.2 Theoretical and Conceptual Background

The development of nations and human beings in general is critical to a long and healthy life of the country's citizenry (Pawar, 2014). Historical literature enlightens us to the fact that human mortality is an intricate occurrence which is caused by a sequence of bodily and biological attacks (Null & Feast, 2003). Addison also indicates that death usually occurs due to disease, which is a medical phenomenon (Addison *et al.*, 2009). Diseases or injuries therefore result from other factors (intermediate) or the lack of such factors (Lopez *et al.*, 2006). When such diseases are due to external factors, they are considered to be caused by exogenous factors (Ahmed *et al.*, 2007).

Davis and Blake were the first to come with the idea of proximate determinants analytic framework for the study of fertility (Davis & Blake, 1956). These scholars hypothesised that social factors influencing the level of fertility had to operate through one or more intermediate variables. Similarly, Mosley and Chen, 1984) postulate that social and economic elements of child mortality function over a set of organic mechanisms or intermediate variables to initiate the probability of mortality.

Further to the above, these researchers assert that socio-economic determinants of child mortality operate through contiguous variables to upset child survival (Mosley & Chen (1984). Mosley and Chen (1984) argue against Davis and Blake's theory and posited that it ignored the biological factors through which socio-economic factors operate to influence mortality and thus created a framework that fused both the socio-economic and biomedical factors. Hence, this study used the Mosley and Chen background as the foundation for recognising imperative factors associated with under-five mortality in Tanzania.

Mosley and Chen (1984) categorised the determining factors of infant and child mortality as exogenous when considering cultural, social and economic factors and as endogenous factors. According to Mosley and Chen (1984), these aspects function over maternal, biological, environmental, nutritional and health seeking social factors until a child is sick or well, and ultimately even death of the child. The factors influencing death in the neonatal stage are attributed to endogenous and exogenous factors (Lalou, 1997). Factors which customarily contribute to neonatal deaths are largely endogenous, while those which affect post-neonatal deaths are primarily exogenous.

The word endogenous signifies deaths produced by subjects that are free of pathological, socio-economic and cultural circumstances (Tymicki, 2009). The endogenous backgrounds are premised on the biological and genetic aspects that impact on survival. Evidently, the external environment factors which affect foetal growth enter through the mother. Therefore, the mother's welfare during pregnancy explains the health status of the baby after birth. Yet again, endogenous diseases are those diseases that children are born with and have been generated during pregnancy or development of the foetus (Perera & Herbstman, 2011).

Todaro (2011) mentions development as a precursor for the reduction in fertility and mortality. The survival of children from infant to adulthood, therefore, influences the ultimate survival of human beings against many hazardous and distressing encounters they come across in the process of their development. Other fundamental factors which affect child mortality may be: poor health knowledge, low educational status, poor economy and inequality (Fantahun, 2008).

Parenthetically, many theories that explain the survival and increments of life expectancy have been developed in the past. The classical demographic transition theory (DTT) is an antecedent to the evolution of mortality patterns. The DTT is premised on the postulation that socio-

economic development instigates mortality decline among historical populations (Carr, 2003). Compatibly, the epidemiologic transition theory attributes the mortality decline to socio-economic development whilst further suggesting medical technology to be responsible for mortality decline in developing countries where basic health infrastructure, sanitation, environmental degradation and living conditions are excessively insufficient (Notestein 1953; Omran, 1971).

Other studies have examined the connection between socio-economic factors and the death of children and pointed to the maternal education as an important factor of child survival (Bicego and Ahmad, 1996). These studies revealed a relationship of socio-economic and demographic factors which influences child mortality (Caldwell, 1979). Caldwell also found that mother's education has an effect in reducing infant and child mortality. Furthermore, his theory proves that a mother's education has a positive effect on the health status of the baby and is premised on how the mother learn ways of feeding the baby and accessing healthcare facilities, including altering traditional settings that improves child survival within the family setting. Similarly, Hobcraft (1993) posits that education helps women to take care of their reproductive health, improve their capabilities within the family and deciding on the number of children they intend to have.

Furthermore, the availability and non-availability of water, electricity and proper sanitation are explained as environmental factors impacting on the survival chances of children. Maternal factors such as age of the mother at birth, education of the mother, birth order, interval, place of residence and health seeking behaviours are important determinants of infant survival (Rutstein, 1984). Moreover, child factors such as breastfeeding, which is related to child development outcomes and is pivotal past the neonatal stage as well as sex of the child, are related to the threat of dying at infancy (Cleland & van Ginneken, 1988). This study therefore attempts to examine socio-economic factors such as maternal, environmental and child factors associated with under-five mortality by using the Mosley and Chen framework. As a consequence, the framework in this study embodies a theoretical model which elucidates the grounds of child mortality and survival.

Infant mortality is explained as the threat for a child dying within 12 months after it was born. On the other hand, neonate mortality refers to the probability of death of new-borns within 28 days of life and post-neonates mortality is the death of new-borns that takes place between the

first month of life and 12 months of a new-born. Child mortality is the death of children aged between 12 and 59 months. Evidently, all these components fall under the explanation of what under-five mortality is. From the above narration, it becomes evident that under-five mortality incorporates the neonates, post-neonates, infants and child mortality. Therefore, the use of the term "under-five mortality" in this study refers to neonates, post-neonates, infants and child mortality.

The conceptual framework of this study offers a coherent representation of socio-economic factors to analyse their influences on under-five mortality such as child; maternal and environmental variables. Conceptual frameworks of child survival have been developed including the Mosley and Chen model (1984) which is widely accepted as the prudent theory to elaborate the conceptual framework for explaining socio-economic influences on child mortality. The conceptual core of this model postulates that socio-economic and cultural factors employ a set of immediate elements that stimulate the threat of illness and the result of morbidity progressions.

Most researchers have based their frameworks on the intangible framework of child survival for developing countries offered by Mosley and Chen (1984). Boerma and Bicego (1993) incorporated the framework presented by Mosley and Chen (1984) with alterations premised on the restrictions and structure of the DHS data. Mosley and Chen's framework of child survival opine that all socio-economic factors of child mortality function through a collective set of intervening factors where independent variables wield effect on the results of the variable through a gamut of overriding variables. In this way, socio-economic factors influence infant and child mortality, and thus work through the related factors (Mosey & Chen, 1984).

However, for the purpose of this study, the variables have been arranged into three groups. This is demonstrated in figure 2.1 below. Maternal factors; the first of these is: highest educational level, age maternal age, children ever born, sex of household head, age of household head, breastfeeding, household size, marital status and wealth index. Secondly, we have child factors which cover the following: birth order, sex of child, size of the child at birth and child is twin. Lastly, we have environmental factors which refer to: availability of electricity, type of bednet(s) slept under the previous night, water source, type of place of residence, type of toilet facility and regional zones.

The current study was lucidly directed by both the revised literature and the theoretical representations offered earlier. As shown in Figure 2.1 below, the independent variables encompass variables at the three setups: maternal, child and environmental variables. The relationship between maternal factors and child factors is premised on the fact that mother's schooling plays a pivotal role in infant and child mortality and is used as a measure of socio-economic well-being of the mother and her household decision-making (The World Bank, 2005).

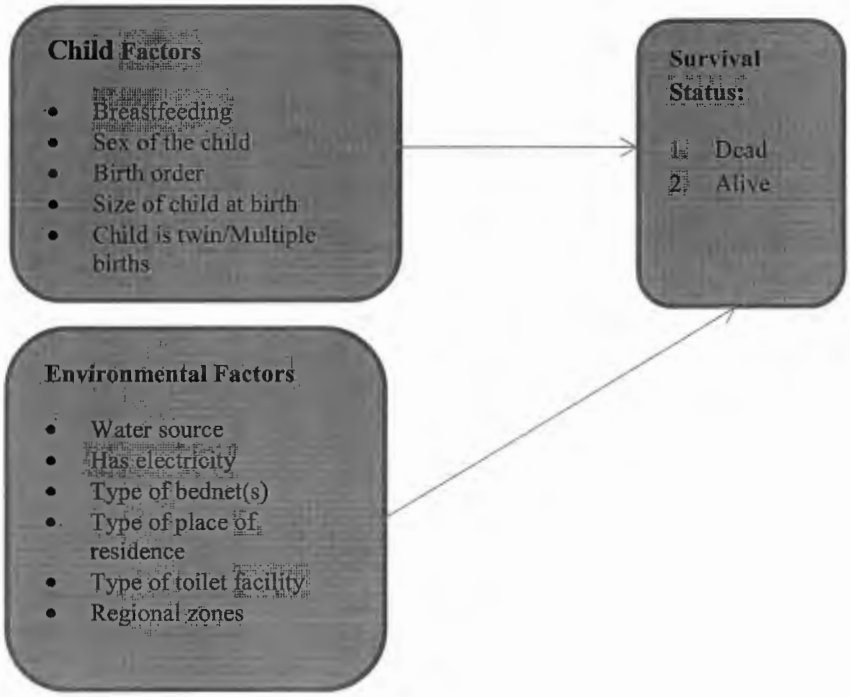

Figure 2. Adapted Framework for the Study of Under-five Mortality

2.3 Literature Review

The main aim of this chapter is to provide relevant literature and the theoretical framework used to explain maternal, environmental and child factors of under-five mortality. It is also intended in this chapter to highlight and show that child mortality problem as discussed by Shehan (2016) extends beyond the family level into society. Moreover, high child mortality points to a lack of or poor state of basic hygiene facilities. In such circumstances, there is usually an outbreak of infectious diseases with a possibility of reaching epidemic proportions (National Research Council, 1993).

Infant mortality, which is a component of under-five mortality, is high in less developed countries of Sub-Saharan Africa and Asia than in developed North American and European countries (Wesley *et al.*, 2009). This statement therefore points to a close association between child mortality and socio-economic development. From the above statement, it should be clear that socio-economic development drives disparities between countries of the world.

2.3.1 Maternal Factors

There are a number of variables under maternal factors which could have an effect on child mortality. These include: personal factors such as education level of the mother, number of children ever born to a woman, marital status, maternal age and age at first birth. In addition, maternal factors can include factors within the household from which a woman comes from, such as size of the household, sex of the head of the household, age of the head and wealth index.

2.3.1.1 Maternal Education

The education level of a mother is critical to child survival (Joshi, 1996). Educational attainment of the mother positively influences the reproductive decisions of the mother in as far as birth and marriage are concerned. It influences the mother's decisions and upsurges her capability to deal with: healthcare, nutrition, hygiene, contraception, preventative care and disease treatment (Vandresse, 2007). In addition, educated women can increase child survival by delaying their marriage and deciding on their own how many children they would like to have; in the process utilizing prenatal care and immunizing their children/progeny (Hobcraft, 1993). It is in this context that the relationship between the mother's education and child survival commonly controls other socio-economic variables. For example, a study by Kamal (2012) in Bangladesh indicates that child mortality is significantly associated with maternal educational level. In addition, the study identifies variables such as: place of residence, religion, maternal age, birth order, toilet facility and number of antenatal care (ANC) attendances to have meaningful relationship with child mortality.

It is evident from the above discussion that the educational attainment and level of the mother has a pivotal role to play in nurturing, upbringing and survival of children. A study by Maitra and Pal (2007) found child mortality to be high among adolescent mothers who are school failures, unemployed and thus have financial problems that encumbered them to provide healthcare and nutrition for their infants (Maitra & Pal, 2007). This factor (education), further incapacitates women to have the liberty to seek healthcare for themselves and their children because educated women can delay marriage and birth in pursuit of their careers (Fynn, 2010).

2.3.1.2 Children Ever Born

This variable reflects the number of children born to a woman in the five years prior to the survey. Adhikari and Podhisita (2010) conducted a study in Nepal to investigate factors that impact on child mortality among mothers who have given birth during a five-year period. The results indicate that women who had given birth to three or more children were more likely to experience a child death than those who have given birth to lesser number of children.

2.3.1.3 Maternal Age

Generally, high infant mortality is pronounced among less educated teenage mothers (Mostert *et al*, 1998). At younger ages, mothers are socially, psychologically and physiologically immature for reproduction. Maternal age has also been associated with child mortality rate in different countries. Using a multilevel survival analysis for the analysis of correlated nested time survival data in Ethiopia, Daraje (2015) found that child mortality significantly differed between women in different ages. In Nigeria, Ezhe *et al.* (2017) found that in relation to those born of mothers aged between 30 and 39 years, post-neonates born of younger mothers (age <20 years) were more likely to die.

In a nearly similar study to the above, Chwuku and Okonkwo (2015) employed the Cox proportional hazards regression model to investigate frailty among individuals to determine those demographic characteristics responsible for under-five child mortality and hazard rates in Nigeria. The study showed that there is a relationship between mother's age and under-five mortality and that the age group less than 20 years had the highest hazard ratio followed by 25-29, 30-34 and lastly, the age group greater than or equal 35 years. Similarly, in a study in Ethiopia, Getachew and Bekele (2016) employed the Cox proportional hazard model and Stratified Cox proportional method of analysis to examine the mortality hazard of under-five children for various variables. The results of the study pointed out that those children born of young mothers commonly experienced high under-five mortality.

Brockeroff (1996) posited that a mother's age at birth (<age 18) substantially increases the probabilities of infants deaths than other children by 40% in the first month and by 63% thereafter. In addition to that, Ajaari *et al.* (2012) also discovered that maternal age at delivery was the reason behind high new-born deaths. In the same study, women in the ages 20-29 had

reduced neonatal deaths than women under 20 years old at the time of delivery. Similarly, women aged 30 years and above also experienced lower neonatal deaths than those who were under 20 years of age. Middleberg (2003) also found out that the probability of neonatal deaths was high among women under the age of 15. Nevertheless, this finding is in direct contrast to the findings of Mamood (2002) which indicated that the survival probabilities of children born to young mothers were very high for both neonatal and post-neonatal categories.

2.3.1.4 Marital Status

Marital status of parents can affect the mortality risk of children. In addition, being a single or widowed parent can also influence the survival of children as much as having both living parents lowers the mortality risk of children (Kang *et al.*, 2016). Mturi and Curtis (1995) used the Cox Proportional hazards technique to find out the factors that have an effect on infant and child mortality. As a result, the outcome of the study showed that matrimonial state of a woman positively affects child survival probabilities (Mturi & Curtis, 1995). Similarly, Worku (2009) employed the South Africa Demographic Health Survey (SADHS) of 2003 data to investigate socio-economic factors impacting on child mortality in South Africa. In this study, Worku (2009) discovered that children born from married mothers have an increased probability of survival.

2.3.1.5 Wealth Index

A concern among researchers is the affordability of households to provide for their children and child mortality apparently triggered by the inability to provide basic healthcare. Some households are poor while others are exceptionally rich. The amount of wealth that families possess can have a bearing on the survival probability of children and their risks of death. In addition, the relationship between wealth and education is premised on the fact that wealthy families can afford the best education available and the highest quality healthcare for their children. As a consequence, children born to educated and affluent families are usually healthier and well-nourished, and the risk of mortality among them is significantly reduced. Furthermore, children born to women from poor households and middle-class households as compared to those born within wealthy households are more at a risk of dying (Gaimard, 2014).

This assertion therefore makes wealth index a pivotal factor of child mortality and was further proven in a study by Adetoro and Amoo (2014) using the Nigeria DHS 2008 dataset. Consequently, the results of the study indicated that the survival prospect of children born from poor families had increased mortality than those from rich families. In addition, the results proves that child mortality rate is highest among the illiterate mothers and lowest among mothers with tertiary education.

Yet another study by Nattey *et al.* (2013) also explored the link between socio-economic status and under-five mortality at Rufiji Demographic Surveillance Site (RDSS), Tanzania. Consequently, the results of the study depicted considerable survival differentials posed by varying socio-economic status of households. In the least poor households, children had attenuated mortality propensity than children from the poorest families.

Furthermore, a study on wealth index conducted by Susuman and Hamis (2012) on under-five mortality in Tanzania shows an increased survival chance of the under-five children born in richest households. In that study, richer households are found to be more at an advantage to circumvent child mortality than poorest households. The study further reveals that under-five children were dying more in rural areas than in urban areas. On the contrary, a study by Mturi and Curtis (1995) discovered an absence of infant and child mortality variances by wealth index, ethnicity and sex of the child in Tanzania.

2.3.2 Child Factors

Child factors associated with child mortality include among others: the sex of the child, the order in which the children were born (birth-order) and whether the birth was a single or multiple births. Other variables which impacted positively on under-five mortality include being of male gender; children of a second or third higher birth order with a short birth interval less than two years and those of a fourth or higher birth order with a short birth interval ≤ 2 years were also more likely to die.

2.3.2.1 Breastfeeding

Breastfeeding is important for the development of children whose vulnerable bodies are still growing. Breastfeeding advocates insist that the least period of breastfeeding should be at least six months to curtail mortality among new-borns and infants. Furthermore, breastfeeding is very important for infants as it attenuates the possibility of infants dying earlier in their lives (Cleland and van Ginneken, 1988).

Additionally, the hazard analysis of a study by Getachew and Bekele in Ethiopia shows that breastfeeding has a critical influence on under-five mortality. They also add that the employment prestige of the mother and her husband is another important factor that decides the affordability of parents to provide for their children. The amount of money received by both parents governs their affordability for basic needs and that is also likely to affect the child's survival in many ways.

Moreover, lack of proper feeding especially breastfeeding for the first few months may affect the chances of child survival (Hobcraft *et al.*, 1984). The benefit of this action is reduced prospect of dying among infants who are breastfed for longer periods. In another study conducted by Edmond *et al.* (2006), the results showed a larger risk of death among children who are given fluids or solids instead of breast milk.

2.3.2.2 Sex of the Child

The sex ratio in demography has revealed that more boys than girls are born (Caselli *et al.*, 2006). Coincidentally, boy preference in most Sub-Saharan African countries is common (United Nations, Department of Economic and Social Affairs. Population Division, 2009) and these sex-biased attitudes may have influenced the observable mortality differentials between boys and girls. According to Chen *et al.* (1981), male infants' deaths generally surpass female deaths in the neonatal period. Furthermore, in traditional settings and some countries of the underdeveloped world where infanticide is still rife, the preference for male infants distorts the ratio of male infants to female ones (Paxton & Hughes, 2007).

Supporting the finding above, is a study by Mondal *et al.* (2009) who in Bangladesh found that there is generally a stronger preference for sons over daughters and this attitude made mortality levels to be generally favourable for male children. On the other hand, in a study by Stoltman (2011), infant deaths were increased for male than female children and this stems from

biological reasons which claim that baby boys are naturally more vulnerable to infections than baby girls. Conversely, a research done by Pande (2003) in India reveals a preferential treatment for boys and girls based on their birth order. For example, a girl born in the third order, with two boys born before her is treated better than a boy who has two brothers.

In a study related to the above findings by Pande (2003), Nasejje (2013) applied the survival analysis techniques on the 2011 Demographic Health Survey data for Uganda to distinguish the characteristics responsible for the under-five child mortality. The result indicates that sex of the child is strongly related to the under-five mortality where a female child was at a lower risk of death than a male. This occurrence is attributed to the fact that in Uganda, most of the tribes are in favour of female children. A female child is seen as a source of bride price and thus preferentially given more care or attention over a male child.

2.3.2.3 Birth Order

Increased probability of death among children of first birth order in many instances is related to maternal age of the mothers at first birth. Numerous demography studies have shown an increased likelihood of mortality among children of first and higher birth orders (World Bank, 2005). These conditions are more pronounced in most of the less developed countries (Livi-Bacci &De Santis, 1999).

However, in contrast to the pronouncement above and popular findings; Seçkin's study discovered a reduced possibility of mortality to children of the first birth order in the infant stage. The study revealed that the odds of dying increase with the birth order (Seçkin, 2009). Considering other factors which might impact on child mortality, Sangber-Dery (2009) conducted a study in Ifakara in rural Tanzania from January 2005 to December 2007. Sangber-Dery used the Poisson Regression to estimate risk ratio (RR) of death associated with birth order and the findings of the study discovered that children of first and upper birth orders were exposed to high mortality in that region of Tanzania. Another variable which Sangber-Dery examined was age of the mother at birth where the outcome indicated that maternal age of <20 years had the highest infant mortality.

Nevertheless, considering the study of Seçkin (2009), one is compelled to infer that the situation in Turkey, a developed country where Seçkin conducted the research, the condition

is enhanced by the high education levels of women who thus marry late when they are physiologically and psychologically mature, and materially secure to marry and give birth. Studies by Mosley and Chen (1984), Onyemunwa (1988) in Nigeria, Hobcraft *et al.* (1984) have also shown that birth order exert strong influences on infant and child mortality. This assertion therefore suggests that high infant mortality occurs in events of high birth order supposedly caused by other socio-economic factors (Shryock *et al.*, 1976).

The above findings were confirmed by Kembo and Van Ginneken (2009) who carried out a study in which they used the results of the 2005-06 Zimbabwean DHS to explore the maternal, socio-economic and sanitation factors exerting influence on infant and child mortality by employing the Cox regression model. The results of the study revealed that upper birth order was significantly associated with infant and child mortality. On the other hand, Hobcraft (1991) posits that the outcome of the first birth could be associated with the age of mother rather than the order. According to Hobcraft (1991), delaying to have the first birth until a woman is 18 years of age has the potential to reduce the risk of death for first born children by up to 20% on average.

2.3.2.4 Size at Birth

Kramer *et al.* (2000) apprise us that poor socio-economic circumstances initiate behaviours which might subsequently affect the child's physical appearance at birth. The physiological features of a new-born might have an effect on infant mortality rate. In addition, Mahmood (2012) in his study found out that size of the baby at birth has significant bearings on neonatal mortality. In such instances, very large babies are more at a risk of dying than normal-sized born babies. Similarly, another study by Ezhe *et al* (2014) revealed that infants born very small in size were at a greater risk of dying than those born average or larger in size (Ezhe *et al.*, 2014).

2.3.2.5 Child is Twin/Multiple Births

As implied above, the most common type of birth that occurs among humans is single births. However, the birth of triplets is less expected than twins and the birth of quadruplets and more is almost non-existent in many communities (Wood, 2009). Furthermore, Wood (2009) apprises us that more often than not, multiple births usually result in premature birth than single

pregnancies. In his study, Wood (2009) found out that twins and triplets are most likely to die within a year of being born and those who survived might suffer complications later in life. Those born as multiples, every so often, have low birth weight, are underdeveloped and need intensive care to survive.

Tymicki's study (2009) also agrees with the findings of Wood (2009) in this respect. According to Tymicki, during the infant stages, there is a competition for sources of nutrition such as breast milk which may result in lower intake of calories important for child development and survival. A study confirming this was conducted by Hong (2006) who used a multivariate analysis to examine the relationship between multiple births and infant mortality in Bangladesh. The results of the study indicated that infant survival is strongly compromised in multiple births and singletons have a better survival rate than multiple births.

2.3.3 Environmental Factors

According to Wang (2014), child mortality is much pronounced in situations where poor sanitation and living conditions are absolutely inadequate. Evidently, in situations where these facilities are absent or are in a poor state, there is an indication of poor hygienic conditions and frequent outbreak of epidemic diseases that characterises most developing countries in the SSA (Kasper & Fauci, 2016).

2.3.3.1 Have Electricity

The variable, "electricity", plays an important role in the death of infants (Wang, 2002). The availability of electricity in a household helps in many ways. Electricity is important for studying, cooking, warmth, for television and radio which are important appliances for information. In the study of Wang the results suggests that access to electricity has significant impact on mortality. The study also reveals that there is a mortality difference between children born in households with a connection to electricity and those born in households that do not use or have electricity. Similarly, a study by Mekonnen (2011) discovered that electricity decreased infant mortality by about 32 %.

2.3.3.2 Water Source

Environmental health indicators explain the socio-economic status and place of residence of the communities. Demographic literature has revealed that because of the supposed better infrastructure in urban areas than in rural areas, child mortality is usually expected to be lower in urban than in rural areas. It is against this background that in places where better environmental infrastructure is not equitably provided, these areas do not usually fair equally in child mortality (Angelakis *et al.*, 2012). In such instances, those children living in households with piped water have a better chance of surviving than those born in places where water is sourced from a river, a stream or a dam.

Consistent with the above finding of Angelakis *et al.* (2012), is a study by Mahmood (2002) further reveals that children born in houses with a piped water supply have attenuated chances of death in relation to those born in houses with a well as a source of drinking water. On the contrary, a study conducted by Liu (2014) in Kenya contrasted popular findings and gave a divergent result when it revealed that variables such as "source of drinking water", "type of housing floor material" and "type of toilet facility" had no significant effect on infant death.

2.3.3.3 Household Size

Traditional African families preferred a larger family in anticipation of the contribution of children to family assets accumulation. However, researches previously conducted have revealed that household size and quality influence child survival. This assertion is premised on the fact that a larger number of siblings in a household may reduce children's access to resources and increase their risk to a healthy life which could be exacerbated by poor ventilation and overcrowding. Evidently, under such conditions, there is inadequate sanitation space, toilets, sleeping space and clean drinking water.

On the contrary, Mutunga (2003) investigated environmental factors impacting on child mortality in Kenya and discovered that more members in the family increase child survival. This finding means that higher child survival prospects are experienced in larger households in Kenya. The results of Mutunga (2003), however, are contrary to what was observed by Mesike *et al.* (2012), who found environmental factors of the family to be meaningfully correlated to child mortality. In such instances, a bigger family compromises resources and thus increase the risk of a healthy life due to poor ventilation and overcrowding.

2.3.3.4 Place of Residence

Sub-Saharan countries are urbanising at a faster rate than developed countries did (Kararach, 2014). However, the problem with urbanisation in Africa is that it is not preceded by development as was the case with developing countries (Olukoshi and Wohlgemuth, 1995). In addition, the economies of these countries have not developed enough to cater for the magnitude of increasing population (Obadare, 2014). Evidently, this event was occasioned by infrastructural under-development, poor economic performance and governance resulting in mushrooming of slums and informal settlements with inadequate infrastructure and provision of basic services (World Bank, 2009). Rural areas usually experience higher mortality of children than urban areas (Gunasekaran, 2008). The health infrastructure that is available in urban areas is usually better than that of rural areas. Correspondingly, poor road conditions and a lack of transportation may aggravate and discourage people especially those in rural areas from travelling to a distant health facility (Teller & Hailemariam, 2014).

Consequently, there exists a dichotomous healthcare infrastructural relationship between urban and rural areas characterised by improved services and access to facilities in urban areas than in rural areas. In such settings, rural areas usually lack healthcare services and the health risks are relatively amplified in these areas. Demography studies came to this conclusion after examining the influence of place of residence and concluded that restricted access to healthcare facilities, maternal healthcare, pre-natal and post-natal care in rural areas were the major obstacles and contributes to high infant death. A study by Niboye (2007) found that there was a difference in infant mortality rate between urban and rural areas.

Additionally, a study by Ezhe *et al.* (2017) in Nigeria found that a substantially high number of child deaths occurred to children whose mothers resided in rural areas and found that rural children faced a higher probability of dying than those living in urban areas. However, similar to Ezhe *et al.*'s findings, Abou-Ali (2003) in his study found that living in urban areas decreases the mortality risk of infant as opposed to living in rural areas.

On the other hand, Sastry (2002) conducted a research to investigate the influence that differentials in under-five mortality are brought about by both living in urban or rural areas and the economic inequalities that influence under-five mortality in Sao Paolo, Brazil. The results of the study revealed that despite the rural areas having more complimentary scenery for child

survival which included less polluted environment, better networks of family and social support, fewer hazards and less exposure to infectious diseases, under-five mortality rates were lower in urban areas than in rural areas in all years. As a result, Sastry attributed the low levels of under-five mortality in urban areas to the survival advantages conferred by higher social and economic status of urban areas.

Another study supporting the one above was conducted by Mekonnen (2011) with the view to investigate the association between infant and child mortality and socio-economic factors in Ethiopia. Mekonnen (2011) found out that the place of residence negatively influences infant mortality and children born in urban areas experienced reduced infant mortality compared to those born in rural areas.

However, inconsistent with the above findings, Mahmood (2002) found that babies born of mothers living in rural areas had better survival chances than those born in urban areas. These results are in direct contrast to popular findings by other researchers where child survival was higher in urban areas due the accessibility of health facilities. Evidently, this shows that with proper and accessible health facilities, more lives can be saved when such facilities are equally spread across the country and fully utilised.

2.3.3.5 Type of Bed-Nets

Sub-Saharan Africa is a region highly infested with malaria. This disease contributes to a substantial number of both maternal and child mortality wherein miscarriage/stillbirth, maternal death and the death of a baby are common (WHO, 2016). It is in this context that Afoakwah *et al.* (2015) undertook a study to investigate the correlates of the high under-five mortality among children in the northern part of Ghana and the usage of insecticide-treated bednets (ITN). The results of the study indicates that children sleeping under insecticide-treated bednets had enhanced survival chances. Consequently, under-five mortality among children who sleep under treated bednets was about 18.8% lower compared to those who do not sleep under treated bed nets.

2.3.3.6 Type of Toilet Facility

Access to an improved toilet, either flush or pit, is potentially an important determinant of child mortality (Detels *et al.*, 2015). In households that lack access to proper toilets, children have higher exposure to diseases such as diarrhoea and other gastrointestinal disorders than other children (Desai & Potter, 2014). Incidentally, these are preventable diseases that contribute to the highest levels of neonate and infant mortality in less developed SSA countries. A study conducted by Ogada (2012) found out that although the type of toilet facility was significant in influencing under-five mortality, however, there was no relationship between child mortality and no access to proper toilets.

Furthermore, household environment is important for keeping children out from coming into contact with viruses. It is in this context that the household environment should be clean and conducive for the proper care of infants and children. To this effect, Adeolu *et al.* (2016) conducted a study to investigate environmental, maternal, demographic, socio-economic characteristics and their effect on child mortality in Nigeria. As shown in this study which used the 2013 Nigerian Demographic Health Survey (NDHS), it was revealed that these variables have substantial impact on child mortality.

Worku (2009) conducted a research study to investigate key predictors of mortality among children under five years of age using data from the Demographic Health Survey data set in South Africa. He used the logistic regression analysis and Cox regression to perform data analysis. The results of Worku's study have discovered among others that under-five mortality is significantly influenced by the availability and ownership of toilet facilities. Similarly, a study by Gule (1996) also found provision of better sanitation to have a significant impact on reducing under-five mortality rate.

2.3.3.7 Regional Zones

Sub-Saharan Africa is a region dominated by poor countries and such countries are lacking in socio-economic development (Young, 1995). Lack of socio-economic development in such circumstances includes inadequate provision of services such as clean water, quality education, employment, sanitation and healthcare which are prominent predictors of infant and child mortality (Cockerham, 2017). However, households differ in the level of poverty and wealth accumulated.

The assertion above was authenticated by a study conducted by Ntimba and Mbago (2005) on the socio-economic and demographic determinants of infant and child mortality in Tanzania, Karagwe district. The results of the study indicate that although Tanzania had made a great effort to reduce infant and child mortality through various means, infant and child mortality has remained high. These researchers found variations between regions and districts in terms of performance related to reduction of infant and child mortality levels. In the same study, they established that there were more child deaths in rural areas than in urban areas. In addition, another study conducted by Byaro and Musonda (2016) to examine factors responsible for infant and under-five mortality differentials in Tanzanian zones revealed that infant and under-five mortality over the period 1992 to 2010 was high in the Southern zone and low in the Northern zone.

2.4 Chapter Summary

This chapter presented a review of the theoretical, literature and a conceptual framework analysis which was used for under-five and child mortality determinants. The framework illustrates how different factors such as maternal, child and environmental factors contribute to under-five mortality. In the next chapter, which is the chapter on methodology, the data sources and types of methods of analysis and limitations of the study are presented.

CHAPTER 3: METHODOLOGY

3.1 Introduction

In this chapter, sources of data and methods that were used in the data collection, the research instruments and sample design are discussed. In addition, operational definitions of the variables of the study and data-analysis methods used are also presented in this chapter.

3.2 Sources of Data

The Demographic Health Survey (DHS) is a rich source of data on developing countries in general and Africa in particular. The principal objective of the 2010 TDHS was to collect data

on household characteristics. This study therefore is based on the 2010 Tanzania Demographic and Health Survey (2010 TDHS) which was implemented by the National Bureau of Statistics (NBS) and the Office of the Chief Government Statistician - Zanzibar (OCGS), conducted from 19 December 2009 to 23 May 2010. This survey, therefore, was an analytical study based on secondary data from the 2010 TDHS.

Among others, the survey collected information on: fertility levels and preferences, marriage, sexual activity, awareness and use of family planning methods, maternal and child health, breastfeeding practices, nutritional and anaemia status of women and young children, use of bednets and anti-malaria awareness and behaviour regarding HIV/AIDS, adult and maternal mortality. Further to the above variables, the list also included: childhood and adult mortality, antenatal care, childhood immunisation and diseases, nutritional status of young children and women, malaria prevention and treatment, female circumcision, sexual activity, knowledge and behaviour regarding HIV/AIDS, and prevalence of domestic violence.

For the accomplishment of this survey, the Tanzanian Ministry of Health and Social Welfare (MoHSW), Tanzania Food and Nutrition Centre (TFNC), Department for International Development (DFID), World Health Organization (WHO)/Zanzibar), United Nations Fund for Population Activities (UNFPA), United Nations Children's Fund (UNICEF), World Food Programme (WFP), United Nations Development Programme (UNDP), Irish Aid funded the survey. Furthermore, the ICF Macro provided technical assistance for the survey through its MEASURE DHS programme.

3.3 Study Design

The 2010 Tanzania Demographic and Health Survey (TDHS) was the eighth in a series of Demographic and Health Surveys conducted in Tanzania. The 2010 TDHS was a nationally representative survey of 10,300 households selected from 475 sample points throughout Tanzania. All women aged 15-49 in these households were individually interviewed. The sample was designed to produce separate estimates on key indicators for the national level, for urban and rural areas and, for seven zones. For selected indicators, estimates were calculated at the regional level. Estimates in the 2010 TDHS sample design were provided for the entire country and for Zanzibar. In an effort to estimate geographic differentials for certain demographic indicators, seven geographic zones were incorporated in the regions of mainland

Tanzania. This was done in order to have a comparatively bulky number of cases and a reduced sampling error.

The 2010 TDHS selected a representative probability sample of 10,300 households where 475 clusters were selected from a list of enumeration areas (AEs) in the 2002 Population and Housing Census. In this survey, 25 sample points were selected in Dar es Salaam and 18 were selected in each of the other 20 regions in mainland Tanzania. Subsequently, 18 clusters were selected in each region for a total of 90 sample points in Zanzibar. A total of 10 139 women were interviewed in the 2010 TDHS.

In the 2010 TDHS sample survey, a complete household listing was done in all selected clusters where households were then systematically selected for participation in the survey. At the end, 22 households were selected from each of the clusters in all regions, except for Dar es Salaam where 16 households were selected. Included in the sample survey were all women of ages 15-49 who were either permanent residents in the households or visitors present in the household on the night before the survey was conducted i.e. de facto.

In an effort to evaluate geographic discrepancies for some of the demographic indicators, the regions of mainland Tanzania were buckled into seven geographic zones. Zones were used in each geographic area in order to have a relatively large number of cases and a reduced sampling error. However, the zones vary marginally from the zones used in the 1991-92 and 1996 TDHS reports but are the same as those in the 2004-05 TDHS and the 2007-08 THMIS.

3.4 Variables used in the Study

In this study, the outcome variable is under-five mortality, defined as death that takes place between birth and less than five years (59 months). The independent variables with their covariates included in this study are: (i) Maternal factors - highest educational level, maternal age, children ever born, currently/formerly/never married and wealth index (ii) Child factors - breastfeeding, birth order, sex of child, size of the child at birth and child is twin (iii) Environmental factors: has electricity, water source, type of bednet(s) slept under last night, household size, type of place of residence and regional zones.

Since the purpose of this study was to examine socio-economic factors associated with under-five mortality, the approach adopted in this study is the Mosley and Chen study (1984). The study was premised on the socio-economic determinants influencing child mortality through a set of biological and proximate mechanisms to influence under-five mortality (dependent variable). However, this study adapted socio-economic variables such as maternal, child and environmental factors including their covariates which influence child mortality. The dependent and independent variable(s) are described and discussed below.

(a) Maternal Factors

***Mother's Education*:** In the Tanzanian Demographic and Health Survey, the parental education variable referred to the highest level of education attained separately for males and females where it had seven categories: "no education", "some primary", "completed primary", "some secondary", "completed secondary" and "more than secondary". The 2010 TDHS questionnaire on the education variable asked the following questions: Have you ever attended school (Q108)? What is the highest level of school you attended (109)? What is the highest grade you completed at that level (110)? However, for the resolve of this study, three categories of the same variable were created: (1) No education; (2) primary (3) secondary and more.

***Maternal age*:** Child mortality differs with women's ages (Daraje, 2015). Maternal age in this study is used to observe the age at which women experienced under-five mortality. This variable was categorised into these groups; 15-19, 20-24, 25-29, 30-34, 35-39 and 45-49. In an effort to determine the age of the respondents (mothers), the woman's questionnaire in the TDHS 2010 asked the following questions: in what month and year were you born (Q106)? How old were you at your last birthday (Q107)?

***Children ever born*:** Data on the number of children ever born reflect the accumulation of births to a woman over her entire reproductive lifespan ((Nwokocha *et al.*, 2015). The categories of this variable have been arranged from the first born child to the seventh and more. The questions from the 2010 TDHS woman's questionnaire which established children ever born to a woman were: were there any other live births between (name of previous birth) and (name of child), including any children who died after birth (Q221)? What name was given to your (first/next) baby?

Marital Status: Child mortality can be affected by the marital status of their parents (Kang *et al.*, 2016). This variable examined whether a woman has: never married, currently married or living together and formerly married. The 2010 TDHS questionnaire on the marital status variable asked the following questions: what is your marital status now: are you widowed, divorced or separated (Q603)? Are you currently married or living together with a man as if married (Q601)? Have you ever been married or lived together with a man as if married (Q602)?

***Wealth index*:** Families' wealth status can have an effect on the survival and mortality risks of children. Wealthy families can afford the best education available and the highest quality healthcare for their children. As a consequence, children from poorest households are likely to die before the age of five than those from the richest (Gaimard, 2014). This variable measures the affordability of respondents and has not been changed, its arranged categories stayed as in the data set; poorest, poorer, middle, rich and richest. In an effort to establish the wealth and affordability of the respondents, some of the questions which the 2010 TDHS woman's questionnaire asked included: does your household have: electricity, a paraffin lamp, a radio, a television and a refrigerator (Q104)? Do you own this or any other house either alone or jointly (826A)? Do you own any land either alone or jointly with someone else (826B)?

(b) Child Factors

***Breastfeeding*:** Breastfeeding is an important determinant for child survival and contributes a significant benefit for the reduction of infant and child mortality. Breastfeeding also lowers diarrhoea and infectious diseases and thus serve as a nutrient which protects infants against such diseases. The World Health Organisation (WHO) recommends that all infants should be breastfed within 1 hour after birth (WHO, 2017). It is important therefore for the child to be breastfed for its survival (UNICEF, 2011). According to Oniang'o (2005), breastfeeding a child should continue for at least 2 years or more. The TDHS 2010 collected information on children, who were ever breastfed; who were breastfed in the first hour and the first day after birth, and who were fed anything other than breast milk before breast milk was regularly given. In addition, mothers of children were also asked the following question in relation to breastfeeding: did you ever breastfeed (Q460)? How long after birth did you first put the baby to breast? Are you still breastfeeding (Q461)? For how many months did you breastfeed (Q466)? How old was s/he when s/he was first fed something other than breast milk (Q469A)? Furthermore, mothers who were breastfeeding and those who were not breastfeeding their

children at infant stage were coded with a "Yes" or "No" respectively. However, in this study, this variable was re-categorised into the following four groups, namely: not breastfeeding, breastfeeding for less than 6 months, 12 months and 13 months and above.

***Birth order number*:** Studies in demography have found first born children to have the highest risk of survival at birth (Wang, 2016). A significant number of demography studies has revealed that the odds of dying increase with the birth order (World Bank, 2005). In order to establish the birth order of children, the following question was asked in the 2010 TDHS woman's questionnaire: what name was given to your (first/next) baby (Q212)? In this study, birth order is categorized into four groups; 1-2 births, 3-4, 5-6, 7 and more birth orders.

Child sex: Studies in demography have indicated that sex of the child is strongly related to the under-five mortality where a female child is at a lower risk of death than a male. Mortality differentials between boys and girls revealed that male deaths exceed female deaths in the neonatal period (Chen *et al.*, 1981). Sex of the child variable in this study is coded into two categories; male and female where the male category is the reference. The woman's questionnaire (2010 TDHS) in relation to sex of the child asked respondents the following question: is (name) a boy or a girl (Q213)?

***Size of child at birth*:** The size of a child at birth is an important factor which can be used to predict its future health, weight and height (Ayatollahi, Sharafi and Haem, 2015). The normal weight of a baby is 2.7 - 4.1kg and the average weight is 3.5kg. If a baby weighs less than 2.5kg, it is considered to have a low birth weight. Similarly, a baby who weighs more than 4kg at birth may be considered to be larger than normal (Messenger and Hilton, 2004). The size of the baby; either very big or very small puts the baby at an increased risk of dying during neonatal period compared with neonates with normal birth weight (Mahmood, 2002). Many factors can affect the size and weight of the infant at birth. These include, among others: prospective mothers who had poor nutrition, drinking, smoking or using drugs during pregnancy. Poor socio-economic conditions can also lead to detrimental behaviours which may consequently affect the child's physical appearance at birth (Aber, Bennett, Conley and Li. 1997). The 2010 TDHS questionnaire in relation to size of the child variable asked the following questions: when (name) was born, was he/she very large, larger than average, average, smaller than average or very small (Q432)?

***Child is twin/Multiple births*:** This variable was created into six categories in the data set (2010 TDHS); 0=single birth, 1=1st of multiple, 2=2nd of multiple, 3=3rd of multiple, 4=4th of multiple and 5=5th of multiple. However, for the purpose of this study, this variable was recoded into single births, 1st of multiple and 2nd of multiple+. The woman's questionnaire (2010 TDHS) in relation to the variable 'child is twin/multiple births' posed this question to mothers who experienced child mortality: were any of these children twins?

c) Environmental Factors

The following are environmental variables used in the study. The 2010 TDHS directed the questions to mothers whose children died before their fifth birthday in order to find the conditions of the households under which the children were born and died.

***Has electricity*:** Access to electricity has significant impact on mortality of children (Wang, 2002). Inside households, electricity helps in many ways and is used among others for lighting, cooking, warmth, for television and radio. Consequently, there exist mortality differentials between children born in households with a connection to electricity and those born in households that do not have electricity. Source of energy, which is represented by the availability of electricity in the households, was categorized into two categories: No (0), Yes (1). The 2010 TDHS woman's questionnaire (Q104) on the source of energy variable asked the following question: does your household have electricity?

***Source of water*:** Households which have safe drinking piped water in their yards do not usually fair equally with those households which obtained water from other sources (Angelakis *et al.*, 2012). As a consequence, there exist mortality differentials between those children living in households with piped water and those born from where water is sourced from a river, a stream or a dam. The 2010 TDHS woman's questionnaire (Q101) on the source of water asked the following question among others: what is the main source of drinking water for members of your household? For the purpose of this study, this variable has been recoded into the following six categories: piped water, open well, protected well, river/lake water, spring water and rain water.

***Type of bednet(s) slept under last night*:** Sub-Saharan Africa is a region highly infested with malaria and this disease contributes to a considerable number of both maternal and child

mortality (Afoakwah *et al.*, 2015). The use of bednets in this region is important for curbing the spread of malaria. The 2010 TDHS questionnaire (Q130) on the use and availability of bednets asked the following questions among others: does your household have any mosquito nets that can be used while sleeping? How many months ago did your household obtain the mosquito net (Q133)? Who treated the net (Q136)? Who slept under this mosquito net last night (Q139)? However, for the purpose of this study, this variable has been categorised as follows; no bednets, only treated bednets, only untreated bednets.

***Place of Residence*:** This variable was generated using the location variable which gives details about those mothers who resided in rural areas and those living in urban areas. The reference variable was those who resided in rural areas. There is profound lack of socio-economic development in rural areas which includes inadequate provision of services such as clean water, quality education, employment, sanitation and healthcare which are prominent predictors of infant and child mortality (Olukoshi & Wohlgemuth, 1995). In addition, the health infrastructure that is available in urban areas is generally better than that in rural areas and thus the health risks are relatively amplified in these areas. It is in this context that children born to mothers residing in rural areas faced a higher probability of dying than those living in urban areas (De Poel *et al.*, 2009).

Regional Zones: Variations between regions and districts in terms of performance related to healthcare infrastructure and provision are common in SSA. This means that under-five mortality is geographically distributed. Due to unequal development and inequitable distribution of resources, infant and under-five mortality is usually high in some regions than others. This variable consists of various provinces or zones of Tanzania and their regions categorised in this manner: Western: Tabora, Shinyanga, Kigoma; Northern: Kilimanjaro, Tanga, Arusha, Manyara; Central: Dodoma, Singida; Southern Highlands: Mbeya, Iringa, Rukwa; Lake: Kagera, Mwanza, Mara; Eastern: Dar es Salaam, Pwani, Morogoro; Southern: Lindi, Mtwara, Ruvuma and Zanzibar; Unguja North, Unguja South, Town West, Pemba North, Pemba South.

3.5 Data Analysis

Survival analysis technique modelling is a well-developed statistical tool in analysing time to event data and was adopted in this study to examine factors affecting under-five mortality in

Tanzania using the TDHS data for 2010 where the SPSS.24 was utilised. In this study, survival analysis was employed to determine factors associated with under-five mortality in Tanzania. In addition, the study used the Cox proportional hazard model to distinguish the covariates which influence the under-five mortality.

Furthermore, the Cox proportional hazard model was employed to examine the relationship between the outcome variables (under-five mortality) and independent variables which were categorised into the following three categories; maternal, child and environmental factors and their covariates. The dependent variable is mortality of under-five children. The selection of independent variables affecting child survival in this study was grounded on the paper by Mosley *et al.* (1984). A level of significance of 5% ($p \leq 0.05$) and confidence interval of 95% were used to identify the most statistically significant factors of under-five mortality.

3.5.1. Cox's Proportional Hazards Regression Model

Analysis in this study used the Cox proportional hazard regression model (Cox, 1972) which is a commonly used technique to test the effect of dependent variable and control for all covariates. The Cox proportional hazard model estimates the relationship between the hazard rate and explanatory variables with no need to make assumptions about the shape of the baseline hazard function. This model examines subjects from the beginning of the time of the observation to the time when the subjects die, are lost from the observation or survive beyond the observation period. The probability of mortality is modelled using the following equation.

$H(t) = H0(t) \times \exp(b1x1 + b2x2 + \ldots bkxk$ ....(1)

Where x1...xk are independent variables and H0 (t) is the standard hazard at time t, signifying the probability of dying of infants. By dividing both sides of equation 1 by H0 (t) and taking logarithms, the equation 1 become

$[H(t)/H0(t)] = b1x1 + b2x2 + \ldots + bkxk$ .... (2)

Where H(t)/H0(t) is regarded as the hazard ratio.

3.5.2 Survival Analysis

Survival analysis refers to the statistical methods for analysing survival data. It is premised on studying the time it takes until the event occurs. In this study, survival analysis was conducted to find out factors influencing the survival of under-five children in Tanzania. In this study, data analysis was done using SPSS 24 package.

This study used the survival analysis to find out the factors influencing under-five survival of children in Tanzania. The objectives of the survival analysis are classified into three main purposes; to estimate time-to-event for a group of individuals; to compare time-to-event between two or more groups and to assess the relationship of co-variables to time-to-event. For the deaths of children in this study, the time variables are created by the age at which the child died (<five years). Survival analysis models time to an event or until the subject is lost to the survey or dies. The risk of dying is observed when a child is born and failures take place when the child dies (Knodel, 1988). In this case, it happens that the child either die before celebrating the fifth birth day or the child survives through to the fifth year and therefore the dependent variables are binary and the response outcome for each subject is dead or alive.

The above narration serves to illustrate that in the survival analysis study we would not find every observed subject experiencing the event. It can happen that during the process of observation some subjects had left the study before the failure occurred and some of them ended the observation or were simply lost in the follow-up. In such cases, these survival data are termed right censored. Similarly, when the subject develops an event of concern to be observed before the commencement of the study, the survival time is said to be left censored. However, this event rarely happens in survival studies (Allison, 2010).

3.5.3 Survivor Function (t)

The first step in the analysis of survival data is usually the estimation of the distribution of the survival times. The survivor function S(t) and the hazard function $h(t)$ are commonly used functions in survival analysis studies (Hosmer & Lemeshow, 1999). The survivor function is defined as the probability that the survival time of a randomly selected subject is greater than or equal to some specified time. Thus, it gives the probability that an individual survived beyond a specified time. The goal of survival analysis is to estimate and compare survival experiences of different groups. Survival experience is described by the cumulative survival function which is represented as:

$S(t) = 1 - P(T \leq t) = 1 - F(t)$

Where $F(t)$, represents the probability that a subject selected at random will have a survival time less than some stated value t.

The hazard function $h(t)$ gives the instantaneous potential for failing at time t, given that the individual has survived up to time t. Put in another way, the hazard function is the proportion at which failures occur at time (t). Hazard rate increases linearly with time such that at any point t it parallels directly to concepts of the risk of event occurrence at time t. The hazard function is presented as:

$$h(t) = \lim_{\Delta t \longrightarrow 0} \frac{P(t \leq T < t + \Delta t / T \geq t)}{\Delta t}$$

3.6 Limitations of the Study

Tanzania is a developing country situated in the SSA region and thus inherently confronted by poor quality data which might affect the quality of results in the study (Odimegwu and Kekovole, 2014). Data problems inherent in developing countries include misreporting at the age of death, omissions of those who died in early life and under-reporting. An important concern that fetters the quality of data in most developing Sub-Saharan African countries is that neonatal deaths are barely recorded especially if a baby dies in the first hours after birth (Oestergaard *et al*, 2011).

Similarly, stillbirths and neonatal deaths may be intentionally misclassified in order to avoid filling a death certificate that would be required if a neonatal death is declared. This occurrence can lead to under-estimation of mortality rates in general and unusual low ratio of neonatal deaths (WHO, 2016). Furthermore, cultural practices in developing countries also exacerbate the situation in as far as infants' deaths, under-reporting of infant's death and stillbirths. Infants' deaths are a taboo to mention in a supposed effort to avoid reliving the incident and stillbirths were reported as live births by the respondents. The results can be intriguing and spring up some unexpected inconsistencies which may affect the correct analysis of socio-economic factors (WHO, 2016).

3.7 Chapter Summary

This chapter charted the research methodology and the design that was used in the study. The chapter gave the background of the secondary data which was used for the analysis. The researcher explained the research design to show an understanding of methods that can be utilised when conducting research. He also discussed the sampling method as well as the population and sample size for the study. The following chapter (4) presents the discussion and analysis of the data gathered through the structured framework. The data was analysed, conclusions were drawn and recommendations for future studies were made.

CHAPTER 4: ANALYSIS OF RESULTS

4.1 Introduction

In this chapter, the descriptive results (distribution of the variables) are presented in a mortality frequency and percentage distribution table, followed by the Cox proportional hazard regression and survival analysis. From the total sample of women the focus of the analysis was on those who mothers aged 15–49 years who have experienced under-five mortality, the characteristics of children and the environmental factors of the households. The independent variables in this study consisted of maternal, child and environmental factors that are associated with under-five mortality. The primary outcome of the current study is under-five mortality. The outcome variable was run with each of the independent maternal, environmental and child factors to produce the table below.

4.2 Background Characteristics

4.2.1 Maternal Factors

Variables	Frequency (Death)	Percentage (Death)

Highest educational level		
No education	117	5.95
Primary	312	6.45
Secondary+	43	5.08
Maternal age		
15-19	12	3.58
20-24	113	6.40
25-29	110	5.52
30-34	65	4.36
35-39	89	7.14
40-44	45	3.61
45-49	38	7.49
Children ever born		
1-2	101	7.05
3-4	96	6.20
5-6	146	6.16
7+	129	5.62
Currently/formerly/never married		
Never married	25	7.76
Currently married/living together	384	5.79
Formerly married	63	8.96
Wealth index		
Poorest	87	5.62
Poorer	100	5.73
Middle	119	7.24
Richer	88	5.57
Richest	78	6.87

Table1: Characteristics of mothers.

Table 1 presents maternal factors indicating the educational level of the mother, maternal age of the mother, children ever born to a woman, whether the woman was married, formerly married or never married and also wealth status (index) of the woman.

Highest educational level: Information about the respondents in this study exists in Table 1. The results show that mortality of under-five children was highest among mothers with primary education (6.45%) compared to those mothers who have no formal education (5.95%). Mothers who have attained secondary and higher levels of education experienced the least number of fatalities (5.08%) compared to the rest in this category. The fact that there is high mortality among mothers who have attained primary education compared to those who have no education is rather perplexing and not consistent with the study of Vandresse (2007) which revealed that the survival of children is significantly associated with maternal educational level. However, the least number of under-five mortalities experienced by mothers who have attained secondary education and more concurs with the narration that education of the mother has a positive influence on the survival of her children (Easterlin, 1987).

***Maternal age*:** Demography studies have always shown that child mortality differs between women of different ages (Daraje, 2015). Young mothers are physiologically and psychologically immature to give birth and care for their infants while older women can suffer birth complications (Kibet, 2010). Findings of demography studies commonly agree that children born of younger mothers (age <20 years) usually experienced high child mortality in relation to those born of mothers aged between 30 and 39 years (Chukwu & Uju, 2015). However, the findings of this study in Table 1 show that mothers in the age groups 20–24 and 25–29 accounted for the highest deaths of under-five children at 6.40% and 5.52% respectively. In addition, there was reduced mortality of under-five children among women of the age groups <20 and >30 in Table 1.

***Children ever born*:** Children ever born reflect the number of children born to a woman during her reproductive life (15-49). Birth order is associated with higher mortality risk and women who had given birth to three or more children are more likely to experience a child death than those who have given birth to a lesser number of children. Moreover, first-born children face a lesser probability of dying compared to children of birth orders two to five (Smith, 2008). In relation to the above narration, Table 1 reveals that the highest number of child mortality was experienced between birth orders 1-2 (7.05%) and 3-4 (6.20%).

***Currently/formerly/never married*:** The mortality risk of children can be affected by the marital status of their parents (Wakefield & Wildeman, 2014.). Married parents are expected to collectively carry the burden of providing and raising children, including the most important issue of providing for appropriate healthcare of their children. It is in this context that the survival of children born of married couples is duly expected to increase compared to those born out of wedlock or divorced. Predictably, the results of this variable in Table 1 show the highest mortality of under-five children to be high among those women who are formerly married (8.96%) and never married (7.76%) compared to those who are currently married (5.79%). The result of this variable resonates with the finding of Mekonnen's study (2011) which discovered a reduction in infant mortality among children whose mothers are married relative to those whose mothers are not married (Mekonnen, 2011).

***Wealth index*:** Wealth index shows the economic status and affordability of parents. Therefore, children in the poorest households are more likely to die during infancy than those in the least poor (McKernan & McQuade, 2004.). However, Table 1 shows an unexpected result where a

high percentage of children born to mothers of middle (7.24%) and richest (6.87%) economic status died compared to those born of mothers of poorest economic status (5.62%). Due to the poorest status of the mothers, it is not expected of them to afford the necessities that could help maintain and improve the survival of their infants. The assumed reason for the low mortality rate among the poorest women could be that these women are idling and thus have much time for child care. The results contrast the findings of Nattey *et al.* (2016) which found mortality to decrease as wealth index increases.

4.2.2 Child Factors

Variables	Frequency (Death)	Percentage (Death)
Breastfeeding		
Not breastfeeding	113	51.36
<6 months	262	12.51
12 months	52	1.50
13 months and above	13	0.76
Birth order number		
1-2	175	6.27
3-4	127	5.89
5-6	70	5.22
7+	68	5.63
Sex of child		
Male	245	6.55
Female	195	5.19
Size of child at birth		
Very large	20	12.20
Larger than average	54	4.31
Average	269	5.15
Smaller than average	49	10.17
Very small	33	24.44
Don't know	15	6.33
Child is twin/Multiple births		
Single birth	385	5.27
1st of multiple	26	34.67
2nd of multiple+	29	25.44
Total	440	

Table 2. Characteristics of children.

Table 2 presents child factors indicating whether or not a child was breastfed, birth order, sex, size at birth and whether or not a child was born as single or multiple births.

Breastfeeding: Breastfeeding for at least a period of 6 months curtails mortality among new-borns and infants. The probability of survival is bigger among children who are breastfed than those who are not (Demirci, 2010). Table 2 shows high mortality among children who were

not breastfed at all (51.36%) followed by those who were breastfed for less than 6 months (12.51%). The results in this study are consisted with the findings of Mondal *et al.* (2009) which shows that children who are breastfed are more likely to survive than those who are not breastfed (Mondal *et al.*, 2009).

***Birth order number*:** Studies in demography have revealed a bigger probability of dying among children of first and higher birth orders, which in many instances is related to the age of the mother at first birth (World Bank, 2005). In relation to this variable, Table 2 shows the expected results of first and second birth orders which recorded the highest mortality percentage of 6.27%. However, in contrast to the popular pronouncement in demography, higher birth order in this study recorded the least percentage of under-five mortalities at 5.22% and 5.63% for birth order seven and more and birth orders 5-6 respectively.

***Sex of child*:** The sex ratio in demography shows that more boys than girls are born. Ironically, more male infants die than female infants in the neonatal period, presumably due to the biological factors affecting male children (Chen *et al.*, 1981). With regard to the demographic characteristics of children in this study, the results in Table 2 shows that male deaths surpassed female deaths, recording 6.55% and 5.19% respectively.

***Child is twin/Multiple births*:** Single births are common among human beings and births of twins are not peculiar. In addition, multiple births are linked with a higher mortality risk of infants (Wood, 2009). This assertion stems from the fact that competition for sources of nutrition exists between infants and this may result in lower intake of calories important for child development and survival (Tymicki, 2009). Consistent with this assertion, Table 2 shows high mortality of under-five children for those children born as first multiples (34.67%) than those born as singletons (5.27%).

4.2.3 Environmental Factors

Variables	Frequency (Death)	Percentage (Death)	Total
Has electricity			
No	416	6.13	
Yes	56	.6.50	
Type of bednet(s) slept under last night			
No bednet	145	7.38	
Only treated bednets	73	5.27	

Only untreated bednets	254	8.43
Water source		
Piped water	8	1.7
Open well	157	6.12
Protected well	90	6.66
River/lake water	123	6.01
Spring water	34	6.97
Rain water	60	5.58
Household size		
1-3	96	5.18
4-5	86	5.04
6-7	140	5.10
8+	150	8.53
Type of place of residence		
Urban	108	7.61
Rural	364	5.84
Regional zones		
Western	78	6.05
Northern	37	4.13
Central	23	3.57
Southern Highlands	57	6.78
Lake	98	8.35
Eastern	53	7.98
Southern	40	6.14
Zanzibar	86	5.76

Table 3. Environmental characteristics.

Presented below are the environmental factors indicating the household conditions under which children lived.

Has electricity: Environmental factors which include access to electricity play an important role in the survival and mortality levels of children. Mortality differences exist between children born in households with a connection to electricity and those born in households with no electricity (Mahmood, 2002). The type of source of energy used in households, especially those which emit harmful substances can also exacerbate mortality risk of children. The results in this study indicate a minimal percentage difference between children born in households with no electricity (6.13%) and those born in households with electricity (6.50%).

Type of bednet(s) slept under last night: Most of Sub-Saharan African countries are highly infested with malaria. Malaria contributes to a substantial number of child deaths in this region (Afoakwa *et al.*, 2015). As a measure of curbing the spread and effective control of the disease, the World Health Organization Global Malaria Programme (WHO/GMP) endorsed the use of insecticide-treated mosquito nets. Table 3 shows that 8.43% of children from households which used only untreated bednets died, followed by 7.38% of those who used no nets for sleeping

and subsequently the least recorded percentage of 5.27% for those who used only treated bednets.

Water source: The type of source of water from which mothers and their children drink is important for their survival. As shown in Table 3, the least number of fatalities is from those households which sourced water provided through pipes (1.7%). This result resonates with the findings of Angelakis *et al.* (2012) and Mahmood (2002) which revealed that children born in houses with a piped water supply have attenuated chances of death in relation to those born in houses with a well as a source of drinking water. Water from open wells is not treated in order to kill pathogens of water borne diseases and this compromises the children's probability of survival. Liu's (2014) findings gave a divergent result when it revealed that variables such as 'source of drinking water' had no significant effect on infant death.

Household size: Household size considers the number of all people living in one household. A bigger number of members in a household may reduce children's access to resources and increase their risk to a healthy life, exacerbated by poor ventilation and overcrowding (Blake, 1981). From Table 3 above, it is evident that a bigger number of members in a household contributed to 8.53% of under-five children's deaths, followed by those from households of 1-3 members at 5.18%. However, the results of this variable are not consistent with the findings of Mutunga which found that a bigger family increase child survival in Kenya. On the contrary, Mesike *et al.*'s (2012) study posited that a bigger family compromises resources and thus increase the risk of a healthy life due to poor ventilation and overcrowding. On the flip side of this narrative, the economic viability of bigger families should be taken into consideration when dealing with this variable.

Type of place of residence: Generally, rural areas experience higher mortality of children than urban areas (Gunasekaran, 2008). The consequence of disparities in the provision of healthcare and infrastructure in both areas is the mortality variance of both areas (Kabir & Chowdhury, 1993). It is important to note that the result of this study in relation to this variable is not compatible with the above statement. As shown in Table 3, under-five mortality in urban areas was higher compared to rural areas.

Regional zones: Child mortality differs not only by countries and continents. It also differs by regions within countries (Adentunji & Bos, 2006). Evidently, the variations in mortality levels

of regions clearly point to the fact that there exist disparities of health infrastructure in the regions. This assertion is authenticated by the under-five mortality differentials of regions in this study. Table 3 shows that the highest number of under-five mortality in percentages was recorded in the Lake and Eastern regions at 8.35% and 7.98% respectively. The Central region experienced a lesser number of under-five mortality which stands at 3.57%.

4.3 Mean Survival Times Before Death by Maternal, Child and Environmental Factors

Tables 4, 5 and 6 show the mean survival time for under-five children by different variables under maternal, child and environmental factors. Among the maternal variables, currently married/living covariate showed a significant association with under-five child survival. Among child factors, variables which are significantly associated with child survival include breastfeeding, sex of the child, size of the child at birth and whether child is twin or born as a multiple. Similarly, among environmental factors, variables which showed significant relationship with under-five child survival include type of bednet(s) slept under last night, type of place of residence and regional zones.

4.3.1 Maternal Factors

Variable	Estimate	95% CI	Log-Rank
Highest educational level			
No education	4.740	4.691 - 4.789	
Primary	4.688	4.654 - 4.721	0.14
Secondary+	4.749	4.676 - 4.822	
Children ever born			
7+	4.671	4.609 - 4.733	
5-6	4.715	4.658 - 4.771	0.41
3-4	4.702	4.655 - 4.749	
1-2	4.735	4.689 - 4.782	
Marital status			
Never married	4.607	4.456 - 4.759	0.00
Currently married/living together	4.725	4.697 - 4.752	
Formerly married	4.595	4.497 - 4.692	
Wealth index			
Poorest	4.725	4.669 - 4.781	
Poorer	4.731	4.679 - 4.784	
Middle	4.655	4.594 - 4.715	0.12
Richer	4.744	4.691 - 4.798	
Richest	4.673	4.602 - 4.744	

Table 4. Mean survival times by maternal factors
P-value ≤ 0.05

Table 4 shows that under maternal factors, marital status is significantly associated with under-five child survival rates. The results here show that children born from women who are currently married or living together with their partners had the highest mean survival probability of 4.725 years compared to children born of mothers who were never married and formerly married at 4.607 and 4.595 years respectively. Other maternal variables such as maternal education, children ever born and wealth index were not statistically significant in this study. Be that as it may, consistent with demographic studies, children whose mothers have the highest education attainment show the highest survival time of 4.749 years compared to those whose mothers who had no education and primary education at 4.740 and 4.688 years respectively. Some of the variables which have indicated consistency with demographic studies include children ever born (1-2 children born to a woman) at 4.735 years compared to 7+ children at 4.671 which is the least number of years a child can survive in the variable. Similarly, children born from richer families live for a maximum of 4.744 years compared to other covariates.

4.3.2 Child Factors

Variable	Estimate	95% CI	Log-Rank
Breastfeeding			
Not breastfeeding	2.170	1.920 - 2.419	
6 months	3.935	3.720 - 4.150	0.00
12 months	4.556	4.476 - 4.636	
13 months and above	4.873	4.862 - 4.885	
Birth order number			
1-2	4.690	4.646 - 4.734	
3-4	4.701	4.652 - 4.750	0.52
5-6	4.745	4.687 - 4.802	
7+	4.721	4.658 - 4.784	
Sex of child			
Male	4.675	4.636 - 4.713	0.01
Female	4.740	4.706 - 4.775	
Size of child at birth			
Very large	4.333	4.093 - 4.572	
Larger than average	4.706	4.651 - 4.761	
Average	4.664	4.635 - 4.694	0.00
Smaller than average	4.421	4.290 - 4.552	
Very small	3.723	3.370 - 4.076	
Child is twin/Multiple births			
Single birth	4.736	4.711 - 4.761	
1st of multiple	3.408	2.907 - 3.909	0.00
2nd of multiple	3.782	3.398 - 4.165	

Table 5. Mean survival times by child factors.
P-value $\leq$ 0.05

Table 5 shows that breastfeeding had the highest impact on child survival compared to other variables in the study. Children who were breastfed for more than 13 months had the average survival time of 4.873 years which is the highest among all variables in this part of the study; those who were breastfed for up to 12 months had an average of 4.556 years while those who were never breastfed had the lowest mean survival time of 2.170 years. The log-rank test shows that these differences were highly statistically significant ($p<0.001$).

This analysis further showed that child survival increased with the birth-order when the 6th order children had the longest mean survival time at 4.745 years. However, the differences in this variable were not statistically significant. On the other hand, child survival differed significantly with the sex of the child. Female children survived for an average of 4.740 years from birth compared to 4.675 survival years for male children. Size of the child at birth is another variable which displayed statistically significant association with child survival. This analysis reveals two salient findings for those children born very small and those born very large at 3.723 years and 4.333 years respectively. On the other hand, children who were born larger than the average size tend to survive longer in comparison to the rest at 4.706 years. The results further indicated that children born as singletons survived longer (4.736) than those born as multiples at 3.408 years for the 1st multiple and 3.782 years for the 2nd multiple, and the results were statistically significant.

4.3.3 Environmental Factors

Variable	Estimate	95% CI	Log-Rank
Has electricity			
No	4.710	4.682 - 4.737	0.65
Yes	4.693	4.613 - 4.772	
Toilet facility			
12 Flush - to septic tank	4.619	4.347 - 4.890	
13 Flush - to pit latrine	4.661	4.549 - 4.772	
14 Flush - to somewhere else	4.728	4.430 - 5.027	
21 Pit latrine - ventilated improved	4.670	4.462 - 4.878	0.87
22 Pit latrine - with slab	4.694	4.614 - 4.775	
23 Pit latrine - without slab/open pit	4.722	4.688 - 4.755	
31 No facility- bushveld	4.697	4.640 - 4.754	
Type of bednet(s) slept under last night			
No bednet	4.647	4.591 - 4.703	
Only treated bednets	4.751	4.720 - 4.781	0.00
Only untreated bednets	4.603	4.514 - 4.693	
Water source			
Piped water	4.725	4.681 - 4.769	

Open well	4.711	4.661 - 4.761	
Protected well	4.738	4.673 - 4.804	0.49
River/lake water	4.672	4.607 - 4.738	
Spring water	4.635	4.521 - 4.749	
Rain water	4.674	4.468 - 4.880	
Household size			
1-3	4.472	4.357 - 4.587	
4-5	4.710	4.663 - 4.758	0.00
6-7	4.731	4.683 - 4.778	
8+	4.748	4.706 - 4.790	
Regional Zones			
Western	4.704	4.640 - 4.768	
Northern	4.820	4.758 - 4.881	
Central	4.825	4.755 - 4.895	
Southern Highlands	4.677	4.594 - 4.761	
Lake	4.605	4.530 - 4.680	0.00
Eastern	4.647	4.551 - 4.743	
Southern	4.719	4.632 - 4.806	
Zanzibar	4.714	4.656 - 4.772	

Table 6. Mean survival times by environmental factors.
P-value ≤ 0.05

Among the environmental factors, variables that were significantly associated with child survival included type of bednet(s) slept under, household size, type of place of residence and regional zones. Children who slept under treated bednets have shown to survive longer than those who slept under no bednets and no untreated bednets at 4.751 years, 4.647 years and 4.603 years respectively. The differences in the survival time were statistically significant ($p<0.005$). On the other hand, survival rates increased significantly with an increase in the size of the household from which the mother is residing. For example, while children born from mothers coming from households with 1-3 members survived to an average of 4.472 years, those who were coming from household with eight or more members survived up to 4.748 years longer and the differences were highly significant ($p<0.001$).

An inextricable but not unanticipated result is revealed between children born of mothers residing in rural areas and those born of mothers residing in urban areas. Children born of mothers residing in rural areas survived longer than their counterparts residing in urban areas at 4.723 years and 4.638 years respectively. These differences were statistically significant. Additionally, regional zones were also found to affect the chances of surviving in a significant manner. The highest survival chance is found among children born in Central zone (4.825 years) and the least survivors are found in the Lake zone.

4.4 Multivariate Analysis

Table 7 presents the results of the Cox proportional hazard model showing the relationship between different maternal, child and environmental factors and probability of surviving under the age of five. Table 7 displays the hazard ratios, the p-values and the 95% confidence intervals (CI) in the model.

Using the likelihood ratio test of 0.05 level of significance, variables that were fitted in the Cox regression model included: (i) Maternal factors - highest educational level, maternal age, children ever born, currently/formerly/never married and wealth index, (ii) Child factors - birth order, breastfeeding, sex of child, size of the child at birth and whether child is a twin (iii) Environmental factors: has electricity, type of bednet(s) slept under last night, water source, household size, type of place of residence, type of toilet facility and regional zones.

However, not all of these co-variants showed significant association with under-five mortality. For example, the maternal factor variable which showed interesting results was 'children ever born'. Child factors which were significantly associated with under-five mortality were breastfeeding, birth order number and child is twin/multiple births. Similarly, environmental factors which were also significantly associated with under-five mortality include: household size, type of place of residence and regional zones.

4.4.1 Maternal Factors

Variable	Hazard Ratio	P-Value	[95%CI]
Highest educational level			
No education	1.00		
Primary	1.09	0.67	0.72 – 1.65
Secondary+	0.67	0.38	0.70 – 1.64
Maternal age			
15-19	1.00		
20-24	0.94	0.87	0.43 – 2.04
25-29	0.78	0.60	0.31 – 1.95
30-34	0.75	0.57	0.28 – 2.00
35-39	0.96	0.93	0.36 – 2.58
40+	0.66	0.44	0.23 – 1.88
Children ever born			
1-2	1.00		
3-4	1.31	0.29	0.80 – 2.15
5-6	1.24	0.54	0.63 – 2.41
7+	1.58	0.21	0.77 – 3.22
Marital Status			
Never married	1.00		
Currently married/living together	0.65	0.10	0.39 – 1.10
Formerly married	0.80	0.43	0.45 – 1.40

Wealth index			
Poorest	1.00		
Poorer	1.14	0.08	0.96 – 2.14
Middle	1.37	0.12	0.92 – 2.03
Rich	0.97	0.89	0.59 – 1.60
Richest	1.51	0.22	0.79 – 2.88

Table 7. Hazard ratio for different maternal factors
P-value ≤ 0.05

The results point out that maternal educational level, wealth index and maternal age were still not significantly associated with under-five mortality rate even after controlling for the effects of other variables.

4.4.2 Child Factors

Variable	Hazard Ratio	P-Value	[95%CI]
Breastfeeding			
Not breastfeeding	1.00		
<6 months	2.65	0.00	1.36 – 5.16
12 months	0.93	0.00	0.09 – 0.40
13 months and above	0.11	0.00	0.43 – 0.27
Birth order number			
1-2	1.00		
3-4	1.16	0.37	0.82 – 1.65
5-6	0.73	0.19	0.46 – 1.17
7+	1.45	0.08	0.96 – 2.22
Sex of child			
Male	1.00		
Female	1.04	0.82	0.76 – 1.42
Size of child at birth			
Very large	1.00		
Larger than average	0.46	0.08	0.27 – 1.00
Average	0.58	0.19	0.34 – 1.01
Smaller than average	0.72	0.52	0.37 – 1.41
Very small	1.16	0.77	0.22 – 1.35
Child is twin/Multiple births			
Single birth	1.00		
1st of multiple	4.24	0.00	2.34 – 7.68
2nd of multiple+	1.01	0.94	0.74 – 1.38

Table 8. Hazard ratio for different child factors
P-value ≤ 0.05

In the previous section, the effects of breastfeeding had the most impact in reducing under-five child mortality. The results of Cox proportional model showed that this variable is still significantly associated with mortality reduction ($p<0.001$). Compared to children who are not

breastfed, those who were breastfed for less than six months are 2.65 times more likely to die compared to those who are not breastfed [H.R =2.65, P=0.000, 95% C.I (0.09 – 0.40)] while those who breastfed for 12 and 13 months or more had the hazard ratio reduced by 7% and almost 91% respectively. The results further indicated that children of birth order 7+, though not significant were 1.58 times more likely to die compared to children of birth order 1-2 [H.R =1.58, P=0.21, 95% C.I (0.77 – 3.22)].

On the other hand, there were no significant differences between males and females after controlling for the effects of other variables in the model. The size of the child at birth was not significant; the results indicated that children born as multiple births were more likely to die before age five than those who were born as singles. Those who were born as 1st multiples were significantly 4.24 times more likely to die than those who were born as singletons (p<0.001) [H.R =4.24, P=0.00, 95% C.I (2.34 – 7.68)].

4.4.3 Environmental Factors

Variable	Hazard Ratio	P-Value	[95%CI]
Has electricity			
No	1.00		
Yes	0.70	0.33	0.33 – 1.45
Type of bednet(s) slept under last night			
No bednets	1.00		
Treated bednets	0.70	0.04	0.56 – 1.41
Only untreated bednets	1.18	0.54	0.57 – 1.01
Water source			
1 Piped water	1.00		
2 Open well	0.95	0.75	0.66 – 1.76
3 Protected well	1.02	0.29	0.79 – 2.15
43 River/lake water	0.72	0.07	0.96 – 2.84
45 Spring water	1.38	0.03	1.05 – 3.11
51 Rain water	2.59	0.23	0.42 – 4.70
Household size			
1-4	1.00		
5-6	0.86	0.00	0.29 – 0.62
7-8	0.71	0.00	0.20 – 0.50
8+	0.67	0.00	0.14 – 0.40
Type of place of residence			
Urban	1.00		
Rural	0.52	0.00	0.35 – 0.77
Regional Zones			
Western	1.00		
Northern	0.37	0.00	0.20 – 0.67
Central	0.50	0.04	0.26 – 0.98
Southern Highlands	0.80	0.29	0.53 – 1.21
Lake	1.27	0.25	0.84 – 1.90
Eastern	0.54	0.09	0.27 – 1.10
Southern	0.57	0.07	0.31 – 1.04
Zanzibar	0.65	0.13	0.37 – 1.14

Table 9. Hazard ratio for different environmental factors
P-value ≤ 0.05

After controlling for the effect of other variables, the results here show that type of bednet(s) slept under the previous night (treated bednets), place of residence, household size and regional zones (Northern) were statistically significant. Children who were born in the rural areas had hazard ratio reduced by 48% [H.R =0.52, P=0.00, 95% C.I (0.35 – 0.77)]. Using urban area as a reference group, an increase in the household size was negatively associated with the probability of dying ($p<0.05$). The hazard of death was reduced by 14% [H.R =0.86, P=0.00, 95% C.I (0.29 – 0.62)], 29% [H.R =0.71, P=0.00, 95% C.I (0.20 – 0.50)] and 33% [H.R =0.67, P=0.00, 95% C.I (0.14 – 0.40)] respectively for those children whose mothers were coming from households with 5-6 and 7-8 and more than 8 members respectively ($p<0.05$). These results indicate that the probability of death of under-five children for this variable increases with the number of household members.

On the other hand, the results indicate that children residing in Northern and Central regional zones had the risk of dying being reduced by 67% and 50% respectively compared to those who were residing in Western regional zone. Conversely, children residing in the Lake zone [H.R =1.27, P=0.25, 95% C.I (0.56 – 1.41)] were 1.27 times more likely to die than those from the Western zone. However, type of bednets slept under was significant in the covariate 'treated bednets' when other variables were controlled for in the multivariate analysis [H.R =0.70, P=0.04, 95% C.I (0.84 – 1.90)]. Children from households which used only untreated bednets were 1.18 times more likely to die compared to those who used no bednets [H.R =1.18, P=0.54, 95% C.I (0.57 – 1.01)].

4.5 Chapter Summary

In this chapter, the descriptive results (percentage distribution of the variables) were presented in a frequency and percentage distribution table. In addition, variables used in the study were also included into the Cox proportional hazard model and also the mean survival time to determine the relationship between survival time and the variables pertinent for this study.

Eventually, when the Cox proportional hazard was run, significant association with under-five mortality was found among covariates such as breastfeeding, birth order number, size of the

child at birth and multiple births/child is twin. Environmental factors in which the covariates showed a significant relationship with under-five mortality included the type of bednet slept under, type of place of residence, household size and regional zones.

Chapter 5: Discussion, Conclusion and Recommendations

5.1 Introduction

The main aim of this research study was to determine the maternal, child and environmental factors considered to affect under-five mortality in Tanzania using the 2010 TDHS. This chapter re-examines the results presented in the preceding chapters and highlights the key findings of the study. Accordingly, the discussion, conclusion and recommendations for the study are then identified and suggestions for possible future research are provided.

5.2 Discussion of the Results

The findings from the study reveal that in the multivariate Cox proportional hazard regression, covariates of child factors: breastfeeding, birth order number, size of the child at birth and multiple births/child is twin and; environmental factors: type of bednet slept under, type of place of residence, household size and regional zones were significantly associated with under-five mortality.

Breastfeeding in early neonatal stage is important for the survival of infants. Various studies have publicized the advantageous effects of breastfeeding on morbidity and mortality of infants, especially for those children whose immune system is still maturing (Hobcraft *et al.*, 1984). The multivariate regression of this study showed a highly significant relationship between the duration of breastfeeding and under-five mortality (p-value=0.000). Incidentally, the results are consistent with the findings of a study by Getachew and Bekele (2016) which

showed that breastfeeding has a strong significant effect on child mortality. In another related study by Edmond *et al.* (2006), the results showed a larger risk of death among children who are given fluids or solids instead of breast milk.

Equally, the importance and effects of breastfeeding in this study were further revealed by the highest mean survival time for children who are breastfed compared to all variables in this study. Judicious extrapolation that can be drawn from the observed results is that the least period of breastfeeding should be at least 6 six months to curtail mortality among new-borns and infants (Kyei, 1999; Cleland & van Ginneken, 1988). Children ever born in this study indicate the number of children born to a woman in five years preceding the survey. The number of children ever born to a woman in the African context is dependent to a large extent on the diverse socio-cultural factors which influence the desired number of children. This study showed a higher probability of surviving to age five when there is lesser number of children born to a woman.

Uddin *et al.* (2009) also observed that an increase in child mortality in Bangladesh was associated with the number of children has the woman has given birth to, the desire for children as well as the level of parity. The result of the analysis of this study is consistent with the above finding and has also shown a higher risk of mortality in birth order 5 to 7+ and is also consistent with the findings of the study by Kembo and Van Ginneken (2009); Livi-Bacci and De Santis (1999) and Adhikari and Podhisita (2010). Additionally, the study also concurs with the study of Adedini (2013) which also revealed that a high number of children ever born to a woman increases the probability of death of children compared to a lesser number of children ever born to a woman.

This study further showed a significant relationship between a smaller household size and under-five mortality and the results were consistent with the findings of Mutunga (2003) and Mesike *et al.* (2012). Parenthetically, the findings of this study affirm the study of Mesike *et al.* (2012) which found environmental factors of the family to be meaningfully correlated to child mortality. In such instances, a bigger family compromises resources and thus increase the risk of a healthy life due to poor ventilation and overcrowding.

Type of place of residence in this study showed a significant relationship with under-five mortality in the multivariate regression. In this study, the results reveal that children born in

rural areas had reduced risk of dying compared to their urban counterparts. The results of this study therefore are consistent with studies of Mahmood (2002) which found that babies born of mothers living in rural areas had better survival chances than those born in urban areas. However, the only reasonable inference to be drawn from the observed results is that due to unprecedented urbanisation which is accompanied by overcrowding, high population density, poor infrastructural development and maintenance, and polluted environment among others, expose children to infectious diseases and the risk of mortality in urban areas than in rural areas. Thus, the high number of child fatalities is found in urban than rural areas.

Marital status of parents can either improve or diminish the standard of living within a household. Being a single, widowed or a divorced mother reduces the resources needed to improve the wellbeing of children. Households where both parents are alive can be economically better positioned to alleviate socio-economic challenges within households. Incidentally, the results of this study show that marital status significantly influences child survival. The results from the study are consistent with the result of Worku (2009) and Mturi and Curtis (1995) who showed that marital status of the mother is associated with child survival.

5.3 Conclusion

This study has shown some of the maternal, child and environmental factors considered to have significant effect on the under-five mortality and survival probabilities. A very outstanding finding of this study is the influence of breastfeeding which curtails and increase survival of under-five children. This is based on observation that children who are breastfed have lower diarrhoea and increased resistance against infectious diseases (WHO, 2017). The probability of survival is bigger among children who are breastfed than those who are not. The above assertion is confirmed by a study conducted by Demirci, (2010).

A common characteristic of the maternal factors is that children ever born are tributaries of household size in that the more children are born, the bigger the household size becomes. A bigger household size results in more consumption and competition for resources within the household which consequently impacts on the feeding practices of the family. A similar finding was discovered by Mutunga (2003) and Mesike *et al.* (2012) that a bigger household size

compromises resources within a household and thus increases the probability of death of under-five children.

Similarly, child factor variables which have a significant relationship with under-five mortality in both the Cox proportional hazard and survival analysis include breastfeeding and whether the child is a twin. Birth order number is intrinsically associated with birth spacing; shorter birth spacing always results in high birth orders which impacts on child survival. The results of the variable in this study confirm the findings of Mondal *et al.* (2009) where it was revealed that the higher the birth order, the higher the risk of child mortality. Considering environmental factors, the variables which indicated significant relationship with under-five mortality in both the Cox proportional hazard and survival analysis included type of place of residence, household size and regional zones. Type of place of residence and regional zones are closely related variables since they determine the types of facilities available in both areas and regions. The result of the place of residence in this study contradict the findings of Gunasekaran (2008) and Kabir and Chowdhury (1993) which indicated that urban areas experienced lower child mortality than the rural areas.

Finally, in this study, the results show that Northern and Central regions are significantly associated with under-five mortality compared to all other regions in this study. Manifestly, these results show that under-five mortality in Tanzania varies with regions and the only palpable inference that can be drawn for this occurrence is that there are inherent unequal capital and mineral endowments between regions. In addition, these conditions are ostensibly exacerbated by inequitable redistribution of human and capital resources and thus cause imbalanced socio-economic development within a country. The result in this study confirms the findings by Bedada (2017) where region has been found to be a significant predictor of under-five mortality.

5.4 Recommendations

It is essential to allude to the fact that the results of this study can be used in the formulation of approaches and mediations or to augment the existing ones for the progress of survival of children and child mortality reduction. As pointed above, some of the variables which showed significant association with under-five mortality included breastfeeding and household size. Quite evidently, these are social elements of societal and cultural dimensions which need to be

addressed at that level. Given the fact that breastfeeding had the highest impact on reducing child mortality, the study recommends that awareness campaigns for breastfeeding be intensified and conducive environments for breast-feeding should be encouraged in all facets of society. The stigma associated with frowning upon breastfeeding in public should be discouraged and mothers should feel free to breastfeed their babies in public places. The benefits of breastfeeding children for at least six months should be encouraged and communicated to women. There is, therefore, a need to also advance the value of life of the people in order to increase their choices for nutritious foods and better health care.

Children ever born and household size depict an old tradition in African societies which was premised on large families; either for labour, old age security or societal pride. These factors consequently result in high fertility of populations and subsequent social and developmental challenges within households and at the community level. High child mortality, which usually takes place among women with the least level of education prevails where there is high fertility. It is in this context that campaigns for contraceptive use and family planning should be strengthened to enlighten the society about the vagaries of bigger families and the reimbursements of smaller ones. Reproductive health should be communicated through campaigns and personal contacts with the purpose of eventually accentuating birth spacing in order to curb the number of children ever born and improve survival of new-borns. Additionally, effective use of contraceptives should be encouraged in an effort to thwart high fertility from which high mortality results.

A significant child factor such as birth order number also points to the need to reduce fertility. Added to it is also size of the child at birth which calls for regular and proper antenatal care to be provided. The findings of the Cox proportional hazard, in this study, further revealed that there are more under-five child fatalities in urban areas than rural areas. This is not an unfamiliar occurrence in demographic findings, but an infrequent incidence. A possible reason for this occurrence could be the fact that rural areas offer a more favourable setting for child survival because they have a less polluted environment, better networks of family and social support (Sastry, 2004). The availability and the improved accessibility of healthcare facilities in rural areas can also influence mortality decline in these areas.

Furthermore, it is acknowledged in literature that African cities urbanise faster than they develop and this event usually results in burdening of already weak services and derelict

infrastructure in urban areas. Obsolete burst sewerage and water pipes are a common "neglected" sight in our urban areas and consequently, these are root causes of pathogens in urban environments. It is in this context, therefore, that the government of Tanzania should address this urban/rural infrastructural imbalance which might be caused by urban influx and the resultant overcrowding and lack of or collapse of infrastructure.

A regional variation of under-five mortality has indicated that the Lake region/zone has the lowest survival time compared to other regions whereas the Northern and Central regions are significantly associated with under-five mortality. In view of these findings, it can be inferred that there is unequal distribution of health infrastructure and resources to the regions. It is therefore suggested that these regions should get exclusive investigation to determine the factors influencing such results and, more financial and human capital should be increased in these regions.

Though education in this study was not significantly associated with child mortality and survival, the literature on education in this study has shown the value of education on socio-economic factors in general. For example, education impacts on the reproductive patterns of women. In such situations, there arises a greater need to educate our people, maybe, specifically on issues identified to have effect on both child mortality and survival in this study. It becomes important for the government to extend greater attention to family planning interventions where the vagaries of large families impact on household resources, affordability and generally, child mortality and survival. In the process, women should be encouraged to utilise health services in an effort to acquaint themselves with how to take care of themselves and their children in order to prevent unnecessary preventable deaths that arise from negligence.

In this study, use of bednets has shown a significant association with child mortality and survival. In conclusion, though not part of the variables included in this study, but directly influences use of bednets, it is important to acknowledge the fact that the scourge of malaria is very high in Tanzania. This disease contributes to morbidity and mortality of children under the age of five and pregnant women. Therefore, pregnant women should be encouraged and supported to use mosquito nets at all times. These results, therefore, are intended to contribute towards the improvement of relevant policies that will reinforce the reduction of child mortality, and improve their survival. In conclusion, the results of this study have revealed that socio-economic conditions are influencing under-five mortality in Tanzania. Further research

on factors impacting on child mortality is required in order to gain more insight into the socio-economic influences of under-five mortality in Tanzania.

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