FERTILITY IN ZAMBIA: AN APPLICATION OF THE BONGAARTS' MODEL OF PROXIMATE DETERMINANTS

By

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DECLARATION

I **Boniface Mwanza** declare that I am the sole author of this dissertation on the topic; "**Fertility in Zambia**: **Application of the Bongaarts model to examine proximate determinants"** is my own work, that it has not been submitted for any degree examination in any other college or university, and that all the sources I have used or quoted have been indicated and acknowledged as complete references. I further declare that the views and opinions contained in this report do not in any way represent those of the University of Zambia (UNZA), but my own.

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APPROVAL

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Examiner 3 ....……Signature………………Date…………

Chair person

(Board of examiners)..........................….Signature………………Date…………

DEDICATION

I dedicate this piece of academic excellence to my parents; Mr and Mrs Mwanza and my siblings for their unconditional love and for imparting in me the spirit of not giving up on my goals. I thank you mum and dad for teaching me to love, to be kind, to be humble, to be honest and above all to be a God fearing child.

I also dedicate this paper to my wife Tashana, my son Madalitso and daughters Faith and Katherine for moral support rendered throughout my study. Thanks to all of them for the support during the time that I burnt the midnight oil in pursuit of this achievement and for their strength during times when the going was really tough, for the laughter, the fun and for simply keeping me sane.

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ACRONYMS

Ca	Index of Abortion
Cc	Index of contraception use
Ci	Index of postpartum infecundability
Cm	Index of Marriage
CSO	Central Statistics Office
CSOs	Civil Society Organisations
CHWs	Community Health Workers
FAWEZA	Forum for African Women Educationalists of Zambia
Ip	Index of Primary Sterility
MOFNP	Ministry of Finance and National Planning
MOH	Ministry of Health
MOE	Ministry of Education
NGOs	Non-Governmental Organisations
STDs	Sexually Transmitted Diseases
TF	Total Fecundity
TFR	Total Fertility Rate
TMFR	Total Marital Fertility Rate
TNFR	Total Natural Fertility Rate
UNZA	University of Zambia
WHO	World Health Organization
ZDHS	Zambia Demographic Health survey

ABSTRACT

Achieving sustainable fertility rates is important for any country; however, fertility levels in Zambia have remained relatively high. According to the 2013/14 Zambia Demographic and Health Survey, the country has a Total Fertility Rate (TFR) of 5.3 children per woman (CSO, 2015). Literature for Zambia, showed limited/scanty quantifiable evidence of inhibiting effects of the proximate determinants on fertility. This study sought to address this gap by attempting to generate data on quantifiable evidence of the proximate determinants of fertility in Zambia

The main objective of this study was to apply the Bongaarts model to examine the impact of each of the proximate determinants to the realization of the current TFR in Zambia. This study focused on five proximate determinants of fertility namely marriage, contraceptive use, postpartum infecundity, primary sterility and abortion.

The model used for generating indices for proximate determinants of fertility was the Bongaarts' framework for analysing proximate determinants of fertility developed in 1978. The study used the Zambia Demographic and Health Survey (ZDHS) datasets from 1992, 1996, 2001/2, 2007 and 2013/14. The study also used data on abortion estimates from Guttmacher institute. Using Stata 11 and Excel 2013 analytical software packages, indices for each of the proximate determinants were generated for each of the respective years.

The research findings revealed that non-marriage, contraception and postpartum infecundability seem to be contributing more in reducing fertility than primary sterility and induced abortion. Over the reference period, postpartum infecundity averted most births at 24.5 births followed by contraception use which averted 19.6 births. Non marriage then followed in third place with 12.4 births. This study findings suggest that the number of births to be averted by contraception use will continue to increase as can been seen from the evolving trends globally. Post-partum infecundability will continue to remains an important proximate determinant of fertility in Zambia in years to come, though the number of births averted might continue to drop over time as the country continues to modernise. Furthermore, this study findings suggest that the impact of non-marriage on fertility suppression in Zambia is expected to continue declining at a slow pace in years to come due to strong traditional and cultural beliefs that promote marital union and procreation in marital union

The study offered suggestive evidence on the importance of adopting a holistic approach when dealing with proximate determinants of fertility. Success in addressing high fertility in the country will only be achieved if the country adopted a holistic approach when dealing with proximate determinants of fertility.

Key words: Proximate determinants, fertility, postpartum, contraception use, births averted

DEFINITIONS OF KEY CONCEPTS

- **Total Fertility Rate (TFR):** is the average number of children that a woman would have during ages 15-49 if she survived that age range and had children at the current age-specific fertility rates.

- **Total Fecundity (TF):** is a hypothetical or potential value that the TFR would take if all five of the indices were exactly 1, that is, if there were no non-marriage (if all women were married from ages 15 to 49), no contraception, no postpartum infecundability (beyond a minimum of 1.5 months) and no induced abortion. It is the total fertility rate in the absence of the fertility-inhibiting effects of the proximate determinants.

- **Total Marital Fertility Rate (TM):** Refers to the average number of births that a woman would have during ages 15-49 years if she survived that age range and bear children at the current age specific rates and remain married during the entire reproductive period

- **Postpartum Amenorrhoea:** Refers to the interval between child birth and the return of mensuration. The length and intensity of breastfeeding influence the duration of amenorrhoea, which offers protection from conception. The risk of conception in this period is very low.

- **Postpartum Abstinence:** Refers to the period between child birth and the time when a woman resumes sexual activity. Delaying the resumption of sexual relations can also prolong protection.

- **Duration of postpartum insusceptibility:** The duration of the postpartum amenorrhoea and the period of sexual abstinence following birth jointly determine the length of the insusceptibility period. Women are considered insusceptible if they are abstaining from sex following childbirth or are amenorrhoeic.

Background (Antecedent) Variables

- **Education:** Refers to the number of years of formal schooling years completed. This study classified levels of education into four categories: no education, primary incomplete, primary complete and secondary and above level of education.
- **Regions:** Refers to the 10 provinces of Zambia. These are Central, Copperbelt, Eastern, Lusaka, Luapula, Muchinga, Northern, North Western, Southern and Western
- **Place of Residence:** This category refers to where the respondent was living at the time of the survey, classified as either urban or rural.
- **Wealth index:** The wealth index is a composite measure of a household's cumulative living standard. The wealth index is calculated using easy to collect data on a household's ownership of selected asset ranging from electricity, radio, TV, bicycle, motorbike and car as well as dwelling characteristics like source of water and sanitation facilities and type of material used in flooring.
- **Mother's age:** Refers to the age of the mother of the child/ children. This study classified mother's age into seven categories; 15-19, 20-24, 25-29, 30-34, 35-39, 40-44, 45-49.

Proximate determinants Variables

- **Proportion Married**: This variable is intended to measure the proportion of women of reproductive age 15 and 49 years who reported to be currently married or living with a man during the surveys.
- **Contraceptive Use**: This refers to a deliberate parity-dependent practice including abstinence and sterilization undertaken to reduce the risk of conception.
- **Duration of Breastfeeding**: This is the length of time elapsed since the woman began breastfeeding after birth.
- **Primary Sterility**: Women are sterile before menarche, the beginning of the menstrual function, and after menopause, but a woman may become sterile before the woman reaches menopause for reasons other than contraceptive sterilization.
- **Induced abortion:** Refers to the intentional termination of a pregnancy before the fetus can live independently.

CHAPTER ONE: BACKGROUND

1.1 Introduction

According to the 2013/14 Zambia Demographic and Health Survey (ZDHS), Zambia has a Total Fertility Rate (TFR) of 5.3, meaning that on average, a woman living in Zambia will give birth to 5.3 children by the end of her reproductive cycle (CSO et al., 2015). The 2013/14 ZDHS also showed that the rural parts of the country had a much higher TFR compared to the urban parts of the country. In the rural parts of the country, a woman is expected to have an average of 6.6 children by the time she completed her reproduction cycle while in the urban parts of the country, a woman is expected to have an average of 3.7 children by the time she completed her reproductive cycle (CSO et al. 2015). Fertility trends from the ZDHS surveys during the period between 1992 and 2013/14, reveal that the Total Fertility Rate (TFR) had only decreased by 1.2 children from 6.5 children per woman at the time of the 1992 ZDHS to 5.3 children per woman at the time of the 2013/14 survey. Compared to other countries in the sub-Saharan African region, Zambia’s total fertility rate of 5.3 is considered to be relatively high.

Population growth is at the heart of the nation’s development effort. The relationship between population growth and economic development is a subject that has been studied by scholars for a long time. Machiyama (2010), argued that population growth has an effect on economic development. The analysis of the relationship between population growth and economic growth dates back to the days of Thomas Malthus (1798) who claimed that there is a tendency for the population growth rate to surpass the production growth rate because population increases at a geometrical rate while production increases at an arithmetic rate. In his analysis, Thomas Malthus generally tried to explain the relationship between population growth with resources. However, over the years, the relationship between population growth and economic development has been expanded to include other aspects like access to social services such as education and health, access to decent shelter and accommodation, and access to employment to mention but a few.

Recent analysis of the relationship between populations growth and economic growth in developing countries has revealed that a high rate of population growth not only has an adverse impact on improvement in food supplies, but reduces saving per capita and constraints available social amenities/ infrastructure such as decent shelter/accommodation, access to education and health facilities. In addition, a high rate of population growth leads to an expansion in the number of labour force entrants, rapid increase in school age population that puts pressure on existing education and training facilities (Shapiro, 2008).

In Zambia, the negative effect of high population growth on economic development is evident in the high number of people living below the poverty line. According to the 2010 census, 60 percent of the Zambians live below the poverty line (CSO, 2010). In addition, access to social amenities has been affected by high population growth with the teacher pupil ratio being at 48 pupils per teacher which is much higher than the recommended 40 pupils per teacher. In the health sector, the doctor patient ratio is estimated to be at 1 doctor per 8,400 population which is far from the WHO recommended 1 doctor per 5,000 population. Other sectors equally affected by the high population growth rate is the labour market were the dependency ratio has remained relatively high at 73 percent meaning that for every 73 economically active people, there are 100 economically inactive people (CSO, 2010). This mismatch between population growth rate and economic development can only be addressed once the government and all stakeholders realise that slower population growth creates a pathway for an increase in the rate of economic growth. A rapid decline in fertility is instrumental to reducing the high population growth rate.

The Bongaarts model developed by John Bongaarts (1978), has been used world over to quantify the inhibiting effect of the proximate determinants on fertility. The model critically examines the effect of major proximate determinants namely; 1) marriage, 2) contraception use, 3) prevalence of induced abortion, 4) postpartum infecundability and 5) primary sterility among married women aged 15-49 on fertility. When applied to a population, the model provides useful information which has significant implications on reproductive health programmes and policies needed to regulate future population growth.

This study attempted to apply the Bongaarts model to estimate the inhibiting effect of each of the principle proximate determinants on fertility in Zambia based on the 1992, 1996, 2001/2, 2007 and 2013/4 Zambia Demographic and Health Surveys. The study also attempted to quantify the number of births averted by each of the proximate determinants of fertility.

Findings from this study are important for assessing progress made in meeting the targets in the vision 2030 which aims at decelerating the annual population growth rate from its 2005 rate of 2.9 percent to a rate of less than 1.0 percent over 25 years. In addition findings from this study are important for assessing the implementation of various reproductive health and family planning programmes listed in the national health strategic plan 2017-2021. Some of the areas covered by this study include: contraceptive use, reducing unmet need for family planning and age at first marriage.

1.2 Statement of the problem

According to the population projections from the Central Statistical Office (CSO), in 2015, Zambia had an estimated population of 15,473,905 people with an annual average growth rate of 2.8 percent per annum. High fertility rate was the greatest contributor to this growth in population. Zambia's total fertility rate of 5.3 births is considered relatively high when compared to other countries in the region (CSO, 2015).

Addressing high fertility rate remains high priority on the government development agenda. The national population policy places much emphasis on contraceptive use as one of the more important immediate determinants to regulating high fertility levels in Zambia (MOFNP, 2010). However, the DHS shows that despite a quadruple increase in the prevalence of contraception use between 1992 (11.6 percent) and 2013/14 (49.0 percent), the total fertility rate only reduced by one birth from 6.5 and 5.3 children per woman for 1992 and 2013/14, respectively (CSO, 2015). One possible explanation for this disparity between high increase in contraception use and minimal decline in fertility may be that the other proximate determinants are exerting upward pressure on fertility: Thus, the importance of quantifying the effect of other proximate determinants when explaining fertility variations.

Quantifiable evidence of the inhibiting effects of the proximate determinants on fertility in Zambia has been a challenge over the years. Similar studies on the impact of the proximate determinant of fertility in Zambia have been conducted by Dzekezeke and Nyangu, 1992, Stover J, 1998, and Chola and Michelo (2016), however, none of these studies

quantified births averted by each of the proximate determinants of fertility. Therefore, this research study attempted to generate quantifiable evidence of inhibiting effects of the proximate determinants on fertility including births averted order to bridge the gap.

The Bongaarts model was used in this research study to generate estimates of fertility inhabiting and births averted by each of the proximate determinants for the period 1992, 1996, 2002, 2007 and 2013/14.

1.3 Research objectives

1.3.1 General/Main Objective

The general objective of the study was:-

- To apply the Bongaarts model to determine the impact of the proximate determinants on Zambia's TFR between 1992 and 2014.

1.3.2 Specific Objectives

The specific objectives include:

i. To estimate variations in fertility-inhibiting effects of five (5) proximate determinants of fertility namely: 1) marriage, 2) contraception use and 3) postpartum infecundability 4) induced abortion and 5) primary Sterility among currently women aged 15-49 years over the last five (5) Zambia Demographic Health Surveys (ZDHS) thus 1992, 1996, 2001/2, 2007 and 2013/14 at national and sub-national level.

ii. To estimate the number of births averted by each of the five (5) principle proximate determinants of fertility over the last five (5) Zambia Demographic Health Surveys (ZDHS) thus 1992, 1996, 2001/2, 2007 and 2013/14 at national level;

iii. To provide policy implications and recommendations from the Bongaarts model to inform future national policies on fertility and population growth.

1.4 Research questions

This study sought to answer the following questions;

i. What were the trends in indices of proximate determinants of fertility among women aged 15-49 during the 1992, 1996, 2001/2, 2007 and 2013 Demographic and Health Surveys in Zambia?

ii. How many births were averted by each of the proximate determinants among women aged 15-49 during the 1992, 1996, 2001/2, 2007 and 2013/14 Demographic and Health Surveys in Zambia?

iii. Which of the proximate determinants had averted most births during the 1992, 1996, 2002, 2007 and 2013/14 demographic and health surveys in Zambia?

iv. What are the implications of the results from the Bongaarts model on Zambian policies?

1.5 The rationale of the study

The gaps of lack on quantifiable evidence of births averted in the previous research studies conducted in Zambia necessitated the need for this research study to be conducted in order to generate estimates on the impact of each of the proximate determinants on fertility. The generation of quantifiable evidence of the impact of proximate determinants on fertility is vital when assessing progress made towards meeting the targets in the vision 2030 which aims at decelerating the annual population growth rate from its 2005 rate of 2.9 percent to a rate of less than 1.0 percent over 25 years. The annual population growth rate in Zambia is mainly influenced by fertility rates.

This study is important in that it attempted to estimate births averted by each of the five (5) principle proximate determinants of fertility namely: 1) marriage, 2) contraception use, 3) postpartum infecundability, 4) induced abortion and 5) primary sterility over the last five (5) Zambia Demographic Health Surveys (ZDHS) thus 1992, 1996, 2001/2, 2007 and 2013/14. An analysis of births averted in Zambia was not documented in the various materials and pieces of literature that I reviewed.

Secondly, unlike comparative studies which focus on national estimates only, this study attempted to generate sub-national estimates which were used to demonstrate variation in proximate determinants across the country. An analysis of variations on the impact of the proximate determinants of fertility across the country by location, education and income presents policy makers and programme managers working on reproductive health and family planning programmes with respect to contraceptive use and unmet need for family planning,

with evidence needed to channel the limited resources to the proximate determinants that affect fertility greatly in their respective provinces or locations.

Lastly, this study is necessary for the award of my Master of Arts in Population Studies at the University of Zambia (UNZA).

1.6 Organisation of the dissertation

Chapter One has focused on giving the introduction, background of the study, statement of the problem, research objectives and questions, rationale of research study and also organisation of the research study. Chapter Two dealt with the literature review and the conceptual framework. Chapter Three has presented detailed research methodology outlining the research design, sampling frame, sample size, inclusion criteria, data processing and analysis, variables under study, definition of key terms, study limitations and ethical consideration.

Furthermore, chapter Four focused on presenting study findings and discussions of the research by examining variation in fertility suppression of five (5) proximate determinants thus marriage, contraception use and postpartum infecundability, abortion and primary sterility by four background characteristics namely; place of residence, region, education and wealth using the Zambia Demographic and Health Survey data sets. In addition, this chapter contains the discussion of findings on the trend analysis of indices of five (5) proximate determinants of fertility namely index of marriage, index of abortion, index of contraception use, index of primary sterility, and the index of postpartum infecundability for all the five round of the ZDHS surveys in Zambia. This chapter also quantified the number of births averted by each of five (5) principle proximate determinants of fertility over the last five (5) Zambia Demographic Health Surveys (ZDHS) thus 1992, 1996, 2001/2, 2007 and 2013/14 at national level. Chapter Five provides a summary of key research findings in relation to the research objectives. The chapter has also provided conclusions and recommendations based on the research findings.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

This chapter focused on reviewing relevant literature to identify what had been done by other researchers in other developed and developing countries. The research study adopted Bongaart's Model developed in 1978 to measure the impact of the proximate determinants on fertility. According to the model, measuring of the impact of proximate determinants on fertility forms the basis for formulating policy instruments targeted at addressing high fertility in different settings and locations. Therefore, for government, the formulation of policy instruments based on this model and targeting specific locations and groups of people, is an effective way of addressing high fertility in different parts of the country. More importantly, literature reviewed helped to identity gaps in the previous studies upon which the statement of the problem for this study was anchored to fill up those gaps.

2.1.1 The Bongaarts Model

The relationship between direct and indirect factors that affect fertility was first established by Davis and Blake (1956). Davis and Blake outlined the factors affecting fertility as being classified into two groups namely; 1) background variables and 2) intermediate or proximate variables. The *background variables* were defined as being cultural, psychological, economic, social, health, and environmental factors while the *intermediate or proximate variables* were defined factors that had a direct effect on fertility. The duo concluded that background factors operate through the proximate determinants to influence fertility; they do not influence fertility directly.

Later, in the late nineteen seventies, Bongaarts (1978), proposed a new framework that would mainly focus on seven proximate determinants on fertility. The seven proximate determinants identified by Bongaarts include; 1) marriage, 2) contraception, 3) induced abortion, 4) lactation infecundability, 5) spontaneous intrauterine mortality, 6) frequency of intercourse and 7) primary sterility. Using the proposed new framework, Bongaarts was able to quantitatively examine the impact of the proximate determinants on fertility. The previous framework developed by Davis and Blake was unable to quantitatively examine the impact of the proximate determinants on fertility

Based on data from 41 developed and developing countries, Bongaarts and Potter (1983) observed that 96 percent of the variation in the total fertility rates could be explained by four (4) proximate determinants namely 1) marriage, 2) contraception, 3) induced abortion and 4) postpartum infecundability. The remaining three (3) variables namely; 1) spontaneous intrauterine mortality, 2) frequency of intercourse and 3) Primary Sterility accounted for the remaining 4 percent variation of the total fertility rate. This research study based its analysis on five (5) proximate determinants of fertility namely; 1) marriage, 2) contraception, 3) induced abortion, 4) postpartum infecundability and 5) primary sterility. The other two (2) proximate determinants namely; 1) spontaneous intrauterine mortality and 2) frequency of intercourse were excluded from the analysis due to data limitations.

The Bongaarts model was used to quantify the fertility inhibiting effect of the four major proximate determinants namely contraception use, non-marriage, postpartum infecundability and abortion.

For the purpose of this study, the Bongaarts model was slightly modified to include the index of primary sterility. The study opted to include primary sterility in the model based on findings of Caldwell (1994) who argued that although infertility increases naturally as a woman ages (natural sterility), much of the primary sterility (inability to have any children at all) in sub- Saharan Africa is caused by sexually transmitted diseases (STDs). The study went on to suggest that gonorrhoea was the most prevalent STD affecting African populations.

This study used, the Bongaarts model to summarise the relationship between total fertility rate and the proximate determinants of fertility. The model assumes that the natural reproductive capacity i.e. the Total Fecundity Rate (TF) of a woman is nearly the same for all women and is estimated to be 15.3 births per woman. However, the actual reproductive performance of women is modified mainly by five (5) major proximate determinants. The effects of these five (5) major proximate determinants on fertility are measured by five (5) indices namely, 1) the index of marriage, 2) index of contraception, 3) the index of induced abortion, 4) index of Primary Sterility and 5) the index of postpartum infecundability. Each of these indices lies between the range of 0 and 1. An index value of 0 has the strongest effect of reducing fertility while an index value of 1 has the weakest effect on fertility. The lower the

index, the more influential the proximate determinant is in reducing the total fecundity rate, i.e. the level of fertility that would occur in the absence of all the proximate determinants.

In summary, the proximate determinants can thus be thought of as inhibitors of fertility. For example, delayed entry into marriage, use of family planning methods, and prolonged breastfeeding or postpartum abstinence are factors that reduce fertility to levels lower than those that would occur in the absence of these proximate determinants.

2.2 Proximate determinants of fertility

This section presents empirical evidence for each of the five (5) proximate determinants of fertility. Discussions of some recent additions to the model have been highlighted also.

2.2.1 Marriage

Marriage signals the onset of exposure to the risk of pregnancy for most women, and thus it is an important fertility indicator. In the Demographic and Health Survey (2015), marriage can be classified into two categories: formal marriage and informal marriage. The former refers to legal or formal unions. Informal marriage also known as '*living together*' refers to an informal union between a man and a woman living together even if a formal civil, religious, or traditional ceremony has not occurred.

In the Bongaarts model, the frequency of sexual intercourse is the underlying variable of interest; however, information on this is rarely available in the DHS datasets. Therefore, the proportion of women of reproductive age that are in sexual unions or regularly engaged in sexual intercourse is used as a proxy in the Bongaarts model to measure the impact of marriage on fertility. The high proportion of women of reproductive age engaging in regular sexual intercourse is believed to be the major determinant of high fertility in sub-Saharan Africa since contraceptive prevalence is still relatively low (Mturi and Hinde, 1994). With this in mind, this study measured empirical evidence of marriage and its effect on fertility by looking at proportions of women in the age group 15-49 currently married.

Although marriage and fertility are not biologically related, in most societies marriage it is considered as a pre-requisite to childbearing. The demographic importance of marriage

comes from the fact that formal or informal marriages are the primary indicators of exposure to the risk of pregnancy. The exposure to the risk of pregnancy is influenced by the number of reproductive years spent unmarried. Reproductive years spent unmarried refer to the number of years before marriage plus those spent divorced, widowed or separated. Women who spend a lot of their reproductive years unmarried tend to have lower fertility rates compared to those who spend a lot of their reproductive years married assuming all other variables like contraception use remain the constant (Bongaarts and Potter, 1983 and Coale A, 1996, CSO 2015).

Historically, most African societies considered virginity to be essential for the first marriage and premarital pregnancy was a social embarrassment among most ethnic groups. In these traditional societies, age at first sexual intercourse was closely associated with age at marriage. Today however, premarital sex is being accepted as an inevitable consequence of the modernisation process (Ngalinda, 1998).

During the formulation of the model, Bongaarts assumed that all fertility occurs within marriage or formal unions. This assumption does not hold in many parts of sub-Saharan Africa, where substantial proportions of births are reported by women who describe themselves as single or never married (Gould and Brown, 1996). In Zambia, like many other countries in the region, a formal union is not a pre-requisite to childbearing. Women usually have children before entering formal unions. According to the 2013/14 ZDHS, 0.6 percent of women aged 15-49 years were in informal unions. Additionally, statistics from the ZDHS (2013/4), show that over 51 percent of women aged 15-49 engage in premarital sex and subsequently were exposed to the risk of pregnancy and childbearing.

In 1987, Bloom and Reedy observed that fertility rates tend to be higher in countries where marriage is universal and age at marriage is low. The United States of America in 1960 experienced a substantial decline in fertility due to an increase in delays of marriage, age of childbearing after marriage, proportion never married, proportion separated and proportion divorced (Riddfuss and Parnell, 1989). Furthermore, a considerable percentage of the fall in

fertility in Navarre between 1986 and 1991 was attributed to the postponement of marriage by women (Sanchez, 1998).

Bongaarts (1978), observed that marriage among educated women tended to delay, thus leading to lower fertility because the period of exposure to pregnancy is cut. Gould and Brown (1996), supported Bongaarts statement by suggesting that women who enter marriage late in sub-Saharan Africa, are not supportive of high fertility compared to those who marry early. In addition, a study by Mutetei (1998) also showed a positive relationship between education and age of first birth. According to him, women with higher educational levels are more likely to break away from traditional patterns, including early marriage and childbearing than women with lower education levels. The 2010 Census report also supports these findings by showing that women with no education have almost three times (7.1 children per woman) more children compared to those with more than secondary education (2.8 children per woman) (CSO, 2012).

Norms for marriage vary between urban and rural set ups. Early age at marriage is a common phenomenon in most rural parts of Africa. Jolly and. Gribble (1993) observed that late age at marriage substantially contributed to fertility reduction in urban areas. In Zambia, findings from the 2010 Census strongly suggest that early marriage was one of the main driving forces behind the high fertility rate in the rural parts of the country. Although the difference in the median age of marriage between women in the rural areas (20.3 years) and those in urban areas (21.9 years) is very minimal, the difference in fertility rate is significant 4.6 in urban areas compared to 7.0 in rural areas (CSO, 2012).

2.2.2 Contraception

According to Bongaarts (1978), contraception referred to a deliberate parity-dependent practice including abstinence and sterilization undertaken to reduce the risk of conception. Bongaarts in 1984 later revised the definition of contraception to refer to any deliberate practice aimed at limiting family size and excluded breastfeeding and postpartum abstinence because these two aim at promoting maternal health and child development rather than regulating the number of children born. Bongaarts suggested that if the proportion of women

consistently using contraception was high in any given society, fertility levels will be directly affected. According to Bongaarts (1978), the absence of contraception use and induced abortion implies the existence of natural fertility.

According to Sherris et al, (1985), Mauldin and Segal, (1988) and Pritchett (1994), argued that the contraception use has the most direct influence on fertility because fertility levels have dropped most sharply where the use of family planning has increased significantly. Pritchett (1994) went further to say that variations in contraceptive prevalence among different geographical regions and locations account for over 90 percent of the variations observed in fertility levels. These findings were supported by a study by Robey et.al (1992) which showed that differences in the levels of contraceptive use explain 92 percent of the variation in fertility among the 50 countries they studied. This implies that where contraceptive use is widespread, fertility is low. It is, therefore, essential to study the extent of the use of contraception in order to make sensible statements about the current and future fertility rates in a society (Robey, 1992).

An increase in modern contraceptive use from 8 percent in 1975 to 59 percent in 2007 coupled with a commitment in government in providing effective ways of family planning has seen the total fertility rate for Bangladesh decline from 6.3 children per woman (1975) to 2.7 children per woman (Mahjabeen and Khan, 2011). This result saw Bangladesh undergo a fertility transition from phase 1 with TFR greater than 6 children per woman in 1975 to phase 4 with TFR below 3 births per woman over a period of 32 years which is a much shorter period than historical transitions by the now developed countries (Mahjabeen and Khan, 2011).

A study in Tanzania by Larser (1997) showed that women who used contraceptives take considerably longer to conceive than those who do not use contraceptives. This study estimated the median waiting time to conception for the women who used contraceptives would be around 22 months compared to 15 months for women who did not use contraceptives (Larser, 1997). Contraception use seems to have a minor effect on fertility in sub-Saharan Africa due to its lower prevalence when compared to other parts of the world. By the middle of the 2000s, contraceptive prevalence rates for modern methods in most sub-

Saharan African countries were less than 30 percent in 37 countries, representing 91 percent of the population in the region while utilization rate in 31 countries representing 80 percent of the countries in the region was below 30 percent (Guengant and May, 2011).

Studies by Shapiro and Tambashe (2001) and Jolly and Grabble (1993), have observed that contraception use is higher in women who reside in urban areas compared to women who reside in rural areas. This has resulted in rural areas having a higher fertility level compared to the urban areas. Some of the reasons for this low use of contraception in rural areas include the following: the high desire to have more children, limited access to contraception services and cultural norms and values. In rural areas, large families are more desirable because they contribute to agricultural production at an early age. This benefit, however, seems to diminish in urban areas where children are seen as a cost due to high educational and health costs associated with large families.

2.2.3 Postpartum Infecundability

Postpartum infecundability refers to that time, after birth when women are not at risk of conceiving because either they are not ovulating or they do not engage in sexual intercourse (Bongaarts, 1984). Among women who are not using contraception or in societies where contraceptive prevalence is low, exposure to the risk of pregnancy in the period after birth is influenced primarily by two factors: breastfeeding and postpartum abstinence (Bongaarts, 1984). Jolly and Gribble (1993) revealed that generally, postpartum infecundability is the most significant inhibitor of fertility in most sub-Saharan African countries even though prolonged breastfeeding and postpartum abstinence are not universal. Furthermore, Mturi and Hlabana (1999) observed that breastfeeding was responsible for most of the decline in Lesotho's fertility.

According to the ZDHS (2007) report, breastfeeding prolongs postpartum protection from conception through its effect on the length of the period of postpartum amenorrhoea (the period prior to the return of menses after a birth). The length of lactational amenorrhea is primarily determined by the duration, intensity and patterns of breastfeeding (Jolly and Gribble, 1993). This delay in the resumption of ovulation in the postpartum period caused by breastfeeding postpones the next pregnancy for an average of 0.4 months for every additional

month of breastfeeding (Anrudh and Bongaarts, 1981). When Bongaarts model of the proximate determinants of fertility was applied to the WFS data set, lactation inhibited an average of 4.0 births per woman in Africa and 6.5 births per woman in Bangladesh (Weis, 1993). A study by Guz and Hobcraft (1991) revealed that the risk of conception for women who still breastfeed is between one quarter and two thirds lower than that of a woman who had weaned their children.

Breastfeeding is usually accompanied by sexual abstinence due to cultural beliefs such as the belief that sperms will contaminate the breast milk thus poison the baby. This belief may lead to women abstaining from sexual intercourse until after their child is weaned. This can result in four years spacing between successive children (Goldman et al, 1987). In Zambia, the median number of months of postpartum abstinence is about 4 months (CSO, 2007). This means that 50 percent of women abstain from sexual intercourse for a period of four months after the birth of a child in order to safeguard the health of the mother and her child.

The practice of postpartum abstinence and prolonged breastfeeding vary by region in Zambia. Rural areas are usually associated with longer periods of postpartum abstinence as compared to urban areas. The ZDHS (2007) report indicates that rural women breastfed for longer periods of time (20.8 months) than urban women (18.8 months). In addition, women with no education breastfed for longer time periods (21.6 months) compared to those who have secondary education who breastfed for a shorter period of time (19.9 months). Women who had little wealth breastfed for longer periods of time (20.8 months) compared to women with a lot of wealth who breastfed for a shorter period of time (17.7 months). Similar findings have been documented in Lesotho by Makatjane and Toeba (1999).

In the Bongaarts model, postpartum infecundability is used to measure the effect of postpartum amenorrhea and abstinence on fertility. The ZDHS (2007) report indicates that the median duration of postpartum infecundability is 13 months making it an important inhibitor of fertility even though its practice is not universal in the country.

2.2.4 Induced abortion

Although reliable measurements of the prevalence of induced abortion are often lacking, this practice has long been identified as one of the main determinants of fertility regardless of its legal status (Johnston and Hill, 1996). Estimates of the number of births averted by induced abortion are largely based on numerical exercises using mathematical reproductive models (Bongaarts, 1978). A detailed study by Robert Potter (1984) demonstrated that: 1) an induced abortion always averts less than one birth (his explanation for this was that not all pregnancies end up as live births as others end up in stillbirths or spontaneous abortion). 2) The other explanation given was that after an induced abortion, a woman resumes ovulation much sooner than would have been the case if she carried the pregnancy to term.

Other findings by Robey (1992) demonstrated that the number of births averted per induced abortion is strongly influenced by the practice of contraception following an induced abortion. He observed that in the absence of contraception, an induced abortion averts about 0.4 births while about 0.8 births are averted when moderately effective contraception is practiced (Bongaarts, 1978). A study by Johnston and Hill (1996) showed that induced abortion reduced fertility by 38-55 percent in Latin America. In the Near East, the impact of induced abortion of fertility was estimated to be between 6-19 percent. Evidence from studies done in Japan, China and India have indicated that induced abortion has the potential to reduce fertility in a short time (Foreit and Nortman, 1992).

The measurement of the impact on induced abortion on fertility is important to this study because it is a key indicator of latent contraception demand (Foreit and Nortman, 1992). This suggestion is based on the fact that when women first become motivated to reduce their fertility but have not yet adopted effective contraception methods, declines in fertility are often associated with increased induced abortion rates. As more women are introduced to more effective methods of contraception, the rate of induced abortions begins to drop. This has been documented in countries such as Japan, Hungary and Germany. However, it is not always the case that an increase in the use of effective methods of contraception will result in a decrease in the induced abortion rate. In Korea 1982, it was observed that both induced

abortion rate and contraception prevalence increased concurrently (Foreit and Nortman, 1992).

In Zambia, like many other sub-Saharan African countries, induced abortion is highly restricted. A health practitioner can only perform an abortion if it threatens the life of a mother and/ or the foetus. As induced abortion is a very sensitive and private issue, many women are reluctant to disclose it thus making data collection difficult if not impossible. Zambia does not have national representative data on induced abortion as such, it is difficult to know if the rate of induced abortion is increasing or decreasing.

Scanty records from five major hospitals in Zambia between 2003 and 2008 indicate that induced abortion related complications reported by women are on the increase from 5,606 in 2003 to over 10,689 in 2008. The numbers of safe abortions conducted in these facilities, on the other hand, have remained very low and fall within the range of 115 to about 159 women per year (Likwa, 2009).

Bongaarts (1983) observed that induced abortion is a growing problem among the youngest and unmarried women. In 1990, a study done at the University Teaching Hospital (UTH) showed that 60 percent of the women who visited the facility with induced abortion complications were aged 15-19 years. This study also showed that 60 percent of the women with induced abortion related complications were not married and about 63 percent of them had no previous pregnancy (Likwa, 1996). While not denying that induced abortion is a growing problem among the youngest and unmarried women, evidence suggests that the problem is not limited to them. A study in Nigeria by Coeytaux (1990) revealed that 34.8 percent of the women who aborted were married and 52.2 percent had two or more children.

2.2.5 Primary Sterility

Primary Sterility is associated with diseases in Africa especially those that are sexually transmitted like gonorrhoea. While a small percentage of women are sterile at the beginning of the reproductive years, this might increase with age; reaching almost 100 percent at age 50. A population is said to have primary sterility problems if the proportion of ever-married women who are childless exceeds 3 percent (Bongaarts, 1984). There are three

types of sterility, namely, natural sterility, primary sterility, and secondary sterility. Natural sterility occurs at the beginning of the reproductive years without a woman necessarily contracting any sterilising diseases (Bongaarts, 1984). Bongaarts furthermore highlighted that primary sterility occurs if a sterilising disease is contracted before a first birth, while secondary sterility occurs after contracting a sterilising disease such that additional children cannot be borne.

The incidence of primary sterility is generally a less important determinant of fertility differentials (Jolly and Gribble, 1993). It does not vary much across sub-populations. However, it has been recognized as one of the main determinants of fertility differentials in sub-Saharan Africa (Bongaarts, 1984). One of the factors attributable to the stability of Tanzania's fertility since the 1970s is a decline in primary sterility; it declined from 10 percent to 3 percent between 1973 and 1991/92 (Laser, 1997).

2.2.6 Impact of indices on fertility in Zambia based on previous studies

Dzekedzeke and Nyangu, (1994) applied the Bongaarts model to the 1992 DHS data set to examine the effect of contraception, marriage and postpartum infecundity in generating fertility levels in Zambia. Abortion and sterility were not examined in this study. The findings of the research study showed that total fecundity rate (TF) was at 12.6 which was lower than the 15.3 recommended by Bongaarts. The authors suggested that high levels of illegal abortions and sterility among woman contributed to having a lower TF than what was suggested by Bongaarts. The study findings presented in Table 2.1 implied that in 1992, postpartum infecundity accounted for 37 percent of TF in Zambia, followed by contraception at 7 percent and marriage at 5 percent.

Table 2. 1 : Indices of Bongaarts Model and related measurements Zambia, 1992

	Ci	**Cc**	**Cm**	**TFR**
Indices of fertility	0.63	0.88	0.91	6.4
Percent contribution to TF	37%	7%	5%	51%

Source: Dzekedzeke and Nyangu: 1994

In rural Zambia, the study implied that postpartum infecundability accounted for 39 percent of TF compared to urban Zambia where it accounted for only 33 percent. Contraception accounted for 4 percent of the TF in rural Zambia compared to 13 percent in urban Zambia while marriage accounted for 3 percent of TF in rural Zambia compared to 6 percent in urban Zambia. These finding implied that women in rural areas breastfed and abstained longer than their counterparts in urban areas. Notably, this study did not attempt to quantify births averted by each of the indices of fertility. Conclusively, this study showed that contraception use and age at marriage was much higher in urban areas than in rural areas.

John Stover (1997), applied the Bongaarts model on the 1992 DHS data set. Stover used a revised model which accounted for abortion and sterility among women. The computations by Stover presented in Table 2.2 on the next page, showed a total fecundity of 19.5 which was much higher than what was suggested by Bongaarts. Stover explained that the difference in rates was caused by the revision in the reproductive age of interest from 15-44 years to 15-49 years. The implications of revising the reproductive age of interest to 15-49 meant that there were 35 years of potential childbearing as opposed to 29 years in the original model.

In addition, since infecundity is now incorporated into the sterility index, it should not be subtracted from this childbearing period. Thus, the new definition of total fecundity implies a value of about 21 (35 years * 12 months/year / 20 months per birth) and a range of 18 to 24. The TF of 19.5 was within the suggested range of 18-24. Abortion data accuracy was believed to have also contributed to the lower TF observed. The study findings indicated that postpartum infecundity and non-marriage inhibited fertility more than the use of contraception. This was slightly contradictory to the findings by Dzekedzeke and Nyangu whose findings suggested that use of contraceptives inhibited fertility were more than non-marriage. As was the case in the study done by Dzekedzeke and Nyangu, the analysis by Stover did not quantify births averted by the indices of fertility.

Table 2. 2: Revised proximate determinants Zambia by Stover

TFR	Cm	Ci	Cs	Cc	TF*Ca
6.5	0.688	0.629	0.859	0.898	19.5

Source: Stover J, 1997

Johnson, Kiersten, Noureddine Abderrahim, and Shea O. Rutstein (2011) conducted a comparative study to examine changes in the direct and indirect determinants of fertility in Sub-Saharan Africa. The trio analysed data from 13 sub-Saharan African countries that have implemented three or more DH Surveys. This research study aimed at examining the trends in the Bongaarts indices of the proximate determinants of fertility in order to examine the role that each determinant has played in shaping the fertility trajectory in each country. Indices of abortion and sterility were not examined in this study

The findings from this study presented in Table 2.3 showed that infecundity and non-marriage were virtually unchanged at 0.69 and 0.62 during this 15-year interval, except for a small increase in infecundity between the third and fourth surveys. Contraceptive use increased steadily, but between the third and fourth surveys, its effect on fertility was largely nullified by reductions in infecundity. The study findings implied that in 1992, postpartum infecundity was the greatest inhibitor of fertility followed by non-marriage. Contraception use was third. Over the years, this picture has changed. In 2007, the study findings showed that postpartum infecundity and contraception use were both at 0.64 while non-marriage being in third place 0.69. These findings simply show that the three indices almost evenly suppressed total fecundity (TF). As was the case with earlier studies highlighted above, this study did not quantify births averted by the indices of proximate determinants of fertilit

Table 2. 3: Trends in the effects of each proximate determinant of fertility on TFR 1992-2007

Years	1992	1996	2001-2	2007
Observed TFR	6.46	6.08	5.88	6.17
Non-marriage	0.72	0.69	0.69	0.69
Contraception	0.87	0.78	0.70	0.64
Infecundity	0.62	0.63	0.61	0.64
Cm*Cc*Ci	0.39	0.34	0.30	0.28

Residual factor	1.08	1.17	1.30	1.42

Source: Johnson, Kiersten, Noureddine Abderrahim, and Shea O. Rutstein. 2011

From all the research studies presented above, the impact of the proximate determinants on fertility; the number of births averted still remains unclear. This paper attempted to quantify births averted by each of the proximate determinants of fertility for the period 1992 to 2014.

Table 2. 4: Trends in the effects of each proximate determinant of fertility on TFR 1992-2007

2.3 Conceptual framework

The conceptual framework that was used in this study was adopted from the original framework developed by Bongaarts to analyse the proximate determinants of fertility. However, minor adjustments were made on the indirect determinants of fertility to align the framework to this study. Figure 2.1 on the next page, shows the conceptual framework used in this study.

The conceptual framework shows that socio-economic, cultural and environmental factors influence direct determinants of fertility leading to exposure to pregnancy which will lead to a health outcome; a live birth. As an example, socio-economic and cultural norms and values within society will influence acceptance and practices of certain behavioural patterns surrounding marriage, contraception use and postpartum abstinence and breastfeeding. These, in turn, will also influence exposure to sexual intercourse and risk of pregnancy; and will ultimately result in a live birth.

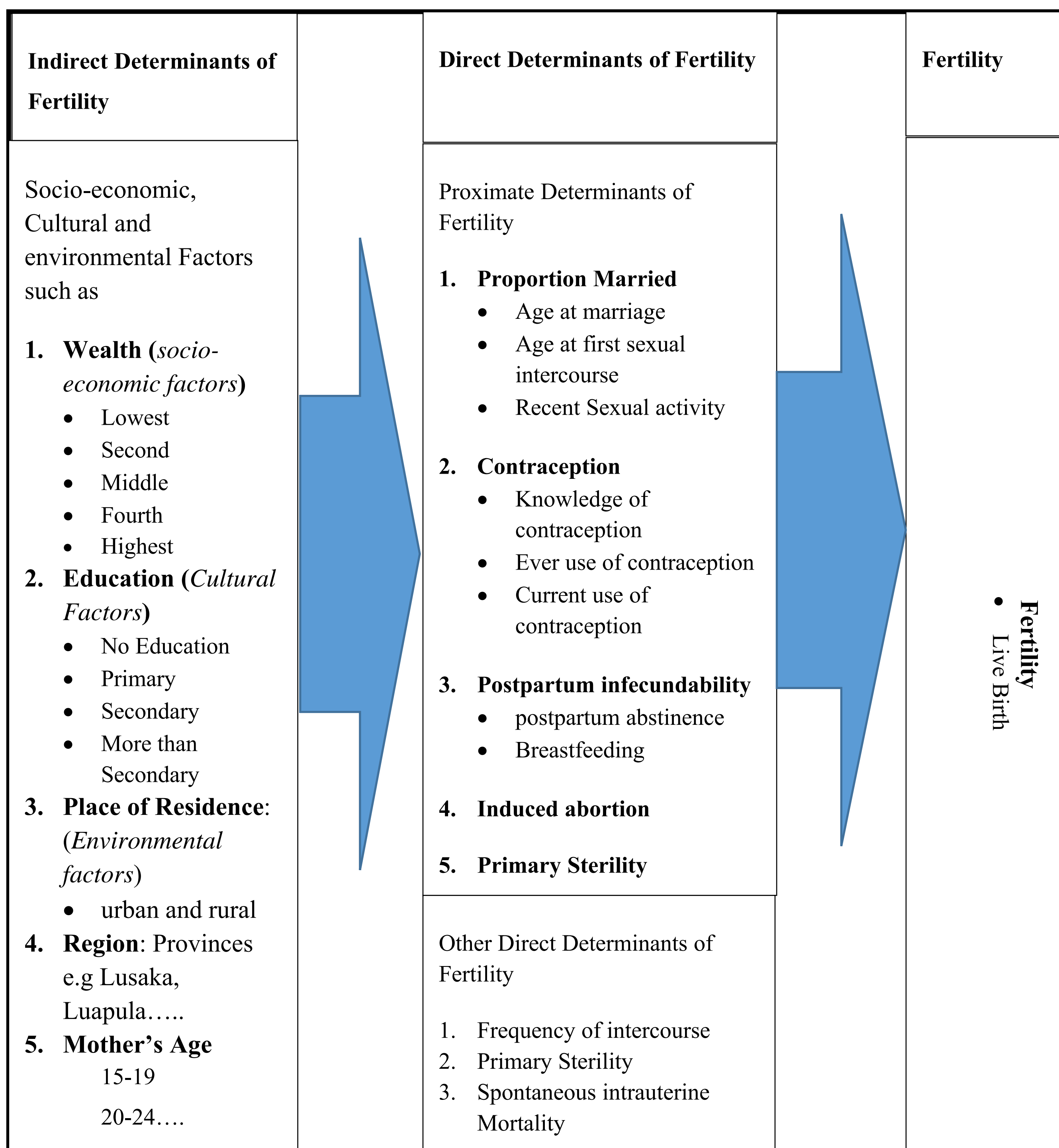

Figure 2. 1: Conceptual framework for analysing proximate determinants of fertility

As earlier stated in previous sections, Bongaarts identified seven (7) variables that affected fertility directly. These seven (7) variables were grouped into two major categories namely primary and secondary. The primary proximate determinants of fertility consisted of four (4) major variables namely; 1) marriage, 2) contraception use, 3) postpartum infecundability and 4) induced abortion which according to Bongaarts accounted for 96 percent of the variation in fertility. The remaining three (3) direct determinants of fertility in the framework namely; 1) frequency of intercourse, 2) Primary Sterility and 3) spontaneous intrauterine mortality (miscarriage) accounted for the remaining 4 percent of the variation in fertility. It is important to note that this research study used the five (5) proximate determinants such as 1) marriage, 2) contraception use, 3) postpartum infecundability, 4) induced abortion, and 5) Primary Sterility to examine for variations in fertility rates in Zambia. The determinant of fertility namely 1) frequency of intercourse and 2) spontaneous intrauterine mortality (miscarriages) were omitted in this study due to non-availability of nationally representative data.

Bongaarts states that substantial insight can be gained if, in addition to the background factors or indirect determinants, social, economic and environmental variables influencing fertility, the specific mechanisms through which these factors operate, are identified. For example, the level of education of women is a socioeconomic indicator that is frequently found to negatively relate to fertility. A more detailed analysis may show that among the educated women, marriage is relatively late or the use of contraceptive is more frequent, thus qualifying the relationship between education and fertility (Bongaarts, 1978). This study research adopted this suggestion by Bongaarts, and considered both the direct and indirect determinants in its analysis of fertility in Zambia.

While they are many indirect determinants that affect proximate determinants and fertility, this study focused on five (5) indirect determinant of fertility namely; wealth, education, place of residence, region and mothers age. These indirect determinants selected based on empirical research that demonstrated their effect on the proximate determinants and fertility. In addition data for these variables was readily available in all the DHS datasets.

From all the research studies presented above, it can be concluded that there is strong evidence that shows the relationship between indirect and direct proximate determinants and fertility. A review of literature on studies that used the Zambia DHS dataset showed that none of the studies provided quantifiable estimates on the number of births averted by proximate determinants of fertility. Lack of quantifiable evidence of births averted makes it impossible to assess progress made in the implementation of programmes aimed at address fertility in Zambia. This paper attempted to quantify births averted by each of the proximate determinants of fertility for the period 1992 to 2014 and thereby providing programme managers with quantifiable evidence needed to assess the implementation of reproductive health programs in Zambia

CHAPTER THREE: RESEARCH METHODOLOGY

3.1 Introduction

3.2 Country Background

This section provides an overview of the geographic, economic and demographic profile of Zambia.

Study setting

3.2.1. Geographic Profile

Zambia is a landlocked country covering an area of 752,612 square kilometres and is located in South Central Africa. Zambia shares a border with eight other countries: the Democratic Republic of the Congo (DRC) and Tanzania to the north, Malawi and Mozambique to the east, Zimbabwe and Botswana to the south, Namibia to the south-west and Angola to the west (CSO, 2012).

The country is divided administratively into Ten (10) provinces and over a hundred (100) districts. Two (2) provinces, Lusaka and Copperbelt are predominantly urban, while the other eight (8) provinces (Central, Eastern, Luapula, Muchinga, Northern, North-western, Southern and Western) are largely rural. About 60.5 percent of the population resides in rural areas while 39.5 percent reside in urban areas (CSO, 2012). Zambia lies between 8 and 18 degrees south latitude and between 20 and 35 degrees east latitude. It has a tropical climate and vegetation with three distinct seasons: the cool dry winter from May to August, a hot dry season during September and October, and a warm wet season from November to April (CSO, 2007).

3.2.2 Economic profile

Zambia has a mixed economy consisting of a modern urban sector that geographically follows the line of rail and a rural agriculture sector. During the period from 1965 to 1975, copper mining was the country's main economic activity accounting for 95 percent of export earnings and contributing 45 percent of government revenue (CSO, 2009). Currently, the country has an estimated real Gross Domestic Product (GDP) growth average of 5 percent per annum while the inflation rate stands at 7.8.0 percent (CSO 2018). Copper mining has remained the country's main sources of revenue (15.2 percent). Other sources of revenue

include transport and communication (14.9 percent), tourism (10.2 percent), construction (8.1 percent), electricity, gas and water (7.4) and agriculture (6.6 percent) (CSO, 2012).

The 2010 Living Conditions and Monitoring Survey indicates that 60.4 percent of Zambians are living below the poverty line. Poverty has remained more prevalent in rural areas than in urban areas at 77.9 and 27.5 percent, respectively. Poverty in the Zambian context can be defined as lack of access to income, employment opportunities, decent shelter and other basic needs (CSO, 2012)

3.2.3 Demographic Profile

The 1980, 1990, 2000 and 2010 census reports reported total populations of 5.7 million, 7.8 million, 9.9 million and 13 million, respectively. The country's population growth rate per annum is estimated to be 2.8 percent. This represents an increase in the population growth rate of 0.3 percent points from the 2.5 percent growth rate reported during the 2000 census (CSO, 2012). Population densities were estimated at 7.5 persons per square kilometre in 1980, 10.4 in 1990, 13.7 in 2000 and 17.4 in 2010. Lusaka has the highest population density of 100.1 persons per square kilometre while North Western province has the lowest population density at 5.8 persons per square kilometre (CSO, 2012).

Figure 3.1 shows that infant mortality rates in the country seem to be taking a downward trend. Infant mortality rates from the census were as follows: 99 infant deaths per 1000 live births in 1980, 123 infant deaths per 1000 live births in 1990, 110 infant deaths per 1000 live births in 2000, and 76.2 infant deaths per 1000 live births in 2010 (CSO, 2012). The infant mortality rates from the ZDHS were as follows: 95 infant deaths per 1000 live births in 2001/2, 70 infant deaths per 1000 live births in 2007, and 45 infants per 1000 live births in 2013/14. Under-five mortality rates from the census showed a decline from 208 deaths per 1,000 live births in 1990 to 183 deaths per 1,000 live births in 2000. The under-five mortality rate further declined to 138 deaths per 1,000 live births in 2010 (CSO, 2012). Under- five mortality rates from the ZDHS were as follows: 168 deaths per 1,000 live births in 2001/2, 119 deaths per 1,000 live births in 2007, and 75 deaths per 1,000 live births in 2013/14.

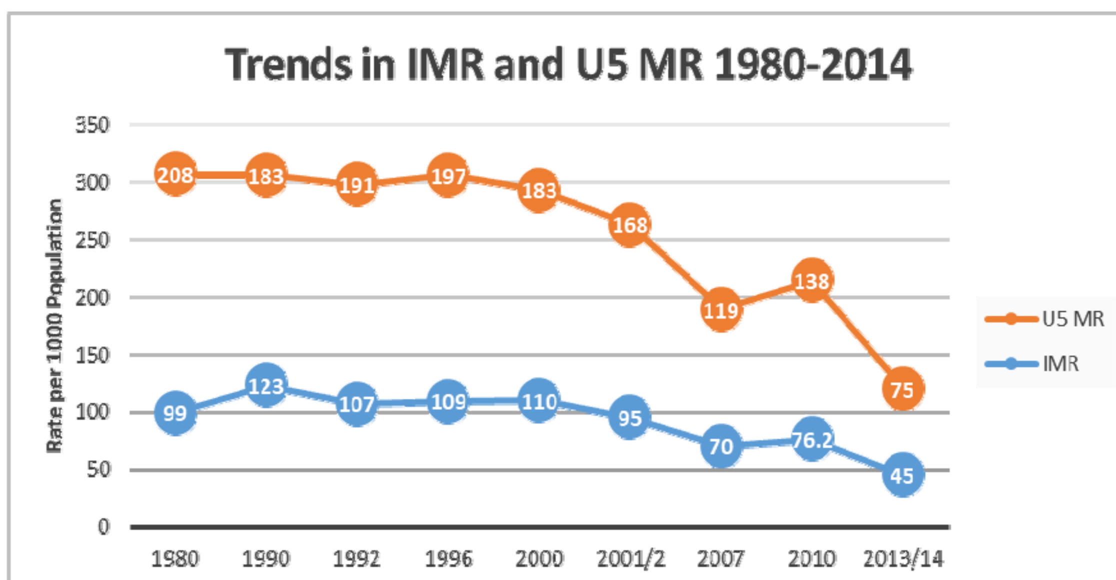

Figure 3. 1: Trends in Infant Mortality rate (IMR) and Under 5 Mortality rate (U5 MR) from 1980 to 2014

Life expectancy at birth in 1980 was estimated to be 52 years for males and 52.5 years for females. In 1990, life expectancy estimates dropped to 46.1 years for males and 47.6 years for females. The 2000 census reports showed that life expectancy rates somewhat increased to 48 years for males and 52 years for females (CSO, 2009). In 2010, life expectancy rates continued to show an upward adjustment of 49 years and 53 years for males and females, respectively. A comparison between the life expectancy reported in the 2000 and 2010 censuses indicated that life expectancy in Zambia had increased by 1.3 years from 50 years in 2000 to 51.3 in 2010 (CSO, 2012).

Figure 3.2 below shows trends of TFR from 1980 to 2014. The Total Fertility Rates (TFRs) from the census were as follows: 7.2 in 1980, 6.7 in 1990, 6.0 in 2000, and 5.9 in 2010. Total fertility rates from the ZDHS were as follows; 6.5 (1992), 6.1 (1996), 5.9 (2001/2), 6.2 (2007), and 5.3 (2013/14). From the figure, it is evident that total fertility rates starting from 1980 to 1990 reduced by 0.5, compared to 0.6 reduction in total fertility rates from 1992 to 2001/2. However, the total fertility rates from 2001/2 to 2007 increased from 5.9 to 6.2 respectively. Notably, a significant decline in fertility was observed between the 2007 and 2013/14 Demographic and Health Surveys from 6.2 children per woman to 5.3 children per woman (CSO, 2015).

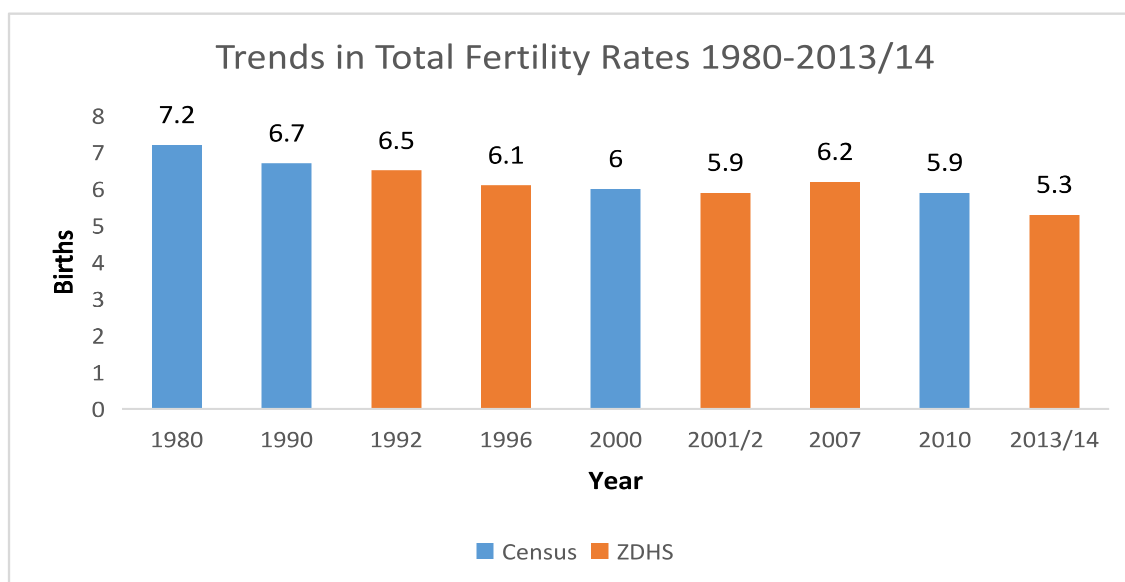

Figure 3. 2: Total Fertility Rates (TFR) from 1980 to 2014

Based on the statistics presented, it can be concluded that despite recording a real Gross Domestic Product (GDP) growth of 5 percent per annum, the majority of Zambians live below the poverty line. Furthermore, infant mortality rate, total fertility rate and population growth rate have remained relatively high in the period between 1980 and 2014

This study utilised datasets from the 1992, 1996, 2001/2, 2007 and 2013/14 Zambia Demographic and Health Surveys (ZDHS). The DHS datasets were used because they contained almost all the information required to fit the model. Among the information contained in the DHS datasets include: the proportion of women currently married, the proportion of married women currently using contraceptives, duration of postpartum infecundability, average duration of breastfeeding, and the proportion of women age 40-49 who are sterile. In addition, the DHS datasets were used for this study because, by design, the DHS datasets provide estimates of population and health indicators at national and provincial level. This design of the DHS datasets enabled the calculation of indices for three (3) key proximate determinants namely the 1) index of marriage, the index of contraception and the index of postpartum infecundability for each of the 10 provinces. This analysis was vital to show variation in proximate determinants of fertility by various background characteristics such as location, education and wealth. In order to show trends of how the indices have evolved over time, this study opted to use all DHS datasets for Zambia for the period 1992 to 2014.

The only information that was missing from the DHS was the information on induced abortion which was obtained from the Guttmacher Institute. The Guttmacher Institute advocates for sexual reproductive rights of women and generates regional estimates for safe and unsafe abortions. The estimates of abortion generated by Guttmacher Institute were obtained from 1069 countries-years that provided official statistics and published or unpublished national studies. Of the 1069 country-years, 625 were for countries in Europe, 239 for Asia, 74 for Latin America and the Caribbean, 40 for North America, 40 for Oceania, and 51 for Africa (Sedgh et al. 2016).

3.3 Research design

This study was a cross-sectional study that attempted to apply the Bongaarts to estimate the impact of proximate determinants on fertility in Zambia. Using the Zambia DHS datasets for the years: 1992, 1996, 2001/2, 2007, and 2013/4 this study sought to generate national and sub-national indices for proximate determinants of fertility.

3.3 Sample size

The study concentrated on women aged 15-49 for each of the survey rounds. The DHS datasets were handled separately meaning that each data set had a different sample size. The sample sizes for women age 15-49 were as follows: 7,060 (1992), 8,021 (1996), 7,658 (2001/2), 7,146 (2007), and 16,411 (2013/14), (CSO, 1993, 1998, 2003, 2009, 2015).

All women aged 15-49 who were either permanent residents of the households or were visitors present the night before the survey were eligible to be interviewed. This study focus was on the women's questionnaire as it provided vital information on knowledge and use of family planning methods, fertility preference, breastfeeding patterns and marriage and sexual activity which were relevant for this study.

3.4 Data processing

Data quality checks: the DHS datasets like all national surveys are prone to incomplete or partial reporting of responses. Additionally, complex questionnaires inevitably allow scope for inconsistent responses to be recorded for different questions. In order to avoid these problems, the datasets used for the analysis were obtained from the DHS Program that has adopted a policy of editing and imputation. Data editing and imputation results in a

data file that accurately reflects the population studied and may be readily used for analysis. Some of the procedures used to manage survey data quality included the omission of missing values, application of sample weights, application of an all women factors and wealth index.

When analysing statistics from any of the datasets, participants that did not met the inclusion criteria I.e. women aged below 15 and those aged over 50, including those that provided incomplete or inconsistent responses, were omitted from the analysis. In addition, sample weights, all women factors and the wealth index was applied to the data sets.

Processing techniques: This Stata files of the women's dataset were accessed from the DHS program website for each of the survey rounds and were saved on the local computer/ laptop.

3.5 Data analysis

The women's dataset for each of the five (5) survey years thus 1992, 1996, 2001/2, 2007 and 2013/14 were obtained from the demographic health survey program website (http://dhsprogram.com). These datasets were analysed using STATA version 11, SPSS version 16 and Microsoft Excel 2013. During the analysis, Total fertility rates, total marital fertility rates and contraceptive prevalence rates were re-calculated using stata and SPSS from the datasets and were compared with rates presented in the reports. The re-calculation of rates ensured consistency in the calculations of rates over time and avoids errors due to variations in calculations or indicator definitions used in the surveys over time. One such indicator whose definition had changed over time was contraception prevalence which tends to be affected by the changes in the definition of modern and traditional methods of contraception.

In the analysis of the index of marriage (Cm), the equation Equation 3-1 index of Marriage (Cm) = TMFR/TFR, where TMFR is the Total marital fertility rate and TFR is Total Fertility Rate was used. STATA command developed by Bruno Schoumaker were used to derive total fertility rates and total marital fertility rates. The proportion of women cohabiting or living together with their partners were added to those reported married in order to account for as many births among women in sexual union. This study considered fertility among women both informal and non-formal marriages.

In analysing the index of contraception (Cc) Equation 3-2 $Cc = 1- 1.08 * u * e$, where u = prevalence of current contraceptive use among married women of reproductive age, e = average use − effectiveness of contraception. The coefficient 1.08 in this equation is an adjustment factor required because women (couples) do not use contraception if they know or believe that they are sterile. To avoid double counting, (overlaps in calculation of indices), women who reported LAM was a method of family planning were not added in this equation as they were well accounted when calculating the index of past partum infecundability. The study used the following contraception effectiveness rates; sterilization (0.99), pill (0.91), IUD (0.99), injectable (0.94), implants (0.99), male condoms (0.82), female condoms (0.79), LAM (0), rhythm method (0.79), withdrawal method (0.78) and others (0.70). These effectiveness rates were obtained from the Bongaarts model (Bongaarts, 1978)

The index of postpartum infecundability (Ci) was derived using the equation 3-3 $Ci=20/(18.5+i)$, where 20 months represents birth interval in the absence of breastfeeding and postpartum abstinence, while 18.5 months is the sum of 7.5 months of waiting time to conception, 2 months of time added by spontaneous intrauterine mortality, and 9 months for a full-term Pregnancy. i represent the duration of postpartum infecundability.

The index of primary sterility (Ip) was derived using the equation 3.4 $Ip = (7.63 - 0.11 * s) / 7.3$, where, *S* is the percentage of women aged 45-49 who have had no live births. This equation is equal to 1.0 when three percent of women are childless at age 45-49. Anything above this level is assumed to be the effect of pathological Primary Sterility. This index only focused on married women aged 45-49 years who had no live birth.

The index of abortion (Ca) was derived using the following equation 3.5 $Ca=TFR/TFR+TA$, where, TFR is the total fertility rate, TA is the induced abortion rate. The TFR was gotten from the ZDHS datasets while the induced abortion rate was obtained from the statistics from the Guttmacher Institute 2016 annual report whose summaries are presented below. Zambia was classified under eastern Africa thus rates for Eastern Africa were applied to the equation

To derive total fecundity, the following equation 3.6 $TF= TFR/ (Cm*Cc*Ci*Ip*Ca)$, TF is total Fecundity, TFR is total fertility rate, while Cm, Cc, Ci, Ip and Ca denoted indices for the five proximate determinants already described in the sections above was use. This

formula is a replica of the original formula developed by Bongaarts (1983) which was revised by John Stover to include the index of Primary Sterility which was not part of the original formula. In addition, the formula includes married aged 15-49.

The following equation was used to generate estimates of births averted by each of the proximate determinants of fertility; Equation 3.7 [TF-TFR] x log Cm / (log Cm + log Cc + log Ca + log Ci), where TF is Total Fecundity, TFR is the Total Fertility Rate, log Cm is the logarithm of the index of marriage, log Cc is the logarithm of the index of contraception, log Ca is the logarithm of the index of abortion, log Ci is the logarithm of the index of abortion, log Ip is the logarithm index of primary sterility.

The study depended on the equations presented above to generate indices and births averted by each of the proximate determinants of fertility. These equations were originally developed by Bongaarts (1978) and revised by Stover (1998) to reduce overlaps when calculating indices. In addition, Stover revised the reproductive aged for women from 15-44 to 15-49 making the model more applicable to the current prevailing situation in Zambia and the world over. In Zambia the Bongaarts model has been applied on Zambia DHS datasets by Dzekezeke and Nyangu, 1994, Stover, J (1998), Kiersten, J et al., (2011), and Chola and Michelo (2016) to generate the following indices, the index of marriage, the index of contraception use, the index of postpartum infecundability. Unlike other models used to estimate the impact of proximate determinants of fertility, the Bongaarts model is the only model that is able to quantify births averted by each of the proximate determinants of fertility thus making it the best model to be used by this study.

Some of the limitations of the Bongaarts model is that it is highly mathematical: inaccuracies in data and overlaps in the calculation of indices can lead to inflated total fecundity rates. In addition, the model omits fertility that occurs among women who are not married as the model assumes that fertility only occurs among women in formal unions.

Over the years Stover J (1998) and Bongaarts (2015) have revised the model and tuned it up to reduced overlaps when calculating the indices hence the model in its current form is more refined than when it was first developed in 1978.

3.6 Variables

Table 3.1 shows variable used in this research study. The total fertility was the dependent variable while contraception use, marriage, postpartum infecundability, primary sterility and induced abortion were the independent variables (or direct determinants of fertility) which have a direct influence on the total fertility as highlighted in the conceptual framework. Furthermore, the indirect determinants of fertility (antecedent variables) such as place of residence, level of educational and economic status (wealth) provided additional strengths on the independent variables to have an influence on the dependent variable over the years.

Table 3. 1: List of variables

VARIABLE TYPE	VARIABLE NAME	Measurement scale
Dependent variables	• **Fertility (live births)** -Total fertility, Total Fecundity	Nominal
Independent Variables (or proximate Determinants of Fertility)	• **Proportion Married** -Age at marriage, Age at first sexual intercourse, Recent Sexual activity	Nominal
	• **Contraception** -Knowledge of contraception, ever use of contraception, current use of contraception	Nominal
	• **Postpartum infecundability** -Postpartum abstinence, Breastfeeding	Nominal
	• **Induced abortion**	Nominal
	• **Primary Sterility**	Nominal
Other Direct determinants of fertility	• **Frequency of intercourse**	Nominal
	• **Spontaneous intrauterine mortality**	Nominal
Indirect Determinants of Fertility (Antecedent Variables): Socio-economic and Cultural factors such as	• **Wealth** -Lowest, Second, Middle, Fourth, Highest	Ordinal
	• **Level of Education** -No Education, Primary, Secondary, More than Secondary	Ordinal
	• **Place of Residence**: -Urban and Rural	Nominal
	• **Region**: -Provinces e.g Lusaka, Luapula…..	Nominal
	• **Mother's Age** -15-19, 20-24, …………45-49	Nominal

3.7 Study limitations

The first limitation of the study was the limited or unavailability of official induced abortion data in Zambia. The Zambia Demographic and Health Survey did not collect data on induced abortion mainly because induced abortion is still a very sensitive issue with some sections of society still, perceiving induced abortion as being illegal thus making data collection very difficult. The study used regional estimates of abortion which may not be representative of the actual country experience.

The second limitation is that the study focused on women in marital union and not all women in general. By focusing on women in marital union only, the study failed to account for fertility or live births that occur among women who are not in marital unions. Hence the research findings were biased towards women in marital unions and not all women in general. This limitation was partly addressed by including women in informal sexual unions (cohabiting). This allowed so additional women to be included in the analysis.

The third limitation is that caused by an overlap among proximate determinants which can lead to generating inaccurate results. For example, the increase in contraception use over the years has led to overlaps with primary sterility and postpartum infecundability. There is a possibility that women who unknowingly are sterile and those who experience longer period of breastfeeding or postpartum abstinence may also be using other forms of contraceptives. This may create an overlap in calculation of indices for each of these proximate determinants of fertility. Given that it is almost impossible to eliminate all the overlaps completely, this study attempted to minimise the overlap among the proximate determinants in order to get relatively accurate results.

The fourth limitation is one related to primary sterility, for this study only considered primary sterility which referred to women who were sterile before a first birth. The study did not consider secondary sterility which occurs among women that have given birth but are unable to bear subsequent children. This form of under reporting of sterility by women may affect study results on the index sterility presented in this study

3.8 Ethical consideration

Ethical clearance was obtained from the University of Zambia. This study used secondary data from the 1992, 1996, 2001/2, 2007, and 2013/14 Zambia Demographic Health Survey. No personal information was obtained during the study. The datasets used in this study were obtained from the DHS program website (www.dhsprogram.com). Ethical Clearance for the DHS survey was obtained from the University of Zambia ethics committee.

CHAPTER FOUR: RESEARCH FINDINGS AND DISCUSSION

4.1 Introduction

This chapter presents the research findings and discussion of proximate determinants in Zambia based on the 1992, 1996, 2001/2, 2007 and 2013/4 DHS datasets. The findings in this chapter showed how the indices of the proximate determinants vary from one region to another and from one socioeconomic stratum to another. The data analysis presentation covered all five (5) proximate determinants namely; 1) marriage, 2) contraception and 3) postpartum infecundability, 4) abortion and 5) primary sterility. For the three proximate determinants: marriage, contraception use and postpartum infecundability, indices of fertility suppression was analysed against four (4) major background variables namely; 1) type of residence, 2) region, 3) level of education attained and 4) economic status. An analysis of fertility variation by background variable for the other two (2) proximate determinants namely; 1) induced abortion and 2) primary sterility is not feasible due to data limitation. This chapter also presents findings and discussions on births averted by proximate determinants.

Background characteristics

The Table 4.1 presents a summary of background characteristics of women age 15-49 in each of the survey rounds. This table shows that almost 60 percent of the women aged 15-49 years in each of the survey rounds was married. In addition, the total marital fertility rates were much higher than the total fertility rates meaning that on average, married women age 15-49 were expected to have one (1) additional child when compared to the general fertility rate. The contraceptive prevalence was much higher among married women when compared to all women age 15-49

Table 4.1 Background characteristics of women in age group 15-49 years (1992-2014)

Variable	1992	1996	2001/2	2007	2013/14
Age					
15-19	1,984	2,003	1,811	1,574	3,625
20-24	1,441	1,830	1,664	1,370	3,006
25-29	1,179	1,286	1,376	1,363	2,813
30-34	915	1,081	972	1,056	2,475
35-39	656	758	766	747	2,009
40-45	505	568	601	561	1,464
45-49	380	494	467	475	1,018
All women age 15-49	7,060	8,021	7,658	7,146	16,411
Currently married women 15-49	4,457	4,902	4,694	4,402	9,859
Region					
Rural	3,636	3,604	3,073	3,009	7,585
Urban	3,424	4,417	4,585	4,137	8,826
Province					
Central	622	653	562	659	1,467
Copperbelt	1,743	1,588	1,544	1,264	2,836
Eastern	729	1,075	926	971	1,930
Luapula	431	726	622	530	1,143
Lusaka	1,234	1,403	1,132	1,172	3,266
Muchinga					868
Northern	652	872	1,040	966	1,200
North Western	183	288	354	365	713
Southern	1,045	816	814	727	2,007
Western	422	600	663	492	980
Education					
No education	1,157	1,067	925	744	1,375
Primary	4,214	4,721	4,439	3,891	7,685
Secondary	1,560	2,007	2,061	2,140	6,521
More than secondary	127	226	234	371	830
Wealth quintile					
Lowest				1,240	2,859
Second				1,283	2,861
Middle				1,280	3,077
Fourth				1,567	3,510
Highest				1,776	4,103
National	7,060	8,021	7,658	7,146	16,411
Total Fertility Rates	6.50	6.10	5.90	6.20	5.30
Total marital fertility rates	7.88	7.69	7.30	7.89	6.95
All Contraceptive use prevalence	11.6	19.2	24.6	29.9	35.1
Married women contraception us prevalence	15.2	25.9	34.2	40.8	49.0

Duration of postpartum infecundability (Months)	13.3	14.1	14.9	12.5	11.5
No of sterile women	4	4	6	5	9

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/14 ZDHS

4.1 Fertility and Marriage

4.1.1 Selected elements that can be used to measure exposure to sexual intercourse and Marriage

Age at first marriage, the proportion of ever-married women, level of polygamy, level of spousal separation and remarriage rates among women in the reproductive age group are some of the elements that are used to measure the extent of exposure to sexual intercourse and pregnancy. The median age at first marriage for women in the reproductive age group 20-49 indicated was 18.7 years. This median age has remained constant at 18 years from the 1996 survey to the 2013/14 survey. It is worth noting that the median age of marriage for women who reside in urban areas reveals that they marry two years later than their counterparts in the rural areas (20 and 18 years respectively). Furthermore, the median age at first sexual intercourse for women aged 20-49 was 17.4 years. A comparison of women in rural and urban setting revealed that women aged 20-49 years living in urban areas, delayed their first sexual encounter by about a year compared with their rural counterparts (18 and 17 years respectively). (CSO, 2015)

An analysis of sexual activity in relation to marital status indicated that 84.5 percent of the women aged 15-49 currently married and or living together had sexual intercourse in the past 4 weeks compared to 15.4 percent for divorced/separated/widowed and 12.1 percent for never married. An analysis of marriage patterns in Zambia revealed that that 60 percent of women of childbearing age were either married or living together with a man; 28 percent had never been married and the remaining 12 percent were divorced, separated or widowed (CSO, 2015).

4.1.2 Index of Marriage

The index of marriage Cm, is intended to measure the effect of marriage on fertility among women of reproductive age in sexual unions. The index of marriage is obtained as a ratio of the Total marital Fertility Rate (TMFR) to the Total Fertility Rate (TFR). When the

index of marriage (Cm) has the value of one (1), it is assumed that all women of reproductive age in a given location were in sexual unions. The opposite is also true that when the value of Cm is equal to zero (0), it is assumed that none of the women of reproductive age in a given location were in sexual unions. With this in mind, the subsequent paragraphs under this subheading will attempt to estimate the influence of marriage on fertility using the following background characteristics namely; mother's age, mother's age at first marriage, region, residence, education and economic status.

Table 4.2 shows estimates of the inhibiting effect of non-marriage on fertility by mother's age, mother's age at first marriage, place of residence, region, education and economic status during the, 1992, 1996, 2001/2, 2007 and 2013/14 ZDH surveys. Non-marriage in this study referred to women who have never been married and/ or women who were formally married: separated, divorced or widowed. The impact on fertility of non-marriage, among woman of reproductive age 15-49 has generally increased over the period from 1992 to 2013/14. Table 4.2 shows that the index of marriage (Cm) for Zambia had steadily reduced from 0.82 (1992) to 0.76 in 2013/14. This steady reduction in the index of marriage over the years has resulted in the gradual increase in suppression of total marital fertility. Non-marriage suppressed total marital fertility from reaching its potential maximum by 18 percent in 1992, 19 percent in 2001, 22 percent in 2007, and 24 percent in 2013/14. The inhibiting effect of non-marriage on total marital fertility by mother's age shows that women aged 15-19 had the most reduction in fertility due to non-marriage compared to women in other age categories. The indices of marriage for women aged 15-19 years, increased slightly from 0.36 to 0.41 representing a slight decline in marital fertility suppression from 64 percent to 59 percent in 1992 and 2013/14 respectively. Marital fertility suppression for women in age the group 45-49 was negligible (below 1%). These findings are consistent with what is expected were older women in the reproductive age group 45-49 have a higher likelihood of being married.

Table 4. 2: Trends in indices of Marriage 1992 - 2013/14

Index of Marriage					
Year	1992	1996	2001/2	2007	2013/14
Mother's Age					
15-19	0.36	0.37	0.43	0.39	0.41
20-24	0.79	0.82	0.85	0.84	0.86
25-29	0.93	0.92	0.93	0.95	0.96
30-34	0.96	0.97	0.99	0.99	0.99
35-39	0.98	0.98	0.99	0.99	0.99
40-44	0.99	0.99	0.99	0.99	0.99
45-49	1.00	0.97	1.00	1.00	1.00
Mother's Age at first marriage					
9-14	1.00	1.00	1.00	1.00	1.00
15-24	0.94	0.94	0.92	0.91	0.90
25-34	0.91	0.90	0.88	0.87	0.87
35-49	0.70	0.72	0.72	0.74	0.74
Residence					
Urban	0.77	0.72	0.73	0.68	0.67
Rural	0.87	0.84	0.85	0.85	0.84
Province					
Central	0.84	0.80	0.81	0.79	0.79
Copperbelt	0.79	0.77	0.74	0.71	0.66
Eastern	0.86	0.85	0.86	0.84	0.81
Luapula	0.86	0.82	0.84	0.82	0.78
Lusaka	0.75	0.71	0.74	0.67	0.66
Muchinga					0.80
Northern	0.85	0.83	0.83	0.84	0.83
North Western	0.86	0.84	0.85	0.83	0.81
Southern	0.87	0.79	0.82	0.80	0.85
Western	0.84	0.79	0.84	0.83	0.78
Education					
No education	0.88	0.86	0.89	0.92	0.89
Primary	0.86	0.84	0.85	0.85	0.86
Secondary	0.69	0.67	0.70	0.66	0.67
More than secondary	0.85	0.41	0.65	0.48	0.60
Wealth quintile					
Lowest		0.92	0.90	0.89	0.87
Second		0.86	0.86	0.85	0.85
Middle		0.85	0.86	0.85	0.83
Fourth		0.75	0.76	0.75	0.74
Highest		0.60	0.66	0.60	0.56

National	0.82	0.79	0.81	0.78	0.76

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/14 ZDHS

As indicated by Bongaarts and Potter 1983, and Coale. A, 1996, marriage is viewed as an indication of sexual initiation and ultimately an indicator of exposure to pregnancy and childbearing. For most women, duration of exposure to the risk of pregnancy depends primarily on the age at which women first marry. The inhibiting effect of non-marriage on total marital fertility by age at first marriage shows that women aged 35-49 had the most reduction in fertility due to non-marriage compared to women in other age categories. The indices of marriage for women whose age at first marriage was 35-49 years, remained relatively steady between 0.70 and 0.74 representing a slight decline in marital fertility suppression from 30 percent to 26 percent in 1992 and 2013/14 respectively. Women whose age at first marriage was 25-34 years followed with indices of marriage at 0.91 and 0.87 representing a slight increase in marital fertility suppression from 9 percent to 13 percent in 1992 and 2013/14 respectively. Women whose age at first marriage was 9-14 years experienced the least reduction in total marital fertility due to non-marriage. The index of marriage for women whose age at first marriage was 9-14 was 1.0 meaning that total marital fertility suppression for women in this age category was negligible. These findings are consistent with findings by Sanchez, 1998 who observed that delays in age at marriage contributed to the decline in fertility rates as exposure to pregnancy is reduced.

The inhibiting effect of non-marriage on fertility by region showed that women in urban areas experienced two-fold fertility suppression due to non-marriage compared to women that lived in rural areas. In urban areas, the index of marriage reduced from 0.77 in 1992 to 0.67 in 2013/14, resulting in total marital fertility suppression of 23 percent and 33 percent in 1992 and 2013/14 respectively. In the rural areas, the index of marriage recorded a minor reduction from 0.87 in 1992 to 0.84 in 2013/14. This minor reduction in the index of marriage resulted in a minimal increase in total marital fertility suppression due to non-marriage from 13 percent to 16 percent in 1992 and 2013/14 respectively.

The inhibiting effect of non-marriage on fertility by province shows that Lusaka and Copperbelt provinces experienced greater total marital fertility suppression due to non-marriage when compared to the other provinces. The index of marriage reduced from 0.79

and 0.75 in 1992 to 0.66 in 2013/14 for Copperbelt and Lusaka provinces. This reduction in the index of marriage resulted in an increase in total marital fertility suppression from 21 percent in 1992 to 34 percent in 2013/14. The index of marriage in the remaining provinces ranged between 0.87 and 0.84 in 1992 to 0.81 and 0.79 in 2013 representing an increase in fertility suppression of between 13 -16 percent in 1992 and 19 - 21 percent in 2013/14. Lusaka and Copperbelt provinces had the greater total marital fertility reduction as a result of non-marriage because of the urban characteristics inherent in these two provinces while the remaining provinces had lower fertility reduction as a result of non-marriage due to the rural characteristics inherent in these remaining provinces. Early marriages which are a common phenomenon in rural areas, can be sighted as one of the main reason for minimal fertility suppression in rural areas. Marital fertility suppression is higher in urban areas may be attributed to late age at marriage. These findings are consistent with findings by Jolly and Gribble (1993) who observed that norms for marriage vary between rural and urban set ups. The two suggested that late age at first marriage substantially contributed to fertility reduction in urban areas.

The inhibiting effect of non-marriage on fertility by level of education shows that as women's education increases, fertility declines monotonically. The indices of marriage for women with no education, with primary education and with secondary education remained relatively stable in each of the survey rounds. The indices of marriage for women with more than secondary education, on the other hand, exhibited an inconsistent pattern. Women who had more than secondary education experienced the most reduction in fertility due to non-marriage as compared to women in other education categories. Non-marriage suppressed total marital fertility by about 33 percent among women with secondary or more education attainment compared to 14 percent suppression experienced by women with less than secondary education attainment. This demonstrates the importance of extensive education on postponement of marriage.

The pattern shows that women with some education, when compared to women with no education, are more likely to experience lower fertility. One explanation for this finding that women with some education have lower fertility compared to those with no education is that the women with education are likely to postpone marriage as they pursue an education while those with no education are likely to marry early and hence experience longer exposure to risk of getting pregnant assuming all other factors remain the same. These findings are

consistent with findings by Mutetei (1998), who observed that there was a positive relationship between education and age of first birth. According to him, women with higher education levels are more likely to break away from traditional patterns including early marriage and childbearing than women with lower education.

The inhibiting effect of non-marriage on total marital fertility by wealth quintile shows that women with the highest wealth quintile had the most reduction in fertility due to non-marriage compared to women in other wealth categories. The indices of marriage for women who had the highest wealth quintile reduced from 0.60 (1996) to 0.56 (2013/14) representing an increase in marital fertility suppression from 40 percent to 44 percent in 1996 and 2013/14 respectively. Women in the fourth wealth quintile followed, with indices of marriage of 0.75 and 0.74 representing a 1 percent increase in marital fertility suppression due to non-marriage between 1996 and 2013/14. The wealth category that experienced the least reduction in total marital fertility due to non-marriage was the lowest quintile which recorded indices of marriage of 0.92, 0.90, 0.89 and 0.87, representing a marital fertility suppression of 8%, 10%, 11% and 13% in 1996, 2001/2, 2007 and 2013/14 respectively.

These findings are consistent with findings by (Chola and Michelo, 2016, Jara et al., 2013, Adhikari, 2010, Weerasinghe, 2002). These scholar attributed the decline in fertility among women with more wealth to the child preferences and access to and usage of contraception among the richer women. Richer women may also delay childbirth and have wide birth intervals which may contribute to their low fertility rates.

In summary, it can be confirmed that wealth quintile, area of residence (urban and rural), province, and education level of women contribute greatly to total marital fertility suppression through non marriage. It is important to note that cultural norms and practices have a bearing on age at first marriage which has a direct bearing on fertility

4.2 Contraception

Contraception refers to a deliberate parity dependent practice undertaken to reduce the risk of conception. It is a measure to prevent/ delay conception or pregnancy. The use of contraception in the Bongaarts model excluded breastfeeding and postpartum abstinence because these two aim at promoting maternal health and child development rather than

regulating the number of children born (Bongaarts, 1984). The use of contraceptives gives a woman an opportunity to space her children or to stop childbearing before reaching menopause. This section of the report shows knowledge of specific contraceptive methods, contraceptive prevalence rate and index of contraceptive among married women aged 15-49 years in Zambia.

4.2.1 Knowledge of contraceptive methods

Data from the 2013/14 DHS shows that knowledge on contraceptives was almost universal with 99 percent of women knowing at least one method of contraception. Modern methods were more widely known than traditional method. 99.7 percent of all women knew of a modern method, compared with 86.4 percent with knowledge of traditional methods. The mean number of methods known by currently married women age 15-49 was higher at 8.9.

4.2.2 Contraception use

Level of current contraception use is the most widely employed and valuable measure of the success of family planning programs. According to the 2013/14, DHS, 49 percent of currently married women were using a method of family planning: 45 percent a modern method, and 4 percent a traditional method of family planning. Injectables were the most widely used modern method (19 percent) among currently married women, followed by the pill (12 percent), implants (6 percent), and the male condom (4 percent). The withdrawal method was the most common traditional method used at 2.0 percent.

4.2.3 Index of Contraceptive use

The index of contraception, *Cc*, is intended to estimate the effect of contraception on marital fertility.

When the index of contraception Cc equals one (1) assumes that married women in the reproductive age group 15-49 did not use any form of contraception. The opposite is also true that the value of Cc equal to zero (0), assumes that all fecund exposed women used modern methods that are 100 percent effective. The subsequent paragraphs under this subheading attempted to estimate the influence of contraception use on fertility using the following background characteristics namely; mother's age, region, residence, education and economic status.

Table 4.3 below shows estimates of the inhibiting effect of contraceptive use by place of residence, region, education and economic status during the five 5 rounds of the DHS surveys conducted in Zambia. The impact of contraceptive use on fertility among married woman of reproductive age 15-49 has remarkably improved over the period between 1992 and 2013/14 DHS surveys. This sharp reduction in the index of contraception use over the years has resulted in a sharp increase in suppression of natural marital fertility. Contraception use suppressed total natural marital fertility (TNMFR) from reaching its potential maximum by 15 percent in 1992, 25 percent in 1996, 35 percent in 2007 and 49 percent in 2013/14.

Table 4. 3: Trends in Indices of Contraceptive use 1992 - 2013/14

Year	1992	1996	2001/2	2007	2013/14
Mother's age					
15-19	0.91	0.87	0.77	0.77	0.63
20-24	0.87	0.79	0.72	0.64	0.53
25-29	0.85	0.76	0.67	0.62	0.48
30-34	0.82	0.76	0.60	0.65	0.47
35-39	0.77	0.72	0.70	0.65	0.47
40-44	0.82	0.70	0.75	0.63	0.47
45-49	0.91	0.83	0.88	0.72	0.66
Residence					
Urban	0.79	0.67	0.56	0.54	0.43
Rural	0.90	0.80	0.75	0.72	0.56
Province					
Central	0.90	0.83	0.74	0.68	0.56
Copperbelt	0.81	0.71	0.57	0.55	0.46
Eastern	0.90	0.79	0.72	0.72	0.47
Luapula	0.90	0.89	0.78	0.88	0.65
Lusaka	0.75	0.65	0.54	0.56	0.42
Muchinga					0.55
Northern	0.83	0.67	0.71	0.65	0.52
North-Western	0.90	0.58	0.73	0.70	0.60
Southern	0.91	0.80	0.75	0.60	0.49
Western	0.83	0.82	0.82	0.69	0.66
Education					
No education	0.92	0.83	0.81	0.78	0.63
Primary	0.87	0.77	0.72	0.69	0.53
Secondary	0.72	0.63	0.53	0.53	0.44

Higher	0.38	0.42	0.36	0.42	0.36
Wealth Quintile					
Lowest		0.85	0.80	0.74	0.62
Second		0.82	0.78	0.73	0.57
Middle		0.84	0.74	0.74	0.51
Fourth		0.74	0.64	0.58	0.47
Highest		0.59	0.42	0.46	0.38
National	0.86	0.75	0.68	0.65	0.52

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/14 ZDHS

This research study did trend analysis to understand fertility inhibition due to contraception use among married women by mother's age. A comparison of the inhibiting effect of contraception use among married women by mother's age shows fertility suppression increased from one study year to the next across all age groups. Statistics have clearly shown that married women in various age group in 1992 suppressed between 8% - 20% fertility due to use of contraceptive. Fertility suppression due to contraception use among women in various age categories during the 2013/14 DHS ranged between 34% - 43%. The increase in fertility suppression across all age categories can be attributed to increased availability and access to various modern contraception methods.

This research study did trend analysis to understand fertility inhibition due to contraception use in rural and urban areas. A comparison of the inhibiting effect of contraception use among married women by place of residence shows that married women who live in urban areas experienced the most reduction in fertility due to contraception use compared to married women who in rural areas. Statistics have clearly shown that married women who lived in rural had 10% and 44% fertility inhibition due to contraception use in 1992 and 2013/14 respectively. In contrast, women who lived in urban areas had 21% and 57% reductions in fertility due to contraception use in 2007 and 2013/14 respectively.

This research study did trend analysis to understand fertility inhibition due to contraception use in all ten provinces across the country. Statistics showed that, the inhibiting effect of contraceptive use on fertility was greater in Lusaka and Copperbelt provinces when compared to the other provinces. The index of contraception use reduced from 0.75 and 0.81 in 1992 to 0.42 and 0.46 in 2013/14 for Copperbelt and Lusaka provinces. This reduction in

the index of contraception use resulted in an increase in total natural fertility suppression from 19 percent in 1992 to 54 percent in 2013/14. The index of contraceptive use in the remaining provinces ranged between 0.90 and 0.83 in 1992 to 0.66 and 0.49 in 2013 representing an increase in fertility suppression of between 10 -17 percent in 1992 and 33 - 51 percent in 2013/14. Lusaka and Copperbelt provinces had the greater total natural fertility reduction as a result of contraception use because of the urban characteristics inherent in these two provinces while the remaining provinces had lower fertility reduction as a result of contraception use due to the rural characteristics inherent in these remaining provinces.

One possible explanation for the observed pattern relates to access and availability of contraceptive is higher in urban areas compared to rural areas. These findings conform to findings by Shapiro and Tambashe (2001) and Jolly and Gribble (1993) that observed that contraception use was higher among women who reside in urban areas compared to those who resided in rural areas. Women who live in urban areas have better and easy access to new contraception methods (family planning services) compared to women who live in rural areas. Additionally, the majority of women who live in rural areas mainly depend on traditional methods of contraception which are not very effective for spacing or limiting childbearing. The increase in fertility inhibition due to contraception use among women living in rural areas can be attributed to increased availability and accessibility of modern contraception in a number of rural health centres.

A comparison of the inhibiting effect of contraception use among married women by education level shows that married women with higher education experienced the most reduction in fertility due to contraception use compared to married women with other education levels. Trends in fertility suppression among women who had higher education fluctuated from one survey round to the next while the pattern for women is other education categories portrayed a downward trend. Contraceptive use suppressed total natural fertility by about 64 percent among women higher education attainment compared to 34 percent suppression experienced by women with less than no education attainment. This finding demonstrates the importance of extensive education on acceptance and use of contraceptives.

These findings are similar to the findings Mutetei (1998) which established that women with higher education have lower fertility compared to women with little or no education. The main explanation is that women with higher education are likely to break away from traditional patterns and practices such as the use of ineffective traditional methods

of fertility planning: educated women more likely to adopt modern methods of family planning which are more effective. Most women with no education mainly depend on traditional methods of contraception which are not very effective for spacing or limiting child bearing.

A comparison of the inhibiting effect of contraception use among married women by wealth quintile shows that married women with the high wealth quintile experienced the most reduction in fertility due to contraception use compared to married women in other wealth categories. The indices of contraception use for women who had the highest wealth quintile reduced from 0.59 (1996) to 0.38 (2013/14) representing an increase in natural fertility suppression from 41 percent to 62 percent in 1996 and 2013/14 respectively. Women in the fourth wealth quintile followed, with indices of contraception use of 0.74 and 0.47 representing a 27 percent increase in natural fertility suppression due to contraception use between 1996 and 2013/14. The wealth category that experienced least reduction in total natural fertility due to contraception use was the lowest quintile which recorded indices of contraception of 0.85 and 0.62, representing a natural fertility suppression of 15 and 38 percent 13% in 1996 and 2013/14 respectively. One possible explanation for this observation is that women with more wealth are likely to have access to modern methods of family contraceptives while those with limited wealth may rely on traditional methods. In addition women with little wealth view large families as beneficial: in that, they contribute to the family labour force while those with more wealth view having more children as a cost due to high educational and health cost associated with large families. These findings conform to findings by Shapiro and Tambashe (2001), and Jolly and Gribble (1993).

In summary, it can be confirmed that wealth quintile, area of residence (urban and rural), province, and education level of women contribute significantly to fertility inhibition through the use of contraception. It is important to note that strong held cultural values, beliefs and practices have an influence on acceptance and use of family planning services.

4.3 Postpartum Infecundability

Postpartum infecundability refers to that time, after birth when women are not at risk of conception because either they are not ovulating or they do not engage in sexual intercourse (Bongaarts, 1984). Among women who are not using contraception, exposure to

the risk of pregnancy in the period after a birth is influenced primarily by two factors: breastfeeding and sexual abstinence. Breastfeeding prolongs postpartum protection from conception through its effect on the length of the period of amenorrhoea (the period prior to the return of menses) after birth. Over the years, literature has shown that more frequent breastfeeding is associated with longer periods of postpartum amenorrhoea.

In the absence of breastfeeding the average amenorrhoeic period may last between one and three months, but when nursing is initiated just after childbirth, the duration of amenorrhoea increases systematically with the duration of breastfeeding though at progressively slower rates (Bongaarts 1983). In addition, literature also reveals that delaying the resumption of sexual relations after birth also prolongs the period of postpartum protection. Women are considered insusceptible to pregnancy if they are not at risk of conception, either because they are amenorrhoeic or abstaining from sexual activity after a birth (CSO, 2015). To collect data on number of months since births, cross-sectional data representing experiences of mothers of all births at a point in time was used rather than showing the experience of a cohort of mothers over time.

4.3.1 Index of postpartum infecundability

The index of postpartum infecundability Ci, assess the effect of postpartum amenorrhoea and abstinence on fertility by quantifying the difference between total fecundity and total natural marital fertility. When there is no lactation or postpartum abstinence, Ci equals 1; when infecundability is permanent, Ci equals 0.

Table 4.4 shows estimates of the inhibiting effects of postpartum insusceptibility by background characteristics during the five rounds of the DHS surveys conducted in Zambia. According to table 4.4, the index of postpartum infecundability slightly increased from 0.63 in 1992 to 0.67 in 2013/14. This increase in this index resulted in a decline in potential maximum total natural marital fertility due to breastfeeding and postpartum abstinence among women aged 15-49 years from 37 percent in 1992 to 33 percent in 2013/14.

Table 4. 4 Trends in indices of postpartum infecundability 1992- 2013/14

Year	1992	1996	2001/2	2007	2013/14
Mother's age					
15-19	0.62	0.67	0.59	0.60	0.64
20-24	0.65	0.63	0.62	0.69	0.69
25-29	0.63	0.59	0.60	0.65	0.67
30-34	0.59	0.60	0.60	0.62	0.67
35-39	0.62	0.58	0.59	0.69	0.64
40-44	0.62	0.69	0.56	0.58	0.64
45-49	0.57	0.64	0.56	0.54	0.77
Residence					
Urban	0.67	0.71	0.64	0.74	0.73
Rural	0.60	0.58	0.58	0.62	0.64
Province					
Central	0.65	0.71	0.63	0.63	0.70
Copperbelt	0.65	0.68	0.63	0.70	0.78
Eastern	0.62	0.59	0.59	0.63	0.67
Luapula	0.61	0.60	0.61	0.62	0.63
Lusaka	0.66	0.71	0.68	0.76	0.70
Muchinga					0.66
Northern	0.58	0.57	0.58	0.62	0.64
North Western	0.62	0.53	0.55	0.60	0.59
Southern	0.62	0.58	0.58	0.65	0.68
Western	0.58	0.54	0.53	0.64	0.54
Education					
No Education	0.59	0.59	0.57	0.60	0.64
Primary	0.63	0.61	0.59	0.64	0.64
Secondary	0.66	0.73	0.64	0.70	0.71
More than Secondary	0.96	0.88	0.79	0.82	1.00
Wealth Quintile					
Lowest		0.58	0.57	0.60	0.60
second		0.59	0.57	0.61	0.63

Middle		0.57	0.59	0.63	0.68
Fourth		0.71	0.63	0.70	0.74
Highest		0.74	0.70	0.80	0.82
National	0.63	0.61	0.60	0.65	0.67

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/14 ZDHS

A trend analysis of the inhibiting effects of breastfeeding and postpartum abstinence on fertility among woman aged 15-49 by place of residence as presented in Table 4.3 shows that fertility inhibition effect due to breastfeeding and postpartum abstinence was greater in rural areas than in urban areas. The indices of postpartum infecundability show that Women aged between 15-49 years in rural areas experienced a slight increase in the index of postpartum infecundability from 0.60 in 1992 to 0.64 in 2014 representing a reduction in natural marital fertility suppression due to breastfeeding and postpartum abstinence from 40% in 1992 to 36% in 2014. Married women in the same age groups residing in urban parts of the country experienced indices of 0.67 and 0.73 in 1992 and 2014 respectively resulting in a reduction in natural marital fertility suppression from 33% to 27% between 1992 and 2013/14 respectively. These findings conform to the findings presented by Maktjane and Toeba (1999) that suggests that women in rural areas practice longer period of breastfeeding and postpartum abstinence than women in urban areas.

This study did trend analysis to understand the fertility inhibiting effect of breastfeeding and postpartum abstinence among woman aged 15-49 by province as presented in table 4.3. A comparison of the inhibiting effect of prolonged breastfeeding and postpartum abstinence among married woman aged 15-49 by province shows that married women from Western and Northwestern provinces experienced the greatest natural marital fertility inhibition due to prolonged breastfeeding and postpartum abstinence as compared to other provinces. Interestingly, the index of postpartum infecundability for Western and North-Western provinces reduced from 0.58 and 0.62 in 1992 to 0.54 and 0.59 in 2013/14 for each of the respective provinces. This reduction in the index of postpartum infecundability resulted in an increase in total natural marital fertility suppression from between 38-42 percent in 1992 to between 41- 46 percent in 2013/14. The index of postpartum infecundability in the remaining provinces increased between 1992 and 2013/14 resulting in reduction in potential

maximum natural marital fertility suppression. Copperbelt, Lusaka and Central provinces experienced the least natural marital fertility reduction as a result of prolonged breastfeeding and postpartum abstinence. The index of index of postpartum infecundability in these three provinces increased from 0.65 and 0.66 in 1992 to 0.70 and 0.78 in 2013/14 representing a reduction in natural marital fertility suppression to 28-30 percent from about 35 percent in 1992. Luapula, Northern, and Muchinga provinces experienced natural marital fertility suppression of 37, 36 and 33 percent respectively in 2013/14. Western and North-Western provinces are predominately rural provinces with strong cultural values that promoted prolonged breastfeed and postpartum abstinence, hence the observed results. In addition, Western province has the lowest contraceptive prevalence in the country. Furthermore, access to affordable nutrition supplements for infants in predominately rural provinces poses a challenge for most mothers hence the high reliance on breastfeeding as the main source of nutrition for infants. These findings conform to findings by Goldman et al., 1987, whose findings suggested that cultural beliefs have an influence on the duration of breastfeeding and postpartum abstinence.

A comparison of the inhibiting effect of breastfeeding and postpartum abstinence on fertility in Table 4.4 shows that women who had primary or no education experienced the most reduction in fertility due to prolonged breastfeeding and postpartum abstinence as compared to women in other education categories. Women with primary or no education had 36 percent fertility inhibition due to breastfeeding and postpartum abstinence in 2013/14. Women with secondary education had 33 percent and 29 percent fertility inhibition due to prolonged breastfeeding in 1992 and 2013/14 respectively. Interestingly, the fertility inhibition due to prolonged breastfeeding and postpartum abstinence among married women aged 15-49 with primary education remained almost the same as 37% in 1992 and 36% in 2013/14. The inhibiting effect of breastfeeding and postpartum abstinence among women with more than secondary education show a fluctuating pattern from one study round to the next. One possible explanation for the observed findings may be that women with little education are likely to adhere to cultural practices that promote prolonged breastfeeding and postpartum abstinence. These findings conform to the findings presented by Goldman et al, (1987), and Jolly and Gribble (1993) that suggests that women with lower education are likely to adhere to cultural norms, values and practices that encourage longer period of breastfeeding and postpartum abstinence compared to women with higher education resulting

in greater fertility suppression as a result of postpartum infecundability among women with lower education compared to those with higher education attainment.

A comparison of the inhibiting effect of breastfeeding and postpartum abstinence on fertility in table 4.4 shows that women with the lowest wealth quintile had the most reduction in fertility due to prolonged breastfeeding and postpartum abstinence compared to women in other wealth categories. Women who had the lowest wealth quintile had 40 percent fertility inhibition due to breastfeeding and postpartum abstinence in 2013/14. Women in the second wealth quintile followed with 37 percent reduction in fertility. The wealth category that experienced least reduction in fertility due to breastfeeding and postpartum abstinence was the highest quintile which had 18 percent reduction in fertility in 2013/14.

One possible explanation for these findings is that women with less wealth are more likely to practice longer periods of breastfeeding and postpartum abstinence compared to women with more wealth resulting in greater fertility suppression as a result of postpartum infecundability among women with less income compared to those with more income. In addition, women with a lot of wealth can afford infant nutritional supplement which are used to substitute or complement breastfeeding. Women with more wealth are therefore more likely to stop breastfeeding earlier than their counterparts with limited wealth. These findings conform to the findings by Maktjane and Toeba, (1999).

In summary it can be confirmed that wealth quintile, area of residence (urban and rural), province, and education level of women contribute significantly to total fecundity suppression through prolonged breastfeeding and postpartum abstinence. The findings showed in inverse relationship between fertility suppression and an increase education and wealth level. It is also worth noting that strong cultural values, beliefs and practices in the region and location have an influence on the duration of breastfeed and postpartum abstinence.

4.4 Primary Sterility

Primary Sterility in women is mostly associated with untreated Sexually Transmitted Diseases (STDs) like gonorrhoea (Caldwell and Caldwell, 1983; Frank, 1983a). A

population is said to have a Primary Sterility problem if the proportion of ever-married women who are childless exceeds 3 percent (Bongaarts, 1984).

4.4.1 The Index of primary Sterility.

Table 4.5 shows percentages of women aged 45-49 who are currently married but have never given a live birth from 1992 to 2013/14. This table shows that the percentage of sterile women remained relative stable at 1.30 percent between 1992 and 2013/14. The table also shows that the proportion of currently married women aged 45-49 that have never given a live birth is less than 3 percent, we can conclude that the country does not have a problem of Primary Sterility. This index of primary sterility was 1.05 indicating that the inhibiting effect of primary sterility on fertility among married women aged 45-49 in Zambia was very negligible. These findings conform to findings by Jolly and Gribble, 1998 who found similar findings in most Sub-Saharan countries.

Table 4. 5: Trend in the index of primary sterility from 1992-2013/14

Year	Estimated number of Sterile Married women in the age group 45-49	Estimated number of women Married aged 45-49	Proportion of sterile married women aged 45-49	Index of Primary Sterility Ip
1992	4.0	295	1.30%	1.05
1996	4.0	367	1.10%	1.05
2001/2	6.0	318	1.80%	1.04
2007	5.0	353	1.40%	1.04
2013/14	9.0	730	1.30%	1.05

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/4 ZDHS

4.5 Induced Abortion

Induced abortion has long been recognized as one of the proximate determinants of fertility which is thought to be practiced throughout the world, regardless of its legal status. However, the demographic impact of induced abortion in Zambia like many other developing countries remains uncertain. Lack of accurate and/or reliable data on induced abortion in Zambia, makes it difficult to arrive at convincing estimate of the index of induced abortion. In order to work around this problem, regional estimates on induced abortion from World

Health Organisation (WHO) and the Guttmacher Institute Data Center were used. Rates for Eastern Africa where Zambia belongs were used as proxy estimates for this study.

4.5.1 Index of induced Abortion

A trend analysis of the inhibiting effect of induced abortion on fertility from 1992 to 2013/14 is presented in Table 4.6. The table show that the index of induced abortion for Zambia was estimated to be at 0.99 thereby suppressing potential maximum fertility by 0.01 percent. These results demonstrated that the contribution of induced abortion to fertility suppression in the Zambia is minor and negligible. Non-availability of accurate in-country data on induced abortion is one of the factors that contributed to the observed results. This study used regional estimates that may not accurately reflect the situation in country. The 2013/14 DHS highlighted a 21 percent unmet need for family planning services among married women. Studies by Robey (1992), demonstrate that the number of births averted per induced abortion is strongly influenced by the practice of contraception. In addition, Foreit and Nortman, (1992), suggest that women are motivated to reduce fertility but have not yet adopted effective contraceptive methods, thus decline in fertility may often be associated with increased induced abortion rates. If this unmet need for family planning services among married women is not quickly addressed, some married women may opt to having medically induced abortion using mifepristone and Misoprostol tablets which are easy accessible from local pharmacies compared to surgical abortions which is more restrictive. Similar findings were documented in Japan, Hungary and German (Foreit and Nortman, 1992).

Table 4. 6: Trends in the index of induced abortion from 1992-2013/14

Year	Number of Induced abortion per 1,000 among women aged 15-44**	Induced abortion Rate per 1000 women aged 15-44**	Total Fertility Rate (TFR)	index of induced abortion *Ca*
1992	45	0.045	6.46	0.99
1996	41	0.041	6.08	0.99
2001	39	0.039	5.88	0.99
2007	38	0.038	6.17	0.99
2013	34	0.034	5.20	0.99

**Source: Guttmacher institute data centre

Source: Computed from data from the Guttmacher institute data centre

4.6 Total Fecundity 1992 - 2013/14.

The combined indices of the proximate determinants are an important component of the Bongaarts model because they are used to derive Total Fecundity (TF).

Table 4.7 shows that in the period between 1992 and 2013/14, the combined inhibiting effect of all indices on maximum potential fertility increased substantially by about 41 percent. The table also shows that the combined inhibiting effect of all these indices in 1992 suppressed maximum fertility by 56 percent. In 1996, the combined inhibiting effect of all these indices suppression on maximum fertility increased to 63 percent. In 2001/2 and 2007, the combined inhibiting effect of all these indices suppression on maximum fertility increased to 66 percent for both years. This increase in fertility suppression continued in 2013/14 where the combined inhibiting effect of all indices suppressed maximum fertility by 74 percent.

Table 4. 7 : Trends in combined inhibiting effect of all indices on fertility

Proximate determinants	Study year				
	1992	1996	2001/2	2007	2013/14
Index of Marriage (*Cm)*	0.82	0.79	0.81	0.79	0.76
index of postpartum infecundability (*Ci)*	0.63	0.61	0.60	0.65	0.67
Index of conception (Cc)	0.86	0.75	0.68	0.65	0.52
Index of Primary Sterility (*Ip)*	1.00	1.00	1.00	1.00	1.00
index of induced abortion (*Ca)*	0.99	0.99	0.99	0.99	0.99
Combination of all indices (*Cm*Ci*Cc*Ip*ca)*	0.43	0.36	0.33	0.33	0.26
Total Fecundity (TF)	14.89	16.84	18.11	19.01	20.46

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/4 ZDHS

As defined in chapter 2, total fecundity is a hypothetical or potential value that the TFR would take if all five of the indices were exactly 1, that is, if there were no non-marriage (if all women were married from ages 15 to 49), no contraception, no postpartum infecundability (beyond a minimum of 1.5 months), and no induced abortion. This study adopted the revised model by John Stover that estimated average total fecundity per woman to be about 18-21 children per woman. This average is much higher than the previous concept by John Bongaarts who estimated average TF to be about 15.3 children per woman. As

alluded to in earlier sections of this report, the increase in reproductive age of interest, from 15-44 years to 15-49 years and the inclusion of primary sterility (Ip) to the original Bongaarts model are factors that contributed to the revision in the average TF.

A trend analysis of the total fecundity indicate that TF increased from 14.89 in 1992 to 16.84 in 1996, this indicated 2.6 births lower than the expected average of 19 births per woman accorded to the revised model by Stover. The total fecundity rate increased further from 16.84 to 18.11 in 2001/2 indicating 0.9 births lower than the expected average per woman. In 2007, the total fecundity rate increased from 18.11 to 19.01. This rate is the same as the expected average number of births per woman recommended by the revised model. In 2013/14, the total fecundity rate increased to 20.46, indicating 1.4 births higher than average of 19 births per woman.

The total fecundity rates reported in 1992, 1996 and 2001/2 where much lower compared to what was recommended in the revised model by Stover. Stover acknowledges the variance in total fecundity rates and highlights the use of inaccurate data as the cause. Some of the sources of data inaccuracies include the following; 1) reported sexual activity is likely to be less accurate than reported marriage or cohabitation, 2) large difference in the accuracy of data on postpartum amenorrhoea or insusceptibility, 3) problems with data on primary sterility, 4) problems in some DHS surveys with births five years before the survey being mis-recorded by some interviewers in order to avoid completing the lengthy child questionnaire (Stover, 1998)

4.7 Ranking of proximate determinants on fertility

The analysis of the relationship between the proximate determinants and the TFR was based on identifying the proximate determinant that mainly attributed to the observed TFR over a short period of time that is from one survey to the next.

Total Fertility rates declined from 6.46 to 6.10 between 1992 and 1996 representing a 6 percent decline. This decline in fertility could mainly be attributed to the index of contraception which recorded an 11 percent decline during the reference period. During the period between 1996 and 2001/2, total fertility rates dropped to 5.9 indicating a 3 percent. This decline in fertility could mainly be attributed to the index of contraception which

recorded an 8 percent decline during the reference period. During the period between 2001/2 and 2007, the total fertility rate increased to 6.2 representing an increase of about 5 percent. This increase could be attributed to the index of postpartum infecundability which recorded an 8 percent increase during the reference period. During the period between 2007 and 2014, the total fertility rate dropped to 5.26 indicating a 11 percent decline. This decline could be attributed to the index of contraception which recorded a 22 percent decline during the reference period.

Evidently, contraceptive use has had the greatest impact on fertility suppression over the years. During the period 1992 to 2013/14, there was a huge improvement in the Contraceptive Prevalence Rate among married women (CPR) as it increased from 15.2 percent in 1992 to 49.0 percent in 2013/14 representing a 224 percent increase in CPR from the 1992 base year. This increase in CPR resulted in an estimate of 0.52 of the index of contraception that implies a 48 percent reduction of maximum fertility making contraception use the greatest inhibitor of fertility in 2013/14. In other words, the index of contraception made the greatest improvement with regard to fertility suppression over the 22 years with a percentage change decline of 40 percent. The TFR in Zambia would have been much higher if there were no married women using various contraception methods.

Postpartum infecundability has remained one of the strongest inhibitors of fertility. However, the impact of postpartum infecundability on fertility suppression seems to be reducing from one study year to the next. As highlighted earlier in this chapter, the index of postpartum infecundability accounted for 37 percent (C =0.63) and 39 percent (C=0.61) inhibition of potential maximum fertility meaning that there was a 2 percent reduction in the index of postpartum infecundability between 1992 and 1996. The index of postpartum infecundability of 0.60 in 2001/2 indicates that postpartum amenorrhoea and postpartum abstinence suppressed potential maximum fertility by 40 percent. In 2007, the estimate of the index of postpartum infecundability increased to 0.65 indicating that postpartum amenorrhoea and postpartum abstinence suppressed potential maximum fertility by 0.35 percent which was slightly lower compared to what was reported in previous study years. In 2013/14, the estimate of the index of postpartum infecundability increased further to 0.67, indicating that postpartum amenorrhoea and postpartum abstinence suppressed potential

maximum fertility by 0.33 percent again was much lower compared to what was reported in previous years.

Despite the observed continued reduction in the impact of postpartum infecundability on fertility suppression, statistics indicate that postpartum infecundability has remained the second strongest inhibitor of fertility. There is no doubt that postpartum infecundability will continue to remain an important proximate determinant of fertility in Zambia in years to come, though its effect might continue to drop over time as the country continues to modernise.

Non-marriage contribution to fertility suppression has remained relatively stable as highlighted in the earlier section of this chapter. The index of marriage (Cm) for Zambia slightly reduced from 0.82 (1992) to 0.76 in 2013/14. This slight reduction in the index of marriage over the years has resulted in the gradual increase in suppression of total marital fertility from 18 Percent to 24 percent in the respective years. When compared to other proximate determinants of fertility, finding from this study ranked the index of marriage as the third strongest inhibitor of fertility in Zambia. The impact of non-marriage in Zambia is expected to continue declining at a slow pace in years to come due to strong traditional and cultural beliefs that promote marital union and procreation in marital union. Women who have children outside marriage are usually frowned upon. It is worth noting that the index of marriage on fertility suppression in Zambia may not immediately yield positive results due to the low median age at first marriage which currently stands at 18.4 years marriage. The median age of 18.4 is likely to contribute significantly to fertility increase due to women being exposed to pregnancy at an early age. There is need for government to address the legal and cultural frameworks for ending early child marriages. Once the frameworks are in place, the index of marriage will begin to yield positive results in terms of fertility suppression.

This study showed the contribution of the index of abortion and the index of sterility on fertility suppression in Zambia was negligible. The study ranks the two indices as fourth and fifth respectively. The index of sterility and the index of abortion remained stable over the years at about 1 making them least when compared to other proximate determinants of fertility listed above. Table 4.8 shows a tabular summary of changes in proximate determinants.

Table 4. 8: Percentage change on proximate determinants of fertility 1992 - 2013/14

	Survey years 1992	1996	2001/2	2007	2013/14	Percentage change between 1992 and 1996	Percentage change between 1996 and 2001/2	Percentage change between 2001/2 and 2007	Percentage change between 2007 and 2013/14	Percentage change between 1992 and 2013/14
Index of marriage Cm	0.82	0.79	0.81	0.79	0.76	-3%	2%	-3%	-3%	-7%
Index of postpartum infecundability Ci	0.63	0.61	0.60	0.65	0.67	-2%	-2%	8%	4%	7%
Index of contraception Cc	0.86	0.75	0.68	0.65	0.52	-11%	-8%	-5%	-22%	-40%
Index of primary sterility Ip	1.00	1.00	1.00	1.00	1.00	0%	0%	0%	0%	0%
Index of induced abortion Ca	0.99	0.99	0.99	0.99	0.99	0%	0%	0%	0%	0%
Combination of Cm*Ci*Cc*Ip*Ca	0.43	0.36	0.33	0.33	0.26	-16%	-9%	0%	-22%	-41%
Total fertility rate TFR	6.46	6.10	5.90	6.20	5.26	-6%	-3%	5%	-15%	-19%
Total Fecundity (TF)	14.89	16.84	18.11	19.01	20.46	12%	6%	6%	9%	37%

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/4 ZDHS

This study compared its findings with previous studies conducted in Zambia. The comparison focused on three key proximate determinants of fertility namely non-marriage, contraception use and postpartum infecundability. Findings from studies conducted by Dzekezeke and Nyangu, 1992, Stover, 1998, Kiersten et al., 2011, Bongaarts, 2015, Chola and Michelo 2016 were reviewed. Table 4.9 shows a summary of the comparison of findings from this study with other studies conducted using DHS datasets for Zambia from 1992 to 2013/14.

Table 4.9 shows that in 1992, all four studies identified postpartum infecundity as having the largest fertility inhibiting effect. This study along with two others studies namely the studies done by Stover, J 1992 and Kiersten et al 2011 ranked marriage as the second inhibitor of fertility while contraception use was ranked third. In contrast, to the findings from the three studies, the study conducted by Dzekezeke and Nyangu ranked contraception use as a second inhibitor of fertility while marriage was ranked third.

Table 4.9: Comparative analysis of findings on indices of fertility by various authors 1992-2013/14

Year	Cm	Cc	Ci	Author (Year)
1992	0.68	0.89	0.62	Stover, 1998
	0.82	0.85	0.63	Mwanza. (2018)
	0.91	0.88	0.63	Dzekezeke & Nyangu , 1992
	0.72	0.87	0.62	Kiersten. J, et al, 2011
1996	0.69	0.78	0.63	Kiersten. J, et al, 2011
	0.79	0.75	0.61	Mwanza , 2018
2001/2	0.69	0.7	0.61	Kiersten. J, et al, 2011
	0.81	0.68	0.60	Mwanza , 2018
2007	0.75	0.78	0.59	Bongaarts, 2015
	0.6	0.92	0.63	Chola and Michelo , 2016
	0.79	0.65	0.65	Mwanza , 2018
	0.69	0.64	0.64	Kiersten. J, et al, 2011

Source: Dzekezeke and Nyangu, (1992), Stover, 1998, Kiersten et al, (2011), Bongaarts, (2015), Chola and Michelo, 2016)

In addition, table 4.9 showed that in 1996 and 2001/2, findings from this study and the study done by Kiersten et al, 2011 identified postpartum infecundability as the largest fertility inhibitor in Zambia between 1996 and 2001/2. Contrary to findings from this study that identified contraception use as the second inhibitor of fertility followed by non-marriage, the study conducted by Kiersten et al, 2011, identified non-marriage as the second inhibitor of fertility while contraception use has ranked third.

In 2007, as was the case in the previous years, all four studies in table 4.9 showed that postpartum infecundability continued to be the largest inhibitor of fertility in Zambia. This study and findings from Kiersten et al, 2011, identified contraception use as the second inhibitor of fertility while non-marriage was ranked third. These findings were somewhat contrary to finding by John Bongaarts, 2015, and Chola and Michelo, 2016 that ranked non-marriage as the second inhibitor of fertility while contraception use was ranked third. It may be suspected that findings from Chola and Michelo (2016) included LAM when computing the index of marriage, thus the high index reported. In addition variation in contraceptive effectiveness used across different studies may have also caused the discrepancy in indices of contraception obtained

In 2013/14, this study showed that contraception use among married woman overtook the postpartum infecundability to become the largest inhibitor of fertility. Postpartum infecundability was the second inhibitor of fertility while non-marriage was the third inhibitor of fertility.

Some of the factors that contributed to the observed variation in ranking include; 1) variation in the definition of marriage, in this study marriage included people you reported being in formal marriages and those in informal marriages (commonly referred to as in union or cohabiting). This contributed to the observed higher indices of marriage reported in this study when compared to those reported in other studies.

The second reason for the observed variation in ranking may have been caused variation in the definition of the index of contraception. When calculating the index of contraception, lactational amenorrhoea method (LAM) method must not be included in the calculation of the index of contraception. The effect of LAM on fertility is accounted for under the index of postpartum infecundability. Including the LAM method under the index of

contraception use would entail measuring the impact of breastfeeding and postpartum abstinence on fertility twice.

The third reason for the observed variation in indices may be attributed to variation in contraceptive effectiveness used across different studies may have also caused the discrepancy in indices of contraception obtained.

It is worth noting that in most cases the indices generated in this study were relatively close to those generated by other scholars.

The indices of postpartum infecundity are almost similar across the different studies as presented in the table 4.9.

4.10 Births averted

The total fertility-inhibiting effect in births for each proximate determinant between 1992 and 2013/14 is presented in table 4.10. The difference between Total Fecundity (TF) and the estimated Total Fertility Rates (TFR) is attributed to the result of the combined sum of the logarithm of all indices (Wang, 1987).

Findings from this study on births averted results indicate that of the 8 births inhibited in 1992 about 4.7 births (or 57 percent) were due to the effect of postpartum infecundability, about 2 births (or 24 percent) were due to non-marriage, and 1.6 births (or 18 percent), were due to contraception use among married women age 15-49 years. Less than 0.1 births (or 1 percent) were due to induced abortion while primary sterility among married women did not avert any births (Table 4.10).

In 1996, of the 10.7 births suppressed, postpartum infecundability inhibited about 5.2 births (or 49 percent), about 3.0 births (or 26 percent) were due to the effect of contraception, while 2.5 births (or 23 percent) were due to non-marriage. Less than 0.1 births (or 1 percent) were due to induced abortion while primary sterility among married women age 45-49 did not avert any births.

In 2001/2, of the 12.2 births suppressed, postpartum infecundability inhibited about 5.6 births (or 47 percent). 4.2 births (or 32 percent) were suppressed by contraception, while non-marriage evidently suppressed about 2.3 births (or 20 percent). Less than 0.1 births (or 1 percent) were suppressed by induced abortion while no births were suppressed by Primary Sterility. Furthermore, in 2007, of the 12.8 births suppressed, postpartum infecundability inhibited about 4.9 births (or 40 percent). 4.9 births (or 37 percent) were suppressed by contraception, while non-marriage supposedly suppressed about 2.8 births (or 22 percent). Less than 0.1 births (or 1 percent) were suppressed by induced abortion while no births were suppressed by Primary Sterility among married women aged 45-49.

In 2013, of the 15.2 births suppressed, use of contraception inhibited about 7.5 births (or 49 percent). 4.5 births (or 30 percent) were suppressed by postpartum infecundability, while non-marriage evidently suppressed about 3.1 births (or 20 percent). Less than 0.1 births (or 1 percent) were suppressed by induced abortion while no births were suppressed by Primary Sterility among married women aged 45-49.

Table 4. 10: Effect of the proximate determinants in terms of Births averted

Proximate determinant	Number of Births averted					Percentage of Births averted				
	1992	1996	2001/2	2007	2013/14	1992	1996	2001/2	2007	2013/14
Index of Marriage	2.0	2.5	2.3	2.8	3.1	24%	23%	20%	22%	20%
Index of infecundability	4.7	5.2	5.6	5.0	4.5	57%	49%	47%	40%	30%
Index of contraception	1.6	3.0	4.2	4.9	7.5	18%	26%	32%	37%	49%
Index of Primary Sterility	0.0	0.0	0.0	0.0	0.0	0%	0%	0%	0%	0%
Index of induced abortion	0.1	0.1	0.1	0.1	0.1	1%	1%	1%	1%	1%
Total	8.4	10.7	12.2	12.8	15.2	100%	100%	100%	100%	100%

Source: Computed from the 1992, 1996, 2001/2, 2007 and 2013/14 ZDHS

Trend analysis of births averted revealed that contraception use made massive improvement in suppressing fertility. The percentage of births suppressed by contraception increased from 1.6 births (or 18 percent) in 1992 to 7.5 births (or 49 percent) in 2013/14. The percent of births averted by postpartum infecundability reduced from 57 percent in 1992 to 30 percent in 2013/14. The absolute number of births averted by postpartum infecundability increased from 4.7 births in 1992 to about 5.6 births in 2001/2 before dropping to 5.0 births in 2007 and 4.5 births in 2013/14 (Table 4.10).

The percentage of births averted by non-marriage seem to range between 20- 24 percent while the absolute number of births averted seem to increase by 1.0 births thus from 2.0 births in 1992 to 3.1 births in 2013/14. The findings presented above were generated to give a general picture of the fertility-inhibiting effects of proximate determinants as expressed in terms of births averted. Therefore it can be concluded that non-marriage, contraception and postpartum infecundability seem to be contributing more in reducing fertility than primary sterility and induced abortion. Over the reference period, postpartum infecundity averted most births at 25 births followed by contraception use which averted 21.2 births. Non-marriage then followed in third place with 12.7 births averted over the reference period. Births averted by abortion and primary sterility remained very low in the period between 1992- 2013/14. During the reference period, the two indexes averted less than 1 birth.

The findings presented foregoing conform to findings by Tsoamathe, 2003 who observed that Non-marriage, contraception and postpartum infecundability seem to contribute more in reducing fertility than sterility and abortion. Tsoamathe observed that the percentage of births suppressed by non-marriage and contraception was lower in the early 1990s when compared to postpartum infecundability. Since the early 2000s, Tsoamathe observed that the percentage of births averted by contraception use has been at an increasing rate.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Introduction

Chapter five provides a summary of the research findings, highlighting the key research findings in relation to the research objectives. This chapter also provided conclusion about the research findings and recommendations based on the research findings.

5.2 Summary

The main objective of this study was to examine the impact of the proximate determinants to the realization of the current total fertility rates in Zambia. To examine the impact of the proximate determinants of the current total fertility rates, the Bongaarts model was applied. 1992, 1996, 2001/2, 2007 and the 2013/4 Zambia Demographic and Health Survey data were the main sources of data which were used. This study had three specific objectives whose findings have been summarised in the paragraphs below.

The first specific objective of the study was to estimate variations in fertility-inhibiting effects of five (5) proximate determinants of fertility namely: 1) marriage, 2) contraception use and 3) postpartum infecundability 4) induced abortion and 5) primary sterility among currently women aged 15-49 years at national and sub-national levels. This analysis and review of data were guided by four (4) background characteristics namely: the place of residence (rural and urban), province of residence, level of education attained and wealth between 1992 and 2013/14.

This study estimated variation in fertility suppression for each of the five (5) proximate determinants of fertility by various background characteristics. Some notable variation in estimates included variation in fertility suppression by place of residence. An analysis of fertility suppression by place of residence against various proximate determinants of fertility revealed variation in fertility suppression between women from urban areas and those from a rural setting. This study revealed that index of marriage and the index of contraception use shared a similar pattern in that women in urban areas experienced greater fertility suppression due to non-marriage and contraception use compared to women that lived in rural areas. The study findings revealed that in the urban area, non-marriage

suppressed fertility by 33 percent (Cm=0.67), while in rural areas, non-marriage suppressed fertility by 16 percent (Cm=0.84). A similar pattern was observed for contraception use were married women aged between 15-49 years in urban areas experienced a 55 percent reduction in fertility due to contraception use compared to 42 percent reduction for married women in the same age groups located in rural parts of the country.

This study went on to show additional variation in fertility suppression by region of residence. This study noted that provinces like Lusaka and Copperbelt that have urban characteristics had the greatest fertility reduction as a result of non-marriage and contraceptive use while the remaining provinces had low fertility reduction as a result of non-marriage and contraception due to the rural characteristics inherent in these remaining provinces. The study findings showed that in Lusaka and Copperbelt provinces, non-marriage suppressed fertility by 34 percent (Cm=0.66), while in the remaining provinces non-marriage suppressed fertility by 19-21 percent (Cm=0.81 and 0.79)

This study highlighted access to education and modern contraception in urban areas as the main explanation for variation in fertility by place and region of residence. Evidence from this study revealed that women living in urban areas were more likely to access education and modern contraception methods compared to their counterparts living in the rural areas where there is limited access to education and modern contraception method. In addition, the study suggested that early marriages which are a prominent feature in rural areas did contribute to the estimated variation in fertility by place of residence. This study suggested that women residing in the predominately rural province are likely to rely on traditional methods of contraception which are not very effective for spacing or limiting childbearing. This study went on to affirmed and conclude that wealth quintile, area of residence (urban and rural), province, and education level of women contribute significantly to fertility inhibition through non-marriage and use of contraception. It is important to note that strong held cultural values, beliefs and practices in the provinces have an influence on the marriage patterns and usage of family planning services.

This study also revealed fertility variation by background characteristic for the index of postpartum infecundability. This study findings observed an inverse pattern when comparing the index of postpartum infecundability to the index of marriage and the index of

contraception use. The study findings convincingly showed that prolonged breastfeeding and postpartum abstinence among women aged 15-49 years in rural areas experienced greater fertility suppression compared to women that lived in urban areas. Women aged between 15-49 years in rural areas experienced 36 percent reduction in fertility due to breastfeeding and postpartum abstinence compared to 27 percent experienced by married women in the same age groups located in urban parts of the country. In addition, this study showed that provinces like Western and North Western provinces that have rural characteristics had the greatest fertility reduction as a result of prolonged breastfeeding and postpartum abstinence while Lusaka and Copper-belt provinces had low fertility reduction due to the urban characteristics inherent in these two provinces. This study suggested strong cultural values that promoted prolonged breastfeed and postpartum abstinence in Western and Northwestern provinces as a key factor behind the observed fertility suppression. In addition, the study noted with concern that western province had the lowest contraceptive prevalence in the country. These findings further reinforced earlier suggestions of high reliance on cultural values that promote prolonged breastfeed and postpartum abstinence among women in the western province. As was the case with the index of marriage and the index of contraception use, findings from the study continuous affirmed the importance of strong held cultural values, beliefs and practices in influencing breastfeeding and postpartum abstinence practices.

This study also presented findings on fertility suppression by the level of education attained which revealed that women with more than secondary experienced greater fertility suppression due to non-marriage and contraception use compared to women with primary or no education. Women with more than secondary education had 40 percent fertility inhibition due to non-marriage while Women with no education had 11 percent reduction in fertility due to non-marriage. Married women age 15-49 with more than secondary education experienced fertility reduction of 64 percent due to contraception use while married women with no education experienced the lowest reduction in fertility due to contraception use (37%). This study findings suggested marriage postponement as a key factor behind the observed variation in fertility suppression. The study suggested and concluded that women with some education have lower fertility compared to those with no education is that the women with education are likely to postpone marriage as they pursue education, while those with no education are likely to marry early hence likely experience longer exposure to risk of getting

pregnant compared to those with some education who postpone marriage assuming all other things remain the same.

This study further analyses postpartum fertility variation by the level of education. Findings from this study revealed that women without education experienced greater fertility suppression due to prolong breastfeed and postpartum abstinence compared to women with more than education. Notably, women with primary or no education had 36 percent fertility inhibition due to breastfeeding and postpartum abstinence; while women with more than secondary education had the lowest reduction in fertility (less than 1 percent) compared to women in other education categories. This study suggested and concluded that married women with lower education are generally correlated with increased in the duration of breastfeeding and postpartum abstinence, which lead to longer intervals between births and thus likely to suppress fertility (Majumder, 2015). Additionally, this study suggested and concluded that women with some education are likely to seek modern contraceptives and other modern reproductive health care services used to regulate fertility as opposed to relying on prolonged breastfeeding and postpartum abstinence.

Finding from this study on fertility suppression by economic status revealed that women with more wealth experienced greater fertility suppression due to non-marriage and contraception use compared to women with little wealth. Women who had the highest wealth quintile had a higher fertility inhibition due to non-marriage while women in the lowest quintile experienced the least reduction in fertility. Women who had the highest wealth quintile had a 70 percent fertility inhibition due to contraception use while women in the lowest quintile that experienced the least reduction in fertility due to contraception at 38 percent. This study suggested that access and availability of contraceptives contributed to the observed variation in fertility suppression by economic status. This study concluded that women with high wealth are likely to be urban dwellers with access to modern contraception methods compared to women with little wealth that are likely to be rural dwellers with limited access to modern contraception method. In addition, this study suggested that the majority of the women with little wealth as noted in this study rely on traditional methods of contraception which are not very effective for spacing or limiting childbearing.

In contrast with what was observed above, an in-depth analysis of fertility suppression by the level of education in the case of postpartum infecundability revealed that women with little wealth experienced greater fertility suppression due to prolong breastfeed and postpartum abstinence compared to women with more wealth. Women who had the lowest wealth quintile had a 40 percent fertility inhibition due to breastfeeding and postpartum abstinence while women in the highest experienced the least reduction in fertility due to breastfeeding and postpartum abstinence at 18 percent. This study suggested and concluded that women who are economically better off are able to afford breast milk substitutes like milk supplements and other nutritional supplements for their children.

A trend analysis of fertility suppression by the five proximate determinants of fertility from 1992 to 2007 revealed that postpartum infecundability suppressed fertility more when compared with the other four proximate determinants of fertility namely marriage, contraception use, primary sterility and induced abortion. The use of contraception by married women aged 15-49 was the second inhibitor of fertility. Non-marriage was ranked third while induced abortion and primary sterility were rank fourth and fifth inhibitors of fertility respectively. In 2013, the picture changed slightly with the use of contraception among married women overtaking postpartum infecundability to be ranked the largest inhibitor of fertility suppressing suppressed fertility by 48 percent from attaining its maximum potential making. Prolonged breastfeeding and postpartum abstinence among married women age 15-49 suppressed fertility by 33 percent making it the second strongest inhibitor of fertility. In third place was non-marriage among woman aged 15-49 which suppressed fertility from reaching its potential maximum by 24 percent. Induced abortion and primary sterility maintained the fourth and fifth ranking.

During the period between 1992 and 2014, the index of marriage recorded a decrease in the index from 0.82 in 1992 to 0.76 in 2013/14 representing a 7 percent decrease. Compared to the other proximate determinants of fertility, the index of contraception recorded the greatest decline from 0.86 in 1992 to 0.52 in 2013/14 representing a 40 percent decline. The index of postpartum infecundability recorded an increase in the index from 0.63 in 1992 to 0.67 in 2013/14 representing an increase of 7 percent. The index of Primary Sterility and the index of induced abortion remained unchanged at 1.0 and 0.99 respectively.

Based on the findings presented above, this study suggested and concluded that the impact of contraceptive use on fertility suppression will continue to increase. In addition, this study suggests and concluded that despite the observed continued reduction in the impact of postpartum infecundability on fertility suppression, postpartum infecundability will continue to remains an important proximate determinant of fertility in Zambia in years to come, though its effect might continue to drop over time as the country continues to modernise. Furthermore, this study findings suggested and concluded that impact of non-marriage on fertility suppression in Zambia is expected to continue declining at a slow pace in years to come due to strong traditional and cultural beliefs that promote marital union and procreation in marital union

The second objective of this study was to estimate the number of births averted by each of five (5) principle proximate determinants of fertility over the last five (5) Zambia Demographic Health Surveys (ZDHS) thus 1992, 1996, 2001/2, 2007 and 2013/14 at the national level. The research findings revealed that non-marriage, contraception and postpartum infecundability seem to be contributing more in reducing fertility than primary sterility and induced abortion. Over the reference period, postpartum infecundity averted most births at 24.5 births followed by contraception use which averted 19.6 births. Non-marriage then followed in third place with 12.4 births averted over the reference period.

Trend analysis of births averted revealed that the index of contraception use and index of marriage showed positive trends in the number of births averted. The contraception use contributed significantly to the massive improvement in suppressing fertility. The number of births suppressed by contraception increased from 1.5 births (or 18 percent) in 1991 to 7.2 births (or 49 percent) in 2013/14. The number of births averted by non-marriage increase by 1.0 births thus from 2.0 births in 1992 to 3.0 births in 2013/14 representing 20- 24 percent.
Furthermore, a trend analysis of births averted by the index of postpartum infecundability revealed that the number of births averted by postpartum infecundability reduced from 4.6 (57 percent) in 1992 to 4.4 births (30 percent) in 2013/14. Finally, a trend analysis of births averted revealed that births averted by the index of abortion and the index of primary sterility averted have remained very stable over the period between 1992- 2013/14. During the reference period, the two indexes averted less than 0.1 birth.

The findings above revealed dynamics in the impact of proximate determinants on fertility from one study year to the next. This study suggests and concluded the number of births to be averted by contraception use will continue to increase. These findings are somewhat consistent with the evolving picture globally. Post-partum infecundability will continue to remains an important proximate determinant of fertility in Zambia in years to come, though the number of births averted might continue to drop over time as the country continues to modernise. Furthermore, this study suggested and concluded that impact of non-marriage on fertility suppression in Zambia is expected to continue declining at a slow pace in years to come due to strong traditional and cultural beliefs that promote marital union and procreation in marital union.
The objectives of the study were meant in that this study was able to show variation in fertility suppression for each of the five proximate determinants of fertility. In addition, this study showed the number of births averted by each of the proximate determinants of fertility between 1992 and 2014.

It should be borne in mind, that the study has a number of limitations. One of the main limitation or restriction of this study was unavailability of official induced abortion data in Zambia. The Zambia Demographic and Health Survey did not collect data on induced abortion mainly because induced abortion is still a very sensitive issue with some sections of society still perceiving induced abortion as being illegal thus making data collection very difficult. This study focused on women in marital union and not all women in general. By focusing on the woman in marital union only, the study failed to account for fertility or live births that occur among women who are not in marital unions hence the research findings were biased towards women in marital unions and not all women in general. Other lists of limitation in this study a listed in the methodology section of this dissertation.

5.3 Conclusion

My study offers suggestive evidence on the importance of adopting a holistic approach when dealing with proximate determinants of fertility. Currently the country has placed much emphasis on contraception use as the most effective interventions for regulating high fertility. This study has revealed that all the proximate determinants have a role to play when it comes to fertility suppression.

5.4 Recommendations

Over the years, government and its cooperating partners have shown strong political and financial commitments to limiting population growth through the provision of family planning services readily and easily in almost all parts of the country. In addition, the government and its cooperating partners have embarked on a campaign to end early marriages in the countries. Other programs aimed at promoting women's educational and economic opportunities have indirectly played a role in suppressing fertility in the country. Although some achievements have been highlighted above, more need to be done. Based on the research findings, the following recommendations have been considered to be of value and useful in addressing high fertility rates in Zambia:-

The country should adopt a holistic approach when dealing with proximate determinants of fertility. Currently, the country has placed much emphasis on contraception use and delayed marriage as the two most effective interventions for regulating high fertility. However, key government strategic documents aimed at addressing high fertility like the population policy are silent of the role played by other proximate determinants such as induced abortion, primary sterility, prolong breastfeed and postpartum abstinence. As seen in this study, prolonged breastfeeding and postpartum abstinence was a key in regulating fertility from 1992 to 2007.

While acknowledging the progress made in making family planning service more easily and readily accessible to women in reproductive age groups the following need to be done:-

There is a need for the government through the Ministry of Health to ensure adequate provision of contraception services so that they are readily available and easily accessible by women both in rural and urban areas. In addition, district health management teams, need to intensify sensitisation in rural areas on available contraceptives in health centres and their importance with regards to family planning. The women and mothers in rural areas will be able to choose the type of contraceptives (short term or long term methods) to use based on their needs. This will help to address inequality in access to family planning service between women in urban areas and their counterparts in the rural areas, the educated and uneducated, the economically empowered and those with limited wealth will be instrumental in suppressing fertility in the country.

While Current effort by government and cooperating partners to end early marriages are acknowledged, this study findings show that the index of marriage has plateaued over the last three survey rounds. If the country is to address high fertility, there is a need for the government to accelerate the efforts to end child marriages by providing political will and financial support. In addition to highlighting health-related dangers of early marriages, the awareness messages on early marriages should be extending to include the negative effects of early marriages on population growth and economic development.

Based on the research findings, the following future research studies are recommended:

Postpartum infecundability: Findings have revealed that prolonged breastfeeding and postpartum abstinence was a key in regulating fertility from 1992 to 2007, therefore there is need to conduct a research study to assess how postpartum infecundability can complement contraception use and non-marriage in regulating fertility.

Abortion and Primary Sterility: It has been revealed that induced abortion and primary sterility also complement contraception use and non-marriage in regulating fertility. Therefore there is a need to conduct a research study to help address data gaps on abortion and primary sterility. Given that these are sensitive subjects in our communities, qualitative studies would be ideal. The findings from these special studies should be triangulated with data routinely collected by various institutions like the ministry of health, WHO to mention but a few

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