Demographic and Socio-Economic Factors Associated with Fertility Among Women of reproductive ages (15-49) in Luapula Province, Zambia: analysis of the 1992-2018 Zambia Demographic and Health Survey.

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A Dissertation submitted to the University of Zambia in Partial fulfilment of Requirements of the Degree of Master of Arts in Population Studies.

The University of Zambia

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DECLARATION

I, **ROBERT ZULU** hereby declare that this dissertation represents my work, and it has not previously been submitted for a degree at this or any other University.

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CERTIFICATE OF APPROVAL

This dissertation of **ROBERT ZULU** has been approved as fulfilling part of the requirements for the award of the degree of Master of Arts in Population Studies at the University of Zambia.

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DEDICATION

I dedicate this paper to my late Father, Chief Jumbe iv Mr. **Robert Zulu** (M.H.S.R.I.P) who always advised me to work extra hard academically and be focused if I want to achieve my goals in life.

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ABSTRACT

The levels of fertility in Luapula province have remained relatively high compared to other provinces of the country. It is for this reason that this study sought to investigate the demographic and socio-economic factors associated with fertility (CEB) of women of reproductive ages (15-49) in Luapula province. This study was undertaken to help fill the gap in knowledge of how the demographic and socio-economic factors have influenced fertility levels in Luapula province. Further, to the lesser extent the factors identified as having contributed more significantly to high fertility levels would help in coming up with policies and other measures of fertility reduction.

The study used a non-intervention research design; based on secondary data from the Zambia Demographic and Health Surveys (ZDHS) conducted in 1992, 1996, 2001-2, 2007, 2013-14 and 2018. The sample included women residing both in rural and urban areas who reported at least with one live birth. Analysis of data in this study was done using the statistical software Stata 14.0 and it was done at three stages namely descriptive analysis; bivariate and multivariate analysis using Poisson regression, producing Incidence Rate Ratios of CEB among women associated with demographic and socio-economic factors by ZDHS year.

The findings of this study show that the age of a mother is associated with the number of Children Ever Born. This is similar with education level, employment status, marital status, contraceptive use, and age at birth of first child. Results from bivariate and multivariate analysis show that women aged 25-34 and 35-49 years had significantly relatively more children for instance 1996 (IRR = 2.386, 95% CI 2.060-2.764) and (IRR = 3.937, 95% CI 3.521-4.401) compared to women aged 15-24. Women of rural areas have statistically significant more children than women from urban areas of Luapula province. The association of CEB and age of a woman at first birth, women who had their first birth/child at ages 15 years and above (15-19 and at 20+) had significantly fewer children for instance 2018 (IRR =0.798, 95% CI 0.681-0.936) and (IRR = 0.682, 95% CI 0.565-0.824) than women who had their first child before age of 15 years. Women who reported to have used contraceptives regardless of the method and type had relatively more children for instance 2018 (IRR = 1.088, 95% CI 1.023-1.158) than women who reported not using any of the contraceptive methods.

In nutshell, the study found that fertility in Luapula province is associated with several different socio-demographic factors such as age of a mother, Education levels, marital status, as well as age at first birth. The study recommends provision of an aiding atmosphere for the attainment of higher education by women. Qualitative studies should be conducted to investigate the reasons why women are using the different contraceptive methods, Government should also revisit (by increasing) the legal age for marriage under statutory law, which is 18 years for women, this will contribute to the reduction in the levels of fertility because marital status highly contributes to high fertility levels.

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ABREVIATIONS

ASFR……Age Specific Fertility Rate

BIC……...Bayesian Information Criterion

CEB……. Children Ever Born

CPR……. Contraceptive Prevalence Rate

CSO……...Central Statistical Office

DHS ……...Demographic and Health Survey

EDHS……. Ethiopia Demographic Health Survey

FP……...Family Planning

MDG.....Millennium Development Goal

MOF……...Ministry of Finance

SDG……..... Sustainable Development Goal

SFH……Society for Family Health

SSA.....Sub-Saharan Africa

TFR.....Total Fertility Rate

UN……...United Nations

WHO.....World Health Organization

ZDHS……...Zambia Demographic and Health Survey

CHAPER ONE: INTRODUCTION

1.1. Background

Fertility patterns, levels and trends vary among countries at a point in time and over time based on different factors which affect fertility. These factors vary when measuring them because they involve subjectivity and some of them may not apply across cultures. For instance, fertility has been changing in most of sub-Saharan African countries due to changing social, culture, economic and demographic conditions. Fertility rate is highest in sub-Saharan Africa (SSA) than any part of the world mainly due to strong kinship networks and high economic and social values attached to children (Romaniuk, 1980; Caldwell, 1987; Hinde and Mturi 2000).

Among the forces of change in the demographic processes are increasing contraceptive use and changing marriage patterns. For most countries with high fertility, their policy is to manage the high levels, particularly adolescent fertility, and to improve sexual and reproductive health, including family planning, to maintain small family size, this is important in helping to address the issues of overcrowding which in return may be a threat on the economy of a given country especially developing nations. For instance, Zambian policy actions to accelerate fertility decline through increased use of effective family planning methods within an integrated reproductive and maternal health programme (MOF, 2015).

Fertility analysis is one of the important aspects in understanding past, current, and future trends of population size, composition, and growth. Information on fertility levels, patterns and trends experienced by a country is quite important for socio-economic planning, monitoring, and evaluation of programmes. In Europe, for example, the declining population growth and the ageing population causes concern about the future of the welfare states, while the same trend in developing countries is regarded as good news because high population growth usually is seen as closely linked with low economic and human development (Gudbrandsen, 2010).

During the crowning years of the baby explosion in the late 1950's, the fertility rate in Canada and the United States of America was 3.91 and 3.77 respectively. By the 1970's it had fallen below 2 in both countries. While in the United States of America the rate went back up to 2.08, Canada's rate kept falling to 1.52 in 1999. Such differences in fertility exist even in countries like Canada and many developed countries in Europe.

Meanwhile, Fertility rates are still at high levels in Africa and some Arabic countries, followed next by countries of Central and South America. Lower rates are found in Europe and other industrialized countries like Canada and Japan.

According to classical economic theory, population growth and economic development are closely linked. Malthus (1798b) claimed in the eighteenth century that the size of a nation's population always will be limited by economic resources and possibilities. Meanwhile Becker (1960) argues that economic development will reduce the number of children ever born. When a country gets richer, women will get better income possibilities and the cost of raising children (lost income) will increase. This and the fact that improved economic conditions also implies that better schools and a better health system may induce families to reduce the number of children and use more resources on each child. Household members may, however, have different preferences over this Quantity - Quality trade-off.

On the other hand, the problems created by high population growth include congestion and rapid depletion of resources, especially in developing countries like Zambia where property rights governing access to the resources are not well-defined. This leads to overexploitation of resources, pollution, and degradation of the environment. Moreover, pressure on limited land in the rural areas due to high population growth has contributed to a massive migration of peasants to urban centers (Acsadi, 1990). Indeed, migration to the city has led to the mushrooming of slums in the cities, which has worsened the problems of unemployment, lack of proper hygiene, and education opportunities.

The Zambia Demographic and Health Survey (ZDHS, 2018) results show that fertility levels for Zambia have declined from 6.5 to 4.7 births per woman from 1992 to 2018 respectively. On the other hand, fertility has remained high in almost all the provinces of Zambia with only Copperbelt and Lusaka provinces experiencing Total Fertility Rates (TFRs) below the national average (ZDHS, 2018). The decline in fertility seems to be concentrated in urban areas, while fertility in rural areas has remained almost constant. Different fertility regulation mechanisms such as use of contraceptives, termination of pregnancies and delayed marriages that have contributed much towards fertility reduction in urban areas are not available in rural areas to play similar roles in most Sub-Saharan Africa (SSA) countries (Markos, 1997).

Table 1 shows estimates of TFR for all the provinces from a series of surveys conducted in Zambia since 1992. From the table below, TFR is seen increasing from 2001 to 2007 for most of the

provinces. Results from the ZDHS show that the national TFR has reduced from 1992 to 2018 by an average of 2 children to a woman. Looking at the fertility levels in Luapula province of Zambia in the past decades, there is need for a quick attention in order to ascertain the influential factors that are responsible for the current fertility trend in the region compared to other regions of the country. Luapula women are on average having three children more than women in Copperbelt province which is the smallest in terms of TFR (2018 ZDHS).

Table 1: Trend distribution of Total Fertility Rates by region.

Province	1992 ZDHS	1996 ZDHS	2001-01 ZDHS	2007 ZDHS	2013-14 ZDHS	2018 ZDHS
Lusaka	5.5	4.9	4.3	4.1	3.7	3.5
Copperbelt	6.2	5.6	4.5	4.8	4.0	3.4
Central	6.8	6.3	6.2	6.4	5.7	4.8
Southern	7.1	6.2	6.1	6.7	6.2	5.5
Western	5.7	5.5	6.4	5.6	5.6	5.4
North-western	6.9	6.2	6.8	6.2	6.2	4.9
Eastern	6.8	7.1	6.8	5.8	5.8	5.5
Northern	7.5	7.2	6.9	6.6	5.6	5.6
Luapula	**7.2**	**6.8**	**7.3**	**7.2**	**6.4**	**6.0**
Muchinga	-	-	-	-	6.3	5.7
National TFR	**6.5**	**6.1**	**5.9**	**6.2**	**5.3**	**4.7**

Source: ZDHS Reports, 1992 to 2018

Fertility levels can be seen reducing if contraceptive prevalence rate is high in each region and vice versa. Contraceptive prevalence rate is the percentage of women who are married or in union and of reproductive age (15-49 years), using any method of contraception, either modern or traditional (UNFPA 2015). It is influenced by a lot of factors including, socio economic factors, socio-cultural factors, bio-demographic, the availability, and supply of contraceptives, and involves the choice to begin and to continue to use contraceptives over a period, to mention but a few. Not only does low contraceptive use have implications on the maternal health but also on fertility; it results in high fertility. Sustained high fertility rates create a large population of young dependents, creating demand for support for young children, for an adequate number of schools and for affordable childcare. This is evidenced by the 1946-1964 baby boom period that caught

communities unprepared and without the school facilities to accommodate the rapidly increasing number of school age children (World fertility Report, 2003). High fertility in turn results in a high growth rate of the population which has further implications on the limited resources in a population.

In line with trying to address the issue of high levels of fertility and its impact, the sustainable development goals (SDGs), goal number 3 intend to achieve good health and well-being. One of the targets under this goal is to achieve, by 2030, universal access to sexual and reproductive health-care services, including for family planning, information and education and the integration of reproductive health into nation strategies and programmes. It is, however, interesting to note that in the initial MDGs, the target of achieving universal reproductive health was not included. It was only made explicit in the 2005 report presented on Preparing National Strategies to Achieve the Millennium Development Goals. This allows couples to avoid high-risk pregnancies as well as choose the timing and size of their families. One of the "quick wins" identified by the report, therefore, was to expand access to contraceptive information and services, among others (UN Millennium Project, 2005; 14). This will partly reduce fertility and indirectly reduce maternal mortality, hence improving maternal health in the long run.

To develop measures that will facilitate the reduction of fertility levels in Luapula province, it is important to understand factors that contribute to it remaining high and the consequences. Therefore, this study investigates how factors in terms of socio-demographic and socio-economic are associated with fertility in Luapula province of Zambia.

1.2. Statement of the Problem

Fertility has an additive function to the population of a given region, if not properly taken care of it can cause a negative impact on the economy of the affected region. From age, 15 to 49 women are expected to be in their prime years for childbearing hence contribute to the fertility increase of a given population of a country. According to Zambia demographic and health survey (ZDHS 2018), Fertility level in Zambia has reduced from 6.2 to 4.7 this is from 2007 to 2018 respectively. In Luapula it has remained relatively high at 6 children per woman compared to other regions of the country.

On average, women from Luapula are having about three children more than Copperbelt women with 6.0 and 3.4 children respectively, (ZDHS, 2018). Though Luapula's fertility has been declining, the rate of decline has been rather slow (Census Report, 2010). High fertility level is a

threat on population's wellbeing in most developing country. This is because of limited resources available hence compromising on provision of fundamental economic, health and social services for everybody in the country, especially for the poor and vulnerable persons.

Despite interventions to lower the fertility rates, empirical evidence shows that there is still high fertility level in Luapula province as suggested by the fertility rate. Thus, there's a disparity between fertility rate of Luapula and that of other regions. There is a problem of high fertility rate despite all efforts put in place to reduce it. Therefore, it is with this background that the study aimed at investigating the reasons behind the high fertility levels in Luapula province even with some family planning services being provided.

1.3. **Rationale for the study**

It is evidently true that fertility of a given group of people tend to be affected or influenced by several factors which include demographic and socio-economic factors. Hence fertility analysis in each region is important since it helps to know fertility levels, trends and patterns. Additionally, it also helps to determine the major specific factors altering fertility. Information on fertility levels, patterns and trends experienced by a region or country is important for socio-economic planning, monitoring, and evaluating programs related to fertility and development of the population (2010 Census of Population and Housing).

The rationale for undertaking this study was to help fill the gap in knowledge of how the demographic and socio-economic factors have influenced fertility trends from 1992 to 2018 in Luapula province of Zambia. Further, the factors identified as having contributed more significantly to the high fertility levels in Luapula for more survey years would help in coming up with policies and other measures such as provision of contraceptive methods concentrating much on Luapula province since fertility is still high. It is for this reason that this study sought to investigate the demographic and socio-economic factors associated with fertility in Luapula province to contribute to the body of knowledge and further inform researchers, family planning programmes such as integrated family planning service (FP 2030) and communication guidelines relating to the importance of small number of children among women.

1.4.0. RESEARCH OBJECTIVES, QUESTIONS AND HYPOTHESIS

This section presents the research objectives, questions and hypothesis established to give direction to the study.

1.4.1. General objective

The main objective of this study was to investigate demographic and socio-economic factors associated with fertility among women of reproductive ages (15-49) in Luapula Province**.**

1.4.2. Specific objectives

1. To estimate fertility trends of women of reproductive ages (15-49) in Luapula Province.
2. To establish demographic and socio-economic factors associated with fertility.
3. To determine the effect of contraceptive use on fertility in Luapula Province.

1.4.3. Research questions

To achieve the above objectives, the following research questions were used:

1. What are the fertility trends in Luapula province?

2. Is there an association between demographic and socio-economic factors and fertility?

3. What effect does contraceptive use has on fertility in Luapula?

CHAPTER TWO: LITERATURE REVIEW

This chapter reviews the existing literature relevant to the problem under study to gain insight and broad understanding of the available information about a research problem. It looks at the studies done on demographic and socio-economic factors associated with fertility. It is evidently that vigorous scholarly investigations of fertility have been done in different parts of the world. On the other hand, fertility has been the furthermost discussed subject in most of the sub-Saharan African countries due to its effect on the size of the population. The studies conducted on determinants of fertility offered a platform on which the arguments and discussion of findings for this study was based.

2.1. Empirical Studies

2.1.1. Demographics, Socio-economic factors, and Fertility

Fertility is said to be affected by different demographic and socio-economic factors in different parts of the word. In Europe, Hondroyiannis (2009) examined the determinants of fertility using panel data for twenty-seven European countries. The study used panel co-integration to estimate fertility as a function of demographic and socio-economic variables. He found that low fertility in most industrialized countries in Europe is due to low infant mortality rates, high female employment, low nuptiality rate (frequency of marriages) and high opportunity cost of having children. Using two measures of economic uncertainty, which are associated with labor market decisions, a production volatility measure and unemployment rate. The paper also examined to what extent economic insecurities affect fertility decision. Empirical results show that both measures of economic uncertainty have a significant negative impact on fertility implying that labor market insecurities might be a significant factor affecting fertility decision.

In the middle East, a study done by khraif (2001) on determinants of fertility in Saudi Arabia, using a regression analysis. He found that age at marriage and woman's education are apparently the most important determinants of fertility behaviour. Furthermore, he also found that some variables like "children death", "son preference" and geographical region are significant determinants of fertility. On the contrary, the analysis showed that living within an extended family setting is associated with low fertility levels. On other notice, women's participation in the labour force and husband's education attainment were not among the significant fertility determinants in Saudi Arabia. There are numerous channels through which education can affect fertility.

It is contended that education provides individuals with a new vision, normative orientation, better health care, and better employment opportunities outside home, better knowledge, and access to family planning methods which in turn may produce a depressing effect on fertility (Cochrane, 1979).

Another study done in Nepal on determinants of fertility among women of reproductive age reviewed that the correlation between education status and fertility is significantly negative. Its effect on fertility is also found statistically significant. This indicates that fertility of Nepal can be reduced significantly by slightly increasing the educational status of women. The study also showed factors that may have contributed to the decline of fertility in Nepal, this include improved communication and greater access to modern methods of contraception (Sharma, 2015)

On the other hand, Residence of a woman influences fertility in some way. Differences in fertility by urban and rural residence occur due to locational factors that affect aspirations and family size preferences. Urban places typically offer better educational and modern sector job opportunities, better health facilities and more access to information on contraceptives and supplies. Urban areas also tend to face lower social and financial costs of fertility regulation, a rather lower labour value of children and higher out of pocket costs of having and raising children compared to rural areas. In a study done by Tadesse (2010) to examine the socioeconomic determinants of fertility in Ethiopia. The EDHS of 2005 and the poison regression model was used. Dependent variable of interest being the number of children ever born by a woman which is a non-negative integer or count data. In the model, wealth is endogenous and access to financial institution is used as an instrument. It was found that urbanization plays a key role in reducing fertility. Improving economic status of a woman leads to lower fertility. And, education of a woman beyond primary level has a strong effect in reducing fertility. On the other hand, lowering child mortality through better access to health services could reduce fertility (Kamal, 2015).

Employment status of a woman is said to be associated with her fertility behaviour. This is evidently in a study done by Mutwiri (2019) in his study an analysis of determinants of fertility differentials among the poorest women population in Kenya. A binary logistic regression model was fitted to DHS 2014. The results showed that all the variables region, women educational level, marital status, age at first marriage and age in five-years group were found to have a significant effect on the total number of children ever born at a significance level of 5%. Contrary to the study by Tsegaye (2010) on assessing the association between employment status and fertility behaviour

of married women in the context of Ethiopia. The analysis made based on the 2000 and 2005 Ethiopian Demographic and Health survey data. The findings showed that there was an insignificantly relationship between employment status of women and fertility behavior at country level. However, this relationship turned and got significantly negative in urban areas of Ethiopia. And it was found that there was no significant association between employment status of a woman and fertility level among the two cross section years (2002 and 2005) under consideration. The potential endogeneity of labor force participation is not considered. Instead, the author minimizes the potential endogeneity bias by running a multiple regression model.

It has also been noted in most literature that age at first marriage has a significance effect on the fertility levels and trends. However, age at first marriage is influenced by different socio demographic and socioeconomic factors. According to Amoo (2017) a study on trends and determinants of female age at first marriage in sub-Saharan Africa (1990-2014). The study analyzed trends and determinants of female age at first marriage in Ghana, Kenya and Zambia using DHS datasets across defined survey horizons: 1990-1999, 1999-2000 and 2010-2014. The study showed that there was a significance association between age at first marriage and level of education of a woman as well as wealth index. In Nigeria a study conducted shows that women who married at ages above 20 years had fewer children than those who married before age 20, this confirmed the importance of delayed marriage for overall fertility reduction. (Mberu and Reed, 2014).

El Lahga and Olfa (2008) assessed the main socio-economic determinants of household fertility decision in Tunisia. The study found that a husband's characteristics are almost as important as those of wives in determining fertility decision. Both women and men's education have an important impact on completed fertility. But the role of women in Tunisian families is dominant.

In another study, Maitra (2004) examined the effect of socioeconomic characteristics on the total fertility rates in Nepal using a household-level data set. He noted that postponement of marriage contributes significantly to a reduction in fertility level by shortening the total reproductive span of women. The higher age at marriage was expected to be associated with a rise in the status of women, as they entered their reproductive life with greater maturity and capabilities. An increase in age at marriage for women was also likely to reduce the age differential between husband and wife. This was likely to increase the bargaining power of the wife and reduce the power imbalance within the family. The estimated results emphasized the role of female education in reducing total

fertility and increasing age at marriage. Also, the higher the education level of woman, the stronger is the effect on age at marriage.(Maitra, 2004)

It is notable that birth intervals are important in maintaining good health of children because short intervals are associated with high childhood mortality. The age at which childbearing begins can also have a major impact on the health and well-being of both the mother and the child. (Sharma, 2015)

2.1.2. **Fertility and Contraception use**

Contraception use is regarded as the most influential measure in try to reduce fertility of any given population. Most of the studies have reviewed how contraception use has impacted on reduction of fertility. Just like Africa, Asia has faced high fertility; however, in Taiwan it is declining. This is evidently seen as Taiwan's fertility declining from 3.9 in 1970 to 1.1 in 2013 thereby being amongst countries with lowest Total Fertility rate (World Population Data sheet 2014). A study was done in Taiwan by Sun (2001) to assess the impact of a family planning program implemented from 1964 to 1990, contraception uses and reduction in fertility. It was found that, universal provision of family planning services was effective and provision of low-cost contraceptives methods to eligible couples had enabled the fast increase in contraceptive use among women in Taiwan. This was through the intensive education on family planning and hence it helped couples to reduce fertility to the idea number of children. A survey on knowledge, attitude, and practice (KAP) conducted by Provincial Institute of Family Planning found that the ideal number of children reduced from 4.0 to 2.4 in 1965 to 1992 respectively this was due to the information, education and community campaigns done on family planning between 1967 and 1971.

A study done on explaining the role of proximate determinants on fertility decline among poor and non-poor in Asian countries show that there was substantial fertility decline, especially among the poor across all the countries over the period. It was quite clear from the analysis that out of four proximate determinants of fertility, contraception had the largest effect, and it was the sole reason for fertility decline particularly among poor women in Nepal followed by India, Bangladesh, Vietnam, Indonesia and Philippines between first to recent survey period. However, the magnitude of inhibiting effect of contraceptives varied among poor women in study countries (Majumder and Ram, 2015).

In Africa, fertility is seen to have declined in most of sub-Saharan African (SSA) though the pace is slow in comparison with regions of the world. For instance, In Malawi the TFR is observed to

have declined from 6.7 to 5.7 children in 1992 to 2010 respectively. And this was noted to be accompanied by the increase in the contraceptive prevalence rate from 7.4 percent in 1992 to 42.2 percent in 2010 (Chintsanya et al., 2012).

Using data from the Malawi DHS of 2000, 2004 and 2010, an analysis to determine the factors influencing fertility decline. Chintsanya, Madise and Bailey (2012) used Bongaarts and potter (1983) fertility model to examine the relative contribution of each proximate determinant of fertility to observed fertility reduction. It was seen that increase in the age at first marriage played a role in fertility decline in 1992 and on the other hand women's education level had contributed to fertility reduction from 2000 to 2010. With regards to contraception use, it was noticed that women used contraceptive for child spacing but not limiting the number of children.

Contrary to the findings of Chintsanya et al 2012, most of the decline in fertility in SSA is attributable to increase in the proportions of women unmarried, and to a lesser extent, increase in contraceptive use. On the other hand, a positive association exists between unmet need and total abortion rate for countries of SSA though the pathways inherent in this relationship are still unclear. (Madhavan, 2014)

According to (Onda, 2020) in a study conducted in Uganda, using the Demographic and Health Survey of 2006 to examine the relationship between female education, contraceptive use, and fertility rates in Uganda. The findings of the study reveal that female education, especially at the secondary and post-secondary levels, increases the likelihood of using contraceptives and reduces fertility. These findings further show that access to or use of contraceptives is positively associated with the education of both the woman and her partner. Another study done in Ethiopia shows that contraceptive use on fertility reduction increased from what it was in 2005(15%) by 2016 (37%) (Shallo, 2020).

Similarly, a study conducted on examining the impact of each proximate factor (contraception, postpartum infecundability, abortion and sexual activity) on fertility in Eswatini. Using the cross-sectional data from the 2006-7 Eswatini Demographic and Health Survey (EDHS), and the revised Bongaarts proximate determinants model of fertility was applied at national level and the analysis was extended to observe educational variation among women aged 15-49. The analysis showed that contraception had the greatest impact of fertility reduction (Chemhaka and Odimegwu, 2019).

2.1.3. Demographic, socio-economic factors, contraception use and fertility.

Contraceptive use is another substantial proximate factor affecting fertility among countries. At the same time, demographic and socio-economic conditions have played significant roles in the use of contraceptive methods. Africa is described as the most populous continent around the universe with an estimated population of about 1.3 billion (UN 2019). World Health Organization (WHO) reported that African countries are all growing fast because there is large number of women who have no access to family planning (WHO, 2008). In turn, Zambia is among those African countries with the fastest population growth rate estimated at 2.7% and yet family planning services have become the interventions to slow the population growth (CSO, 2011).

In Zambia studies that have been conducted mostly focused on fertility and contraceptive use differentials by various demographic and socio-economic factors of a women. For instance, women with tertiary education have an average of 2.4 children compared to those with no education who have on average 6.4 children in lifetime (2018 ZDHS). It has further been observed that contraceptive use increases as education of a woman increase, and relatively high among women with tertiary education than women with no education.

A study done by Mwewa 2017, on the Effects of the pill, injectable and Male Condom on Fertility in Urban Zambia using ZDHS 1992 to 2014 and deploying Poisson, it was noted from the findings of this study that Contraceptive Methods alone are inefficient to explain fertility reduction among urban women in Zambia.

Contraceptive use is affected by several demographic and socio-economic factors of a woman which includes Education, Residence, Wealth of a woman etc. A study done by (Chola and Michelo, 2016) the effect of proximate determinants of fertility in Zambia using Bongaarts' model. This was a cross-sectional analysis of women's data from the 2007 Zambia Demographic and Health Survey (ZDHS). A total of 7,146 women aged 15 to 49 years participated in the ZDHS. Bongaarts' model was employed in the data analysis. The study found that with contraception, however, the impact on fertility increased with increase in both education and wealth. The effect of contraception on fertility was higher among women with higher education (13%) than among those with no education (5%). Similarly, the effects of contraception were higher among the richest women (9%) than among the poorest women (6%). This was in line with a study conducted in sub-Saharan Africa which found that there was an association between education of a woman and contraceptive use (Bongaarts and Hardee, 2019).

Table 2 below shows the trends of contraceptive prevalence rate (CPR) from the period 1992 to 2018 for Luapula province. The contraceptive prevalence rate (CPR), a percentage measure of women of the reproductive age, currently married or in a union and are using contraceptive methods. The rate has increased from 15.8 percent in 2007 to 39.1 percent 2018 (2007, 2018 ZDHS).

Table 2: Percent distribution of contraceptive prevalence rate for Luapula Province 1992-2018

	1992	1996	2001-2	2007	2013-14	2018
CPR	9.5	10.9	31.8	15.8	34.5	39.1

Source;*1992- 2018 ZDHS Reports*

On the other hand, Table 3 below shows the trends of contraceptive prevalence rate (CPR) from the period 1992 to 2018 for Zambia. The contraceptive prevalence rate (CPR) has increased from 15.2 percent in 1992 to 49.6 percent 2018 (2007, 2018 ZDHS).

Table 3: Percent distribution of contraceptive prevalence rate for Zambia 1992-2018

	1992	1996	2001-2	2007	2013-14	2018
CPR	15.2	25.9	34.2	40.8	49.0	49.6

Source;*1992- 2018 ZDHS Reports*

The above literature has given an overview of how demographic and socio-economic factors have affected fertility in many countries of the world. However, all these studies reviewed show very little or no information that is directly discussing studies in Luapula province. On the other hand, the studies did not utilize data from Luapula, and no trend study was done. Hence the study was undertaken to understand the trend of fertility using data for Luapula in understanding.

In nutshell, this literature review gives a basis for the comprehensive analysis of this study as the results observed in above studies helped to explain the results obtained in this study.

2.2. Theoretical and Conceptual framework

2.2.1. John Bongaarts (1978) analytical fertility Framework

To understand demographic and socio-economic factors associated with fertility in Luapula province, the study used analytical fertility framework developed by John Bongaarts in 1978.

Davis and Blake (1956) classified the factors affecting fertility into background determinants and intermediate or proximate determinants. The background determinants include cultural, psychological, economic, social, health and environmental factors. These operate through the proximate determinants to influence fertility.

Davis and Blake identified a framework with 11 proximate determinants of fertility, but their classification failed to obtain a wide acceptance as it was not easily incorporated into the analysis of fertility. In 1978, John Bongaarts restructured the ideas of Davis and Blake and developed the proximate determinants framework and a model for assessing the impact of each of the proximate determinants on fertility. On the other hand, unlike the main precept of Davis and Blake theory which is to limit fertility analysis to married women. Bongaarts recognized the fertility analysis to unmarried women too. Davis and Blake noticed that the onset of marriage in many societies marks the beginning of reproduction for women and determines their length of exposure to childbearing. Furthermore, married women are likely to have more children as compared to those who are single. Bongaarts' new classification comprised of eight proximate determinants of fertility, namely proportion married, contraception, induced abortion, lactational infecundability, frequency of intercourse, sterility, spontaneous intrauterine mortality and duration of the fertile period (Bongaarts, 1978)

Using data from 41 developed and developing countries Bongaarts and Potter (1983) observed that 96 per cent of the fertility variation among populations could be explained by four principal proximate determinants: proportion of married women, contraceptive use and effectiveness, induced abortion, and postpartum infecundability. Later in 1984, Bongaarts added a fifth variable, primary sterility to the proximate determinants model. Bongaarts and Potter 1983 summarized the effect of each determinant on fertility in an index, which generally ranges from 0 to 1 with 0 having the great inhibiting effect on fertility and 1 having the least inhibiting effect. This means the lower the index of a proximate determinant, the more it reduces fertility.

These proximate factors are important in understanding the fertility trends, pattern and levels of a given population which in this case is the fertility of Luapula province of Zambia. Besides the

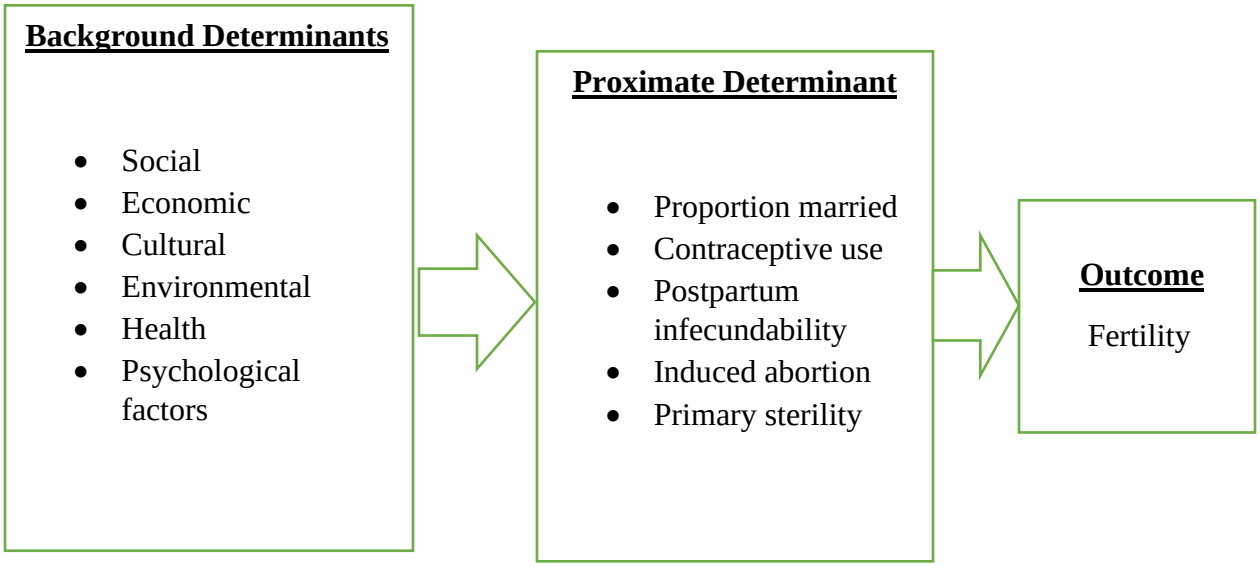
behavioral and biologic proximate factors that influence fertility directly, Bongaarts also noted the factors that affect fertility indirectly through the proximate factors these include cultural, psychological, economic, social, health and environmental factors (Bongaarts, 1978).

Using the Bongaarts variables relating to fertility, this study aimed at investigating the role of demographic and socio-economic factors on fertility of Luapula province. This study did not concentrate on the entire Bongaarts framework.

Nevertheless, the analysis of Children Ever Born (CEB) in this study considered all women in Luapula province irrespective of their marital status and regardless of either reported using or non-use of contraceptives. This is since the commencement of sexual unions exposes all woman to the risk of getting pregnant regardless of their marital status and hence influencing the fertility levels, trends and pattern in each population. Hence the framework below (Figure 1) forms a base of an important aspect of this study on demographic and socio-economic factors associated with fertility of Luapula province. The framework explains the interaction of background determinants with proximate determinants to affect fertility, this gives a proper understanding on possible association of demographic and socio-economic variables with fertility.

2.2.2. Conceptual Framework (Bongaarts' Fertility Framework, 1984)

Figure 2.2.2.1: Conceptual Framework



Source: John Bongaarts (1984)

2.2.3. Study Conceptual Framework

In the study framework, the study only used some of social demographic, socio-economic factors, and proximate factors, thus it operationalized social demographic (age, residence, and marital status), Socio-economic (education level and employment status), proximate (contraceptive use and age at first birth) factors only. This was relevant in understanding and showing the factors influencing fertility in Luapula province of Zambia.

For instance, socio-economic factors such as education level of a woman influences the fertility in the sense that the more educated a woman is, the more likely she delays childbearing because of high school commitments. A woman with high education level has more access to contraception information and good health seeking behavior. Educated women do not prioritize childbearing until in their late twenties or early thirties this is due to the fact of wanting to pursue their career hence this may have a great effect on fertility. On the other hand, employment status also indirectly affects the fertility of a woman, working women tend to have fewer children than those not working, this is achieved using contraceptives.

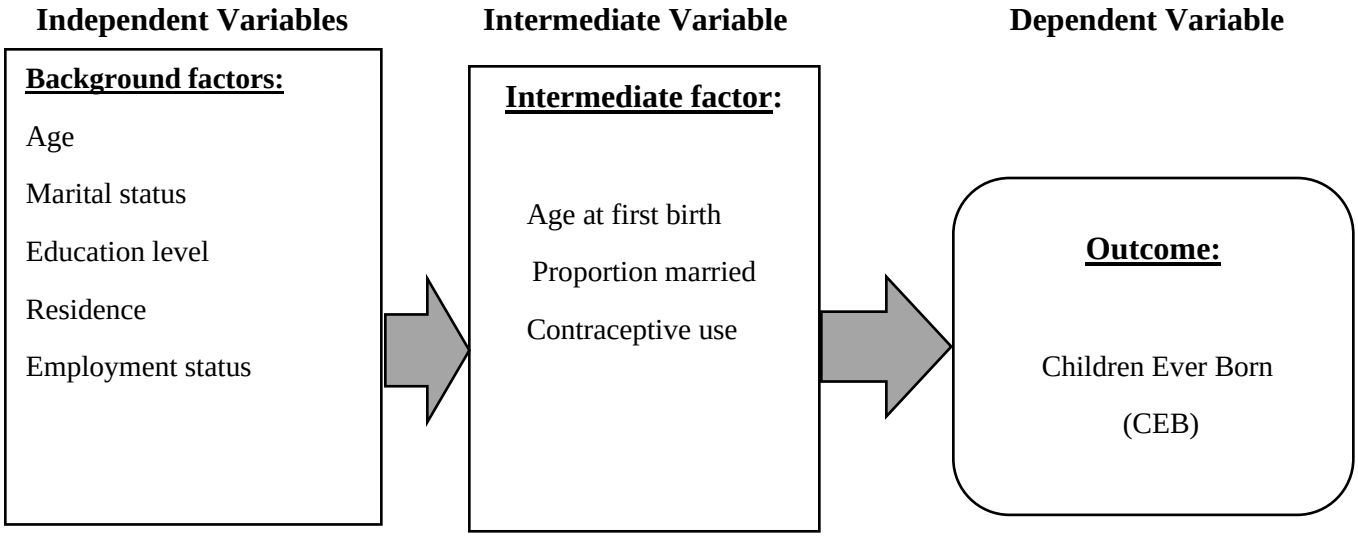
Demographic factors such as age, residence and marital status of a woman affects the fertility of a woman. With residence (rural or urban) influence the level and pattern of fertility of a woman, women from urban areas are expected to positively contribute to the reduction of fertility levels than women from rural areas. Urban women have proper access to family planning services, hence utilizing the opportunity. It is also assumed that women in urban areas tend to marry at older ages thereby delaying the onset of childbearing leading to less time spent in marriage. This means less time in childbearing, hence affecting the fertility.

Marital status may cause an effect on levels of fertility of a woman. If there are a lot of married women, this translates into having a larger proportion married. Marriage has a great effect on fertility as it is assumed that the most important reason to why people marry is to have children. Henceforth fertility is seen to be high for the married compared to the unmarried women. On the other hand, women who are unmarried tend to use contraception to prevent themselves from getting pregnant at a wrong time before they get married.

As a result of high use of contraception, it influences fertility because those using contraceptives stand less chances of having children compared to those not using. Age at marriage also plays a

role in affecting fertility in the sense that those who marry at younger ages spend more time at risk of childbearing than those who marry in older ages.

Figure 2.2.3.1: Study Conceptual Framework



Source: Adapted from John Bongaarts

Definition of terms

i. **Fertility:** Fertility is the ability to conceive and bear children through normal sexual action. Total Fertility Rate is defined as the average number of children a woman would bear if fertility rates remained unchanged during her lifetime (UN, 2013).

ii. **Socio-economic factors:** these included education, wealth index and employment status of the women interviewed in the survey.

iii. **Demographic factors:** these included Age, Residence and Marital status of the women interviewed in the survey.

iv. **Contraceptive –** this is the intentional prevention of conception using various devices, sexual practices, chemicals, drugs or surgical procedures. In this study, contraceptive use was referred to as whether one is currently using contraceptives or not. (UNFPA 2015)

v. **CEB** is defined as the total number of children a woman would have until the end of her age reproductive age given that she is subjected to a prevailing age specific fertility rate.

CHAPTER THREE: STUDY METHODOLOGY

This chapter describes methods applied to achieve objectives of this study, vigorous systematic and scientific approach was used paying much attention to study design and population definition. The chapter is presented by detailing the description of the study design, data sources and justification; target population and sample, inclusion/exclusion criteria of sample and description of variables. It also comprises of details of the data analysis.

3.1. RESEARCH DESIGN

The research used a non-intervention research design; this is because non-intervention study involves no manipulation to the target population. The study is also descriptive in nature since it only sought to investigate on how demographic and socio-economic factors are associated with fertility (CEB) among women of reproductive ages (15-49) in Luapula Province of Zambia since 1992 to 2018.

3.2. DATA SOURCE

The study used secondary data from the Zambia demographic and health surveys (ZDHS) conducted in 1992, 1996, 2001-2, 2007, 2013-14 and 2018. The Zambia Demographic and Health Surveys (ZDHS) is among the activities under the measure DHS Program and has since 1992 been able to produce data on socio-economic and demographic aspects of the population in Zambia. Data is collected from women and men aged 15-49 and 15-59 years respectively; using two different questionnaires. For this study, the women's dataset was used, and this includes data such as: reproductive history, fertility preferences, knowledge, access and use of contraceptives, breast-feeding practices, and maternal health service utilization, nutrition of women and children, and child mortality. This data gives a good source of information that was relevant for this research.

3.2.1. Justification on use of the ZDHS

The ZDHS gives a good source of data for this research since the sample size is nationally representative, the samples for ZDHS were stratified samples selected in two stages from the census of population and housing frames. Stratifications for all surveys were achieved by separating every province into urban and rural areas, samples were selected independently in every stratum by two-stage selection. Furthermore, the ZDHS applies comprehensive consistency checks and data quality methods that make the data of high quality. The women's dataset contains information on Children Ever Born (CEB) to women until the date of the survey, demographic, and socio-economic factors as well as the proximate determinants of fertility.

3.3. DESCRIPTION OF THE TARGET POPULATION AND SAMPLE

All the ZDHS samples are nationally representative samples of women who are in the reproductive age (15-49 years) and, hence, gives good estimates of data on CEB and the factors that might be influencing it. The target population for the study is women in the age group 15-49 years throughout all the ZDHS conducted between 1992 and 2018. The sample for the study was all women who reported residing in Luapula province. Furthermore, the sample focused on all Luapula women who were sexually active regardless of their marital status and who reported ever using of contraceptive and the non-use (will be treated as a reference category). Luapula province was used because it is where fertility has remained relatively high. Therefore, this helped to investigate which demographic and socio-economic factors have contributed to high fertility.

3.3.1. Sample inclusion and exclusion

Women residing in Luapula province both in rural and urban areas were included in the research sample. To measure properly the variable CEB, the sample only included women who have ever had a child and those who have never had a child were excluded from the sample.

3.3.2. Study Sample Size

Below were the samples for the given survey years after having met the criterion for inclusion to the study.

Table 3.3.1.1: ZDHS samples

Survey Year	1992	1996	2001	2007	2013-14	2018
Actual Sample	589	896	626	704	1585	1414
Included Sample	437	649	478	546	1263	1070

3.4. VARIABLE IDENTIFICATION AND MEASUREMENT

3.4.1. Outcome/ Dependent variable

This study used Children Ever Born as its dependent variable. CEB is defined as the total number of children a woman would have until the end of her age reproductive age given that she is subjected to a prevailing age specific fertility rate. The children ever born is count data and is given by 1,2,3,4, 5……16.

3.4.2. Independent Variables

The independent variables the study included age of woman, residence, education level of the woman, marital status, employment status, age of a mother at first birth and contraceptive use. Age of woman was categorized as; 15-24 (treated as reference category), 25-34 and 35-49, Residence had two categories urban and rural. The education level of woman had three categories: No education, primary education and secondary +. In all the regression analysis, women with no education were treated as reference category. Marital status of woman had two categories; married and unmarried; Unmarried was treated as reference category. And age of a mother at first birth was categorized as; <15 (treated as reference category), 15-19 and 20+. Employment status was categorized as Working and not working. The main independent variable is the contraception use and it was categorized as using and not using. Those reported not using was treated a reference category.

3.4.3. Operational definitions of variable

This section presents operational definitions of the dependent and independent variables used in this study.

Table 3.4.3.1: Operational definitions of dependent and independent variables

VARIABLE	QUESTION	RESPONSE	SCALE OF MEASUREMENT
DEPENDENT VARIABLE			
Children ever born	this developed from a series of questions on birth history of a woman such as the number of sons and daughters currently living with her, sons and daughters living elsewhere, and number of sons and daughter who were born alive but later died.	0, 1, 2, 3, 4,……..15	Ordinal
INDEPENDENT VARIABLE			
Age	How old were you on your last birthday?	15,16, 17, 18, …49	Ordinal
Education	Have you ever attended school? What is the highest level you have attended?	No education Primary Secondary Higher	Nominal
Employment	whether a woman had done any work in the 12 months prior to the survey?	Yes No	Nominal
Marital status	Whether a woman has ever been married/lived with someone as if married?	Yes, currently married Yes, living with a man Widowed Separated Divorced No, not in union (never married)	Nominal
Age of a mother at first birth	How old were you on your first birth?	12, 13, 14, 15, 16, 17, 18, …49	Ordinal

Contraceptive use	Whether or not a woman was currently doing something or using any method to delay or avoid getting pregnant. And if using, which method.	Yes No	Nominal
Residence	what is your place of residence	Urban Rural	Nominal

3.5. DATA ANALYSIS

Analysis of data in this study was done using the statistical software Stata 14.0. Data was thoroughly assessed before any analysis was conducted, it was checked for completeness and consistency for all dataset hence all missing responses were dropped. This was done by ensuring that all datasets for the different survey years had uniform data to be used for analysis. In addition, recoding of variables was done according to the definition of the researcher and to ensure that all survey years had the same variables. All missing and inconsistent cases were excluded from the sample and analysis. Survey weights were then applied to make an inference of the results to the entire Luapula province women population.

The analysis of the data was done in three stages. First, descriptive statistics was conducted to determine the percentage distribution of women of Luapula province in the study sample. Second, bivariate, and multivariate analysis were conducted. To achieve objective 1, bivariate analysis was performed to determine the association between CEB and all background and proximate variables. To attain objectives 2 and 3, multivariate analysis was conducted using Poisson regression to determine whether the Incidence Rate Ratios (IRR) of CEB are associated with all the independent variables and how the interaction of proximate factors have influenced CEB among women of Luapula province; stepwise regression method was used in model building. The Goodness-of-fit of the model using Poisson BIC was used to determine how good the model is. To enable the presentation of study findings, tables were used.

3.5.1 Poisson Logistic Regression model

To measure the extent of the effect of each independent variable on the dependent variable, regression analysis was performed. The study used Poisson regression to measure the influence of demographic and socio-economic factors on Children Ever Born. The choice to use Poisson regression was since the outcome variable “Children Ever Born” has some traits which prompts the use of Poisson regression. To start with, CEB is a count data for instance 1, 2, 3…. 16; CEB

has non-negative values, and its distribution is likely not to be normally distributed. Hence Poisson regression was suitable for such a dependent variable.

Below is Poisson regression equation showing the interaction of independent variables.

$$\ln(\mu) = \alpha + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \ldots\ldots\ldots\ldots + \beta_k X_k$$

Where, ln(μ), log of the mean count. (Mean CEB)

$\alpha, \beta_1, \beta_2, \beta_3 \ldots\ldots\ldots\ldots \beta_k$ are Poisson regression coefficients.

$X_1, X_2, X_3 \ldots\ldots\ldots\ldots X_k$ these are the independent variables of the study.

Assumption of Poisson regression

- Changes in the rate from combined effects of different explanatory variables are multiplicative.
- At each level of the covariate the number of cases has variance equal to the mean,
- Errors are independent of each other

For this study, results of the Poisson Regression of children ever born (CEB) have been interpreted using Incidence Rate Ratio (IRR). The incident rate, ri for the *i*th observation is given by:

$$ri = e^{\beta 1X1+\cdots+\beta i(Xi+1)+\cdots+\beta nXn}{}_i$$

where: *e* is the exponentiated coefficient

Therefore, the incidence rate ratio is given by:

$$IRR = \frac{e^{\beta 1X1+\cdots+\beta i(Xi+1)+\cdots+\beta nXn}{}_i}{e^{\beta 1X1+\cdots+\beta iXi+\cdots+\beta nXn}{}_i}$$

For categorical variables, the interpretation of IRR is as follows:

- IRR less than 1 means women in a particular category of a variable had fewer children than women in the reference group.
- IRR more than 1 means women in a particular category of a variable had more children than women in the reference group.

- IRR equal to 1 means there are no differences in the observed number of children ever born to women in a particular category of a variable and women in the reference group.

3.5.2 Modelling strategy using Poisson Logistic Regression

The modelling strategy firstly grouped variables into three groups as follows; the outcome variable which is CEB. The independent variables (age, marital status, education level, residence, employment status), the intermediate variables (age at first birth and contraceptive use)

The first model was a model of CEB with demographic factors, this was so to help find the effects of demographics on CEB. In the second model, all the socio-economic variables were added. The third model was developed to include all independent variables adjusted for proximate determinants. This was done to determine the influence of proximate determinants on CEB. The models are demonstrated below:

1. $\ln(\text{mean } \mathbf{CEB}) = \alpha + \beta_1 \text{age} + \beta_2 \text{residence} + \beta_3 \text{marital status}$
2. $\ln(\text{mean } \mathbf{CEB}) = \alpha + \beta_1 \text{age} + \beta_2 \text{residence} + \beta_3 \text{marital status} + \beta_4 \text{education level} + \beta_5 \text{emploment status}$
3. $\ln(\text{mean } \mathbf{CEB}) = \alpha + \beta_1 \text{age} + \beta_2 \text{residence} + \beta_3 \text{marital status} + \beta_4 \text{education level} + \beta_5 \text{emploment status} + \beta_6 \text{ Age at first birth} + \beta_7 \text{ contraceptive use}$

3.6. LIMITATION OF THE STUDY

The use of secondary data at times yields a lot of challenges, especially where analysis is conducted for different survey years and results must be compared and a conclusion on the study topic made. This requires that the same variables are used. Therefore, the major limitation of this study was wealth index which might have an influence on children ever born was not used in the analysis as the ZDHS datasets before 2001-2 did not have this variable.

3.7. ETHICAL CONSIDERATION

This study is a secondary analysis of 1992-2018 ZDHSs and as such, the datasets had comprehensive ethical clearance at different levels, and it had no known research subject identifiers. no ethical approval was required. Considering that the Zambia Demographic and Health Survey [ZDHS] datasets are managed by micro-international under the measure DHS, the researcher sought for permission from Measure DHS to use the Zambia female datasets for 1992 to 2018 specifically for use in analysis for this study and the datasets were not used for any other

purpose. The researcher registered and requested for access to the female datasets from DHS on-line archive and received an approval to access and download de-identified DHS data files particularly for this study. All guidelines, including treating data as confidential and not making effort to identify individual respondents, were respected. For the ZDHS consent is obtained from respondents. Besides the initial consent, respondents are also informed about the availability of sensitive questions in the questionnaire and are reassured regarding the confidentiality of their responses.

CHAPTER FOUR: STUDY FINDINGS

This chapter is the key findings of the study. To start with, the chapter presents the background characteristics (demographics and socio-economic characteristics) of women of reproductive ages in Luapula province. Second the chapter presents the bivariate analysis results associations of CEB and demographics, socio-economic and proximate factors using the Incident Rate Ratios (IRR). Last but not the least is the multivariate analysis, this involved model building to show the Adjusted Incident Rate Ratios (AIRR).

4.1: Background and Proximate characteristics of Luapula province women in reproductive age group.

This section presents percentage distribution of women aged 15-49 years of Luapula Province who had at least one child and reported either to have used or not used any contraceptive methods by demographic and socio-economic characteristics. Results in Table 4.1 shows that most women in the study were aged 25-34 with the lowest being women aged 15-24. Majority of the women in the study for all the survey years are from rural area. In terms of education level most of the women had acquired primary education with 68.2 percent, 68.7 percent, 74.5 percent, 65.8 percent, 59.5 percent, and 56.7 percent in the year 1992, 1996, 2002, 2007, 2014 and 2018 respectively. Women with Secondary + education was fewer for survey years from 1992 to 2002, on the other hand from 2007 to 2018 survey years those with no education were fewer compared with other education levels.

In terms of Marital status, most of the women were married with few of them reported having never been married. The results also show that most of the women in the study were working compared to those reported not working, except for the years 1992 and 2007 which show that women not working were more than those working.

Table 4.1 shows percentage distribution of women by age at birth of their first child and contraceptive use status in Luapula province. In all the survey years under study (1992 to 2018), results show that age at birth of a first child for most women was 15-19 for all survey years followed by those having first birth at ages 20 and above. Findings also show that fewer women had given birth before 15 years of age. In terms of contraceptive use, majority of women in Luapula province were reported not using contraceptives for all the survey years with few reported having used contraceptives regardless of the type and method used.

Table 4.1: Percent distribution of Luapula Province women by demographic and socio-economic characteristics, 1992-2018

Table 4.1: Background characteristics of women of reproductive ages of Luapula province						
	n (%)					
Variable	**1992**	**1996**	**2002**	**2006**	**2014**	**2018**
Age						
15-24	148 (33.9)	204 (31.4)	140 (29.3)	149 (27.3)	283 (22.4)	281 (26.3)
25-34	149 (34.1)	233(35.9)	170 (35.6)	238 (43.6)	551 (43.6)	408 (38.1)
35-49	140 (32.0)	212(32.7)	168 (35.1)	159 (29.1)	429 (34.0)	381 (35.6)
Residence						
Urban	68 (15.6)	118 (18.3)	79 (16.5)	172 (31.5)	465 (36.8)	312 (29.2)
Rural	369 (84.4)	531 (81.8)	399 (83.5)	374 (68.5)	798 (63.2)	758 (70.8)
Education level						
No education	86 (19.7)	113 (17.4)	67 (14.0)	63 (11.5)	127 (10.1)	127 (11.9)
Primary	298 (68.2)	446 (68.7)	356 (74.5)	359 (65.8)	752 (59.5)	607 (56.7)
Secondary +	53 (12.1)	90 (13.9)	55 (11.5)	124 (22.7)	384 (30.4)	336 (31.4)
Marital status						
Unmarried	84 (19.2)	132 (20.3)	103 (21.5)	105 (19.2)	308 (24.4)	300 (28.0)
Married	353 (80.8)	517 (79.7)	375 (78.5)	441 (80.8)	955 (75.6)	770 (72.0)
Working status						
Not working	271 (62.0)	141 (21.7)	15 (3.1)	330 (60.4)	361 (28.6)	322 (30.1)
Working	166 (38.0)	508 (78.3)	463 (96.9)	216 (39.6)	902 (71.4)	748 (69.9)
Age at first birth						
<15	40 (9.2)	55 (8.5)	27 (5.7)	35 (6.4)	59 (4.7)	65 (6.1)
15-19	305 (69.8)	449 (69.2)	337 (70.5)	377 (69.1)	809 (64.1)	651 (60.8)
20+	92 (21.1)	145 (22.3)	114 (23.8)	134 (24.5)	395 (31.2)	354 (33.1)
Contraceptive use						
Not using	401 (92.0)	585 (90.1)	341 (71.3)	454 (83.2)	830 (65.7)	665 (62.2)
Using	35 (8.0)	64 (9.9)	137 (28.7)	92 (16.8)	433 (34.3)	405 (37.8)
Total	437 (100.0)	649 (100.0)	478 (100.0)	546 (100.0)	1263 (100.0)	1070 (100.0)

Source Based on 1992, 1996, 2001-2, 2007, 2013-14 and 2018 ZDHS Datasets

4.2: Bivariate Association: CEB by Demographic, Socio-economic and Proximate Factors

This section presents results of the bivariate association between CEB and demographic and socio-economic as well as proximate (intermediate) factors. Findings in Table 4.2 show that older women 25 years and above (25-34 and 35-49 years) had significantly more children for instance 1996 (IRR = 2.386, 95% CI 2.060-2.764) and (IRR = 3.937, 95% CI 3.521-4.401) than younger women aged 15-24 years. In terms of residence, the results show that women from rural areas had significantly more children than women from urban area for all the survey years apart from 1996 (IRR =0.973, 95% CI 0.778-1.216) where it shows a slightly more children for urban women compared to rural women.

The findings on IRR of CEB by education level of women of Luapula province show that women with secondary + education had significantly fewer children for 1992, 2002 and 2006 (IRR = 0.671, 95% CI 0.474-0.950), (IRR = 0.823, 95% CI 0.580-1.166) and (IRR = 0.754, 95% CI 0.599-0.951) respectively compared to women with no education. The results from the table below show that married women had significantly more children than women who were unmarried for all the survey years apart from 1992 survey year which shows married women had more children than unmarried women though results were not significant, this means that the difference in children ever born for the two categories was by chance. The currently working women of Luapula province had significantly more children compared to the unemployed (not working) for all the survey years apart from the 1992 (IRR = 1.064, 95% CI 0,928-1.220) which shows vice versa.

Table 4.2 also shows the IRR of CEB by proximate determinants (age of the woman at first birth and the contraceptive use status). The findings show that women who had their first birth/child at ages 15 years and above (15-19 and at 20+) had significantly fewer children for instance 2018 (IRR =0.798, 95% CI 0.681-0.936) and (IRR = 0.682, 95% CI 0.565-0.824) than the women who had their first child before age of 15 years. Women who reported to have used contraceptives regardless of the method and type used had relatively more children than women who reported not using any of the contraceptive methods.

Table 4.2: IRR of CEB by socio-economic, demographic, and proximate variables, 1992-2018

Unadjusted IRR of CEB by Demographic, Socio-economic and Proximate variables, 1992-2018							
		IRR	IRR	IRR	IRR	IRR	IRR
Variable	Category	1992	1996	2002	2006	2014	2018
Age group	15-24 (RC)						
	25-34	2.386**	2.219**	2.129**	2.316**	2.371**	2.382**
		[2.060-2.764]	[1.873-2.630]	[1.940-2.336]	[2.070-2.591]	[2.201-2.554]	[2.210-2.566]
	35-49	3.937**	3.885**	3.821**	3.707**	3.721**	4.196**
		[3.521-4.401]	[3.469-4.351]	[3.434-4.252]	[3.227-4.259]	[3.443-4.021]	[3.907-4.505]
Residence	Urban (RC)						
	Rural	1.248*	0.973	1.157	1.196**	1.102**	1.214**
		[1.038-1.501]	[0.778-1.216]	[0.871-1.537]	[1.054-1.356]	[1.026-1.185]	[1.091-1.349]
Education level	No education (RC)						
	Primary	0.847	0.898	0.985	1.018	0.998	0.967
		[0.623-1.152]	[0.750-1.074]	[0.793-1.224]	[0.814-1.274]	[0.907-1.098]	[0.840-1.113]
	Secondary +	0.671*	0.650**	0.823*	0.754*	0.675**	0.600**
		[0.474-0.950]	[0.489-0.864]	[0.580-1.166]	[0.599-0.951]	[0.602-0.757]	[0.522-0.690]
Marital status	Unmarried (RC)						
	Married	1.064	1.211*	1.214**	1.199**	1.303**	1.419**
		[0,928-1.220]	[1.042-1.407]	[1.026-1.436]	[1.023-1.405]	[1.189-1.427]	[1.293-1.556]
Working status	Not working (RC)						
	Working	0.948	1.387**	1.813**	1.175**	1.227**	1.360**
Age at first birth	<15 (RC)	[0.809-1.111]	[1.127-1.706]	[1.210-2.718]	[1.046-1.320]	[1.130-1.332]	[1.221-1.513]
	15-19	0.761*	0.788**	0.771*	0.823*	0.787**	0.798**
		[0.623-0.928]	[0.672-0.924]	[0.613-0.970]	[0.709-0.954]	[0.677-0.914]	[0.681-0.936]
	20+	0.587**	0.574**	0.584**	0.627**	0.681**	0.682**
		[0.448-0.773]	[0.489-0.673]	[0.450-0.758]	[0.520-0.757]	[0.571-0.812]	[0.565-0.824]
Contraceptive use	Not using (RC)						
	Using	1.135	1.231*	1.135	1.048	1.204**	1.087***
		[0.755-0.1.706]	[1.039-1.458]	[0.965-1.334]	[0.920-1.195]	[1.111-1.305]	[1.013-1.142]

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; RC: Reference Category*
Source: Calculated using the 1992-2018 ZDHS Dataset

Figure 4.1 strengthens the information observed in Table 4.2, it provides a trend in IRR of the CEB by age and marital status of Luapula women. The figure shows that there is a steady increase in

the number of children born to women who are married over the years, from 1.064 children in 1992 to 1.419 children in 2018. Women aged 35-49 saw a slightly reduction in the number of children from 3.937 in 1992 to 3.707 in 2006 but increases to 4.196 in 2018.

Figure 4.1: IRR of CEB by age and marital status

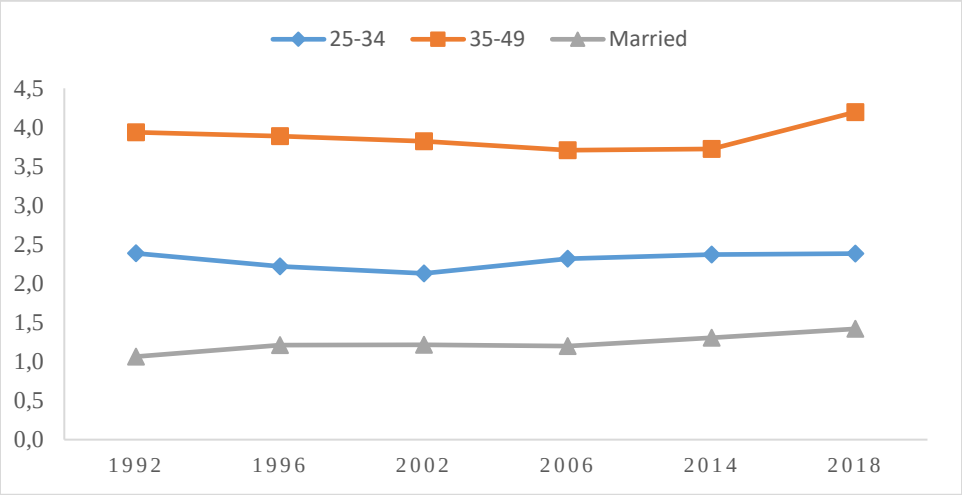


Figure 4.2: IRR of CEB by contraceptive use and education

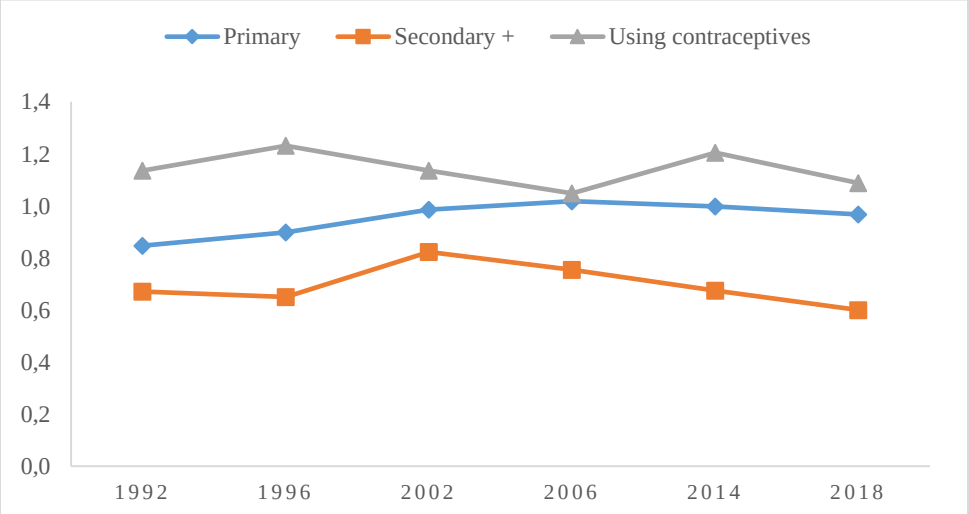


Figure 4.2 above provides a trend in IRR of the CEB by Contraceptive use and educations of women in Luapula. There is a steady increase in the number of children born to women using contraceptives from 1.135 children in 1992 to 1.231 in 1996 and a slight increase from 1.204 children in 2014 to 1.087 in 2018.

4.3: Multivariate Results: CEB, Demographic, Socio-economic Characteristics and Proximate factors.

This section shows multivariate results for the survey years; 1992 to 2018. Results shown in this section are for the final models (Model 3) and the Adjusted Incidence Rate Ratio (AIRR) of CEB which is adjusted for age, residence, marital status, education level, employment status, age at birth of first child and contraceptive use. Other results showing model building are in the Appendix.

In model 3 of Table 4.3, the AIRR of CEB by women aged 25-34 and 35-49 years shows that these women had relatively more children than women aged 15-24 years. However, to prove that the difference was not by chance, the results for all the survey years show women aged 25-34 and 35-49 had significant more children e.g., 2018 (IRR =2.393, 95% CI 2.148-2.667) and (IRR =4.081, 95% CI 3.675-4.532) compared to those aged 15-24. Results also show that there were no statistically significant differences in the number of children ever born between women residing in Urban and Rural, except for survey years 2014 and 2018 with (IRR =1.053, 95% CI 0.992-1.118) and (IRR =1.090, 95% CI 1.012-1.173) respectively which indicate that women from rural areas had statistically significant more children compared to women from urban areas. Furthermore, results in table 4.3 also show that there were fewer children born to unmarried women, women who were currently married were likely to have more children. It can be seen from the table below that married women had statistically significant more children than the unmarried women for all the survey years. For instance, 1992 and 2018 show (IRR = 1.178, 95% CI 1.051-1.321) and (IRR = 1.205, 95% CI 1.120-1.297) respectively.

Additional, table 4.3 also shows that women with secondary + education for survey years 2014 and 2018 had significantly fewer children than women who had no education (IRR = 0.803, 95% CI 0.725-0.889) and (IRR = 0.763, 95% CI 0.686-0.849) respectively. Women with primary education had fewer children compared to those with no education, there was no statistically significant differences in the number of children between the two categories for all the survey years.

However, with employment status, there were no statistically significant differences in the number of children ever born between currently working women and not working women for all the survey years apart from survey year 1996 which shows the difference was statistically significant.

Results also reveal that women who had their first child at 20 years and above were associated with having fewer children compared to women who had their first child at ages less than 20 years. For instance, survey years 2014 and 2018 show (IRR = 0.625, 95% CI 0.555-0.704) and (IRR = 0.858, 95% CI 0.599-0.757)

With contraceptive use, it can also be seen that women who were reported using contraceptives had more children than those not using contraceptives for all survey years, for example survey year 2018 (IRR = 1.088, 95% CI 1.023-1.158). As for 1996 and 2006 survey years, the association between Contraceptive use and CEB is not statistically significant meaning the difference in the number of CEB between those using and not using was by chance.

Table 4.3: AIRR of CEB by demographic, socio-economic, and proximate variables, 1992-2018

Table 4.3: AIRR of CEB by Demographic, socio-economic and Proximate variables, 1992-2018							
		AIRR [95% CI]	AIRR [95% CI]	AIRR [95% CI]	AIRR [95% CI]	AIRR [95% CI]	AIRR [95% CI]
Variable	**Category**	**1992**	**1996**	**2002**	**2006**	**2014**	**2018**
Age group	15-24 (RC)						
	25-34	2.426**	2.242**	2.287**	2.330**	2.295**	2.393**
		[2.113-2.784]	[1.99-2.522]	[1.977-2.645]	[2.031-2.673]	[2.075-2.538]	[2.148-2.667]
	35-49	4.025**	3.820**	4.030**	3.727**	3.681**	4.081**
		[3.529-4.590]	[3.412-4.477]	[3.517-4.617]	[3.252-4.272]	[3.329-4.070]	[3.675-4.532]
Residence	Urban (RC)						
	Rural	1.092	0.995	1.017	1.076	1.053*	1.090*
		[0.947-1.258]	[0.905-1.094]	[0.896-1.155]	[0.978-1.184]	[0.992-1.118]	[1.012-1.173]
Marital status	Unmarried (RC)						
	Married	1.178**	1.220**	1.248**	1.207**	1.182**	1.205**
		[1.051-1.321]	[1.107-1.444]	[1.111-1.401]	[1.076-1.354]	[1.104-1.266]	[1.120-1.297]
Education level	No education (RC)						
	Primary	0.965	0.996	1.009	1.006	0.981	0.995
		[0.865-1.075]	[0.908-1.093]	[0.892-1.143]	[0.884-1.145]	[0.900-1.069]	[0.913-1.085]
	Secondary +	0.918	0.911	0.973	0.853***	0.803**	0.763**
		[0.759-1.111]	[0.787-1.055]	[0.807-1.173]	[0.724-1.004]	[0.725-0.889]	[0.686-0.849]
Working status	Not working (RC)						
	Working	1.026	1.113***	1.219	1.027	1.010	1.048
		[0.934-1.128]	[1.009-1.228]	[0.876-1.695]	[0.943-1.118]	[0.947-1.077]	[0.976-1.124]
Age at first birth	<15 (RC)						
	15-19	0.890***	0.957	0.881	0.974	0.830**	0.858*
		[0.775-1.021]	[0.851-1.075]	[0.748-1.038]	[0.835-1.136]	[0.741-0.929]	[0.768-0.957]
	20+	0.611**	0.687**	0.611**	0.700**	0.625**	0.673**
		[0.516-0.724]	[0.594-0.791]	[0.507-0.737]	[0.590-0.832]	[0.555-0.704]	[0.599-0.757]
Contraceptive use	Not using (RC)						
	Using	1.152***	1.099	1.194**	1.048	1.107**	1.088*
		[0.980-1.354]	[0.981-1.231]	[1.084-1.314]	[0.939-1.170]	[1.046-1.172]	[1.023-1.158]
	Total	437	649	478	546	1263	1070

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category.*
Source: Calculated using the 1992-2018 ZDHS Dataset

CHAPTER FIVE: DISCUSION, CONCLUSION AND RECOMMENDATIONS

5.1: Discussion of findings

5.1.0: Overview

This chapter summarises the findings of the study and makes comparison of the findings of the study with other similar studies done worldwide by different researchers. Despite having remained relatively high in other regions of the country, fertility has declined in Zambia with more contribution from urban areas such as Lusaka and Copperbelt provinces. Therefore, this study investigates how demographic and socio-economic factors are associated with fertility in Luapula province of Zambia. The study achieved its results by investigating demographic and socio-economic factors associated with fertility of women of reproductive ages (15-49) in Luapula Province.

Additionally, the research hypotheses for the study were that women with Secondary + education are more likely to have fewer children than women with no education. Women who are unmarried are more likely to have fewer children than married women. And, that women using any method of contraceptives are more likely to have fewer children than women not using. The study sought to answer the following research questions: Is there an association between Demographic and socio-economic factors and fertility? If yes, which of the factors have played a more significant role in the prevailing levels of fertility in Luapula province? What effects does contraceptive use have on fertility in Luapula province?

5.1.1: Summary of main Results

Looking at the findings of the study, it can be noticed that women aged 25-34 and 35-49 years had relatively more children than women aged 15-24 years. Women of rural areas have statically significant more children than women from urban areas of Luapula province this could be because of women in rural areas have little knowledge on family planning services. The study findings also show that women with secondary + education had fewer children than their counterparts. On the other hand, the association of CEB and age of a woman at first birth, women who had their first birth/child at ages 15 years and above (15-19 and at 20+) had significantly fewer or less children than the women who had their first child before age of 15 years. Women who reported to have used contraceptives regardless of the method and type had relatively more children than women who reported not using any of the contraceptive methods, this implies that women are using contraceptives for child spacing but not minimizing number of children.

5.1.2: Demographic, Socio-economic factors and fertility

The findings of the study have shown that fertility of women in Luapula province is affected by different demographic and socio-economic factors. Results indicate that older women (25-34 and 35-49 years) had statistically significant more children than younger women aged 15-24 for all the survey years. This is because older women have spent more time in the childbearing age group compared to the younger ones. And the other reason is that older women have spent more time exposed to higher chances of bearing children or giving birth due to their marital status, most of them would have already been married at their ages compared to the younger ones who are likely to be single at these ages, this can also be explained by a low mean age (less than 20 years) at first marriage among women in Zambia (Fagbamigbe and Adebowale, 2014).

These results are in a way consistent with those from Kenya, in a study done by Mutwiri (2019) on his study of analyzing determinants of fertility differentials among the poorest women population. A binary logistic regression model was fitted to DHS 2014. The results showed that all the variables Age, Region, women educational level, marital status, and age at first marriage were found to have a significant effect on the total number of children ever born.

The study has also found that women with secondary + education had significantly fewer children compared to women with no education for survey years excluding 1992 to 2002 survey years which show there was no statistically significant difference in the number of children ever born between women with secondary + education and women with no education, this shows that the difference was by chance. The findings are in line with other studies that have found that education of a woman has a negative relationship with fertility. This is because education enables women to become knowledgeable about contraceptives, access, and use (Sackey, 2005; Lam and Duryea, 1999; Schultz, 1973; 1974; 1997; 2008; Mason, 1986).

A study in Albania, for example, found that decline in fertility from about 7 children in 1960 to about 3 children in 1990 was because of increased women's education, increased use of contraceptive methods and rapid expansion of jobs (Kent, 2010). Therefore, having an extra child is seen as a cost rather than as a benefit for an educated and working woman. This is because having a child comes with responsibilities and would require giving up developing a professional career which some women might not be willing to sacrifice. This makes educated women more likely to use contraceptives and reduce the number of children that they would have.

Furthermore, a study conducted about the decline in U.S fertility found that education level of women had contributed to the observed decline in fertility. According to the findings of this study, as more women attended and completed higher levels of education, this affected the timing of first marriage and birth, by typically delaying both (Jacobson and Mather, 2011).

In terms of residence, the results show that women from rural areas had significantly more children than women from urban area for all the survey years apart from 1996 where it shows a slightly more children for urban women compared to rural women. The reason for the results is because urban places typically offer better educational and modern sector job opportunities, better health facilities and more access to information on contraceptives and supplies. Urban areas also tend to face lower social and financial costs of fertility regulation, a rather lower labour value of children and higher out of pocket costs of having and raising children compared to rural areas. The findings are consistent with the findings of Tadesse (2010) in a study to examine the socioeconomic determinants of fertility in Ethiopia, it was found that urbanization plays a key role in reducing fertility compared to rural areas.

The study also found that there are fewer children born to women who are unmarried, women who were currently married were likely to have more children. The results show that women currently married had statistically significant more children compared to the unmarried women for all the survey years. This is because married women are highly visible to childbearing because of exposure to sexual activities.

On the other hand, the study's results on association of CEB and age of a woman at first birth for bivariate and multivariate analysis show that women who had their first birth/child at ages 15 years and above (15-19 and at 20+) had significantly fewer or less children than the women who had their first child before age of 15 years (bivariate). This is because women who had their first birth before age 15 have ample time spent in childbearing age group before they reach menopause compared to their counterparts. For multivariate analysis, there was not statistically significance difference in the number of children ever born between women who had their first birth/child at ages 15-19 and women who had their first child before age of 15 years for survey years 1992 to 2006.

5.1.3: Demographic, Socio-economic factors, Contraceptive use, and fertility

Demographic and socio-economic factors of a woman such as education level, residence, working status and wealth of a woman influence contraceptive use which may have an impact on fertility. A study done by (Chola and Michelo, 2016), the effect of proximate determinants of fertility in Zambia using Bongaarts' model. The study found that with contraception, however, the impact on fertility increased with increase in both education and wealth. This was in line with a study conducted in sub-Saharan Africa which found that there was an association between education of a woman and contraceptive use (Bongaarts and Hardee, 2019).

Using results from both bivariate and multivariate analysis level of this study, women of Luapula province in Zambia who reported using contraceptives regardless of the method and type had relatively more children for all survey years from 1992 to 2018 compared to women who reported not using any contraceptive methods. Nevertheless, it can also be noticed from the results that there was no statistically significant difference in the number of children born to women reported using and women who reported not using any of the contraceptive's methods and type in the survey years 1992 and 2006. This implies that the two groups of women had the difference in the number of children by chance. Looking at the results, women from Luapula are using contraceptives for child spacing and not reducing on the number of children born.

The results of this research conflict with the study hypothesis which states that women using any method of contraceptives are more likely to have fewer children than women not using, which is not the case with the findings. One possible explanation could be that women of Luapula province in Zambia are more likely to have been using these contraceptives for spacing of births rather than for limiting children. A similar study conducted by Chemhaka and Odimegwu, 2019 to examine the impact of each proximate factor (contraception, postpartum infecundability, abortion and sexual activity) on fertility in Eswatini. The analysis showed that contraception had the greatest impact of fertility reduction, the findings are in a way contradicting with this study's findings.

5.2: Conclusion

Fertility has an additive effect on the size of the population as well as likely to highly contribute to maternal mortality due to pregnancy complications, if not properly taken care of it may cause a negative impact on an economy of the affected region. The study aimed at investigating which Demographic and socio-economic factors are associated with fertility of women of reproductive ages (15-49) in Luapula province of Zambia, an analysis of Zambian Demographic and Health Surveys (ZDHS) female datasets for survey years 1992 to 2018. The researcher did a trend analysis of the association of Children Ever Born (fertility) with different Demographic and socio-economic factors.

The study concluded that factors such as age of a woman, education, residence, marital status, age of a woman at first birth have an influence on fertility of a woman. The findings show that older women (25-34 and 35-49 years) had significantly more children. In terms of residence, the results show that women from rural areas had significantly more children. There are several reasons for fertility differentials in the urban and rural populations. It has been argued that urban settings provide more economic opportunity and social freedom for women. In the urban areas, women are generally less dependent on men. Majority of women are from rural areas hence high illiteracy levels which gives no special ability to help women understand the importance of having small numbers of children.

Based on the findings of bivariate analysis, education level of women in Luapula province is highly correlated with fertility, women with primary and secondary + level of education had significantly fewer children. It is plausible that education depresses fertility by helping individuals to learn about contraception and by providing opportunities that may conflict with childbearing as well as by affecting the values and overall outlook of people towards life.

Furthermore, marital status of a woman has a strong association with CEB as results found that married women had statistically significantly more children than unmarried, this implies that married women contribute more to high fertility of Luapula. In terms of working status of a woman, the currently working women of Luapula province had significantly more children.

Age of the woman at first birth and the contraceptive use status are also correlated with fertility of a woman. The findings show that women who had their first birth/child at ages 15 years and above (15-19 and at 20+) had significantly fewer children. Similarly, women reported using

contraceptives regardless of the method and type had relatively more children than women who reported not using any of the contraceptive methods, this means the rejection of the research hypothesis which stated that that woman using any method of contraceptives are more likely to have fewer children than women not using.

5.3: Recommendations

Based on the findings of the study, the following recommendations are made to help in reducing fertility of women in Luapula province:

1. The study found that women with no education have more children, there is need to provide an aiding atmosphere for the attainment of higher education by women, Education will enable women to weigh the cost of having an additional child, henceforth contribute to low fertility. Additional, increased education level will impact women to obtain sufficient knowledge about contraceptive methods and access as well as use.
2. The study found that women marrying before age 15 have more children, The Government should revisit (by increasing) the legal age for marriage under statutory law, which is 18 years for women, this will contribute to the reduction in the levels of fertility because marital status highly contributes to high fertility levels.
3. Qualitative studies should be conducted to investigate the reasons why women are using the different contraceptive methods, whether it is for limiting the number of children or for spacing the births.
4. The Government together with family planning services implementing partners should educate the communities on benefits of using available family planning methods (modern and traditional FP) to women of reproductive ages in limiting the number of children.

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Appendix

Appendix 1: AIRR of CEB by Demographic, socio-economic and Proximate variables, 1992

		Model 1	Model 2	Model 3
Variable	**Category**	**AIRR [95% CI]**	**AIRR [95% CI]**	**AIRR [95% CI]**
Age group	15-24(RC)			
	25-34	2.264**	2.364**	2.426**
		[2.061-2.711]	[2.062-2.712]	[2.113-2.784]
	35-49	3.927**	3.936**	4.025**
		[3.447-4.473]	[3.453-4.487]	[3.529-4.590]
Residence	Urban (RC)			
	Rural	1.092	1.042	1.092
		[0.959-1.243]	[0.907-1.199]	[0.947-1.258]
Marital status	Unmarried (RC)			
	Married	1.193***	1.194**	1.178**
		[1.065-1.336]	[1.066-1.337]	[1.051-1.321]
Education level	No education (RC)			
	Primary		1.006	0.965
			[0.903-1.111]	[0.865-1.075]
	Secondary +		0.849***	0.918
			[0.708-1.018]	[0.759-1.111]
Working status	Not working (RC)			
	Working		1.043	1.026
			[0.950-1.145]	[0.934-1.128]
Age at first birth	<15 (RC)			
	15-19			0.890***
				[0.775-1.021]
	20+			0.611**
				[0.516-0.724]
Contraceptive use	Not using (RC)			
	Using			1.152***
				[0.980-1.354]
	Total	437	437	437

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category*
Source: Calculated using the 1992 ZDHS Dataset

Appendix 2: AIRR of CEB by Demographic, socio-economic and Proximate variables, 1996

		Model 1	Model 2	Model 3
Variable	**Category**	**AIRR [95% CI]**	**AIRR [95% CI]**	**AIRR [95% CI]**
Age group	15-24(RC)			
	25-34	2.217**	2.187**	2.242**
		[1.972-2.493]	[1.944-2.260]	[1.99-2.522]
	35-49	3.908**	3.775**	3.820**
		[3.499-4.365]	[3.374-4.223]	[3.412-4.477]
Residence	Urban (RC)			
	Rural	1.007	0 .980	0.995
		[0.917-1.105]	[0.891-1.077]	[0.905-1.094]
Marital status	Unmarried (RC)			
	Married	1.265**	1.254**	1.220**
		[1.150-1.391]	[1.139-1.380]	[1.107-1.444]
Education level	No education (RC)			
	Primary		1.014	0.996
			[0.924-1.113]	[0.908-1.093]
	Secondary +		0.848***	0.911
			[0.735-0.978]	[0.787-1.055]
Working status	Not working (RC)			
	Working		1.149**	1.113***
			[1.042-1.267]	[1.009-1.228]
Age at first birth	<15 (RC)			
	15-19			0.957
				[0.851-1.075]
	20+			0.687**
				[0.594-0.791]
Contraceptive use	Not using (RC)			
	Using			1.099
				[0.981-1.231]
	Total	649	649	649

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category*
Source: Calculated using the 1996 ZDHS Dataset

Appendix 3: AIRR of CEB by Demographic, socio-economic and Proximate variables, 2002

		Model 1	Model 2	Model 3
Variable	**Category**	**AIRR [95% CI]**	**AIRR [95% CI]**	**AIRR [95% CI]**
Age group	15-24(RC)			
	25-34	2.113**	2.120**	2.287**
		[1.830-2.440]	[1.835-2.449]	[1.977-2.645]
	35-49	3.871**	3.843**	4.030**
		[3.383-4.431]	[3.357-4.400]	[3.517-4.617]
Residence	Urban (RC)			
	Rural	1.011	0.980	1.017
		[0.894-1.143]	[0.863-1.113]	[0.896-1.155]
Marital status	Unmarried (RC)			
	Married	1.307**	1.297**	1.248**
		[1.169-1.462]	[1.159-1.453]	[1.111-1.401]
Education level	No education (RC)			
	Primary		0.999	1.009
			[0.883-1.130]	[0.892-1.143]
	Secondary +		0.876	0.973
			[0.729-1.053]	[0.807-1.173]
Working status	Not working (RC)			
	Working		1.261	1.219
			[0.907-1.752]	[0.876-1.695]
Age at first birth	<15 (RC)			
	15-19			0.881
				[0.748-1.038]
	20+			0.611**
				[0.507-0.737]
Contraceptive use	Not using (RC)			
	Using			1.194**
				[1.084-1.314]
	Total	478	478	478

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category*
Source: Calculated using the 2001-02 ZDHS Dataset

Appendix 4: AIRR of CEB by Demographic, socio-economic and Proximate variables, 2007

		Model 1	Model 2	Model 3
Variable	**Category**	**AIRR [95% CI]**	**AIRR [95% CI]**	**AIRR [95% CI]**
Age group	15-24(RC)			
	25-34	2.246**	2.233**	2.330**
		[1.961-2.573]	[1.949-2.559]	[2.031-2.673]
	35-49	3.776**	3.663**	3.727**
		[3.303-4.317]	[3.197-4.196]	[3.252-4.272]
Residence	Urban (RC)			
	Rural	1.119*	1.076	1.076
		[1.022-1.225]	[0.978-1.184]	[0.978-1.184]
Marital status	Unmarried (RC)			
	Married	1.257**	1.238**	1.207**
		[1.124-1.405]	[1.105-1.387]	[1.076-1.354]
Education level	No education (RC)			
	Primary		1.054	1.006
			[0.929-1.195]	[0.884-1.145]
	Secondary +		0.864	0.853***
			[0.737-1.014]	[0.724-1.004]
Working status	Not working (RC)			
	Working		1.054	1.027
			[0.968-1.147]	[0.943-1.118]
Age at first birth	<15 (RC)			
	15-19			0.974
				[0.835-1.136]
	20+			0.700**
				[0.590-0.832]
Contraceptive use	Not using (RC)			
	Using			1.048
				[0.939-1.170]
	Total	546	546	546

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category*
Source: Calculated using the 2007 ZDHS Dataset

Appendix 5: AIRR of CEB by Demographic, socio-economic and Proximate variables, 2014

		Model 1	Model 2	Model 3
Variable	**Category**	**AIRR [95% CI]**	**AIRR [95% CI]**	**AIRR [95% CI]**
Age group	15-24(RC)			
	25-34	2.295**	2.211**	2.295**
		[2.078-2.535]	[2.001-2.445]	[2.075-2.538]
	35-49	3.698**	3.512**	3.681**
		[3.556-4.076]	[3.179-3.880]	[3.329-4.070]
Residence	Urban (RC)			
	Rural	1.099**	1.030	1.053*
		[1.039-1.163]	[0.970-1.093]	[0.992-1.118]
Marital status	Unmarried (RC)			
	Married	1.221**	1.203**	1.182**
		[1.141-1.306]	[1.124-1.287]	[1.104-1.266]
Education level	No education (RC)			
	Primary		1.004	0.981
			[0.921-1.093]	[0.900-1.069]
	Secondary +		0.792**	0.803**
			[0.715-0.876]	[0.725-0.889]
Working status	Not working (RC)			
	Working		1.008	1.010
			[0.945-1.075]	[0.947-1.077]
Age at first birth	<15 (RC)			
	15-19			0.830**
				[0.741-0.929]
	20+			0.625**
				[0.555-0.704]
Contraceptive use	Not using (RC)			
	Using			1.107**
				[1.046-1.172]
	n	1263	1263	1263

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category*
Source: Calculated using the 2013-14 ZDHS Dataset

Appendix 6: AIRR of CEB by Demographic, socio-economic and Proximate variables, 2018

		Model 1	Model 2	Model 3
Variable	**Category**	**AIRR [95% CI]**	**AIRR [95% CI]**	**AIRR [95% CI]**
Age group	15-24(RC)			
	25-34	2.339**	2.300**	2.393**
		[2.103-2.602]	[2.066-2.561]	[2.148-2.667]
	35-49	4.121**	3.885**	4.081**
		[3.723-4.562]	[3.502-4.310]	[3.675-4.532]
Residence	Urban (RC)			
	Rural	1.206**	1.070***	1.090*
		[1.127-1.291]	[0.995-1.150]	[1.012-1.173]
Marital status	Unmarried (RC)			
	Married	1.225**	1.226**	1.205**
		[1.140-1.316]	[1.141-1.318]	[1.120-1.297]
Education level	No education (RC)			
	Primary		1.003	0.995
			[0.921-1.094]	[0.913-1.085]
	Secondary +		0.727**	0.763**
			[0.655-0.808]	[0.686-0.849]
Working status	Not working (RC)			
	Working		1.080*	1.048
			[1.007-1.158]	[0.976-1.124]
Age at first birth	<15 (RC)			
	15-19			0.858*
				[0.768-0.957]
	20+			0.673**
				[0.599-0.757]
Contraceptive use	Not using (RC)			
	Using			1.088*
				[1.023-1.158]
	n	1070	1070	1070

*Significant level codes: * p<0.05, ** p<0.01, *** p<0.1; IRR: Incidence rate ratio; AIRR: Adjusted Incidence rate ratio; CI-Confidence Interval; RC: Reference Category*
source: Calculated using the 2018 ZDHS Dataset

Appendix 7a: Measures of Fit for Poisson of CEB

	1992			**1996**		
	Model 3	Model 1	Difference	Model 3	Model 1	Difference
Model:	Poisson	Poisson		Poisson	Poisson	
N:	437	437	0	649	649	0
Log-Lik Intercept Only	-1144.350	-1146.099	1.749	-1689.965	-1689.965	0
Log-Lik Full Model	-850.200	-879.727	29.627	-1277.550	-1311.448	33.898
D	1700.400(419)	1759.454(429)	-59.054(10)	2555.099(631)	2622.895(641)	-67.796(10)
LR	588.300(10)	532.744(4)	55.556(6)	824.831(10)	757.035(4)	67.796(6)
Prob > LR	0.000	0.000	0.000	0.000	0.000	0.000
McFadden's R2	0.256	0.232	0.024	0.244	0.222	0.022
McFadden's Adj R2	0.241	0.225	0.016	0.233	0.219	0.014
ML (Cox-Snell) R2	0.741	0.705	0.036	0.719	0.689	0.030
Cragg-Uhler(Nagelkerke)	0.741	0.705	0.036	0.719	0.689	0.030
AIC	3.983	4.063	-0.080	3.992	4.066	-0.074
AIC*n	1736.400	1775.454	-39.054	2591.099	2638.895	-47.796
BIC	-840.054	-848.838	8.784	-1530.899	-1527.857	3.042
BIC'	-527.523	-508.424	-22.599	-760.077	-731.133	-28.944
BIC used by Stata	1767.254	1789.853	-22.599	2626.329	2655.273	-28.944
AIC used by Stata	1722.400	1769.454	-47.054	2577.099	2632.895	-55.796

Appendix 7b: Measures of Fit for Poisson of CEB

	2002			2007		
	Model 3	Model 1	Difference	Model 3	Model 1	Difference
Model:	Poisson	Poisson		Poisson	Poisson	
N:	478	478	0	546	546	0
Log-Lik Intercept Only	-1222.131	-1222.131	0.000	-1313.406	-1313.406	0
Log-Lik Full Model	-925.089	-959.538	34.449	-1034.658	-1062.065	27.407
D	1850.179(460)	1919.007(470)	-68.898(10)	2069.315(528)	2124.131(538)	-54.816(10)
LR	594.083(10)	525.185(4)	68.898(6)	557.497 (10)	502.682 (4)	54.815(6)
Prob > LR	0.000	0.000	0.000	0.000	0.000	0.000
McFadden's R2	0.243	0.215	0.028	0.212	0.191	0.021
McFadden's Adj R2	0.228	0.208	0.020	0.199	0.185	0.014
ML (Cox-Snell) R2	0.711	0.667	0.044	0.640	0.602	0.038
Cragg-Uhler(Nagelkerke)	0.711	0.667	0.044	0.640	0.602	0.038
AIC	3.946	4.048	-0.102	3.856	3.920	-0.064
AIC*n	1886.179	1935.077	-48.898	2105.315	2140.131	-34.816
BIC	-987.842	-980.640	-7.202	-1258.467	-1266.678	8.211
BIC'	-532.387	-500.506	-31.881	-494.471	-477.471	-17.0
BIC used by Stata	1918.044	1949.925	-31.881	2138.644	2155.644	-17.0
AIC used by Stata	1872.179	1929.077	-56.898	2091.315	2134.131	-42.816

Appendix 7c: Measures of Fit for Poisson of CEB

	2014			2018		
	Model 3	Model 1	Difference	Model 3	Model 1	Difference
Model:	Poisson	Poisson		Poisson	Poisson	
N:	1263	1263	0	1070	1070	0
Log-Lik Intercept Only	-2959.368	-2959.368	0	-2614.530	-2614.530	0
Log-Lik Full Model	-2355.895	-2442.711	86.816	-1959.191	-2033.570	74.379
D	4711.791(1245)	4885.422(1255)	-173.631(10)	3918.382 (1052)	4067.141 (1062)	-148.759(10)
LR	1206.945(10)	1033.314(4)	173.631(6)	1310.679 (10)	1161.920 (4)	148.759(6)
Prob > LR	0.000	0.000	0.000	0.000	0.000	0.000
McFadden's R2	0.204	0.175	0.029	0.251	0.222	0.029
McFadden's Adj R2	0.198	0.172	0.026	0.244	0.219	0.025
ML (Cox-Snell) R2	0.615	0.559	0.056	0.706	0.662	0.044
Cragg-Uhler(Nagelkerke)	0.615	0.559	0.056	0.706	0.662	0.044
AIC	3.759	3.881	-0.122	3.696	3.816	-0.120
AIC*n	4747.791	4901.422	-153.631	3954.382	4083.141	-128.759
BIC	-4179.059	-4076.841	-102.218	-3419.754	-3340.749	-79.005
BIC'	-1135.533	-1004.749	-130.784	-1240.925	-1134.018	-106.907
BIC used by Stata	4790.345	4921.128	-130.784	3995.111	4102.018	- 106.907
AIC used by Stata	4733.791	4895.422	-161.631	3940.382	4077.141	-136.759

For this study, a measure of fit for Poisson of children ever born data, Fit stat was used for each survey year. The choice of the final model accepted in this study was done by comparing the Bayesian Information Criterion (BIC) of the first and last model. The model with a lower BIC was chosen as explained below;

- 1992-Difference of 22.599 in BIC' provides very strong support for current model, Model 3 than Model 1.
- 1996-Difference of 28.944 in BIC' provides very strong support for current model, Model 3 than Model 1.
- 2002-Difference of 31.881 in BIC' provides very strong support for current model, Model 3 than Model 1.

- 2007-Difference of 17.0 in BIC' provides very strong support for current model, Model 3 than Model 1.
- 2014-Difference of 130.784 in BIC' provides very strong support for current model, Model 3 than Model 1.
- 2018-Difference of 106.907 in BIC' provides very strong support for current model, Model 3 than Model 1.