Socioeconomic and Demographic Determinants of Fertility in North Eastern Kenya

By

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DECLARATION

This research paper is my original work and has not been presented for a degree award in any other university.

Signature..... Date 31/10/2016

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This research paper has been presented for examination with my approval as university supervisor.

Signature..... Date 31/10/2016

DR. MARY MBITHI

DEDICATION

This research paper is dedicated to my loving parents, Mr. Fredrick Murigi Njoroge and Mrs. Ekila Murigi to whom I owe so much.

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LIST OF ABBREVIATIONS

GoK	Government of Kenya
KDHS	Kenya Demographic and Health Survey
NCPD	National Council for Population and Development
OLS	Ordinary Least Squares
REGLAP	Regional Learning and Advocacy Programme
TFR	Total Fertility Rate
WHO	World Health Organization

ABSTRACT

The key objective of this study is to analyze the socioeconomic and demographic factors influencing fertility of women in North Eastern Kenya. North Eastern region was selected because its Total Fertility Rate (TFR) of 6.4 in 2014 was the highest among all regions in the country and was much higher than the national average of 3.9. While TFR for other regions have been reducing over time, in the North Eastern region the fertility rate has been on the rise. This research uses data from the 2014 Kenya Demographic and Health Survey (KDHS) data and focuses on women aged 15 - 49. A Poisson count data model is employed. Variables studied include: total children ever born, educational level, residence, contraceptive use, age, work status, access to media, religion, age at first marriage and marital status. Among these, respondent's age, age at first marriage, marital status, religion, access to media, ever use of contraceptives, higher education and work status were found to have a significant relationship with fertility. Age, marital status, use of contraception and religion positively influence fertility while age at first marriage, higher education, access to media and work status negatively influence fertility. Therefore, based on these study findings, increasing opportunities for higher education for women, engagement of Muslim religious leaders in population control activities, improving access to radio and use of radio programmes for awareness and information are recommended.

CHAPTER ONE

1.0 INTRODUCTION

During the 19th century and the early decades of the 20th century, scholars were divided between the supporters of Marx and the supporters of Malthus regarding the association between population growth and economic development. Malthusians argued that population explosion damned societies to poverty and underdevelopment and that standards of living would only be improved through reducing population growth rates. Marxians on the other hand believed that high rates of population growth were a mere symptom and not a cause of poverty and that addressing poverty and other socio-economic challenges is what brings a slow-down in the growth of population.

In the period after 1950, demographers, economists, and other social scientists seemed to reach a consensus that rapid population growth foils efforts towards enhancing economic development. This followed the works of some intellectuals including Coale and Hoover (1958), Myrdal (1968) and Enke (1970) on extraordinarily increasing populations in various developing countries. Coale and Hoover (1958) analyzed the nexus between population rise and economic development in India and concluded that population growth adversely affects economic development due to changes in the size and composition of population translating to rising poverty levels and dependency ratios.

Since 1960s the modern 'population movement' has continued to shape this debate. The movement posits that implementing policies towards reduction of population growth rates is an important precondition to sustainable development. A forceful set of arguments and evidence has been advanced indicating that rapid population growth hampers poverty reduction efforts. Expanding population see diversion of a country's resources away from expanding productive capacity to meeting the growing needs for health and educational facilities and other social amenities. At household level, resources are diverted from investment to current consumption.

The most prominent aspects of population dynamics include fertility, mortality and migration (United Nations, 1987). However, within the developing world population growth is majorly

fuelled by fertility (Sinding, 2009). Fertility analysis is therefore important for understanding trends in the size, composition and growth of population.

1.1 Fertility in Kenya

Kenya has a history of having had among the highest population growth rates and fertility rates in the world. According to the 1977/1978 World Fertility Survey, Kenya had a total fertility rate (TFR)[1]of 8.1. This was a great increase from 6.8 children per woman in 1962. The rapid increase in fertility was attributed to improvement in the living standards and healthcare facilities, low contraceptive prevalence rate, low age at marriage and high value attached to children (Dow & Linda, 1983).

However, Kenya experienced a remarkable fertility reduction through 1980s and 1990s. The TFR fell from a high of 8.1 children per woman in 1977/78 to 6.7 in 1989 and to 4.7 in 1998. This reduction was one of the most rapid ever documented. This was attributed to massive support from the government and development partners for the National Family Planning Programme which emphasized on smaller family sizes and spacing of births as means to arrest population growth rate.

By the start of the new millennium, the remarkable fertility reduction observed before began to decelerate. TFR increased marginally to 4.9 in 2003. This sent signals that the decline of fertility had stalled. By 2008/009, TFR stood at 4.6 children per woman. This was way higher than the rate of fertility replacement of 2.1 children per woman at the time. The 2014 KDHS findings reveal that the country's TFR has again fallen to 3.9 children per woman. Figure 1 shows the trend in fertility in Kenya (1978- 2015).

[1] TFR depicts the average number of children born to a woman by close of her reproductive period – 49 years of age - if levels of fertility remain unchanged at the level observed in the three-year period prior to the survey.

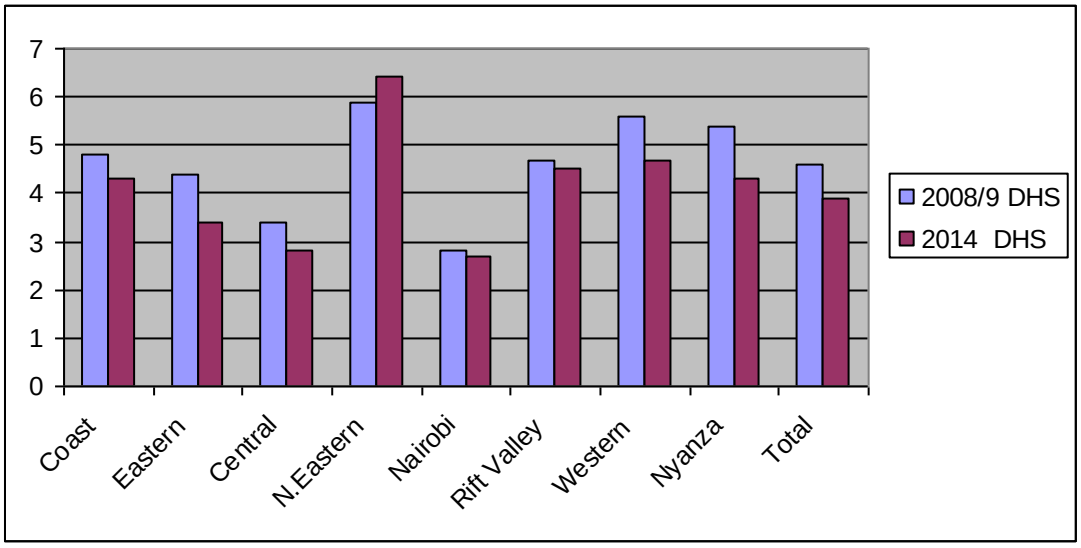
Figure 1.1: Trend in Fertility in Kenya

Source: Odwe, Agwanda, & Khasakhala (2015)

Though the trend shows that the country's total fertility rate has been declining, all the fertility surveys done in Kenya show serious disparities in the fertility levels among regions in the country. According to the 2014 KDHS, North Eastern region had, by far, the highest TFR at 6.4. Nairobi region had the lowest at 2.7. Coast, Eastern, Central, Rift valley, Western and Nyanza regions had TFR of 4.3, 3.4, 2.8, 4.5, 4.7 and 4.3 respectively. The nation's average stood at 3.9(Kenya National Bureau of Statistics, 2015).

North Eastern region also appears distinguishable from the rest of the regions in the country in that it is the only region that recorded an increase in the TFR from the levels attained earlier as per the 2008-09 DHS. The increase was from 5.9 in 2008-09 to 6.4 in 2014. On the other hand, all the other regions in the country have been achieving substantial decline in the TFR not just in the mentioned period but also from the previous surveys (KNBS, 2015).Figure 2 shows the TFR for various regions in Kenya in 2008/09 and 2014.

Figure 1.2: TFR for Various Regions in Kenya



Source: KNBS (2015)

1.2 Kenya Population Control/ Birth Control Policy

National population programmes and activities in Kenya are currently guided through a framework provided by Sessional Paper No. 3 of 2012 on Population Policy for National Development. It was formulated as a response to the country's development agenda as spelt by the Kenya Vision 2030 blue print and the Kenyan Constitution of 2010. It succeeded the Sessional Paper No. 1 of 2000 on National Population Policy for Sustainable Development.

The aim of the policy is to ensure that population growth, which stood at a high 2.9% in the 1999 -2009 period, doesn't hamper the Vision 2030 goal of transforming Kenya into a middle-income economy and achieving quality living standards for her people. It recognizes that Kenya's high level of fertility has created a large and young population which has presented challenges to the process of achieving the nation's development goals. Thus among the key objectives of the policy is to lower fertility rates that have sustained the high population growth rate. The target is to bring down the TFR from 4.6 in 2009 to 2.6 by 2030.Among the principles recommended towards the implementation of the policy is the recognition of regional differentials in matters population and development. It is pointed out that there are considerable and persistent variations in fertility levels by region and socio-economic categories within the country. North Eastern and Nairobi regions that in 2009 recorded TFR of 5.9 and 2.8 respectively are cited in the policy as examples.

1.3 Problem Statement

The literature shows broad consensus that population dynamics and economic development are closely related. High fertility rates have been cited as a major cause of underdevelopment in poor countries (Birdsall et al., 2001). High fertility rates frustrate poverty reduction efforts. This is because limited government revenues are drained into providing rudimentary basic social services for the bulging population instead of being used for increased production and development. Resource poor countries face the challenge to create jobs for an expanding workforce while their capacity to satisfy increasing demand for services and infrastructural needs is curtailed. At the household level, high fertility levels have numerous consequences. When a

woman bears many children, the economic burden for the household enlarges and there is increased chance for the family sinking into poverty. Women become less productive economically as more time goes to caring for more children rather than personal development. High fertility raises the risk that a child will be born prematurely or with low birth weight and has stunted growth. High fertility also keeps maternal mortality high (WHO et al., 2010).

According to the National Council for Policy for Population and Development (NCPD), Kenya's population is expected to reach 77 million by 2030. This is likely to pose serious challenges in the realization of the country's development goals. NCPD therefore set the following targets for key demographic indicators for the country: TFR to reduce from 4.6 in 2009 to 2.6 by 2030 and by 2050 to a further 2.1.Additionally, the national population growth rate to reduce from 2.5 % per year in 2009 to 1.5% per year by 2030 (NCPD, 2012). However, it has been cautioned that the policy objective of reducing TFR to 2.6 children per woman by 2030 may not be realized unless the fertility levels in the arid areas particularly North Eastern Kenya are addressed as they are still very high (NCPD,2013).

In Kenya, efforts have been exerted towards developing the arid and semi-arid areas with North Eastern region, the only among the former provinces that is regarded as wholly arid, being a major focus. The said areas have consistently registered the worst indicators of poverty and under development in Kenya (Government of Kenya, 2004). It is for that reason that in 2008 a special ministry, Ministry for the Development of Northern Kenya and other Arid Lands, was created to spur development in these areas. According to the Vision 2030 Development Strategy for Northern Kenya and other Arid Areas, a key impediment to development in Northern Kenya is the very high fertility rates and population growth rates (Government of Kenya, 2011). This is despite the region having high and increasing poverty levels. A livelihood study done in 2007 found a remarkable increase in poverty in North Eastern Province with the poor increasing from 45% to 55 % over just 5 years. It was also said that only in the arid lands was poverty worse in 2009 than in 2005 (Government of Kenya, 2011). Citing these distinct features, a paper written for the Ministry of State for Northern Kenya and other Arid Lands recommended that researchers

would best focus on North Eastern Kenya and other arid lands by themselves rather than lumping them together with the rest of the country (Muurling & Apeldoorn, 2011).

Studies on fertility conducted in the developing world link fertility transition to the broad context social, economic and demographic dynamics and hence confirm the importance of socioeconomic and demographic factors and their correlation with fertility (Ainsworth, 1994; Bauni, Gichuhi & Wasao, 2000; Kelly & Nobe, 1990; Khasian & Ayiemba, 2005; Kimani & K'oyugi, 2004; Robinson, 1992; Robinson & Harbison, 1995; Sinding, 1991; United Nations, 1987; Wasao, 1998; Wortham, 1995). They underscore the fact that reduction in fertility stems from various aspects of social and economic wellbeing. It is for that reason that this study will only concentrate on socio-economic and demographic factors. The various socioeconomic and demographic factors responsible for fertility change are also said to be dynamic over time and between regions.

1.4 Study Objectives

The general objective of this study is to analyze the socioeconomic and demographic determinants of fertility among women in North Eastern Kenya.

Specifically, the objectives are:

(a) To identify the socioeconomic and demographic factors associated with fertility among women in North Eastern Kenya.

(b) To analyze the relationship between the identified determinants and fertility in North Eastern Kenya.

(c) Suggest appropriate policy measures to be implemented based on the findings above.

1.5 Justification

Determinants of fertility in Kenya have been studied by many scholars. However, this research contributes to past knowledge on this subject in several ways. The study focuses on a region, North Eastern Kenya rather than the whole country as many studies have, which tends to mask the distinct characteristics of a region. As a departure from the past studies on fertility in Kenya that have largely employed linear regression models in their analysis, this study will use Poisson

model, a non-linear model. The study will also analyze data from the most recent DHS dataset, KDHS 2014.

The findings from this study are expected to further our understanding on the socioeconomic and demographic determinants of fertility and help policy planners to develop appropriate strategic plans, policies and programmes. The study will also help to investigate whether the situation in North Eastern region of Kenya is consistent with results from other regions in Kenya and other developing countries. The study will contribute towards a deeper understanding of the determinants of fertility within the region. This in turn would inform policy and program implementation and evaluation, particularly where interventions are concerned. Policies aimed at reducing fertility need to be based on a sound assessment of the factors influencing fertility since policy decisions based on intuition are likely to be misguided. It will be essential in setting priorities in the allocation of resources towards the factors that could greatly influence fertility desires and hence future fertility reduction.

CHAPTER TWO

2.0 LITERATURE REVIEW

2.1 Theoretical Literature

The vast collection of literature on determinants of fertility begins with the works of Leibstein (1957) and Becker (1960) and was formalized into a theoretical framework by Willis (1973) who introduced 'new home economics of the Chicago School' methodology where children are viewed analogously to consumer durable goods. Other works in Population Economics have viewed children as public goods and investment goods (Werding, 2014).

Children as consumption goods increase the utility of their parents directly like many other consumption goods (Becker, 1960). As investment goods, children indirectly increase utility of their parents through growing their cumulative life time income and consumption of other commodities (Cigno, 1993). Consumption and investment roles of children depict treatment of children as purely private goods. They can otherwise be viewed as public goods intended for preservation of a cultural heritage, sustenance of tax systems and public pension schemes and

enabling future technological progress (Folbre, 1994). Children can additionally be viewed as mere by-products of other activities, majorly sex.

The 'household demand model' was developed by Becker (1960) in his 'economic theory of family'. He emphasized on the impact of prices and income on the demand for children and the substitution versus income effects on fertility. According to this approach, households produce a bundle of consumer commodities, which include children, in their endeavor to maximize household utility. Another key concept in Becker's works was that of quantity - quality tradeoff in making fertility choice. According to Becker and Lewis (1973), child quality is signified by spending per child. Implying that increasing spending on each child (quality) makes increasing quantity (number of children) more expensive. On the other hand, increasing quantity makes increasing quality more costly. Becker and Tomer (1976) broadened factors that affected child quality from just parental inputs to also endowments in form of inherited ability and public investments on children.

Critics of the 'household demand model' argued that in most instances fertility is a matter of supply rather than a matter of demand and hence the model becoming less suitable for the analysis of fertility especially in the context of the developing world (Simmons, 1985). Easterlin (1975), proposed the 'synthesis model' which synthesized the household demand model with sociologists' and demographers' approach of analyzing the supply of children. His objective was to link the demand for children, the yield of children per family and the costs of fertility control.

A framework of household bargaining power has also been employed to study fertility behaviour. This approach posits that bargain power within the household is derived from various individual-linked factors such as age, personal and partner's income, wage rate, education and the assets owned. Other extensions of this approach points at the significant role of factors such as culture in allocating bargaining power among household members particularly the spouses. This framework assumes existence of different utility functions for spouses (Rasul, 2008).

Earlier economic models of fertility considered the household as the relevant decision-making unit with regard to fertility behaviour. They emphasized the joint-decisions between spouses or

partners on the optimal number of children they would have and how these were influenced by various factors. However, economic models now distinguish between the two parents and consider fertility choices as made by women only though the existence of a partner is sometimes insinuated through inclusion of partner's attributes among other background variables (Werding, 2014).

2.2 Empirical Literature

Rodriquez and Cleland (1981) conducted a multivariate study of the impact of socio-economic characteristics on marital fertility, based on 20 countries (27 populations) partaking in the World Fertility Survey. They found involvement of women in the labour force to be the most important among the factors studied. Work status had a large and significant impact on fertility with statistically significant independent effects in 19 of the 27 populations studied. Rural fertility was higher than urban fertility in 22 populations. The study also found out that the wife's educational attainment had a significant influence on fertility. In most cases, it is women with secondary education who had substantially lower fertility than the rest. Exceptions to this pattern were Bangladesh, Kenya and Indonesia, where respondents with no education had lower fertility than those who had acquired some education. The findings provided strong evidence that employment opportunities for the wife represent a genuine alternative to childbearing for many couples, and can make a major contribution to reducing fertility.

Junsen (1990) used micro data from the China-In-Depth Survey of 1985 and Ordinary Least Squares to study socioeconomic determinants of fertility. He found education and fertility to have a significant but negative relationship. Area of residence also had a statistically significant effect on fertility. Women residing in urban areas tended to have fewer births and so did women with more education. The findings also showed that marital duration was significant and had a positive coefficient. Ten years of marriage increased cumulative fertility by about one and a half children.

Namkee and Shariff (1994) did a comparative analysis on the determinants of fertility between Uganda and Togo. This was based on DHS 1988-89 datasets. They used multivariate hazard

analysis to analyze the effect of each socioeconomic variable on fertility. They found out that in Togo, women's education had a largely significant and negative effect on fertility while women's education had no significant effect on fertility in Uganda. Their study further revealed that fertility was not significantly affected by work status and polygamous unions. Wives in polygamous marriages may compete in childbearing and thus reach a level of fertility similar to that of women not in polygamous unions. The findings in the same study showed that urban residence had a significantly negative impact on fertility. In urban areas, the higher costs of children, the weakening of such traditional practices as postpartum abstinence and the lower cost of and access to birth control methods could have been the main factors that led to lower fertility.

Junsen (1994), using the 1985 Chinese -In –Depth Fertility Survey explored the socioeconomic and demographic factors that influenced fertility, using Sequential Logit model. According to Junsen, common regression techniques like Ordinary Least Squares and the Tobit ignore the fact that children ever born can take only non-negative values. The study found out that place of childhood residence was an important factor affecting parity-specific fertility while maternal education was found to have little effect.

Njai (1998) examined and compared the socioeconomic and demographic factors that affected fertility in 4 districts in Kenya. These were Bungoma, Kisii-Nyamira, Taita-Taveta and Nyeri districts. The data used in the study was drawn from KDHS 1993. To determine the relationship between total children ever born and selected socio-economic and demographic factors, he employed cross-tabulations, simple bivariate regressions and multiple regression. Socio-economic and demographic determinants that were significant across the 4 districts included: ages of respondent, age of respondent at first birth, education level and ever use of contraception. Current marital status and number of surviving children were only significant in Taita-Taveta and Kisii-Nyamira districts. Desired family size was significant only for Kisii-Nyamira and Bungoma districts. Respondents' income only mattered in Taita-Taveta district. Contrary to expectations, respondent's work status was found not to be significant as a determinant of fertility in all the 4 districts.

Wasao (1998) examined some socioeconomic correlates of fertility in Kenya. The objective of the study was to analyze the trends in a number of socioeconomic indicators and ascertain their importance in fertility transition. He highlighted the factors associated with fertility in Kenya. Bivariate and multivariate regressions were used to analyze data from various governmental sources. He found that contraceptive use and urbanization were significant determinants of fertility. He underscored the prominence of these socio-economic factors in comprehending fertility transition in Kenya.

Kabeer (2001) estimated separate linear models for different age groups (i.e. 12 to 19, 20 to 40, and 41 and above) to study women's fertility in Bangladesh. She used the 1989 Bangladesh Fertility Survey. She found that for all the age groups under study, male and female education, wealth and working status of women were negatively related to fertility. Muslim women had a higher fertility rate than those in other religions. She also found out that rural-urban difference existed for age-groups 20 to 40, 40 and above but not for 12 to 19.

Evelia (2003) examined the determinants of adolescent fertility in Kenya using data from KDHS 1993. The women considered in this study were aged 15-19. The socio-cultural variables considered in the study were ethnicity, religion and place of residence. Socio-economic variables studied were occupation, knowledge of any method of contraception and education level while demographic variables were age, age at first intercourse and marital status. Data was analyzed using logistic regression analysis. The study found that age, current marital status, education level, ethnicity, occupation, knowledge of any method of contraception, age at first intercourse, ever use of contraceptives and religion were significantly associated with adolescent fertility in Kenya. Among the unexpected findings was that adolescents with no education had lower fertility than those with primary school education. She strongly recommended commissioning of such studies at sub-national levels to increase the understanding of adolescent fertility.

Makau (2010) did a study aimed at investigating the effect of a number of socioeconomic factors on fertility in Kenya. He looked into the effect of level of education, wealth status, type and region of residence and work status on children ever born. The control factors used were age, religion, ethnicity, type of marriage, duration of marriage and contraceptive use. The study was

conceptualized using the Bongaarts' framework on fertility. The data used was sourced from Kenya Demographic and Health Survey (KDHS) of 2003. Main methods of analysis used were descriptive statistics, binary regression and multiple regression analysis. He found age at first cohabitation and women's education to be the major determinants of fertility. Other significant variables included: type and region of residence, wealth index and work status. Contrary to his expectations, use of contraceptives was also found to be associated significantly with high fertility.

In a comparative study of Nyanza and Central provinces, Yogo (2011) examined the influence of demographic, socio-cultural and economic factors on children ever born in the two provinces. The 2008-09 KDHS data from the two provinces were used. The study was premised on the John Bongaarts' (1978) framework. Simple bivariate and multivariate linear regression methods of analysis were used. All demographic variables studied were statistically significant for Nyanza but surprisingly ever use of contraception was not significantly related to children ever born in Central province. With regard to socio-economic factors, wealth index was the only statistically significant determinant in Central province. On the other hand, in Nyanza province, place of residence, education and wealth index were significantly related to children ever born. Women's work status was not a significant socio-economic determinant of fertility in both provinces. Type of marriage as a socio-cultural determinant of fertility was significant in Central but not in Nyanza province.

Kulaba (2011) analyzed the socio-economic and demographic determinants of fertility in the Northern region of Uganda. He selected the region for it had the highest fertility level in the country despite its long history of political instability. The used UDHS 2006 data for women in the 15-49 age bracket. He employed a Poisson model for count data. His findings were that woman's education, occupation; marital status and use of contraceptives significantly influenced fertility. However, religion, husband's education and age at first marriage did not affect fertility.

2.3 Overview of Literature Review

This section has examined the relevant literature for this study. It is clear from this review that fertility is influenced by socioeconomic and demographic factors. Some of these factors influencing fertility include: education, residence, contraceptive use, age, work status, religion, age at first marriage and marital status.

It is also evident from the literature review that all the socioeconomic and demographic factors considered in this study do not have a unidirectional influence on fertility and that their importance in influencing fertility varies across areas. This implies that investigation of socioeconomic and demographic factors influencing fertility with regard to specific areas is still a fertile area of research. It is with this in mind that the study aims to analyze the socioeconomic and demographic determinants of fertility in North Eastern Kenya.

Most studies that have been done on fertility in Kenya used ordinary least squares technique of estimation. However, OLS estimation has been found to have serious weaknesses. OLS regression for count dependent variable like children ever born, commonly used in many studies, is inefficient and its standard errors' estimates inconsistent. OLS could also give negative count predictions. Therefore OLS estimation has only been found to be feasible where the count variable is independently and identically distributed (Long & Freese, 2006).These problems have pushed researchers to seek alternative techniques of estimation. This study will employ Poisson regression, which is superior to the OLS regression method.

CHAPTER THREE

3.0 METHODOLOGY

3.1 Theoretical Framework

The model employed is based on Easterlin's (1975) "Economic Framework of Fertility Analysis" and Easterlin and Crimmin's (1985) "Supply-Demand Analysis of Fertility" which attempted to improve the existing micro-economic theories of fertility by integrating both the supply and demand sides of fertility. They explained that households and/or individuals attempt to maximize the well-being of their immediate selves over time and that fertility plans are made in this context (Easterlin & Crimmins, 1985). That is, they tend to balance the expected benefits and gains from bearing children against perceived costs and disadvantages. Socioeconomic factors enter fertility plans by affecting perceptions about these benefits and costs. It was observed that factors such as education, urban-rural residence, use of contraceptives and others influence the demand, supply and cost of fertility regulation which consequently affect fertility behavior (Butt & Jamal, 1993; Easterlin, 1975; Easterlin, 1978; Easterlin & Crimmins, 1985; Mutuku, 2013; Pollak, & Watcher, 1980).

The study estimated a reduced form equation for the number of children ever born per woman, an approach that is in concurrence with economics based estimations (Schultz & Zeng, 1995; Winkelmann & Zimmermann, 1994).To study the factors that determine fertility, the study will use a Poisson model. The model is recently popular for investigating the relationship between children ever born, as count data, and socio-economic and demographic factors (El Lahga & Olfa, 2008). Poisson regression is one of the robust models for the analysis of discrete data and is founded on the assumption that the dependent variable, in this case the total children ever born, is distributed as Poisson and its logarithm is a linear function of the explanatory variables (Cameron & Trivedi, 2013). This is as follows:

$$Log\ (CEB) = \alpha + b_1x_1 + b_2x_2 + \ldots + b_kx_k + e_i$$

Where: ***CEB*** represents children ever born.

α is a constant.

b_is are coefficients of the independent variables.

x_is are the independent variables.

e_i is the error term.

Poisson regression model has the following key advantages: It captures the discrete and non-negative nature of the data and also allows inference on the probability of an event occurring. Unlike in classical regression model, the heterogeneity of the dependent variable is modeled as a deterministic function of the explanatory variables implying that the randomness is intrinsic rather than attributable to other factors. Thus, the model accounts for the heteroscedastic and

skewed distribution inherent in non-negative data, and attributes a non-negligible probability to the outcome zero (Winkelmann & Zimmermann, 1995).

3.2 The Model

This study modelled the children born as a function of socioeconomic and demographic factors. Children ever born, is a count variable taking a non –negative value.

The model is shown as:

$$Log\ (CEB) = a + b_1EL + b_2R + b_3CU + b_4A + b_5WS + b_6\ AM + b_7\ R + b_8\ AFM + b_9MS + e_i$$

Where: ***CEB*** represents children ever born to a woman.

α is a constant.

b_is are coefficients of the explanatory variables.

EL is educational level.

R is residence.

CU is contraceptive use.

A is age.

WS is work status.

AM is access to media.

R is religion.

AFM is age at first marriage.

MS is marital status.

e_i is the error term.

The assumption of the standard Poisson regression model is that the conditional mean and variance of the dependent variable are equal for every observation. This is known as equidispersion. If this assumption fails to be met, then there is over or under dispersion. Over-

dispersion occurs when the conditional mean exceeds the conditional variance and under-dispersion occurs on the reverse.

A test for over-dispersion and under-dispersion of a Poisson regression is carried out by having the value of Pearson statistic divided by degrees of freedom (Hilbe, 2011). If it is greater than one, then there is over-dispersion and if it is less than one there is under-dispersion.

Over dispersion is addressed by running a negative binomial regression, a generalization of Poisson regression, which is a useful alternative to the standard Poisson regression (Famoye, 1993).

The problem of multicollinearity arises when two or more explanatory variables are highly correlated which undermines their statistical significance. The presence of multicollinearity among the variables in the model can be assessed by examining the Variance Inflation Factors (VIF) and the correlation matrices. In case, multicollinearity exists then the problem would best be cured by removing the highly correlated predictors from the model using stepwise regression or best subsets regression (Windmeijer & Silva, 1997).

3.3 Definition of Variables and Expectations

The number of children born is modeled as a function of socioeconomic and demographic factors. Variables used in the model are defined and described as follows:

Total Children Ever Born (CEB)

This is the model's dependent variable. This describes the total number of children ever born to a woman aged between 15 and 49 years.

Educational Level

Improved educational achievements coupled with higher returns to schooling are likely to induce parents to have fewer children and invest more on each child. Therefore, woman's education is expected to have a negative relationship with the number of children born per woman.

Educational level will be a dummy variable of women with higher education (he), secondary-level education (se), primary-level education (pe) and no education (ne)

Residence

Place of residence will be a dummy variable of urban and rural areas. Respondents residing in rural areas are expected to have more children than their urban counterparts. This is because they are likely to be less knowledgeable about contraceptives and have limited access to contraceptives. Rural women are also likely to be under a stronger influence of cultural and religious attitudes and perceptions that they should have as many children as they could.

Contraceptive Use

Variable under consideration here is the ever use of contraceptives by a woman. As a dummy variable, 1will represent 'ever used any contraceptives' and 0 'never used any contraceptives'. It is expected that women who ever used contraceptives will have fewer children.

Age

As older women have had a longer child-bearing period compared to the younger women, the older can be expected to have a higher fertility than the younger. Age will be a continuous variable from 15 years to 49 years.

Work Status

Woman's participation in the labour force is expected to be negatively related with fertility. That is, non-working women are likely to have more children their working counterparts. Work status, which is a dummy variable, will be defined in the model as 1 for 'respondent working' and 0 for 'not working'.

Access to Media

Likelihood of influence of media on the respondent will be known from if she listened to radio or never. The dummies defining these are: 1 for 'respondent ever listens to radio and 0 for never. It is expected that women who are more exposed to information about contraceptives and benefits of fertility regulation, as conveyed through media, will have lower fertility.

Religion

The type of religion one belongs to may have an effect on fertility because different religions have different norms and beliefs about fertility. This will be a dummy variable of Muslim (mu) and non-muslims (n-mu). The effect of religion on fertility may be ambiguous.

Age at First Marriage

Age at first marriage influences exposure to the risk of pregnancy. It also affects the childbearing period with those who enter marriage earlier having long periods of childbearing. As age at first marriage rises, fertility is expected to lower because the period of exposure to pregnancy in the absence of contraceptives is reduced.

Marital Status

Marriage, divorce and widowhood are demographic events that influence exposure to pregnancy/ fertility. Marriage exposes one to the risk of pregnancy if there is no use of contraceptives. It is therefore expected that women who ever married will have more children than those who have never married. For this study, marital status as a dummy variable will take value 1 if ever married and 0 if never married.

3.4 Data Types and Sources

This study will utilize secondary cross sectional data drawn from Kenya Demographic and Health Survey (KDHS), 2014. This is a national survey that was designed to avail information on aspects of health such as fertility, family planning, maternal health, child health and survival, female circumcision, use of mosquito nets, nutritional status and HIV across all regions and counties in Kenya. However, as this study aims to study determinants of fertility in North Eastern Kenya, it will only utilize data collected from respondents of ages 15 to 49 years and who resided in the North Eastern region.

3.5 Area of Study

Demographic and Health Survey identified eight regions based on the former provinces that were recognized by the independence constitution in Kenya. These are: North Eastern, Nyanza, Rift

Valley, Coast, Nairobi, Central, Western and Eastern. This study focuses on the North Eastern region. The region comprises the counties of Mandera, Wajir and Garissa. Previously during the colonial era and early years of the independent Kenya, the region was referred to as the North Frontier District. It has a land area of 127, 358.5 KM^2 and it is the only region in the country that is wholly arid.

According to the 2009 Kenya Population and Housing Census, North Eastern region had a population of 2,310,757 residents. It is almost entirely inhabited by ethnic Somalis belonging to Ajuran, Ogaden, Hawiye, Degodia, Murale, and Gurreh clans. The predominant economic activity in the region is nomadic pastoralism.

The defining feature of the North Eastern Kenya is its exclusion from the rest of the country that is evidenced in the stark contrast between the region and the rest of Kenya in economic, social and cultural matters. Notably, apart from negative practices like early forced marriage and female genital mutilation, the counties in North Eastern Kenya fall behind in all other human socio-economic development indicators (REGLAP Secretariat, 2012).

CHAPTER FOUR

4.0 RESULTS AND DISCUSSION

4.1 Descriptive Statistics

In this subsection the characteristics of the sample used in the study are analyzed. The section also gives an in-depth description of the variables; their mean, standard deviation, minimum and maximum values.

Table 4.1: Descriptive statistics

Variable	Observations	Mean	Std. Dev.	Min	Max
Children Ever born	1,637	3.465	3.099	0.00	13.0

Age	1,637	27.93	8.787	15	49.0
Age at First marriage	1,637	18.06	3.244	10	35.0
No education	1,637	0.735	0.442	0.00	1.0
Primary education	1,637	0.146	0.353	0.00	1.0
Secondary education	1,637	0.0843	0.278	0.00	1.0
Higher education	1,637	0.0348	0.183	0.00	1.0
Rural	1,637	0.541	0.498	0.00	1.0
Urban	1,637	0.459	0.498	0.00	1.0
No media access	1,637	0.623	0.485	0.00	1.0
Media access	1,637	0.377	0.485	0.00	1.0
Non-Muslim	1,637	0.0342	0.182	0.00	1.0
Muslim	1,637	0.966	0.182	0.00	1.0
Never used contraceptive	1,637	0.9871	0.1126	0.00	1.0
Ever used contraceptive	1,637	0.0128	0.1126	0.00	1.0
Never married	1,637	0.245	0.430	0.00	1.0
Ever married	1,637	0.755	0.430	0.00	1.0
Not working	1,637	0.932	0.251	0.00	1.0
Working	1,637	0.0678	0.251	0.00	1.0

From the descriptive statistics presented, of the 1637 women that were sampled and interviewed, the oldest was 49 years while the youngest was 15 years old with the mean age being 28 years. The mean number of children per woman in the sample was 3.5 children. About 54.1% of these women lived in the rural areas while 45.9% lived in the urban areas. A massive 96.6% were Muslims while only 3.4% belonged to other religions.

Majority of the interviewed women (73.5%) had no education, 14.6% had primary education, 8.43% had secondary education and just a paltry 3.48% had higher education. Only 6.78% were working compared to 93.2% who indicated that they were not working. Access to media, in this case radio which is generally regarded as the most popular and accessible medium, stood at 37.7% of the women in the sample.

24.5% of the women had never been in marriage while the rest were in marriage or had been in marriage before. The least age at first marriage was 10 years and the highest was 35 years. Use

of contraceptives was found to be unpopular because only a low 1.28% of the women in the sample had ever used contraceptives.

4.2 Diagnostic Tests

4.2.1 Multicollinearity

This bias arises when one or more pairs of independent variables are perfectly correlated to each other. Multicollinearity increases the variance of coefficient estimates making them unstable and difficult to interpret. To this effect, the Variance Inflation Factors (VIF) and the correlation matrices are examined.

4.2.1.1 Variance Inflation Factors

The VIF test measures how much variance of an estimated coefficient increases due to collinearity. In other words, the variance inflation factors are used to determine if any pair of independent variables becomes highly collinear. Therefore, for VIF values greater than 10 and 1/VIF values less than 0.10, multicollinearity is deemed to be present.

From Table 4.2, we confirm the absence of multicollinearity since all variables have coefficients which conform to the requirements stated earlier.

Table 4.2: Variance Inflation Factors

Variable	VIF	1/VIF
Age	1.93	0.518834
Age at first marriage	1.17	0.855987
Primary education	1.40	0.712700
Secondary education	1.47	0.678143
Higher education	1.24	0.805640
Urban	1.26	0.7963798
Muslim	1.26	0.796054
Used contraceptive	1.18	0.850972
Ever married	2.12	0.471467
Working	1.15	0.872980
Access to media	1.14	0.875126
Mean VIF	1.39	

Source: Author's computation based on KDHS 2014

4.2.1.2 Correlation Matrix

This study used a Spearman's rank correlation matrix to measure the existing relationships in terms of both magnitude and direction among the various explanatory variables. The strength of the association among these variables is explored whereby strongly and weakly correlated variables are measured by the coefficients close to absolute value of one and zero respectively. The Spearman's rank correlation is as shown by Appendix 1 with the significance of association indicated in bold figures.

From these relationships, there is no multicollinearity since all coefficients of correlation matrix are less than |0.8| which is a threshold upon which if correlation coefficient exceeds elucidates multicollinearity (Gujarati, 2014).

4.3 Econometric results

Tables 4.3 and 4.4 report the results of Poisson regression.

Table 4.4 Poisson regression results

	Children Ever Born	
Variables	**Coefficients**	**Z**
Age	0.0648***	34.36
Primary education	-0.0883	-1.60
Secondary education	-0.171	-1.49
Higher education	-0.253***	-2.74
Age at First Marriage	-0.0569***	-15.75
Urban	-0.0429	-1.59
Media access	-0.0556**	-2.00
Muslim	0.251***	2.61
Used contraceptive	0.255***	2.85
Ever married	4.110***	6.91
Working	-0.0883	-1.63
Constant	-3.877***	-6.37
N	1637	
Wald chi2(11)	1702.71	
Prob> chi2	0.00	
Log Pseudo likelihood	-2492.9709	
pseudo R^2	0.467	

*p< 0.10, **p< 0.05, ***p< 0.01

From the Poisson results, the variables that had a significant relationship with the dependent variable, children ever born, included: Age, age at first marriage, access to media, religion, use of contraceptives and the higher education dummy.

Due to the difficulty of directly interpreting the Poisson regression coefficients, we computed the marginal effects and the incidence rate ratios as shown:

Table 4.5 Marginal Effects and Incidence Rate Ratios

Variables	Children Ever Born			
	Marginal Effects		Incidence Rate Ratios	
	dy/dx	Z	Coefficients	Z
Age	.077059***	6.65	1.066981***	34.36
Primary education	-.1017913	-1.57	.9154567	-1.60
Secondary education	-.1898629	-1.51	.8425521	-1.49
Higher education	-.2684865***	-2.75	.7760963***	-2.74
Age at First Marriage	-.0676344***	-6.31	.9446846***	-15.75
Urban	-.0509105	-1.51	.9580002	-1.59
Media access	-.065672**	-2.03	.9458928**	-2.00
Muslim	.2662332***	2.90	1.285474***	2.61
Used contraceptive	.3435091**	2.30	1.289958***	2.85
Ever married	.915209***	41.71	1.92362***	6.91
Working	-.101074*	-1.66	.9154695	-1.63
Constant			.0207139***	-6.37
N	1637		1637	
Wald chi2(11)	-		1702.71	
Prob> chi2	-		0.0000	
Pseudo R^2	-		0.4671	
Log Pseudolikelihood	-		-2492.9709	

*p< 0.10, **p< 0.05, ***p< 0.01

Note: dy/dx for dummy variables is discrete change from 0 to 1

4.4 Interpretation of the Estimation Results

Age was positively related to the number of children ever born. Increase in a woman's age by one year increased the expected number of children ever born by a factor of 1.067, holding the other variables in the model constant. Alternatively, this can be interpreted as increase in a woman's age by one year increased the number of children born by 0.77 births holding other variables at their mean. This is because an older woman would definitely have had a longer reproductive period than a younger one and therefore expected to have had more births.

Lower levels of education did not show any significant relationship with total children ever born. However higher education showed a significant and negative relationship. After controlling for other variables, on average, women with higher education- post secondary education- had 26.85% fewer children than women with no education. Education especially higher education adequately exposes women to information on family planning and empowers them to agitate for equal opportunities in decision making especially on the number of children, when and how to have them.

Age at first marriage had a negative relationship with the number of children ever born, as it was expected. An increase in the age at first marriage by one year decreased the number of children ever born by 6.76%, when all other factors were held constant. Alternatively, a one year increase in the age at first marriage increased the number of children ever born by a factor of 0.945.Age at first marriage also affects the childbearing period with those who enter marriage unions earlier having longer periods of child bearing.

Access to media emerged to be a crucial determinant of fertility. Ceteris paribus, women who listened to radio had 6.57% fewer children than those who did not have access to radio. This is because those who enjoy access to media receive greater information on family planning and modern contraceptive technology.

Religion weighed greatly on child bearing. Muslim women had 26.62% more children than their non-muslim counterparts, other factors being unchanged. Religion was considered because of the influence it has on fertility and marriage patterns. Some religions are not supportive of

contraceptive use and encourage particular marriages which have an effect on the number of children born to a woman.

Women who ever used contraceptives had 34.35% more children than those that never used contraception. It is well known that as contraceptive use increases, fertility rate decreases (John & William, 2002). However, the findings of the analysis show that women who ever used contraceptives had more children that those who never used. The reason for this contradicting result could be that most women who used contraceptives might not have been persistent in their use. Data analyzed is about ever use of contraceptives not currently using contraceptives, which is more effective in reducing births. It is also possible that women who used contraceptive methods had already completed their family sizes which were high.

Marital status significantly influenced the total number of children ever born. Women who were or had ever been in marriage had 91.52% more births than those who had never been in a marital union. Women in marital unions stand a higher chance of producing many children due to the higher coital frequency. They are also likely to have a higher frequency of engaging in sex without contraceptives due to the perceived trust of one another.

Working status of a woman is believed to affect the number of children ever born. Wage work has been found to transform fertility decision making (Dudley & Pillet, 1998). The results in Table 4.5 show that women who were working had 10.1% fewer children than those who were not working.

CHAPTER FIVE

5.0 SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

5.1 Summary of Study Findings

The objective of this paper was to identify the socioeconomic and demographic determinants of fertility in North Eastern Kenya and analyze their relationship with fertility. Among the explanatory variables considered were: Educational level, residence, religion, marital status, access to media, contraceptive use, age, age at first marriage and work status.

The variables that showed significant relationship with the total number of children ever born upon Poisson regression included: Age, age at first marriage, access to media, religion, ever use of contraceptive, marital status, work status and higher education dummy. Residence, primary education dummy and secondary education dummy seemed not to be of any significant impact on the number of births reported. Woman's age was found to have a strong positive relationship with number of children ever born while age at first marriage had a strong negative relationship with fertility. Marriage, Islam religion and ever use of contraceptives positively affected fertility levels in North Eastern Kenya while women engagement in wage work, access to media especially radio and higher education negatively affected fertility among women in the region.

5.2 Conclusions

To address the high and rising levels of fertility in North Eastern Kenya, efforts should be channeled towards increasing the proportion of women attaining higher education (post-secondary education), improving access to media (radio) and encourage women's participation in labour force. Initiatives aiming to delay women's entry to marriage and tap into the influence of religion to control fertility should be implemented.

5.3 Policy Recommendations

To transform Kenya as it is envisioned in the Vision 2030, it is targeted that the country's TFR be reduced to 2.6 children per woman by the year 2030. The National Council for Population and Development in the Sessional Paper No.3 on Population Policy for National Development

cautioned that this set TFR target may not be realized if the high and rising fertility in North Eastern Kenya is not addressed.

The inverse relationship observed between higher educational attainment and fertility suggests the possible catalytic role of education in fertility decline. Higher education delays childbearing, opens up more job opportunities and empowers women to have alternative investments besides children and to make informed decisions on the number of children they will have. We therefore recommend that the government and non-governmental organizations put more effort in increasing the proportion of women with higher education in North Eastern Kenya. The national government and the county governments of the North Eastern Kenya counties should consider setting up more technical training colleges and village polytechnics. These should deliberately come up with programmes that would interest women and attract them to enroll. They should be imparted with life and technical skills that would help them to engage in self –employment or to seek employment for their socio-economic empowerment.

There is a need for the government to engage Muslim religious leaders in programmes to lower fertility in the region. In most rural communities, especially where Islam dominates, religious leaders are very influential on the public. They may therefore be very instrumental in passing the message on the need for control of family sizes and family planning.

The government should consider airing content on family planning through the state sponsored Somali-language radio station. Various influential leaders among the North Eastern Kenya communities should be invited to contribute to the awareness campaign. Non-governmental organizations could participate by distributing affordable radio sets to the communities to address the financial hurdles that they would be facing in acquiring radio sets. This way, radio would serve a major role in transmitting information about the need for family planning and fertility control.

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Appendix 1: Correlation matrix

Variables	Age	Primary education	Secondary education	Higher education	Age at First Marriage	Urban	Media access	Muslim	Used contraceptive	Ever married	Working
Age	1.00										
Primary education	-0.314***	1.00									
Secondary education	-0.239***	-0.126***	1.00								
Higher education	-0.011	-0.079**	-0.058*	1.00							
Age at First Marriage	0.269***	0.010	0.046	0.121***	1.00						
Urban	-0.081***	0.137***	0.224***	0.167***	0.081**	1.00					
Media access	-0.078**	0.086***	0.150***	0.093***	0.068**	0.331***	1.00				
Muslim	0.014	-0.131***	-0.124***	-0.258***	-0.053*	-0.158***	-0.062*	1.00			
Used contraceptive	0.014	0.091***	0.044	0.067**	0.0581*	0.113***	0.035	-0.307***	1.00		
Ever married	0.619***	-0.320***	-0.395***	-0.109***	0.0001	-0.213***	-0.121***	0.042	0.052*	1.00	
Working	0.108***	-0.002	0.014	0.201***	0.055*	0.152***	0.076**	-0.203***	0.250***	0.046	1.00