A COMPARATIVE ANALYSIS OF FACTORS EXPLAINING FERTILITY DIFFERENTIALS IN NYERI AND MANDERA COUNTIES IN KENYA

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DECLARATION

This project is my original work and has not been presented for a degree in any other university

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DEDICATION

This project is dedicated to Almighty God, whose teachings on the importance of handwork and dedication provided the source of inspiration and endurance.

I also dedicate the work to my late father Abel Wabwalaba, who time from time, mentored me on the importance of education in life. The mentoring inspired me to continue advancing my skills and knowledge in various fields.

Finally, I dedicate this work to my wife Christine, who encouraged me to continue pursuing this quest despite a challenging working environment and the fact that my commitment to it would have affected our family in various ways.

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ABSTRACT

The study's objective was to determine and explain the effects of the socio-economic, cultural and proximate factors influencing fertility differentials in Nyeri and Mandera counties in Kenya. Two subsets of the 2014 Kenya Demographic and Health Survey data, containing 521 women for Mandera County and 698 women for Nyeri County were used for analysis.

This study analysed the effects of ten explanatory variables, consisting of five background variables and five proximate determinant variables, on rate of childbearing in each county. The explanatory variables analysed were wealth index, education level, place of residence, age at first marriage and religion. The proximate variables: were marital status, ever use of modern contraceptives, experience of child mortality, age at first birth and ideal number of children. Rate of childbearing was measured by a composite variable consisting of children ever born and respondent age.

The study applied descriptive statistics to describe the study variables and Poisson regression analysis to determine the effects of predictor variables on the outcome variable. Bivariate Poisson regression models were used to screen the independent variables considered in this study. Multivariate Poisson regression models fitted involved only the significant explanatory variables at bivariate analysis stage in both or either of the two counties.

The results of the bivariate regression established that except for religion, all the selected background and proximate variables had significant effect on the rate of childbearing in both or either of the two counties. The results of multivariate regression revealed that age at first birth and experience of child death were common across the two although with varied effects, marital status was only unique in Mandera while wealth index, use of modern contraception and ideal number of children were unique in Nyeri.

Experience of child death and low use of modern contraceptives were attributed to high fertility in Mandera while improved wealth status accounted for low fertility in Nyeri. In view of these, key interventions to reduce childhood mortality, reposition family planning and increase wealth creation are recommended. Also, further studies should be undertaken using datasets containing information on proximate factors that were not analysed in this study due to various limitations.

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CHAPTER ONE: INTRODUCTION

1.1 Background

The study of differentials in fertility behaviours in different population strata has attracted attention of several demographers in the recent past. Bongaarts (2009, 2011) noted that several demographers have been conducting research in an attempt to explain the observed differences in the total fertility rates in developing countries. For instance, Blacker et al (2004) did a comparative study on Uganda and Kenya focusing on trends and determinants while Olatoregun et al (2014) compared the fertility levels of Nigeria and Ghana. Other than country-based studies, there have also been conducted in attempts to study the topic at ethnic and regional levels. Htun and Ardh-am (2015) analyzed the fertility variances among different regions and states in Myanmar, South East Asia while El-Ghannam (2005) investigated the relationship between fertility rate differentials among 53 least developed countries (LDC's) and 53 most developed countries (MDC's).

Based on the findings from the above and other studies, it has been observed and documented that fertility levels vary considerably among different groups of the same population. Much of the evidence accumulated so far allude only to a few factors as being accountable in explaining what influenced the fertility differentials. These factors include proximate determinants such as contraceptive use, post-partum infecundity and marriage (Cochrane and Farid, 1990). Background factors that have been identified include residence, household wealth, employment and education (Prasithrathsin et al. 2000). It is generally expected that education and fertility are inversely related. In a study that was conducted to analyse factors behind regional fertility differentials in Burma, age at first marriage and female's education were the most significant factors (Htun and Ard-am, 2015). Apart from the common factors above, the following background variables; ideal number of children, polygyny, individual wealth, ethnicity, religion, media exposure, female life expectancy, household headship, age at first sex and marital status were used in part across selected studies on fertility differentials (Olatoregun et, al. 2014; El-Ghannam, 2005; Nwabuisi, 2011; Htun and Ardh-am, 2015). Some of them showed statistically significant effects on fertility while some were not.

The effects of the above factors on fertility also depend on the setting (Reed et al., 1999). A factor that promotes fertility decline in one region may coincidentally enhance it in another region (Martine et al., 2013). In a study conducted to compare the fertility levels between Ghana and Nigeria, the results showed that Ghanaian women without formal education were

17 times more likely to belong to a high fertility level when compared with those with advanced formal education (Olatoregun et al. 2014) while on the other hand, Nigerian women with no formal education were 2.5 times more likely to belong to a higher fertility against a lower fertility. Overall the results of various studies underpin the fact that regions in the same setting may not only experience vast differences in fertility rates, but trends could be in contrast. This suggests that while the factors affecting fertility may be similar, their impacts differ from country to country or region to region or even from a community to a community (Kim, 2016).

Although Kenya's fertility rate has declined drastically - from eight children for each woman to four children per woman- over the last four decades, concerns continue to be expressed on the persistent and striking differences in the levels experienced regionally (KNBS 2014; NCPD, 2012). Surveys on fertility transition in Kenya show that total fertility rate has been increasing in some areas and declining in others. For instance, the Kenya Demographic Health Survey results showed that in 2009, TFR was 5.9 for North Eastern while the 2014 KDHS show that this increased to 6.4 children which was the highest by region. In Rift Valley and Western regions fertility was five births, Coast and Nyanza four, Eastern (3.4), Central 2.8 while Nairobi had the lowest rate of about 2.7.

1.2 Problem statement

Explaining regional fertility differences is one of areas that has attracted widespread attention from demographers in the recent past (Blacker, 2002; Bongaarts and Potter, 2013). In studies that were conducted in West Africa, Southeast Asia and Kenya-several researchers used a variety of socio-economic and proximate factors in attempts to explain the differences across selected countries, sub-regions and sub-ethnic groups (Olatoregun et, al. 2014; El-Ghannam, 2005; Nwabuisi, 2011; Htun and Ardh-am, 2015). The most common factors tested across the studies were age at first marriage, education, household wealth, employment status, the use of contraceptive and the type of residence. The following factors although not common, were sometimes included as background variables in some of the studies and revealed inconsistent findings; ideal number of children, polygyny, individual wealth, ethnicity, religion, media exposure, female life expectancy, household headship, age at first sex and marital status.

While most studies acknowledged the role played by education, age first marriage and contraceptive use in influencing fertility, variations in the combinations of the variables and

their influences depended on the setting. In a study conducted by Nwabuisi (2011) to study the factors influencing fertility in Guinea and Nigeria, while age at first sexual intercourse, education level and employment influenced fertility in Nigeria, they were not found to be associated with fertility in Guinea (Nwabuisi, 2011). Similarly, Olatoreun et al. (2014) found that Ghanian women with no formal education were 2.5 times more likely to fall in higher fertility category compared to those from Nigeria who ranked 3.8 times more likely to be in a higher fertility category.

Although Kenya has recorded a remarkable decline in total fertility rates at the national level as shown by a reduction of about 52 percent in the last four decades (KNBS, 2014), fertility rates have not been homogeneous within the regions (Blacker, 2002). Of general concern over the four decades has been that regions with the higher fertility levels predominantly come from semi-arid and arid areas in the north. On the other hand, the counties with the lowest TFRs were largely from the Central part of the County. For example, while North East recorded TFRs of 7.0 (KDHS 2003), 5.9 (KDHS 2009) and 6.4 (KDHS 2014), the Central region recorded 3.4 (KDHS 2003 & 2009) and 2.8 (KDHS 2014). A similar trend was depicted in the 2014 KDHS results for the county level with Mandera County recording a TFR rate of 5.2 higher than the national score of 3.9. In contrast, Kirinyaga County (2.3) recorded the lowest rate nationally followed closely by Nairobi, Nyeri, and Kiambu with a TFR of 2.7. Analysis of the relationship between various determinants and fertility and is therefore necessary for establishment the factors explaining the huge regional fertility differentials.

Most of the studies conducted in Kenya to explain the above fertility differentials although have focused on data at the national level without factoring trends depicted at the county level. In a research done to determine the fertility differentials of various sub-groups in Kenya, low fertility levels in Central and Nairobi were most attributed to postpartum infecundability, higher levels of women's education, the increased contraception use, delayed marriages and non-marriage (Mutetei, 1998). This study focuses on Nyeri and Mandera Counties. With Nyeri County representing a low fertility regime and Mandera County representing a high fertility regime therefore making it interesting to search for combinations and effects of factors responsible for promoting the reductions in Nyeri and hindering the reduction in Mandera.

1.3 Research questions

The overall research questions are addressed in this study to explain the role of the various socio-cultural, proximate factors and socio-economic factors in influencing fertility differentials in Nyeri and Mandera counties. Specifically, the study will address the following questions:

1. What factors are driving fertility differentials in Nyeri and Mandera?
2. What are the various effects of the factors driving fertility differentials in Nyeri and Mandera?
3. How do the factors explaining fertility in Nyeri and Mandera compare?

1.4 Objectives

1.4.1 Overall objective

To explain the fertility differentials in Nyeri and Mandera counties.

1.4.2 Specific objectives

1. To determine principal factors and their effect in explaining fertility in Nyeri and Mandera
2. To undertake a comparative analysis of factors explaining fertility in Nyeri and Mandera.

1.5 Justification and significance of the study

This study is conducted on the motivation that previous studies and current knowledge about factors responsible for explaining fertility differentials did not reach an agreement. Different factors were established as being responsible in explaining fertility in different regions including in the former provinces of Kenya. This study will therefore be justified in revealing the main factors responsible for explaining the variations in Nyeri and Mandera counties in Kenya.

The findings will form a repository for further research and reference on fertility at county levels in Kenya. In addition, policy formulators may find the study results suitable for establishment of measures that can be incorporated in the national population policy to further reduce further the current national TFR of 4.6 to the targeted 2.6 children per woman by 2030 (Policy Brief No 35, 2013 & NCPD, 2012).

The study is also justified with respect to the study populations and setting being associated with the processes of the demographic transition theory which underlines the importance of social and economic development on fertility. In one of the theory's processes, large families are highly valued for status and economic reasons. Most of the rural and arid areas including Mandera County in North Eastern Kenya are presumed to be in this high population growth process. In due course, modernization brings socio-economic changes eventually resulting in the decline in the birth rates leading to declining population growth rates characterized by most developed/modernized societies (Macionis, 1991). Areas with low fertility regimes such as Nyeri County are believed to be more advanced in this process.

Finally, the study is significant because it will use Poisson regression, a robust model with attractive properties as its primary method of analysis marking a shift from the use of standardized (logistic and multiple) linear regressions which were common in past studies. The use of Poisson in studies where the outcome variable is of a count nature has proved to have multiple advantages over the two linear regression methods. Its use here will therefore offer fresh insight and will evaluate the existing knowledge on fertility differentials.

1.6 Scope and limitation of the study

The study will rely on secondary data from the 2014 Kenya Demographic Health Survey (KDHS). One of established limitations of this data is that it contains missing values or cases for some of the variables. The researcher chose to omit those variables and recoded categories that contained a significant number of omitted cases to attain the same sample for the fitted Poisson model. The deletion of the cases was likely to cause variations in the results since it further reduced the already chosen small samples for each of the two counties.

Furthermore, despite being the first survey to release estimates at the county level, the researcher is aware of the fact that being like any other secondary data, it may have suffered quality related issues such as age heaping- which is the tendency of respondents to round off their ages to the next 0 or 5. In addition, information on children ever born, one of the components of our dependent variable, was reported retrospectively thus possibly resulting in the omission of infants who died few weeks after being born and those who might have been staying elsewhere at the time of the interview. The proportions omitted tend to increase with age as older women begin to suffer from memory lapse.

Lastly past literature suggests that the decision regarding the use of modern contraceptives, one of key proximate determinants of fertility, is dependent on the input of the husband. However, the KDHS survey focused only the responses of women regarding family planning and fertility preference.

CHAPTER TWO: LITERATURE REVIEW AND CONCEPTUALIZATION

This section reviews past and recent literature of studies conducted on fertility differentials. To begin with, a discussion of the theoretical aspects was undertaken. Here, the first three theories are mentioned briefly followed by a focus on the socio-economic theory that best explains the causes of fertility differentials across populations and regions, The next part reviews empirical studies on fertility variances. This section is divided into two; a review of empirical literature on fertility differentials at a broader category followed by a regional level review.

2.1 Theoretical literature explaining fertility changes

Three theories are identified and discussed but only two are discussed in detail because of their link to the study.

Several attempts have been undertaken to try to understand the dynamics of human fertility. To begin, the demographic transition theory which underlines the importance of social and economic development is broadly linked to this study. This theory was developed by Thompson (1929) and improved by Notestein and Davis (1945) on the foundation that societal change is a unilineal movement from "traditional" to "modern" society. It holds that the immediate impact of modernization improves traditional societies socio-economic statuses resulting in sustained birth rates and a significant drop in their mortality rates (Caldwell, 2006; Weiguo, 2002). This results in rapid population growth shown in the earlier stages of transition. In this stage, large families are highly valued for status and economic reasons. Most of the rural and arid areas including Mandera County are presumed to be in this high population growth stage. Eventually, modernization brings socio-economic changes eventually resulting in the decline in the birth rates leading to declining population growth rates characterized by most developed/modernized societies (Macionis, 1991). Areas with low fertility regimes such as Nyeri County are believed to be more advanced in this process.

On the other hand, the Microeconomics theory attempts to explain fertility by focusing on individual fertility behaviour as influenced by the constraints of time, price, taste and income. The children are assumed to have utility value to parents and hence the parents may make rational choice to have children of their own as they do with consumption goods. This original theory was improved by Becker (1965), Easterlin and Crimmins (1985) with the

focus on the factors behind the demand for children including cultural values, beliefs and norms.

Interpretation of data was specifically guided by the proximate determinant framework. The framework of intermediate variables was introduced to study the influence of socio-economic factors on fertility by Davis and Blake in 1956. The two compiled a list of critical variables in the reproductive process-from intercourse to conception to gestation to parturition- through which socio-economic variables must work to affect fertility. They found that with the three steps, 11 factors are connected through which cultural conditions may affect fertility. Their model was later improved and popularized by Bongaarts (1978, 1982) through an empirical study which showed that most of the observed fertility differences in populations are explained using four primary intermediate variables: postpartum_infecundability, marriage, induced abortion and contraception use. This improved socio-economic framework has become the most dominant in explaining of fertility rates and differences across and in populations. One of the strengths of this model is that it reveals certain relationships between socio-economic variables and fertility as linked by intermediate variables and hence proving useful in the analysis of complex, interlinked fertility and socio-economic processes (Caldwell, 1982).

Based on the above background, the study was therefore an attempt to understand and explain the key demographic, socio-cultural and socio-economic characteristics (including residence, household wealth, levels of social development, educational level status) that have been found to promote childbearing behaviour and account for fertility rates, and differentials (Bongaarts, 2008).

2.2 Review of empirical studies on fertility

2.2.1 Empirical studies of fertility differentials at country levels

Olatoregun et al. (2014) compared the fertility levels of Nigeria and Ghana, their determinants and the differentials in the effects of the various factors. Their study relied on analysis of Demographic Health Surveys (DHS) data from Ghana and Nigeria of 2008.

The study used children ever born (CEB) as the outcome variable and examined respondent's age, occupational status, marital status, residence, household wealth index, education level,

contraception usage, age at first marriage and household headship as the explanatory variables.

The factors influencing fertility in the two countries were tested using ordinal logistic regression with a significance level of 5 percent. The researchers performed bivariate analyses to determine the empirical relationships between selected explanatory factors and the outcome variable. All non-statistically significant independent variables including those with collinearity were left out from the analysis.

To enhance good comparison, the study grouped children ever born into three groups. Each woman was grouped into one of high (greater than four), medium (two to four), and low (one or no child) fertility groups.

Through bivariate analyses, the study established statistically significant relations between fertility level measured by children ever born were education, the age of women, wealth index, residence, occupation, marital status, household head, age at first marriage, contraceptive usage and age at first sexual intercourse.

The results of ordinal regression showed that age, educational level, employment status, place of residence and use of contraceptive and age at first sex were significant although with varying levels of significance in the two countries. Nigerian women between 35-44 years were 33 percent unlikely to have higher fertility against lower fertility compared to those aged beyond 44 years. Also, the chances the probability of high fertility Nigerian women in were 3.8 times more among women who had attained primary level schooling compared to women who attained advanced schooling. Nigerian women who were non-employed were 0.4 times less likely to fall in higher fertility compared to those employed. Separately, married Ghanian women were twice likely to be in a high fertility category against a lower fertility category when compared to those who had been formerly married. This odd was higher among currently married Nigerian women who were more likely to belong to a higher fertility category by two and half times compared to Nigerian women who were not in any type of union.

Ghanaian women without schooling were 17 times more likely to belong to a high fertility group compared to those who had attained higher level of schooling. This odd was lower for

Nigerian women without formal education who were 2.5 times likely to report high fertility. Nigerian women who had primary level schooling were 1.8 more likely to fall in a medium fertility level compared to ones who were highly educated.

Also, Ghanaian women residing in urban centres were 24percent less likely to belong to a high fertility group compared to those staying in rural places. On the other hand, Nigerian women in urban areas were 4percent more likely to record high fertility against low fertility.

Poor and middle-class women and those who never used oral contraceptives had high chances of falling in a higher fertility level compared to those out of any marital union. Also, women who married at a low age (before age 20) had high chances of being in a higher fertility category against low fertility category in both countries. The odds ratio was higher in Nigeria than Ghana.

One of the striking findings was that more than half of the women engaged in first sexual encounter before reaching age fifteen. This was assessed to have a high impact in influencing high fertility.

El-Ghannam (2005) conducted a study on the association fertility rate differentials between less developed and most developed nations. The demographic transition theory formed the basis for interpretation of data. This theory was chosen since fertility rate differentials were based on the impact of social and economic which were defined by the status of women, such as life expectancy, the education level of women and their labour force. The basic assumption underpinning fertility transition theory is that more advanced societies were likely to experience low fertility than traditional societies.

The study examined empirically which of the following determinants had the most effect on fertility differentials: life expectancy, child mortality, age at first marriage, duration of schooling and participation of women in labour force. The outcome variable was the total fertility rate (TFR) defined as “the average number of children that would be born alive to a woman during her lifetime if she were to pass through all her childbearing years conforming to the age specific fertility rates of a given year”.

Sample data of 53 LDC's and 53 MDC's was collected from various sources including World Bank 2000 Social Indicators of Development, the 2002 UN's Statistical Yearbook and Trends and Statistics in the World's Women published by UN in 2001,

The methods used were a combination of descriptive and multiple regression analysis. Descriptive analysis compared the average TFR. Multiple linear regression assisted in estimating the levels of variance or effects in TFR explained by each of the explanatory variables.

The results of correlation coefficients for the LDC group revealed a significant positive link between child mortality and TFR and a significant negative link between TRF and age at first marriage, life expectancy, labour force and education level. Those for the MDC found a significant negative effect between TFR and life expectancy, education, age at first marriage and labour force. The findings suggested that decline in TFR in both the MDC and LDC was more likely to happen among women with advanced age of marriage, more of years of life expectancy, advanced level of education, and those actively engaged in work. The results also showed that child mortality rate was most important in affecting TFR for the LDC group. Increase in child mortality corresponded with an increase in the TFR rate.

The results of multiple regression for the LDC group suggested that increase in total fertility rate was reported for women who had experience of child death. Moreover, the TRF declined among women who were actively involved in labour force and who had more years of life expectancy. The level of education and age at first marriage were not best predictors of total fertility rate in LDC since they were not significant. Secondly, the results of the regression in MDC's group showed that the standardised regression coefficients for women in labour force and life expectancy were negatively and statistically significant. This implies that total fertility rate declines for women with advanced years of life expectancy and those in active labour force. The remaining factors including age at first marriage, the education and infant mortality rate were insignificant.

Nwabuisi (2011) conducted a study to examine the trend and factors influencing fertility in Nigeria and Guinea. Secondary data from the Demographic Health Surveys (DHS) for the years 1999 and 2003 for Nigeria and in Guinea in the years 1999 and 2005 were used for analysis. The Bongaarts 1978 framework was used as the conceptual framework. logistic

regression was used to determine the effect of variables affecting the total number of children ever born in the two countries. The independent variables tested included respondent age, education, place of residence, current use of contraceptive, age at first sex, religion age at first marriage, partner's education and employment all the year.

The results for Guinea established an association between contraceptive use and all the selected socio-demographic variables. The regression established that a respondent's age and current use of contraception had a positive impact on children ever born. The level of education and type of place of residence, age at marriage and religion had negative bearing on children ever born in Guinea. However, the age at first sex, the education level and a women's employment status were not associated with fertility in Guinea at all. Similar observations were made for Nigeria except for a few explanatory variables. While religion had influence on fertility rate in Guinea, it had no effect in Nigeria. A partner's education influences fertility in Nigeria whereas it does not in Guinea. Employment of the women has no effect on fertility in Nigeria and Guinea. The study also established that while increased contraceptive use in Guinea may contribute to the fertility decline, contraceptive use in Nigeria appeared to have no relationship with fertility. However, it was not known to what extent it had been underreported in Nigeria.

2.2.2 Empirical studies of fertility differentials at regional levels

Htun and Ardh-am (2015) conducted a research to describe the fertility differential and its determining factors at states and regional levels in Myanmar, South East Asia. Secondary data for 2007 was used and bivariate and multiple linear regression were used. Factors analyzed included education level, age at first marriage, employment status, residence, knowledge about contraceptive methods, religion, and occupational status.

The results from the multiple linear regression showed that education and age at first marriage e mainly explained the fertility differential in all the eight states. The age at first marriage had a negative relation on fertility in every state. For instance, in Kachin State, women who married a year late reduced the number of children by 0.12, in Kayah State (0.17), Chin state (0.22), Mandalay (0.15), Kayin State (0.15), Mon State (0.17), Shan State 0.10), and Rakhine State (0.19). The study established that the educational level for women also had a negative association with children bearing across all the states. On the other hand,

the employment status had a negative effect on the number of children ever born across all states except in Shan where it positively influenced the number of children ever born. Furthermore, the type of residence had negative effect on children born in Kachin, Mon, Chin, Mandalay and Rakhine States and), but positively affected number of children born in two namely Shan and Kayin States. Religion was statistically significant in only Rakhine State where most natives were Muslim.

The knowledge about contraceptive methods had varying degrees of effect on children ever born. For instance, it was found to have negative effect on children ever born in Chin, Kachin, Rakhine and Shan and Mandalay States. On the other hand, it had positive effect in Kayin, Kayah, and Mon States. It was also established that the occupational status had a negative association on children born in four of the eight states.

Mberu and Reed (2014) conducted research to understand subgroup fertility differentials in Nigeria. The study primarily used the 2013 Nigerian Demographic and Health Survey (DHS) dataset for analysis but went ahead to rely on survey indicators from the 2008 and 2003 reports. Multiple linear regression was chosen as the tool of analysis.

Total fertility rate was chosen as the outcome variable. The independent variables were modelled in the three theoretical models; reproductive behaviour model (ideal number of children, age at first marriage, age at first sex, age at first birth), institutional model (opposed to family planning use, Woman thought husband was opposed to family planning, ethnicity and religion), socio-economic model (highest educational level obtained, urban/rural residence, wealth index, employment). The results from a combined linear regression revealed that marrying above age 20 had the strongest negative effect on children ever born. Women who married above 20 had least number of children than those who married before age 20, which underlined the significant role that delayed marriages have on reduction. The age at first sex had a significant but least negative influence on childbearing. The age at first birth had a significant but lesser effect on childbearing. The number of children significantly increased in line with a corresponding increase in women's preferred number of children. The final test found no significant variations in fertility among rural and urban dwellers. The net significant fertility effects of the socio-economic status variables — current age, level of educational attainment, marital status, employment status, and household wealth status — stayed moderate and significant in the final model.

Adhikari (2010) did research to investigate the socio-economic, demographic and cultural determinants accounting for fertility variations in Nepal. The study incorporated data from the Nepal Demographic and Health Survey (NDHS) of 2006. The outcome variable was the children ever born. The predictor variables used were respondents' age group, occupation, age at first marriage, knowledge wealth status, mass media exposure, place of residence, literacy status, household headship, religion, previous use of family planning methods and experience of child death. The study used a combination of bivariate and multivariate analyses tests. One-way ANOVA was used to examine the link between the dependent factors and outcome variable. Before performing a multiple linear regression test, a correlation matrix test was done to determine the degree of the association between every pair of dependent and independent variables. The results showed no multi-collinearity between the independent variables and the outcome variable. All the explanatory variables were therefore included all the variables in the bivariate analysis and multivariate linear regressions.

The multiple linear regression results displayed considerable differentials in children ever born based on women's socio-economic, demographic and cultural settings. It was shown that that age at first marriage, place of residence, perceived ideal number of children, mass media exposure, literacy status, religion, household headship, use of family planning and child-death experience were the most significant factors accounting for the variances in fertility.

In contrast to previous studies, the results showed that women who in any way used contraception gave birth to more children compared to those who never used contraception in their reproductive age. It could be linked to the fact that Nepalese women only preferred using contraception when they reached or exceeded the ideal number of children.

An association between fertility and mortality was also established. Women who had any of their children dying were likely bear more children than those never experienced child deaths. Akpa and Ikpotokin (2012) studied the effects determinants of fertility on fertility rates for the various ethnic groups in Nigeria. The 2008 data of the Nigerian Demographic Health Survey was used. Poisson regression was the preferred method of analysis. The main outcome variable was the level of fertility defined by children ever born. The explanatory

factors were divided into two categories. The proximate category had age at first intercourse, current marital status, age at first marriage, polygyny (husbands with several wives), age at first birth and use of contraceptives. The socio-demographic factors analysed included individual wealth index, household wealth index, highest education status, place of residence, ethnicity, religion and whether husband stayed with the woman. Although the researchers wanted to test the effect of postpartum amenorrhea, recent sexual activity and abstinence and insusceptibility, these three variables were excluded in the modelling process because of the large missing observations recorded.

The results established that apart from religion, all the selected socio-demographic factors did not only possess individual influences but are also strongly related with the level of fertility across Nigeria's ethnic groups even when the proximate determinants were included. Fertility among the Hausa was 1.02 times higher compared to other smaller groups. Fertility was lesser among the Yoruba women who had 18 percent compared to other minority groups. Women from families had 1.04 times more children compared to those from wealthy backgrounds. Women who had first birth between 15-30 years and those whose delivery was after 30 years had 18 percent and 61 percent lower fertility respectively in comparison with those who delivered their first child before attaining 15 years. Women in rural areas were 1.02 times most probably to experience the risk of higher fertility those who lived in urban places.

Odwe (2015) conducted comparative research to study the link between poverty and fertility Western and Coast regions. The study used data from the Kenya Demographic and Health Surveys (KDHS) of 1989 ,1993, 1998, 2003, and 2008/9. Household poverty and fertility as measured by the number of children ever born were the key variables. Since KDHS did not collect information on expenditure and income, the wealth index was the proxy measure of household poverty. The analysis adopted Poisson regression and fitted two models for Coast and Western Provinces. Apart from the household wealth, experience of under-five mortality and the level of education were included as socioeconomic factors and the type of marital union was included in the model for use as a control socio-cultural factor. The partner's endorsement of family planning, contraceptive use, and communication of spouses regarding family planning use were introduced to control for psychological factors. The woman's age in was also included as a control in all the estimated regressions.

In the first model, household wealth status was tested as the only explanatory variable, while the second model had child mortality and level of education. The use of the two was motivated by literature which had established that there exists high fertility in the region of sub-Saharan Africa mainly attributed to low levels of women schooling and high levels of child deaths (Bongaarts, 2008).

The results showed that household wealth was a major determinant that explained fertility in Western and Coast and Western regions. In both regions, child mortality increased the fertility especially among the poor women. Education was found be a significant variable influencing fertility in both regions although level of influence weakened over a period of time in Western region. Some notable differences were documented in the two regions. In the Coast region, the impact of education was significant except in the year 1989 and was becoming more pronounced in every survey. In contrast, its influence in Western region was weak and diminished over the years. This shows that fertility levels in Western were mainly determined by other variables other than the level of education.

2.3 Summary of literature review

In summary, the literature reviewed above show that studies on fertility differentials can be well tested and explained through a combination of socio-cultural factors, socio-economic factors and proximate determinants. The common dependent variable used in most studies is children ever born. The main factors which have been identified as having relationships in explaining fertility transitions in some of the regions studied include education level, wealth index, the type of place of residence, contraceptive use, desired fertility or ideal family size, marital status, type of marriage and age at first marriage. Others which were tested in isolation in some of the studies included ethnicity, religion, media exposure, female life expectancy and household headship.

Descriptive statistics were mostly used to present the summaries of the countries or regions, bivariate analysis (One Way Anova, chi square test) was used to test the relations between the independent and outcome variables while multivariate analyses (multiple linear regression, logistic regression and Poisson) were the main methods used to test the effects of the associations.

2.4 Conceptual framework

The study utilized Bongaarts 1984 framework in which the background and socioeconomic characteristics are posited to influence fertility indirectly through their effects on the proximate variables. Studies on factors causing fertility differentials and transitions were often conducted to measure directly the influence of socio-cultural and socio-economic factors on fertility. Bongaarts found this approach more problematic simply because relationships tend to differ in different times and settings (Bongaarts, 2015). He argued that substantial insights can be gained if for instance in measuring the socio-economic factors effect on fertility, the specific mechanisms through which these factors operate, are identified and incorporated in the measurement process (Mahjabeen & Khan, 2011). For example, the education level is one of the socio-economic factors which has been established to possess a negative effect on fertility. However, a further analysis may show that among the highly educated women frequent use of contraceptives or preference for late marriage may clearly explain the association between fertility and level of education.

The first systematic grouping of the proximate determinants of fertility came from by Davis and Blake in the year 1956). The two scholars had heralded the demographic literature for having explicit the distinguished between the factors, which directly and indirectly affected fertility. Bongaarts (1978) improved on their work which had outlined the idea of background and intermediate variables as influencing fertility. He enumerated eight proximate determinants of fertility and narrowed down on four (contraceptive use, marriage patterns, postpartum infecundability and induced abortion) as the most important ones (Bongaarts, 2015). The remaining four which were considered least important include spontaneous intra-uterine mortality, frequency of intercourse, sterility levels and duration of fertility period. It has therefore appeared reasonable to ignore the ‘redundant’ proximate variables. To quantify the fertility inhibiting effect of the four main proximate factors, Bongaarts used a relatively simple model, which has now the most preferred in the analysis of fertility among populations.

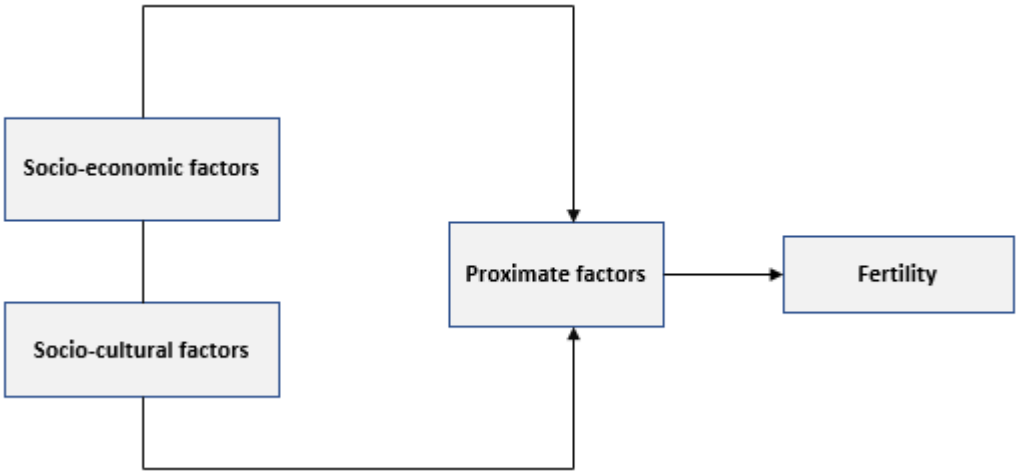

Figure 2.1: Conceptual model for fertility analysis (Adopted from Bongaarts 1978)

The framework shows the relationships between socio-economic, socio-cultural and proximate variables in affecting fertility. The empirical evidence supporting the concepts has been covered above.

2.5 Operational framework

The following operational framework shows the variables considered important in explaining fertility differentials. These are the ones that were tested to explain the differential in fertility levels between Nyeri and Mandera.

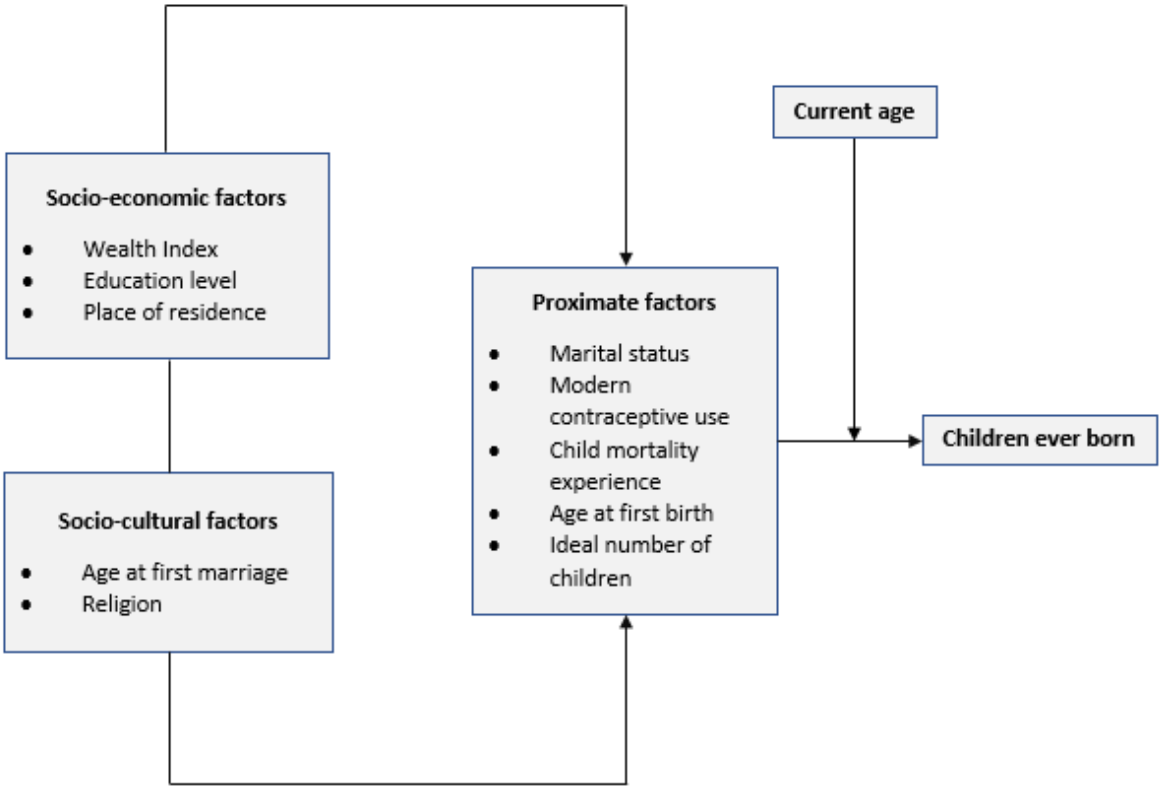

Figure 2.2: Operational model for fertility analysis

As shown in figure 2.2, the woman's current age was used in the framework as an offset predictor to account for the risk of exposure to childbearing. Its effect and that of children ever born were used to measure the rate of childbearing (λ)

The following relationships were also hypothesized and analyzed in the study.

Socio-economic factors

a. Wealth index influences fertility differentials in Nyeri and Mandera

b. The level of education is a key contributor to fertility differences in Mandera and Nyeri

c. Place of residence is a key determinant of fertility differentials in Nyeri and Mandera

Socio-cultural factors

d. Age at first marriage contributes to fertility differentials in the two counties

e. Differences in types of religion are likely to influence fertility differences in the two counties

Proximate factors

f. Marital state impacts fertility differences in Mandera and Nyeri

g. The level of contraceptive use influences differences in fertility levels in the two counties.

h. The experience of child death impacts on fertility in Mandera and Nyeri.

i. Preferred number of children influences fertility in the two counties

j. Age at first birth leads to fertility differences in Mandera and Nyeri

CHAPTER THREE: METHODOLOGY

This chapter is divided into four sections. Section 3.1 describes the source of data and selection of the sample. Section 3.2 defines the dependent and the selected interdependent variables while section 3.3 focuses on providing a background and justification for the main method of analysis. Section 3.4 concludes this chapter by describing, justifying and operationalizing the main method of analysis.

3.1 Source of data

The data used in this study was a subset of the Kenya Demographics and Health Survey (KDHS 2013/14) which recorded levels of fertility, family planning (FP) and other relevant indicators. The survey was conducted countrywide covering a sample of 39,679 households selected from 5,360 clusters (sample points) in which a total of 31,079 women were interviewed. To get the files for Nyeri and Mandera, the entire country dataset was filtered based on information collected at the counties. Two datasets were then derived, one containing information for 521 women who were interviewed in Mandera and the other containing information for 698 women who were interviewed in Nyeri. This research study utilized data collected for women using the Woman Questionnaire (both short and full versions) which produced estimates of indicators at country, regional and county categories.

During the data preparation process, several activities were undertaken. To avoid bias in results at the regression stage, usually introduced by retaining categories with very few cases, the final sample used in the analysis excluded cases with missing data in at least one of the variables. In addition, the percentage of missing cases in each variable were investigated using the SPSS frequency option. Two proximate variables – ideal number of children and child mortality – were found to contain half of the observations missing. Further investigations established that for 'ideal number of children', data was only available from about half of the women who only respondent to the full woman questionnaire. These were retained by creating a category to take care of the many missing cases in the two variables. It was necessary to retain these categories since deleting many cases or responses of many persons usually results in a smaller sample size, larger standard errors and bias in the effects of regression coefficients (Smith, 2018).

3.2 Variable definitions and categorizations

The study used ten independent variables-consisting of five background and five proximate. The relationship between these variables was illustrated in detail in the operational framework guiding this study in section 2.6 of chapter two above.

3.2.1 Dependent/Response variable

A composite outcome variable [the rate of childbearing (λ)] was used and was based on total children ever born (CEB) by individual women in reproductive ages and the ages at which they responded to the interview. The proxy index was operationalized by computing the natural log of current age [ln (Current Age)] in each of the two datasets (Mandera and Nyeri). The new variable was then used in the model as an offset predictor in cognizance of its limitation that the range of age for a girl to experience her first period (menarche) varies between ages 8-15.

3.2.2 Independent variables

Socio-economic factors

Wealth index

This is a composite measure of a household's collective living standard. Asset-based-wealth indices are commonly used for measuring the economic situation of households in developing countries. Three classifications for poor (reference category), middle, and richer were adopted.

Education level

This variable measured the highest level of schooling attained by the women. The variable was categorized into three dummy variables of no education, primary school and a combination of secondary and higher schooling. The category for women who have no education was taken as the reference category.

Type of place of residence

This variable refers a woman's place of residence. It had two categories; rural (reference category) and urban.

Socio-cultural factors

Age at first marriage

This is the age that the woman entered first marital union. This was a dummy variable, coded 1 if married ≤19 (reference category), 2 if married between 201-24 years and 3 if 25 plus.

Religion

This variable identified the respondent's religious belonging. Although in the literature review the studies focused on several categories such as Protestants, Catholics and Muslims, in this study, two religious categories were used Muslims (reference category) and Christians. This is because Muslim is the most dominant form of religion in Mandera while Christianity is the most dominant in Nyeri. Muslim women are expected to have higher fertility.

Proximate variables

Marital status

Refers to whether the respondent is currently married (reference category), formerly married and not married. In this study ever married and never married were chosen for analysis. Those who have ever been married are projected to bear more children compared to those who have never considered to be in a marriage union.

Ever use of modern contraceptive

Refers to the type of method of fertility control a woman uses. Two categories were preferred; 'ever used modern and never used modern (reference category).

Experience of child mortality

It is used to monitor the probability of a young one dying between the first and fifth birthday. It was categorised into experience (reference category) or no experience of death of a child. Fertility has been observed to be high as parents get more children as insurance. The missing observations were included as third category of "not given birth."

Age at first birth

Refers to the exact age at which a woman got her first child. Younger age at first birth is projected to be linked with higher fertility compared to older age at first birth. It was coded as 1 = ≤19 (reference category), 2 = 20-24 and 3 = 25+

Ideal number of children

This refers the total children a woman prefers to bear in her reproductive lifetime. It was coded 1 if a woman desired 5+ children, 2 if 3-4 children and 3 if 0-2 children. The missing observations were included as a fourth category of "unselected women."

Table 3.1 Study variables and their categorizations

Study variable	Categorization	References
Dependent variables		
Children ever born	Measured on continuous scale	Akpa & Ikpotokin (2012)
Respondent age	Measured on continuous scale	Htun & Ard-am, 2015; Olatoregun et al. 2014
Socio-economic variables		
Wealth Index	1 = Poor® 2 = Middle 3 = Richer	Mberu & Reed, 2014
Education level	1 = No education® 2 = Primary 3 = Secondary & higher	Mberu & Reed, 2014
Type of Place of Residence	1 = Rural® 2 = Urban	Nwabuisi, 2011; Olatoregun et al. 2014
Sociocultural variables		
Age at first marriage	1 = 15-19® 2 = 20-24 2 = 25+	Mberu & Reed, 2014
Religion	1 = Muslims® 2 = Christians and others	Own categorization
Intermediate variables		
Marital Status	1 = Currently married 2 = Formerly married 3 = Not married®	Olatoregun et al. 2014
Ever use of modern contraception	1 = Never used modern ®. 2 = Ever used modern	Nwabuisi, 2011; Olatoregun et al. 2014; Htun & Ard-am, 2015
Experience of child mortality	1 = Yes® 2 = No	El-Ghannam, 2015; Nwabuisi, 2011

Age at first birth	1 = 15-19® 2 = 20-24 3 = 25+	Nwabuisi, 2011
Ideal number of children	1 = 5+® 2 = 3-4 3 = 0-2 4 = Unselected women	Olatoregun et al. 2014

N.B. The category with the highest risk of outcome (fertility) was selected as the reference category denoted as ®.

3.3 Methods of analysis applied

The study used two methods namely: descriptive statistics and Poisson regression. The first was used in the description of the study variables while the second was for determining the effect the effects of the independent variables on the outcome variable.

3.3.1 Poisson regression description

Poisson model is a statistical distribution introduced by mathematician Simeon Denis Poisson in 1837 to depict the number of times statistically independent events are likely to occur within a specified interval of time (Letkowski, 2014; Islam & Shapla, 2018).

Although a review of the literature in this study show that logistic and multiple linear were the two most popular types of normal linear regression models utilized, the analysis for this study was undertaken using the Poisson model because of the following reasons: First, since the study was interested in analysing data where the dependent is a count of only positive events, Poisson regression is preferred since it does not allow for negative outcomes. In Poisson, the events are also assumed to occur randomly over time (heteroscedasticity) unless the counts are very large. In the context of this study, the explanatory variables influence the dependent variable composed of CEB in a time interval through instantaneous occurrence. This implies that Poisson remains a valid approximation tool because there is no need to include an error term at the end of the model as should be the case in the normal linear models to account for all the variations in the outcome variable Y that cannot be described by the independent variables X. Furthermore, normal linear models will generate an inconsistent estimator of the regression coefficient β since Poisson assumes that the mean function is an exponential $E(y/x) = \lambda = \exp(x'\beta)$.

Poisson regression analysis is in cognisant of the fact that some single counts or observations may significantly vary from others (i.e. are outliers) and hence suitable in our case where our dependent variable rate of childbearing is only confined to women of assumed child-bearing ages 15-49. There exists a possibility that some women below age 15 and above 49 may have been excluded from the sample. Logistic and multiple linear assume that there are no outliers and that the data is normally distributed. The Poisson model is also preferred since it allows for the incorporation of an exposure or offset parameter (in this case age of individual woman) in the modelling to account for the amount of risk each individual woman had to the event (birth). For instance, an older woman is exposed more to the risk of childbearing compared to a young woman.

Despite the above strengths, the choice of Poisson regression model was done in acknowledgement of the following shortcomings. Overdispersion (great variability in the data modelled) is a common feature of this model because in practice, events with count data such as populations are heterogeneous. In Poisson, overdispersion occurs because the mean and variance are assumed to be equal and depend on the same parameter being predicted using the independent variables (i.e. it does not allow for the variance to be adjusted independently of the mean). In addition, Poisson favours the use of large samples for the results to be more accurate. This is a shortcoming in this study because the sample sizes are only limited to the county levels.

Operationalization

To achieve its purpose, the model was operationalized as follows;

General model

If the probability that a random variable X is equal to x is assumed to follow a Poisson distribution with mean μ, then the probability function is defined as;

$$P(X=\frac{x}{\mu}) \qquad \text{.....(1)}$$

$$P(X) = \frac{e^{-\mu}\mu^{x}}{x!} \qquad \text{.....(2)}$$

Where X represents probability distribution of a Poisson random variable X

e=2.71828, a constant

μ= mu= mean number of events occurring in a given time interval

x = specific values of the random variable X (0,1,2,3…n)

For the purposes of this study, μ = mean rate of children ever born by woman i per unit time. According to Akpa and Ikpotin (2012), this is sometimes denoted as λiti. In this study, ti was the offset variable representing the observation time for the i^{th} woman.

In view of this, equation ii) above can be expanded into equation iii) as shown below.

$$P(X_i) = \frac{e^{-\lambda iti} * (\lambda iti)^x}{x!} \quad \ldots\ldots\ldots\ldots\ldots\ldots (3)$$

Since we assumed that Xi has a Poisson distribution, then the log of the mean can be given by;

ln μi = ln (λiti) …… (4)

ln μi = lnλi + lnti

By introducing the independent variables (regressors) that will help us to explain the relationship given by Poisson regression, we can formulate the following equation.

ln (μii) =β_0+βjXji+lnti……. (5)

Since the Poisson regression uses the log link function to exponentiate the linear predictors and fit the count variables, the following version of the equation will apply;

μi=exp(β_0+ BjXji) or λi= exp(β_0+BjXji +lnti)……..(6)

Where, μi or λiti is the expected number of children born per woman i at time ti; β0 is the intercept; βjs are regression coefficients; and Xjis are the characteristics (explanatory variables) of the ith woman, ti = offset variable (current age of woman).

From the above, the study will essentially be estimating λi which is simply interpreted as comparing the rate of children born by individual women of reproductive ages in the two counties and is also referred to as the incidence rate ratio (IRR) (Vandenbroucke & Neil, 2012).

Preparing the data for analysis entailed several steps. The first step involved creating two analysis data files each for the two counties from the individual KDHS 2014 women file from the Demographic and Health Surveys (DHS). The second step was the recoding of the study variables into dummy categories. Ideal number of children and child mortality, which contained many missing cases, were also recoded. In the modelling processes, the reference

category was assumed to be the category with a high risk of women experiencing high rate of fertility in the two counties.

After filtering and recoding the individual variables, a preliminary analysis test was undertaken and frequency tests showing the selected variables and their distribution.

To achieve the objectives of this study, two Poisson regression models were fitted each for Mandera and Nyeri. The modelling process involved two steps. First, the predictive ability of each explanatory variable was tested using a bivariate analysis in which Poisson regression models were fitted for each independent variable against the outcome variable; the rate of childbearing λ for each county. The significant factors in each county were then identified at this stage and used in the next stage of analysis. This means that factors included in the final modelling were either significant in the two counties or in any of the counties at the bivariate level. This formed the essence and basis for comparisons to be done.

The second and final step was a fitting a Poisson regression models containing all the variables identified above for each of the counties. combining both the background and proximate factors.

The predictive capability of the explanatory factors was tested using a Wald Chi-square statistic (P<.005). A nighty five (95) percent Confidence Interval (CI) of the exponentiated coefficient (B) was included to test the level of significance for each of the variables.

The overall goodness of fit of the model was tested using the log likelihood ratio test (the deviance) for Poisson regression. In SPSS, if the model fits well, the deviance should be close to 1 (0.9 –1.1). The lower or higher the deviance from this cut off interval, the less accurate or poorly fitted was the model.

CHAPTER FOUR: FACTORS EXPLAINING FERTILITY DIFFERENTIALS IN NYERI AND MANDERA COUNTIES

This chapter presents the study findings. Section 4.1 describes the study variables while section 4.2 presents the results of the bivariate analysis. Section 4.3 presents the results of multivariate analysis and section 4.4 concludes the chapter by giving a summary.

4.1 Description of the study variables

The description of background characteristics of the study variables is presented in table 4.1. Two variables children ever born (CEB) and current age representing years of exposure to giving birth were used to obtain the composite dependent variable, the rate of childbearing (λ).

The results show that a substantial proportion (28 percent) of women in Mandera had given birth to more than six children compared to their counterparts in Nyeri (3 percent). In contrast, a majority (69 percent) of the women in Nyeri had given birth to two or fewer births. The distribution by age on the other hand show that the women in Nyeri are slightly older although there are no major differences. For instance, the proportion of women aged 25 and above in Nyeri were 71 percent while those in Mandera were 66 percent.

Three socio-economic variables: wealth index, education level and place of residence were selected to analyze their influence on fertility in Mandera and Nyeri. The results generally suggest that Nyeri women are of higher socio-economic status compared to Mandera. Women in the poor wealth index category were 73 percent in Mandera compared to only 10 percent in Nyeri while more than two thirds of the women in Nyeri belonged to the richer category as compared to only 23 percent in Mandera. The distribution by educational level show that almost three quarters of Mandera women had no formal schooling while there were none in Nyeri. On the other hand, two-thirds of the women in Nyeri had attained secondary and higher level of schooling compared to only 8 percent in Mandera. The level of urbanization is almost same in the two counties with both having about 40 percent of the women staying in urban centres while the rest stay in the rural areas.

The socio-cultural factors which have been chosen as impacting fertility in the two counties are age at first marriage and religion. The results summarized in the table show that women in Mandera married at early ages and were mainly of Muslim faith while a majority of the

women in Nyeri married at advanced ages and were of the Christian faith. For example, more than half of the women in Mandera married below 19 years of age compared to about a third of the women in Nyeri while on the other hand, 41 percent of women in Nyeri married at advanced ages 25 and above compared to Mandera's 27 percent. Nearly all women in Mandera professed the Muslim religion contrasting with situation in Nyeri where nearly all the women in Nyeri who professed Christianity. In conclusion, the results suggest that Mandera has a traditional or conservative culture (where women have strong adherence to norms, beliefs and behaviors concerning fertility) compared to Nyeri has an open or modernized culture.

Table 4.1 Distribution of study variables by county

	Nyeri (N=698)		Mandera (N=521)	
Variable	**Frequency**	**Percent**	**Frequency**	**Percent**
Risk of birth components (Total CEB-V201)				
0-2	480	69	209	40
3-5	196	28	166	32
6-10	22	3	146	28
Current age of respondent (V012)				
≤19	104	15	98	19
20-24	98	14.	80	15
25+	496	71	342	66
Socio-economic variables (wealth Index-V190)				
Poor (Ref)	66	10	378	73
Middle	145	21	25	5
Richer	487	70	118	22
Education level (V106)				
No education (Ref)	7	1	412	79
Primary schooling	277	40	67	13
Secondary & Higher	421	60	42	8
Type of Place of Residence (V025)				
Rural (Ref)	420	60	306	59
Urban	278	40	215	41
Socio-cultural (age at first marriage-V511)				
≤19 (Ref)	202	29	272	52
20-24	209	30	112	22
25+	287	41	137	26
Religion (V130)				
Muslims ((Ref)	3	.4	520	99.8
Christians & others	695	99.6	1	.2
Proximate factors				
Marital Status (V501)				
Ever married (Ref)	486	70	409	78
Never married	212	30	112	22
Ever use of modern contraceptives (V302)				
Never used modern (Ref)	171	24	512	98
Ever used modern	534	76	9	2
Experience of child death/mortality (B5)				

Yes (Ref)	46	7	358	69
No	483	69	22	4
Not given birth	169	24	141	27
Age at first birth (V212)				
≤19 (Ref)	224	32	180	34
20-24	225	32	156	30
25+	249	36	185	36
Ideal number of children (V613)				
5+ (Ref)	23	3	242	46
3-4 children	201	29	12	2
0-2 children	131	19	2	1
Omitted/Unselected women	350	50	265	51
Totals	**698**	**100**	**521**	**100**

Proximate factors comprising of marital status, level of modern contraceptive use, contraceptive use by method, experience of child deaths, age at first birth and ideal number of children were used as proximate determinants in this study. The results in the table show that in both counties the proportion of women who have ever been in some form of union is high. In Nyeri 70 percent of the women have ever been married compared to 78 percent in Mandera and only less than a third of the women in both counties had not been ever in a union. The results on ever use of modern contraceptive show that Nyeri had 50 percent of women who had ever used in contrast to Mandera's 1 percent. Thus, use of modern method of contraceptives in Mandera is almost non-existent. Nearly 99 percent of the women in Mandera had never used a modern method.

The distribution of women according to those who had experienced a child death shows that the majority of women in Mandera (69 percent) had experienced the death of a child while the proportion in Nyeri was only7 percent). Almost an equal proportion (a quarter) of women had not given birth in the two counties. On age at first birth, the percent of women who gave birth in Mandera at age 19 and below were 34 percent which was slightly above those in Nyeri with 32 percent. An equal proportion (36 percent) in the two counties gave birth at ages 25 and above. The results show that 46 percent of women in Mandera preferred 5 and more children compared to Nyeri where only 3 percent of women preferred giving birth to 5 and above children. Twenty-eight (28) percent of women in Nyeri preferred between 3-4 children.

Overall, the results show that a bigger proportion of women in both counties had ever been in a marriage (preferred getting married), contraceptive usage was high in Nyeri compared to Mandera, childhood mortality was high in Mandera compared to Nyeri, women in both

counties had an equal proportion of women giving birth at early ages and that a majority of women in Mandera preferred giving birth to a high number of children.

4.2 Screening of factors associated with fertility differentials in Nyeri and Mandera counties

Table 4.2 summarizes the Poisson bivariate results on the rate of childbearing and each of the independent variables.

Table 4.2 Results of Poisson bivariate regression models

	Nyeri				Mandera			
Variables	β	Exp(β)	95% CI	P-value	β	Exp(β)	95% CI	P-value
Socio-economic (wealth index)								
Poor®								
Middle	-0.102	0.903	0.749 – 1.090	0.288	-0.392	0.676**	0.525-0.870	0.002
Richer	-0.367	0.693**	0.585– 0.821	0.000	-0.205	0.814**	0.793-0.917	0.001
Education level								
No education®								
Primary					-0.755	0.470**	0.381-0.580	0.000
Secondary & higher	-0.516	0.597	0.536-0.664	0.000	-1.243	0.289**	0.208-0.400	0.000
Residence								
Rural®								
Urban	-0.267	0.766**	0.683-0.858	0.000	-0.196	0.822**	0.947-0.905	0.000
Socio-cultural (age at first marriage)								
≤19®								
20-24	-.257	0.773**	0.687-0.870	.000	-0.103	0.902	0.813-1.001	0.053
25+	-1.044	0.352**	0.304-0.858	.000	-1.257	0.284**	0.237-0.341	0.000
Religion								
Muslim®								
Christians & others	0.009	1.009	0.419-2.429	.983	-0.347	0.707	0.228-2.193	0.548
Proximate								
Marital status								
Ever married®								
Never married	-1.407	0.245**	0.198-0.303	0.000	-3.891	0.020**	0.009-0.046	0.000
Use of modern contraceptives								
Never used modern ®								
Ever used modern	-1.643	0.193**	0.156-0.240	0.000	-0.035	0.966	0.681-1.370	0.844
Experience of child mortality								
Yes®								
No	-0.443	0.642**	0.551-0.747	0.000	-0.176	0.839**	0.699-1.007	0.050

Not given birth* **	-33.933	1.8322E-15	0.000-0.000	-	-33.965	1.7748E-15	0.000-0.000	-
Age at first birth								
≤19®								
20-24	-0.276	0.759**	0.678-0.850	0.000	-0.091	0.913	0.807-1.008	0.073
25+	-1.461	0.232**	0.192-0.279	0.000	-1.090	0.336**	0.291-0.389	0.000
Ideal number of children								
5+®								
3-4	-0.301	0.740**	0.587-0.933	0.011	-1.798	0.166**	0.069-0.399	0.000
0-2	-0.761	0.467**	0.360-0.607	0.000	-0.285	0.752	0.312-1.811	0.525
Unselected women* **	-0.471	0.624	0.498-0.783	0.000	-0.077	0.926	0.844-0.926	0.101

Note: Education level variable was recoded differently for the two counties hence results are displayed separately.

** P<0.05, ® = reference category

*** Not for interpretation

The results show that except for religion, all the selected variables were significantly associated with the rate of childbearing.in the two or at least one of the counties.

The bivariate results for the socio-economic variables show that wealth index is a significant factor influencing rates of childbearing in the two counties. Women in the richer category in Nyeri had 0.3 lower rate of childbearing compared to those in the poor category. On the other hand, women who belonged to the richer class in Mandera had 0.2 lower rate of childbearing compared to those in the poor class. Women in the middle level category in Mandera had 0.4 lower risk of giving birth compared to those in the poor category. Intriguingly, being in the middle level class does not have any strong association with the rate of childbearing in Nyeri.

Education level is also an important determinant of the rate of childbearing in the two counties. Attaining any category of schooling had a strong relationship to the rate of childbearing in Mandera while the impact of schooling on the rate of childbearing in Nyeri was only felt when one only attained secondary and higher schooling. Women in Mandera who attained primary schooling had 0.6 lower rate of childbearing in comparison to those who never enrolled for formal schooling. Mandera women who advanced to the secondary and higher categories had the rate reduced even further to 0.3 than those who never went to school. Women who schooled to secondary and higher level in Nyeri had 0.5 times lower rate

of childbearing underlining that the effect of advanced schooling was felt more in Mandera than in Nyeri.

The type of residence had a strong negative relationship to the rate of childbearing in the two counties. Women who lived in urban setting in Nyeri had 0.3 lower rate of childbearing compared to those who dwelt in rural areas. Women who lived in urban areas in Mandera had 0.2 lower rate of childbearing compared to their counterparts who lived in rural areas. The minimal difference is effect could possibly have less impact in explaining fertility differentials in the two areas.

The socio-cultural variables results' show that marrying at any age has influence on the rate of childbearing in Nyeri while only marrying at age 25 and above had relationship to childbearing in Mandera. Nyeri women who married between ages 20-24 had 0.2 lower rate of childbearing compared to their counterparts who married at age 19 or below. Marrying at age 25 had dominant effect on the risk of giving birth supported by a 0.8 lower rate of childbearing in Mandera and 0.7 lower rate of childbearing in Nyeri compared to marrying at a minor age. The study did not establish any significant relationship between religion and childbearing in the two counties.

The results of the bivariate regressions for the proximate variables show that four of the five the selected predictor variables are significantly associated with the rate of childbearing in all the two counties. Ever use of modern contraceptive was only significant in Nyeri.

Marital status has a significant negative effect on the rate of childbearing in the two regions. Women in Nyeri who never married had 0.8 lower risk of giving birth than their counterparts who had been ever been in a relationship. The results show that the effect was more felt in Mandera with such women having a 0.98 lower rate of childbearing than those who had been in a union.

Ever use of modern contraceptives was a significant predictor of childbearing in Nyeri. Women who had ever used modern contraceptives in Nyeri had 0.8 lower rate of childbearing compared to those who had never used modern contraception. This relationship was consistent with the theory which holds that increased use of modern contraceptive is

associated with a low rate of childbearing particularly for modernized areas like Nyeri. On the other hand, contraceptive use has no significant relationship to childbearing in Mandera.

Child mortality was a significant determinant of the rate of childbearing in both regions. Women in Nyeri who not experienced death of a child 0.4 lower rate of childbearing compared to their counterparts who had experienced the death of a child. The effect on such women was more felt in Mandera as shown by a lower rate of 0.2.

Age at first birth is a significant predictor of the rate of childbearing in both counties although its influence appears to be evenly spread and pronounced across all the reproductive ages in Nyeri compared to Mandera. Nyeri women who gave birth to their first child between ages 20-24 had 0.3 lower rate than their counterparts who gave birth at age 19 or below. In Mandera, giving birth to a first child in this age category did not have any strong relationship with the rate of childbearing. The findings show that giving birth to a first child at advanced ages has more dominant and almost same effect as shown in Nyeri where women had 0.8 lower rate of childbearing compared to those who gave birth at younger ages. In Mandera, the rate for such women was 0.7 lower.

The results show that the desire for more children is also an important factor negatively affecting the rate of childbearing in Nyeri and Mandera. Women who desired 3-4 children in Nyeri had 0.3 lower rate of giving birth than those who desired five and more. The findings show that this variable had more effect in Mandera where such women had 0.8 lower rate compared to those who desired five and above. Women who desired fewer children (less than 2) in Nyeri had 0.5 times lower rate compared to those desiring more. The women in Mandera who were in this category were not influenced in any way on the number of children they gave birth to.

4.3 Determinants of fertility in Nyeri and Mandera counties

In model 2, background factors (excluding religion which was not significant in any of the counties at the bivariate level) and all proximate factors were fitted in a multivariate Poisson regression**.**

Table 4.3 Results of multivariate Poisson regression for Nyeri and Mandera

	Nyeri				Mandera			
Variables	β	Exp(β)	95% CI	P-value	β	Exp(β)	95% CI	P-value

Socio-economic (wealth index)								
Poor®								
Middle	-0.156	0.856	0.707-1.036	0.110	0.071	1.073	0.815-1.414	0.614
Richer	-0.229	0.795**	0.663-0.955	0.014	0.060	1.062	0.897-1.258	0.483
Education level								
No & primary education®					-0.062	0.940	0.755-1.170	0.578
Secondary & higher	-0.102	0.903	0.797-1.023	0.110	-0.234	0.791	0.562-1.114	0.180
Type of place of residence								
Rural®								
Urban	-0.084	.919	0.812-1.040	0.181	-0.040	0.961	0.839-1.100	0.561
Socio-cultural (age at first marriage)								
≤19®								
20-24	-0.036	0.965	0.838-1.111	0.619	0.052	1.054	0.923-1.202	0.437
25+	-0.179	0.836	0.686-1.019	0.076	0.248	1.281	0.996-1.647	0.053
Proximate								
Marital status								
Ever married®								
Never married	-0.162	0.850	0.650-1.113	0.238	-3.182	0.041**	0.018-0.095	0.000
Use of modern contraceptives								
Never used modern ®								
Ever used modern	-0.306	0.736**	0.562-0.965	0.026	-0.024	0.977	0.675-1.413	0.900
Experience of child mortality								
Yes®								
No	-0.271	0.762**	0.650-0.894	0.001	-0.741	0.476**	0.382-0.595	0.000
Not given birth***	-32.956	4.865E-15	0.000-0.000	-	-0.037	0.964	0.782-1.188	0.731
Age at first birth								
≤19®								
20-24	-0.122	0.885	0.772-1.014	0.078	-0.158	0.854**	0.754-0.967	0.013
25+	-0.382	0.683**	0.550-0.848	0.001	-0.600	0.549**	0.448-0.673	0.000
Ideal number of children								
5+®								
3-4	-0.226	0.797	0.631-1.007	0.058	-0.263	0.769	0.314-1.881	0.564
0-2	-0.351	0.704**	0.539-0.919	0.010	-0.246	0.782	0.321-1.905	0.589
Unselected women***	-0.314	0.730	0.581-0.919	0.007	-0.040	0.961	0.874-1.056	0.403
Constant	-1.965	0.140	0.094-0.210		-1.532	0.216	0.175-0.267	0.000
Model fit								
Likelihood ratio χ^2	592.622				743.521			
Degrees of freedom	15				16			
p-value	0.000				0.000			

Note: Education level variable was recoded differently for the two counties hence results are displayed separately.

** P<0.05, ® = reference category

*** Not for interpretation

The results of the multivariate Poisson regression presented in table 4.3 show similarities and prominent differences in the factors and their effects on fertility in the two counties. In Nyeri, five factors comprising of wealth index, use of modern contraceptives, age at first birth, experience of child mortality and ideal number of children were found to be significantly associated with the rate of childbearing. In contrast, three factors comprising of marital status, age at first birth and experience of death of a child were the significant factors associated with the rate of childbearing in Mandera.

In Nyeri, wealth index was found to be a significant factor influencing the rate of childbearing by women although the effect was only evident for women in the richer category. The findings showed that women in this category experienced 0.3 lower rate of childbearing compared to their counterparts in the poor category. Ever use of modern contraceptive was significant in influencing fertility in Nyeri as shown by the results showing that women who ever used modern contraceptives had 0.3 lower rate of childbearing compared to those who had never used modern contraceptive.

The study also revealed that age at first birth was a key determinant of the rate of childbearing in Nyeri with women giving birth to their first child at advanced ages having 0.4 lower risk of giving birth compared to those giving birth to their first child at a tender age of 19. Finally, the results for Nyeri show that ideal number of children is a significant determinant of the rate of childbearing with women who desired 0-2 children having 0.3 lower rate compared to those desiring five and more children.

In Mandera, marital status was found to be a key determinant of the rate of childbearing by women. Women who never married had 0.9 lower rate than their counterparts who had ever been married. The effect of experiencing the death of a child was also prominent with women who had never experienced death of their young one having 0.6 lower rate than those who had experienced it. Finally, the age at first birth was found to be statistically significant with the rate of childbearing in Mandera with the effect being felt and consistent across all the age

groups. Women who gave birth to their first child between ages 20-24 had 0.2 lower rate compared to their counterparts who gave birth to their first child while aged either 19 or below. Mandera women who gave birth to their first child while aged 25 and above had 0.5 lower rate of childbearing children compared to those who gave birth to their first child while aged 19 or below.

4.4 Discussion of the results

In view of the findings above, the study established that only one socio-economic factor and all the five proximate factors were associated with differences in fertility levels in the two regions. Starting with the socio-economic factor, the findings showed that being in the richer category was significantly associated with low rates of childbearing in Nyeri. This is consistent with the findings of a study by Odwe (2015) which showed that the fertility rate of non-poor women Western regions were 0.7 lower and 0.6 lower than that of poor women in 2003 and 2008/2009. More than two thirds of the households in Nyeri were in this category compared to about a fifth in Mandera thereby contributing in explaining the lower fertility in Nyeri compared to Mandera.

Focusing on proximate factors, differences in the rates of childbearing were also explained by marital status with women in Mandera who never been married having 0.9 lower risk of giving birth compared to those who were in a marriage. The general finding also conforms to results of previous studies which showed that married women gave birth to more children compared to those who never got married (Olatoregun et al. 2014). The finding showing that this factor has a strong effect in Mandera can be linked to our previous result which showed that most women in Mandera (70%) preferred being in some form of a union in line with their tradition and culture. This suggests that the relationship between marital status and fertility in the county is influenced by the cultural context (where women have strong adherence to norms, beliefs and behaviours concerning fertility).

In addition, this study established that ever use of modern contraceptive was associated with explaining the differences as supported women in Nyeri who had never used modern contraception having 0.3 lower risk of giving birth compared to their counterparts who had ever used. This agreed to the results of most studies and the hypothesis in our conceptual framework. In his various research works, Bongaarts (2008, 2015) found that increased uptake of contraceptives led to a reduction in the fertility rates. It is worth to highlight that the risk could have been much lower since in this study women who were not-currently married

were included in our analysis. It is highly likely that these women, who formed half of the total sample, were not at any risk of getting pregnant were not therefore using any reliable birth control method such as modern contraceptives.

The findings also revealed that child death explained the differences in the levels of fertility in the two counties. The impact of not losing an under five was more felt in Mandera, with such women having 0.6 times lower rate of childbearing compared to Nyeri's 0.3. A possible explanation to the variations in the effects can be attributed to many women in Mandera (69 percent) who had experienced the death of a child, compared to only 7 percent in Nyeri. The overall finding conformed to those in the literature review which suggested that increase in child mortality corresponded with an increase in the fertility rates in most regions. For instance, in a comparative research that studied the relationship between poverty and fertility in Western and Coast regions of Kenya, the findings revealed that in both regions, child mortality increased the fertility rates especially among the poor women.

Age at first birth was also significantly associated with the differences in the fertility levels although on a small extent. In Nyeri, women who gave birth to a first child at advanced age (25+) had 0.3 lower rate of childbearing. This finding was almost in line with that in Mandera (0.5 times) although a slight variation was revealed in that the associated age range in Mandera started at 20. The variations in the age range can be explained by the increased tendency of women in Mandera to start childbearing at low ages compared to Nyeri, where more women start childbearing at advanced ages. These general findings are consistent with those in the previous studies which associated younger age at first birth with higher fertility (Mberu & Reed, 2014). In previous studies, the delay in childbearing was attributed to prolonged schooling resulting in delayed marriages (Mutetei, 1998).

Regarding ideal number of children, the results in the table showed that in Nyeri, women who preferred between 0-2 children had 0.3 lower rate of childbearing compared to their counterparts who preferred more children. Only 3 percent of women in Nyeri preferred 5 and more children compared to Mandera's 46 percent therefore explaining why there is high fertility in Mandera compared to Nyeri.

In summary, the results of the bivariate regression showed that except for religion, all the selected background factors were associated with childbearing in the two counties although to

different extents. The results of the multivariate regressions indicated that marital status, wealth index, education level, age at first birth, age at first marriage, and ideal number of children were significant factors explaining the differences in the fertility rates in the two counties. Of these, age at first birth and experience of child mortality were the only two common proximate determinants that influenced childbearing in the two regions. Educational level, type of place of residence and age at first marriage were not significant determinants of fertility in the two regions.

CHAPTER FIVE: SUMMARY, CONCLUSION AND RECOMMENDATIONS

The objective of this study was to determine key factors and their effects in explaining fertility differentials in the two counties. Section 5.1 presents summary of key findings while sections 5.2 and 5.3 presents the study conclusions recommendations respectively.

5.1 Summary of key findings

The research found that five key factors influencing fertility in Nyeri were wealth index, use of modern contraceptives, experience of child mortality, age at first birth and ideal number of children. Examining the wealth index, the results showed that only women in the richer category in Nyeri had 0.3 lower rates of childbearing compared with those in the poor category. On the use of modern contraceptives, the results showed that Nyeri women who had ever used modern contraceptives had 0.3 lower rate of childbearing compared to non-users. On ideal number of children, the results showed that only Nyeri women who preferred between 0-2 children had 0.3 lower rate of childbearing compared to their counterparts who preferred more children. Women who experienced death of a child had 0.3 lower risk of giving birth compared to those who had had not experienced the child death. On age at first birth, the results showed that only women who gave birth at advanced ages experienced 0.4 lower rate of childbearing compared to those who gave birth below age 19.

The results of the multivariate relationship also showed marital status, age at first birth and experience of child death were the three principal factors impacting fertility in Mandera. On marital status, the results showed that women who never marry in Mandera have 0.9 lower rate of giving birth compared to those who marry. On age at first birth, the results showed that women who gave birth at age 24 experienced 0.15 lower rate of childbearing than those who gave birth to a first child at age 19. Giving birth at age 25 and above had 0.45 lower rate of childbearing. The results also showed that women who experienced the death of an under five in Mandera had 0.6 lower rates of childbearing compared to those who experienced it.

The specific objective of this study required determination of significant factors common in affecting fertility in both counties. Age at first birth and experience of child death were the only two common factors. However, age at first birth had significant effects in all categories in Mandera while in Nyeri it only had effect on the last age category of women who gave birth to a first child at 25+. The variations in the age range can be explained by the increased tendency of women in Mandera to start childbearing at low ages compared to Nyeri, where

more women start childbearing at advanced ages. A comparison of the effects on women who gave birth to a first child at 25+ shows that this category had almost similar effect supported by women in Nyeri having 0.4 lower rate in line with their counterparts in Mandera who had 0.5 lower rate. A possible explanation to this could be results in the description of the variables showing that an equal proportion (36 percent) in the two counties gave birth at ages 25 and above. The study also found that the experience of an under five mortality has a strong relationship with childbearing in Mandera compared to Nyeri ((women who had not experienced death of a child were 60 percent less likely to give birth compared to Nyeri's 30 percent). This could be linked to previous findings of this study showing that most women in Mandera (69 percent) had experienced the death of a child while a few (7 percent) had in Nyeri.

The study objectives also required determination of factors that were unique to each county. The findings showed that marital status was only significant in Mandera but not in Nyeri. This could be explained cultural setting in Mandera where women have strong beliefs on the importance in a union. Wealth index ever use of modern contraceptive and ideal number of children were significant factors explaining the rate of childbearing in Nyeri but not in Mandera. These could be attributed to the high proportion of women in Nyeri who were wealthy, preferred using modern contraceptives and desired low number of children.

5.2 Conclusion

The results generally suggest that Nyeri women are from higher socio-economic backgrounds compared to Mandera where most women are from low or traditional societies thereby contributing in explaining fertility differentials. In Nyeri, women from richer households were the majority and experienced lower rates of childbearing compared to those from poor households. This was a contrast to Mandera where a majority of women were from poor households and experienced higher rates of childbearing.

Other factors explaining why fertility is lower in Nyeri and higher in Mandera comprise of proximate factors such as modern contraceptives, ideal number of children, age at first birth, marital status and experience of child death. The results showed that half (50 percent) of women in Nyeri had ever used modern contraception compared to Mandera's very few (2 percent) thereby lowering the risk of getting pregnant and hence lower fertility. The majority of women in Nyeri married at delayed ages and also gave birth to their first child at advanced

ages compared to Mandera thereby lowering the risk of giving birth to many children. Prolonged schooling was a factor in the delayed marriages in Nyeri. Only 28 percent of women in Nyeri preferred 3-4 children compared to 48 percent in Mandera therefore contributing in lower rates of childbearing in Nyeri and higher rates of childbearing in Mandera. In addition, Mandera women preferred being in a union thereby increasing exposure to the risk of giving birth in given low contraceptive use. Child mortality rates were still high in Mandera with more than two thirds of women in the reproductive ages having recorded a death of a child. This is likely to have contributed in more women giving birth to more children in an effort to compensate for the losses thereby contributing to higher fertility.

5.3 Recommendations

5.3.1 Policy recommendations

The study results established that more than two thirds of women in Mandera experienced a child mortality death thereby contributing to high rates of birth. This study recommends that the Government, in conjunction with other donors, should focus on scaling up key interventions for childhood mortality reduction in the region to reduce its high rate of childbearing.

In view of the low use of modern contraceptive in Mandera, efforts to reposition family planning should be intensified by various actors including the NGOs, local leaders through community campaigns and local institutions and youth groups.

Improved wealth status has significant negative relationship with childbearing in Nyeri, this study recommends that efforts towards increased investments in wealth creation to empower women should be intensified to sustain low rate of childbearing in Nyeri.

5.3.2 Recommendations for further research.

Arising from the study results that established high rates of child mortality in Mandera, this study recommends a qualitative or an in-depth study in Mandera to understand the link between child mortality and household context.

Arising from the existing small samples of data at the county level, this study recommends that relevant bodies led by the Kenya National Bureau of Statistics (KNBS) should explore

ways and means of increasing the number of women to be interviewed at the county levels in future KDHS undertakings so as to enhance prospects for further analysis on fertility differentials.

Further researches should be undertaken using datasets on proximate determinant factors that were analysed in this study despite containing missing information (due to KDHS data limitations). This would enhance the understanding of factors explaining fertility differentials in counties with low and high rates of childbearing in Kenya.

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