UNIVERSITY OF NAIROBI

COVARIATES AND RISKS OF BIRTH ORDER TRANSITIONS IN KENYA

BY
EZEKIEL MASHA OTIENO

A RESEARCH PROJECT SUBMITTED TO THE SCHOOL OF MATHEMATICS OF UNIVERSITY OF NAIROBI IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR AWARD OF THE DEGREE OF MASTER OF SCIENCE IN SOCIAL STATISTICS

2014
DECLARATION

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

_______________________________________________________________
EZEKIEL MASHA OTIENO
156/77540/09

This project has been submitted for examination with my approval as the university supervisor.

____________________________________                     ________________________
MRS. ANN WANG’OMBE                     DATE
DEDICATION

Adequate child spacing is considered as a positive factor on the health of mothers and their children. The inter-birth spacing has been reported to have significant effect on the child’s future, physical and mental capabilities. This work therefore is dedicated to young women, potential adults of reproductive age and in particular teenage mothers who despite existing programmes on birth control tend to reverse the gains made in achieving leaner familial sizes and subsequently lower fertility levels.
ACKNOWLEDGEMENT

The conduct of this study was a strenuous exercise accomplished through concerted efforts of the University of Nairobi, The School of Mathematics, my supervisors and my colleagues who assisted in a variety of ways in preparing, collecting and processing of the study’s results. I thank them all and sundry.

Acknowledgement is due to the Director, School of Mathematics, for his tireless efforts in preparing me for such a research undertaking and providing an enabling environment for the study. Also the valuable individual contributions by all teaching staff at the School towards the successful completion of this work cannot be forgotten.

Special thanks go to my supervisors Mrs. Ann Wang’ombe and Mrs. Idah Orowe for taking time out of their normally busy schedules to supervise the research project from the beginning to the end. I am greatly indebted to their kind gesture in tirelessly and individually providing all guidance through comments, helpful advice, editing and above all close monitoring during the write-up process.

I appreciate the support accorded by the University of Nairobi and in particular not forgetting to acknowledge a smooth sailing throughout the entire course period without hitches, interruptions and / or any other observable hindrance. Knowledge imparted will improve my job-competiveness and forever remain a landmark in my lifetime.

Finally, I also appreciate and acknowledge constructive criticisms and diverse views from fellow students.
TABLE OF CONTENTS

DECLARATION ........................................................................................................................................ i
DEDICATION ........................................................................................................................................ ii
ACKNOWLEDGEMENT ................................................................................................................... iii
TABLE OF CONTENTS ................................................................................................................... iv
LIST OF TABLES ................................................................................................................................ vi
LIST OF FIGURES ........................................................................................................................ vii
ABSTRACT .......................................................................................................................................... viii
CHAPTER ONE .................................................................................................................................. 1
  1.1 Background .................................................................................................................................. 1
  1.2 Problem Statement ...................................................................................................................... 3
  1.3 Objective of the Study .................................................................................................................. 6
    1.3.1 Specific Objectives ................................................................................................................ 6
  1.4 Justification ............................................................................................................................... 6
CHAPTER TWO .................................................................................................................................... 8
LITERATURE REVIEW ...................................................................................................................... 8
  2.1 Review of Past Research and Findings ...................................................................................... 8
  2.2 Summary of Past Research and Findings .................................................................................. 17
  2.3 Conceptual Framework ............................................................................................................. 18
  2.4 Operational Definition ............................................................................................................. 20
  2.5 Study Hypotheses ..................................................................................................................... 23
CHAPTER THREE .............................................................................................................................. 24
METHODOLOGY ............................................................................................................................. 24
  3.1 Source of Data .......................................................................................................................... 24
  3.2 Sample of the Study .................................................................................................................. 24
3.3 Data Analysis .................................................................................................................. 27
  3.3.1 Cox Proportional Hazards and Regression Models .................................................. 27
  3.3.2 Model Assumptions................................................................................................. 30
  3.3.3 Exploratory Data Analysis ..................................................................................... 30
3.4 Limitation of the Study ................................................................................................. 32

CHAPTER FOUR ............................................................................................................... 33

DETERMINANTS OF TRANSITION BETWEEN BIRTHS: RESULTS OF MULTIVARIATE ANALYSIS .................................................. 33
  4.1 Second-to-Third Birth Order Transitions ................................................................. 34
  4.2 Fourth-to-Sixth Birth Order Transitions ................................................................. 36
  4.3 Seventh-to-Eighth Birth Order Transitions ............................................................. 38

CHAPTER FIVE ................................................................................................................... 40

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATIONS .................................................................................................................. 40
  5.1 DISCUSSIONS ............................................................................................................. 40
    5.1.1 Age at first birth ................................................................................................. 40
    5.1.2 Sex of preceding child ...................................................................................... 41
    5.1.3 Survival of preceding child .............................................................................. 42
    5.1.4 Place of residence ............................................................................................ 42
    5.1.5 Province ........................................................................................................... 43
    5.1.6 Education ........................................................................................................ 44
    5.1.7 Wealth Status ................................................................................................. 45
    5.2 CONCLUSION ......................................................................................................... 46
    5.3 RECOMMENDATIONS ........................................................................................... 49
      5.3.1 For Policy Implications ................................................................................ 49
      5.3.2 For Further Research .................................................................................. 51

REFERENCES ................................................................................................................... 52

APPENDIX A .................................................................................................................... 57
APPENDIX B .................................................................................................................... 58
APPENDIX C .................................................................................................................... 61
LIST OF TABLES

Table 4.1: Cox regression model results for transition between second and third births ........... 35

Table 4.2: Cox regression model results for transition between fourth and sixth births ........... 37

Table 4.3: Cox regression model results for transition between seventh and eighth births ....... 39

Table A.1: Test for independence .......................................................................................... 57

Table C.1: Model diagnostics for proportionality assumption.................................................. 61
LIST OF FIGURES

Figure 2.3: Conceptual Framework .................................................................19
Figure 3.3: Survival curves for the first four covariates ......................................58
Figure 3.4: Survival curves for the last three covariates .....................................59
Figure 3.5: Survival curves for all the seven covariates ....................................60
ABSTRACT

The general objective of this study was an investigation of some of the key factors determining transition between births among women of reproductive age in Kenya. For this purpose, data from Kenya Demographic and Health Survey (KDHS) 2008-09 were used and a total of 4960 eligible women of child bearing age (women who had had more than two children) selected for analysis.

Cox proportional hazards model was used to analyze factors responsible for progression between births. In modeling spacing between births in a hazard function as a time-to-event variable, the study also examined the risk of giving birth in transition to higher orders given that women under study had already had lower order births.

Among the seven explanatory variables of interest used in the analysis, age at first birth, sex of preceding child, place of residence and wealth status were found to have highly significant (p<0.001) impact on the dynamics of inter-birth transition. The other remaining variables namely survival of preceding child (infant and child mortality), region of residence (province) and education had insignificant impact.

Age at first birth was by far the most powerful predictor of timing between births in this analysis. On the other hand transition between male births at lower orders was found to be significantly longer than that between female births, indicating higher parental investment in a boy child. However, in women of higher parity this differential disappeared and subsequently became insignificant.

Although male births were less likely to be followed by a subsequent birth in the lower birth orders, the absence of such a gender scenario in transition to higher parities may have suggested that women in higher parities could already have had the desired number of sons. However, the significantly higher probability of an index child being followed by a subsequent live birth among older mothers (aged 40-49) compared to younger ones needs to be read with caution since this age bracket is normally characterized by onset of disappearance of a woman’s menses.

Findings of this study have generated recommendations which have both policy and program relevance for policy makers as well as program managers in addressing problems related to reproduction among women and in particular teenage mothers.
CHAPTER ONE
INTRODUCTION

1.1 Background

A country’s fertility levels can be attributed to differences in the length of time between births when women are exposed to the risk of conception. Birth intervals are growing longer over time in most developed countries, are lengthening faster in some developing countries and are still shorter in the less developed ones.

A number of factors occurring in the country’s transitional economic growth have been suggested as more likely to have caused the dramatic fertility decline in the past, one of them being the changes in infant and child mortality as a result of the expansion of the immunization programme though this evidence has been described as shaky (Kelley and Nobbe, 1990).

Higher rates of childbearing in Kenya abound and an increased risk of illness to mothers and their children due to insufficient knowledge and information on birth spacing. Of particular concern is lack of behavioural control with regard to sexuality which has resulted in unwanted pregnancies. Ignorance of sexuality is rampant in most parts of Kenya due to lack of basic knowledge about sexual and reproductive health.

Preferences of women’s actual lengths of birth interval have far-reaching implications on the health status of both the mother and child as well as wide-ranging potential effects of a socio-economic nature to the country’s development.
It has been hypothesized that high fertility in Kenya is due to mortality decline, improvements in health and nutritional status of mothers, and general socioeconomic advancements the country has undergone during the last three decades (Brass and Jolly, 1993) all of which have increased the propensity of Kenyan women to reproduce.

An adequate birth interval is considered to be a positive factor in the health of the mothers and their children (Al-Nahedh, 1999). An adequate interval has a positive effect on the physical and mental health of the child and a reduction in the probabilities of suffering a fetal death, premature birth, low birth weight, and neonatal death. Adequate intervals have a positive effect on the mother as well, such as a lowered risk of maternal mortality, hemorrhaging, anemia, malnutrition, and endometritis (CATALYST, 2003).

DHS data in other countries are among the most detailed and include individual-level calendar data which is vital in capturing majority of measurable variation in birth interval effects to fertility and hence the mechanisms through which socio-economic and socio-cultural factors work on birth intervals to affect fertility outcomes. In the case of this study, it is however interesting to ask how much of the measureable variation in birth spacing does the Kenya Demographic and Health Survey (KDHS) data capture.

Event histories such as births, pregnancies and marriages have been used by social scientists to study fertility behavior of women. Birth history analysis undoubtedly provides useful information on reproduction and family formation. Durations of birth spacing as experienced by women may provide some insight into their reproductive
patterns and factors affecting child spacing may have varying effects on fertility. Moreover, a detailed analysis of the sequence of steps in the childbearing process could provide a more comprehensive picture of the dynamics of fertility transitions (Hirschman et al., 1980).

One aim of this study is therefore to examine the risks associated with transition between births among Kenyan women of reproductive age. As factors influencing birth interval are varied, the second aim is to establish some of the determinants of spacing between births in Kenya.

In the next section the study gives a review of the problem and in the subsequent sections provides an outline of various findings of related research undertaken by different social scientists, conceptual framework, methodology, source of data for the current study and a discussion of the analytical results. In the last section discussion, conclusion and recommendations are provided.

1.2 Problem Statement

The recent spurt of increase in population has been as a result of large and sustained excess births over deaths, commonly known as natural increase. The population has more than tripled since independence presenting a rapid increase in growth; a major concern for the government. This growth, attributed majorly to increased birth rates, has significantly increased pressure on socio-economic infrastructure and thus constrained available resources. Children born in Kenya are continuously exposed to a greater risk of dying. The risk is even higher when children are born to young mothers after a short birth interval.
Shorter birth intervals have induced more maternal depletion and early child deaths resulted in parents replacing children who have died. This manifests as high fertility in a low-income country such as Kenya.

Lack of expanded programs on reproductive health for the adolescents and reduction in post-partum abstinence among the married couples has led to high pre-marital sex and shorter birth intervals. This has translated into a high fertility tempo in the country and thus presented a problem in resource allocation during socio-economic development.

One of the major problems concerning adolescent reproductive health results from early marriage, which leads to higher rates of childbearing and an increased risk of illness to mothers and their children. Another major problem centers on adolescents’ ignorance of sexuality, which usually leads to unwanted pregnancies and illegal abortions (WHO, 1989).

Insufficient basic knowledge about sexual and reproductive health is usual in most parts of the world. Laffredo (1994) observed that sex education was lacking in many developed countries where contraception was available. Inadequate sex education contributed to a high number of adolescent pregnancies and sexually transmitted diseases. He observed that adolescent motherhood adversely affected physical growth as well as the educational and socio-economic development of a woman. In spite of these problems, few countries offer comprehensive adolescent programs and most efforts are fragmented and underfunded.
Information on birth intervals provides insight into birth-spacing patterns which have a far-reaching impact on both fertility and child mortality levels. Research has shown that children born soon after a previous birth are at a higher risk of dying at an early age. A study by Foster (1994) showed that short birth intervals significantly reduced chances of survival. Short preceding intervals in particular affected mother’s health and increased the risk of mortality for infants. Delaying the next conception for more than two years after a previous birth doubled the likelihood of the index child surviving to its second birthday. This is not the case in Kenya and as such under-five mortality still remains high.

Findings of many studies suggest and support the importance of child spacing practices as a means of reducing mortality of young children as well as of young mothers. Therefore, early childbearing particularly among teenagers has demographic, socio-economic and socio-cultural consequences to both the community and country at large.

Child spacing is an essential aspect of fertility behavior of any population and signifies how couples space their children. However, teenage reproductive behavior has continued to receive considerably less attention in the country than it deserves. An unsatisfactory situation still remains regarding reproductive health service delivery to young people.

If we have to avert population explosion which poses serious socio-economic implications in the country, the following questions need to be addressed for putting control measures in place. These are:
a) What are the risks related with transition between births and their resultant effects?
b) What are some of the major factors responsible for birth order transitions in the study area?

1.3 Objective of the Study

The general objective of this study was to determine factors influencing birth order transition among women of reproductive age in Kenya.

1.3.1 Specific Objectives

Specific objectives of the study were:

1. To determine and examine the risk of moving from one birth to the next among women of reproductive age.

2. To determine some of the factors precipitating transition between births.

1.4 Justification

An early start of childbearing remains an important issue in reproductive health because of the substantial risks involved which have both mortality and fertility implications. Early childbearing not only affects the young women due to their immature bodies at the time of delivery and the offsprings from such immature bodies but is ultimately an influence in increasing the total fertility in the country.
Kenya has in the past experienced rapid population growth attributed to a high and sustained fertility and steady mortality decline. Due to government intervention the country’s fertility dropped from a peak of 7.9 to 4.9 children per woman and stalled for some years, (KDHS, 2003).

However, despite this stalling there is likelihood of an increase after a period of consistent decline. Given that fertility is a major determinant of population growth rate, a continued relatively rapid rate of population growth presents a major challenge to the country’s overall development and hence concerns over its negative effects.

This study therefore undertakes to contribute to reproductive health and population development in general and to the entire study area in particular.
2.1 Review of Past Research and Findings

In their study in Vietnam, Swenson et al., (1993) found a significantly higher probability of a subsequent birth after birth order 2 in areas with high infant mortality compared to those with low infant mortality while mother’s education was consistently related to the likelihood of another birth at each birth order, with the most-educated women experiencing a significantly lower probability of having a subsequent birth at every birth order. However, no regional differences in parity progressions and length of birth intervals were discovered albeit urban-rural differences persisted at most birth orders.

Upon discovery that male children were less likely to be followed by a subsequent birth in the first few birth orders, they suggested that absence of a gender difference in parity progressions in the higher parities implied that women in higher parities may already have had the number of sons desired. They advanced an explanation that the significantly higher probability of an index child being followed by a subsequent live birth if their mothers were less than 30 years of age may have been due to the younger mothers being more fecund than their older counterparts.

Studies by Foster (1995) and Ping (1991) showed that women’s occupation had an extremely significant effect on their reproductive behavior. Their findings showed that mothers working for pay were less likely to have a next birth at all parities
compared to other women. This led them to conclude that women’s occupation was the main predictor of second and third birth intervals.

Rahman et. al., (1993) in their study found that sex composition of children already born had an influence in determining the birth intervals of second and third births. Their findings further showed that women were more likely to use modern contraceptives after the birth of a male child than after the birth of a female child. Women who preferred sons had shorter duration of spacing between births than those who preferred daughters.

Otieno (1999) sought to identify factors determining fertility response to infant mortality in Kenya. Using Parity Progression Ratios (probability that a couple will have at least one more birth, i.e move to the next parity), he found that the probability of having one more birth was lower at the lower birth orders but higher at higher birth orders (5 and above). This made him to conclude that patterns of birth transitions were almost similar for both lower and higher order births.

Studies in Britain, Sweden and Norway have found a weak impact of labour force participation on the transition to higher order births (Hoem and Hoem, 1989; Kravdal, 1992). It is not clear, however, how women’s labour force participation would impact birth order transitions in Kenya and other developing countries in sub-Saharan Africa where opportunities for women’s employment are scarce.

A National Research Council (1993) study found that the timing of first marriage and transitions to first and second births might be responsive to changes in economic
conditions in a number of sub-Saharan countries, though such economic effects were relatively weak in Kenya.

According to Bongaarts (1982) model proximate determinants were exhaustive determinants of fertility outcomes and as such all the important variations in fertility are captured by these proximate determinants. Therefore, if we have good enough individual-level data on contraceptive use, breastfeeding and post-partum amenorrhea (the most important proximate determinants among women) and the other proximate determinants, there should be no residual effect of social, economic and cultural factors in capturing all important variation in individual–level fertility. However, other studies using individual-level data to analyse birth intervals have reached different results to Bongaarts’, and many have still found direct effects of social and economic variables on birth interval durations.

Baschieri et al. (2007) used 2000 Egyptian Demographic and Health Survey (EDHS) calendar data to analyze determinants of birth interval length among women who were in union. The study limited its focus on the second and third birth intervals because the 2000 EDHS showed that women started using contraception after the first birth. The analytical tool was a discrete time hazard model using a logistic functional form premised on Jenkins (1995) suggestion that if the data was in a person-months format, then the model likelihood had exactly the same form as that for a standard binary logit regression model. This model specification allowed for inclusion of both time-varying and fixed covariates.

In this study, interval between the birth of the first child and the pregnancy leading to the birth of the second was partitioned into several categories. Rodriguez (1984) had
shown that the estimated effects of covariates were quite insensitive to the choice of partition. Duration categories were made narrow at the beginning of the interval on account of the findings of other studies; Hobcraft et al. (1984) in their study had shown that the hazards changed quickly at the beginning of the interval mainly because the effect of lactation changed very rapidly after birth.

The study found that the risk of conceiving the second child increased almost monotonically until two years after the birth of the first child and then decreased. Breastfeeding significantly reduced the risk of conception even among non-amenorrheic women. The use of contraception greatly decreased the hazard of conception with the intra-uterine device (IUD) being more effective than pills or other methods.

Although several socio-economic variables significantly affected the hazard in all the cases when the model was purely a socio-economic model, their effects were reduced in magnitude and thus had a much lower explanatory power compared to when proximate variables were incorporated. They concluded that once proximate variables were fully incorporated into the model, socio-economic and socio-cultural factors become insignificant. Their findings were consistent with Bongaarts (1982) observation that all important variation in fertility was captured by variation in proximate determinants.

Factors influencing intergenesic interval are varied. Setty-Venugopal et al. (2002) in their study to investigate factors affecting intergenesic interval found mother’s personal characteristics to be associated with this interval and this led them to conclude that the health condition of the previous child was a determining factor for
the decision of the mother to become pregnant again. Among the mother’s personal characteristics were age, education, occupation, family income, place of residence, as well as the cultural norms such as breast-feeding and puerperal abstinence, age at the first child, age of the couple (Al-Nahedh, 1999) and the mother’s parity or birth order (Knodel et al., 1984).

Bonilla et. al., (2008) in their study in Costa Rica used Cox’s proportional stratified hazards model to compare intergenesic intervals between Nicaraguan immigrant women and local mothers, and also determine the effect of related socio-demographic factors. Intergenesic interval was modeled as a time-to-event variable and the model included only one variable that changed over time (parity). Analytical results showed a 30 percent greater hazard for a Nicaraguan mother to recur in the following pregnancy than a Costa Rican mother; the hazard ratio was significant and age on the other hand had a protective effect on recurrence of the following pregnancy. For instance, a unit increase in age decreased the hazard of recurring in the following pregnancy by 7 percent.

In their analytical results, nationality and age were found to be the two most significant factors responsible for differences occurring in intergenesic intervals between the two population groups. This led them to conclude that intergenesic intervals among mothers were not a random process but rather explained by several socio-demographic factors. Their findings were consistent with those by Chen et. al.,(2001) which confirmed existence of differential fertility patterns for Nicaraguan and Cost Rican mothers and also with those by Al-Nahedh (1999) who also discovered a negative relation between age and intergenesic intervals.
Several studies have identified that prolonged breastfeeding lengthens the period of non-exposure to the risk of conception and consequently increases the interval between two consecutive births. Sabina et. al., (2006) in their study to establish determinants of duration of breastfeeding among Bangladesh women used survival analysis and proportional hazard model techniques with a set of socio-economic and demographic characteristics of mother and child. Among the findings of the study were that the duration of breastfeeding varied both with closed and open birth intervals. However, duration of breastfeeding was found most significantly related with open birth interval.

Trivers (1972) found that parental investment was anything parents gave to their children that benefited the future reproductive success of that child at a potential cost to the parent. Thus, the interval between births besides being a major determinant of levels of fertility in high fertility populations was also a measure of parental investment in a child. A long birth interval sacrificed time in which a mother could be producing more children, in order to enhance the development of an existing child. The length of the birth interval thus indicated how a particular child could be fairing in the competition for parental and particularly maternal resources at a crucial time in its development.

Mace et al. (1997) in their study to analyse birth interval by sex of children in a traditional African population examined data on birth spacing from Gabbra pastoralists, a traditional group of nomadic camel herders living in the north of Kenya. The study used analysis of variance (using a generalized linear model) and a Cox’s hazards model regression. Analysis of variance results showed that birth intervals
after boys were significantly longer than those after girls taking account of age of mother.

On the other hand, whether the sex of the baby that closed the birth interval influenced its length was also investigated. Results from hazard model analysis on the effect of the sex of the child on the length of the birth interval for all birth intervals and for each parity showed that the sex of the child closing the interval had actually no significant effect. This led them to conclude that sex preferences were influencing birth intervals in a traditional, non-contracepting population in sub-Saharan Africa and that maternal investment in male infants was greater than that in female except at high parity. These findings were consistent with Low (1991) results in Sweden in which birth intervals ending with a boy were found to be significantly longer.

Swenson et al. (1993) in their study in a far more heterogeneous sample of Vietnamese women with lower fertility than the Gabbra, found birth intervals after boys longer in the first and second birth orders, but not in higher parity women. They interpreted the absence of such an effect in higher parity mothers either as mothers already having the number of sons they required or a breakdown of active reproductive decision-making.

Further investigation into the influence of sex composition of all the previous surviving children on the length of the birth interval using Cox’s hazards regression and taking into account the age of the mother, found that those with no son had shorter birth intervals than those with a son, but failed to find a significant difference between those with all sons and those with at least one daughter and a son. The
study concluded that a long birth interval after a boy represented greater maternal investment in the mother’s sons.

Sultana (1997) investigated factors influencing interval between marriage and first birth of adolescent mothers in Bangladesh using data from Bangladesh Demographic and Health Survey (BDHS) 1993-94. The study used multiple regression technique with eleven independent variables, measured either on an interval scale or as a dichotomy. Results from multivariate analysis showed that delay in age at marriage and an increase in ideal family size reduced the first birth interval among the adolescent mothers. Also adolescent mothers who had been exposed to family planning information through radio had longer birth intervals from marriage to first birth than those who never heard about a family planning program from radio while young women who were working had shorter first birth intervals than those who were not. The study concluded that age at marriage was the most important predictor of the first birth interval among the adolescent mothers.

Various studies (Roudi, 1995; Rex, 1995) have shown that maternal age and length of previous birth interval were important determinants of child spacing. Women under the age of 25 had a significantly greater risk of short birth interval than older women, presumably because of greater frequency of intercourse and perhaps greater fecundity.

Age at marriage has a highly significant effect on the length of first birth interval. A study by Chowi et al., (1996) showed that age and age at marriage had a strong effect on family size. But Ping (1991) found that women who married earlier tended to have
shorter birth spacing; an opposite picture regarding age at marriage and birth interval.

Various studies (Poukouta, 1994; Ojeda and Bangel, 1994; Foster, 1995) showed that education affected the birth process through intermediate variables. These studies found that a spouse’s education had a significant positive effect on birth interval. Women married to men with no schooling were 1.4 to 2 times less likely to have a next birth compared to women with partners with some schooling. Poukouta (1994) found that more years of schooling by women were associated with longer birth intervals and concluded that educated women tended to have longer birth intervals. Other studies (Trussell et. al., 1985; Singh et. al., 1993) found that socio-economic variables (women’s education, spouse’s occupation and area of residence) had no significant independent effect on interval length. These studies showed that women’s and husbands’ education seemed to have almost no influence on child spacing.

Breastfeeding has been found to have a positive significant effect on birth interval. Ping (1991) discovered that duration of breastfeeding was the main determinant of second and third birth intervals. But Chowdhury et al., (1995) found that breastfeeding was greater among older mothers with high parity, and mothers with longer birth spacing. Trussell et al., (1985) had shown that there was no strong relationship between breastfeeding and birth interval for women with a birth interval of less than fifteen months.

Rajagopal and Phillip (1995) in their study found that women with longer birth intervals were more likely than those with short birth intervals to practice
contraception and to have a much higher rate of using contraception. Another study showed that women tried to have their first birth as soon as possible after marrying and few of them used a contraceptive before they had their first child (Chi and Hsin, 1996). A study by Mannan et al.,(1995) also revealed that in the interval following their first birth, women were less likely to practice contraception and more likely to have a subsequent birth within fifteen months than were women at parity 2-4.

2.2 Summary of Past Research and Findings

In summary studies undertaken previously with regard to birth interval analysis show that there exists diversity in context and content of the individual study findings with respect to differences in exposure to risk of giving another birth and length of time between births. This confirms differentials in childbearing levels in the sense that whatever the cause, the length of birth interval may vary from one population of women to another.

It has been shown in the review that different studies using similar or different analytical methodologies confirm existence of factors which affect reproductive behavior of women through various pathways. Some of these factors were found to be significantly related to their reproduction while in some other studies no significant impact was found. This study therefore builds on this latter case to establish whether the same scenario holds in the Kenyan perspective. This is premised on the observation that demographic literature in this country (a developing economy) is still inconclusive on factors influencing spacing of births.
Previous studies on risks and determinants of transition between births in Kenya are scanty. Therefore, findings of this study are intended to establish the direct association of each determinant (by selected variables) with spacing between births as well as provide insight on pathways through which birth spacing dynamics affect population growth. Undoubtedly, analysis of birth spacing will provide useful information on reproduction and the resultant implications as a whole.

2.3 Conceptual Framework
It is expected that socio-economic factors have a direct effect on demographic factors and vice versa. That is, if a woman has a job and high education then these factors will have a positive effect on survival and sex of preceding child and vice versa. Such interplay is also expected between family planning related factors and socio-economic and demographic factors. Therefore, these factors are expected to have an effect which in turn should influence time between births and ultimately fertility.
One the other hand, besides the combined effect that socio-economic, demographic and family planning related variables have on each other; they will also have direct individual effects on the time between births which will in the long run eventually influence fertility.

This framework shows the expected relationships among variables used in the study. Socio-economic factors (such as education, occupation, residence etc.,) and
demographic factors (age at first birth, survival, sex etc.,) are considered as independent variables. The length of time between births is used as the dependent variable for this study.

Although the framework incorporates family planning related variables the focus is on socio-economic and demographic variables due to data constraints. This is in view of the fact that there were difficulties in the secondary data with regard to alignment of dependent variable with the family planning related variables. Therefore, the other variables in the framework will be considered in this study but only their direct effect will be focused.

2.4 Operational Definition

Operational definitions of variables used in the analysis of this study are presented below:

Women: In this study women of reproductive age were females aged between 15 and 49 years. The study focused this age bracket only and in particular women who had at least more than just two children in the KDHS 2008-09.

Age at first birth: This is the age of a woman respondent at her first delivery or birth and as a variable for purposes of this analysis was measured on an interval scale.

Education: Woman’s education is measured as a categorical variable at three levels, i.e., no education, primary education and secondary +. If a woman had no education
this level was coded as ‘1’, primary education coded as ‘2’ and secondary + coded as ‘3’. No education was taken as the reference group.

**Sex of Preceding Birth:** This variable refers to gender of the child after birth. It was measured as a dummy variable, that is, whether a child after birth was male or female. For regression, the reference category was ‘female’ and coded ‘0’ while ‘male’ was coded as ‘1’.

**Survival of Preceding Birth:** Survival of preceding birth was measured as a dummy variable. The reference category was the ‘dead’ coded as ‘0’ while the ‘living’ was coded as ‘1’.

**Residence:** Residence was measured as a dummy variable. In this case if the respondent resided in the urban area the variable was coded ‘1’ and ‘0’ for rural area. The rural area was then taken as the reference category.

**Province:** Kenya was divided into 8 provinces and 158 districts (as of the 2009 Population and Housing Census). Each of these provinces was demarcated into urban and rural areas in their respective administrative jurisdictions. The respondent therefore resided either in the urban or rural region of any one province. In this analysis province was measured as a categorical variable at 8 factor levels and coded as ‘1’, ‘2’, ‘3’, ‘4’, ‘5’, ‘6’, ‘7’, and ‘8’ for Nairobi, Central, Coast, Eastern, Nyanza, Rift Valley, Western and North Eastern provinces respectively. Nairobi province, the most developed of all the eight was then taken as the reference category.
**Wealth Status:** A wealth index is a background characteristic that is computed and used in the KDHS as a measure of the long-term standard of living of the household. Its computation was based on the ownership of assets of a household namely consumer goods, dwellings, type of drinking water source, toilet facilities, and other characteristics related to the household’s socioeconomic status. In computing this index each of the household assets was assigned a weight (factor score) generated through principal component analysis and the resulting asset scores standardized in relation to a standard normal distribution, with a mean of zero and a standard deviation of one. Each household was then assigned a score for each asset and the scores summed for each household. Respondents were ranked according to the total score of the household in which they resided. The sample was then divided into five levels namely: lowest, second, middle, fourth and highest to define the individual’s wealth status.

In the analysis the levels of this covariate were reduced and the variable measured as a categorical variable at three factor levels by coding lowest level as “1” and renaming it “low”, merging second and middle levels, renaming it “middle” and coding as “2”, and finally coding the merger of the fourth and highest levels as “3” and renaming it “high”. The low level was then taken as the reference category.

**Inter-birth transition:** This is the duration between successive births and was measured in months since the preceding birth. A complete examination of reproductive health would mean looking at all factors that influence the reproductive behavior of women, but this study focuses on their reproductive health, particularly their birth timing behavior for those with more than just two births. Spacing as provided in KDHS data is measured on an interval scale as the elapsed time between
successive births. In this analysis, the transition (in months) between births is taken as the dependent variable and the median of the interval for each age category is modeled as the hazard function since Cox model hazards are defined on a numeric scale.

### 2.5 Study Hypotheses

1. A woman whose sex of preceding birth was female was more likely to be at higher risk of giving birth compared to the one whose preceding birth was male.

2. A woman whose birth resulted in death of her child was more likely to be at higher risk (shorter birth interval) of giving birth compared to the one whose birth did not result in death.

3. The study variables would have influence in determining transition between birth orders.
CHAPTER THREE

METHODOLOGY

3.1 Source of Data
The source of data for this study was the 2008-09 KDHS data covering information on women in the reproductive age bracket 15-49 years. This data set was chosen because Demographic and Health Surveys (DHSs) were the most common sets of data used in studying fertility aspects in developing countries. DHSs are large, nationally representative sample surveys collected for many countries around the world and provide information about family planning and fertility including detailed fertility histories with records of children’s birth and death rates.

3.2 Sample of the Study
The study sample was the 2008-09 KDHS survey conducted under the auspices of the Kenya National Bureau of Statistics (KNBS) in the Ministry of Planning and Vision 2030.

This survey was household-based and a representative sample of 10,000 households was drawn from the eight provinces covering the entire country. Fewer households and clusters were surveyed in North Eastern province compared to other provinces because of its sparse population. Due to this, a deliberate attempt was made in this region to oversample urban areas to get enough cases for analysis. As a result of these differing proportions, the KDHS sample is not self-weighting at the national level.
Kenya is divided into eight administrative provinces each of which is demarcated into urban and rural areas. The 2008-09 KDHS employed a nationally representative, two-stage sample. The sample was selected from the National Sample Survey and Evaluation Programme (NASSEP IV), master sampling frames maintained by the Kenya National Bureau of Statistics (KNBS) developed on the platform of a two-stage design.

The first stage involved selecting clusters from the NASSEP frame. A total of 400 clusters of which 133 were urban and 267 were rural areas were selected from the master frame. The second stage of selection involved systematic sampling of households from each of the clusters (updated list of households). The primary sampling unit for the KDHS was the household and these units were selected from the NASSEP frame with equal probability to make the KDHS selection equivalent to selection with probability proportional to size.

The 2008-09 KDHS used three questionnaires to collect survey data, that is a household, women’s and men’s questionnaires. The three questionnaires were then translated from English into Kiswahili and 10 other local languages (Kalenjin, Kamba, Kikuyu, Kisii, Luhya, Luo, Maasai, Meru, Mijikenda and Somali). The household questionnaire was the first to be administered during interviews and was used to record information on all household members and visitors. The basic information collected by this questionnaire on each person listed included age, sex, education, relationship to the head of the household, information on characteristics of the household’s dwelling unit (e.g., source of water, toilet facilities, use of mosquito nets, ownerships of various things etc.), and information on height and weight measurements of women aged 15-49 years and children aged five years and below.
The main purpose of this questionnaire was to identify women aged 15-49 and men aged 15-54 who were eligible for the individual interviews.

The women’s questionnaire collected information on the background characteristics, reproductive history, breastfeeding, knowledge and practice of family planning, marriage, fertility preferences, husband’s background characteristics and woman’s work. The men’s questionnaire collected information similar to that collected in the women’s questionnaire, but it was shorter because it did not contain questions on reproductive history, nutrition and maternal aspects. Data for this study were derived from women’s questionnaire.

All women aged 15-49 years (either usual residents or visitors) present in the sampled households on the night before the survey were eligible to be interviewed in the survey. Every second household was selected for the men’s survey and all men aged 15-54 years were also eligible to be interviewed. A total of 9936 households were selected in the survey, of which 9268 were occupied and thus eligible for interviews. Of the eligible households, 9057 households were successfully interviewed yielding a response rate of 98 percent. The main reason for shortfall in the number of households was that some households were vacant, others destroyed and members of others were absent for an extended period during data collection.

From the households interviewed, 8767 women were found to be eligible and 8444 were interviewed giving a response rate of 96 percent. Of 3910 eligible men only 3465 were interviewed, giving a response rate of 89 percent. Response rates were generally higher in rural than in urban areas. The main reason for no response among both eligible men and women was failure to find individuals at home despite
repeated callbacks to the household by the interviewers. Since 323 women were not interviewed and as such had no information on their reproductive history, their number of months since the preceding birth could not be calculated. These 323 cases were excluded thus leaving a sample size of 8444.

Of the 8444 women interviewed, a total of 4960 women who had more than just two children within the reproductive age range 15-49 were used in the analysis. These women constituted a weighted sample and had 4522 births in total.

### 3.3 Data Analysis

Two analytical tools were employed for this study in an R application software environment: Cox proportional hazards model to determine risks associated with transition between birth orders and Cox proportional hazards regression model to identify some of the factors underlying transitions to higher order births.

#### 3.3.1 Cox Proportional Hazards and Regression Models

Cox proportional hazard model gives instantaneous probabilities of experiencing events. In this study the event is birth at some point in time $t$. If we let $T$ represent survival time (transition time from one birth order to the next in this study) then $T$ is a random variable with cumulative distribution function,

$$ P(t) = Pr(T \leq t) $$

and probability density function

$$ f(t) = dP(t)/dt $$.  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  .  (1) $$
Survival function,

\[ S(t) = Pr(T > t), \]

is the complement, \((1 – P(t))\), of the distribution function, \(P(t)\), that is

\[ S(t) = Pr(T > t) = (1 – P(t)) \] . . . . . . . . . . . . . . . . . . . . . . . (2)

Another representation of the distribution of survival times is the hazard function defined as;

\[ h(t) = \lim_{\Delta t \to 0} \frac{Pr[(t \leq T < t+\Delta t) / T \geq t]}{\Delta t} = \frac{f(t)}{S(t)} \] . . . . . . . . . . . . . . . . . . . . . . . (3)

Where,

\( T \) = survival time (transition time between birth orders)

\( \Delta t \) = an infinitely small time interval defined within \( (t, t+\Delta t) \)

\( t \) = a fixed value of time.

\( Pr \) = the probability that a woman will have a higher order birth in an infinitesimal time interval, \( (t, t+\Delta t) \), conditional on survival to that time, \( t \).

\( f(t) \) = probability density function.

\( S(t) \) = survival function.

This function assesses the instantaneous risk of birth at time \( t \) given survival to that time.

Survival analysis models time it takes for the event (birth in this case) to occur and is useful in determining relationship between survival and one or more predictors,
usually termed as covariates. Modeling of survival data employs the hazard function or the log-hazard where the density function assumes exponential, Gompertz or Weibull distribution depending on the assumption whether the baseline hazard is time-independent or time-dependent, (Cox, 1972). This study uses Cox proportional hazards model which assumes that the time-to-event and the covariates are related through the functional form:

\[ h_i(t) = \exp(\alpha + \beta_1 x_{i1} + \beta_2 x_{i2} + \ldots + \beta_k x_{ik}) \]. \hspace{2cm} (4)

Where,

\[ h_i(t) = \text{the hazard for the } i^{th} \text{ case at time } t. \]

\[ \exp(\alpha) = \text{the baseline hazard } (h_0(t) = e^\alpha) \text{ at time } t \text{ when all the covariates are zero.} \]

\[ \beta_k = \text{the value of the } k^{th} \text{ regression coefficient} \]

\[ i = \text{a subscript for observation.} \]

\[ K = \text{the number of covariates} \]

\[ x_{ik} = \text{i}^{th} \text{ value of the } k^{th} \text{ covariate such as age at first birth, education etc.}, \]

The value of the exponent of the parameter estimate, that is \( \exp(\beta) \), represents the relative risk of moving to the next group in relation to the baseline group or percentage change in the hazard rate for a unit change in the independent (predictor) variable. When there is no effect of a covariate in the model, then \( \exp(\beta) \) becomes unity. A value greater than unity indicates the risk of having another birth is greater for that group when compared with the reference group while a lesser value of \( \exp(\beta) \) from unity means lower chance of having another birth as compared to the reference group.
The choice of Cox proportional hazards model for this study was guided by the fact that unlike the other regression models, Cox’s model is semi-parametric and its specification has a compensating virtue of not having to make arbitrary and possibly incorrect assumptions about the functional form of the baseline hazard. Such robustness makes it broadly applicable in the case of this study.

3.3.2 Model Assumptions
   
i) The hazard ratio is constant over survival time thereby not allowing a temporal bias to become an influential player on the endpoint.
   
ii) Censuring is independent of the future value of the hazard.
   
iii) The hazard is proportional to the covariates.
   
iv) Data is homogeneous.
   
v) The constant hazard is independent of time.

3.3.3 Exploratory Data Analysis

For purposes of analysis, the dependent variable was bivariate random incorporating survival time and censoring indicator. Survival time though measured on an interval scale was converted into a point estimate whereas censoring indicator was measured as a dichotomy.

Before application of proportional hazards regression model, chi-square tests of independence were carried out to establish whether there existed any evidence of association between independent variables under the null hypothesis that there existed no association. Analytical results presented in Table A.1 (Appendix A) show
that there were no meaningful associations between the variables. All the computed chi-square values were neither significant at 5 nor 1 per cent levels. The wealth status variable, a household’s economic status index, was included in the regression model premised on the fact that it was readily available in the secondary data and as such would be more appropriate for the study.

Results presented in Appendix B from exploratory data analysis confirmed that the study data conformed to the distribution of survival times with regard to modeling time to event (birth). Survival curves in each of the figures 3.3, 3.4 and 3.5 do not cross; a clear indication that non-proportional hazards did not exist.

Further model diagnostics to examine proportionality assumption are presented in Table C.1 (Appendix C). In model diagnostics, a test for each covariate was computed along with a global test for the model as a whole. Diagnostic results showed that all the per-variable tests were not statistically significant and this was further corroborated by the global test (on 17 degrees of freedom). This therefore confirmed non-existence of non-proportional hazards.

To a larger extent, the assumption of proportional hazards was supported for all the covariates thus justifying the use of hazards model. However, where the assumption was violated such as was the case with inclusion of more covariates (with two or more categories) such predictors were excluded from the analysis.
3.4 Limitation of the Study

This study had several limitations.

1) Secondary data were used for analysis and effects of non-sampling and sampling errors and poor birth reporting could not be ruled out.

2) First births were omitted because about 50 per cent of women in lower age group had a birth before reaching the lowest age of the age bracket.

3) Because of the sample size and high number of factor levels in some covariates the analytical model experienced iteration failures leading to no model output when more covariates beyond the seven used in the analysis were incorporated.

4) The analysis overlooked experiences of abortions or miscarriages the sampled women may have had before having their second, third and so forth child. This was because there was no data as to whether a woman experienced any abortion or miscarriage in between births after onset of childbearing. So the analytical findings of this study might give a partial picture of inter-birth transition among women of reproductive age. This is a major drawback of this study.

5) Analysis relied heavily on age data disaggregated by a ten-year interval due to data constraints and as such could not give a much clearer picture and finer age cohort differentials as would have been the case had age data been uniformly disaggregated by a five-year interval.
In this section the net effect of each of the study variables when the effects of other covariates are controlled is presented. A hazard regression model is used for multivariate analysis and the results for transition to higher order births are presented in the subsequent tables below. In these tables standard errors, parameter estimates and relative risks for each of the covariates are displayed. The coefficient $\beta$ indicates the parameter estimate for each covariate in the study while exponentiated coefficient $\beta$ ($\text{Exp}(\beta)$) estimates the hazard rate (risk of progressing to the next birth) for each birth order transition.

The coefficients ($\beta$) in the tables below represent instantaneous probabilities of having higher order births given that women already had lower order ones while the standard error (S.E) indicates the band of confidence for each coefficient. As can be seen at all levels of the covariates this error is low thus permitting interpretation of the coefficient estimates. On the other hand, the risk estimates ($\text{Exp}(\beta)$) are relative and show the percentage change of moving from the baseline hazard to each category of the predictor. The higher the risk is the shorter is the transition and the lower the risk the longer the transition.

The results of multivariate analysis are interpreted and discussed below.
4.1 Second-to-Third Birth Order Transitions

As Table 4.1 shows women who began childbearing at age 20 and above were 35 per cent at higher risk of having third births in contrast to those who had their second births between ages 15-19. This indicates that women who began childbearing later in life were at much higher risk of entry into the next parity than those who entered motherhood at younger ages, suggesting early childbearing started outside marriage.

Women whose sex of the preceding child was male were at 98 per cent lower risk and as such less likely to have a third birth compared to those whose child was female in the transition period between the two birth orders.

However, when the female sex was compared to male, it emerged that women whose sex of the preceding child was female were at 53 times higher risk of moving to third birth confirming that shorter transitions were associated with female births. This depicted signs of sex preference in the male child.

Whereas there was no significant effect of survival of preceding child and education on transition to third birth, there was detectable influence by both place of and region of residence on this event. For instance, though not statistically significant, women living in urban areas were at 2 per cent lower risk of having a third birth relative to their rural counterparts.
Table 4.1: Cox regression model results for some determinants of transition between second and third birth orders.

<table>
<thead>
<tr>
<th>Covariate</th>
<th>2-3 Birth Order Transition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S.E (Std. error)</td>
</tr>
<tr>
<td><strong>Age at first birth</strong></td>
<td></td>
</tr>
<tr>
<td>(15-19)</td>
<td></td>
</tr>
<tr>
<td>20-29</td>
<td>0.179</td>
</tr>
<tr>
<td>30-39</td>
<td>0.238</td>
</tr>
<tr>
<td>40-49</td>
<td>0.253</td>
</tr>
<tr>
<td><strong>Sex of preceding child</strong></td>
<td></td>
</tr>
<tr>
<td>Male (Female)</td>
<td>0.210</td>
</tr>
<tr>
<td><strong>Survival of preceding child</strong></td>
<td></td>
</tr>
<tr>
<td>(Living)</td>
<td>0.110</td>
</tr>
<tr>
<td>Dead</td>
<td></td>
</tr>
<tr>
<td><strong>Residence</strong></td>
<td></td>
</tr>
<tr>
<td>Urban (Rural)</td>
<td>0.225</td>
</tr>
<tr>
<td><strong>Province</strong></td>
<td></td>
</tr>
<tr>
<td>(Nairobi)</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>0.110</td>
</tr>
<tr>
<td>Coast</td>
<td>0.159</td>
</tr>
<tr>
<td>Eastern</td>
<td>0.175</td>
</tr>
<tr>
<td>Nyanza</td>
<td>0.176</td>
</tr>
<tr>
<td>Rift valley</td>
<td>0.195</td>
</tr>
<tr>
<td>Western</td>
<td>0.301</td>
</tr>
<tr>
<td>North Eastern</td>
<td>0.321</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>(No education)</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>0.109</td>
</tr>
<tr>
<td>Secondary +</td>
<td>0.138</td>
</tr>
<tr>
<td><strong>Wealth Status</strong></td>
<td></td>
</tr>
<tr>
<td>(Low)</td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>0.130</td>
</tr>
<tr>
<td>High</td>
<td>0.143</td>
</tr>
</tbody>
</table>

Notes: Reference categories are in parentheses. The parameter estimates (hazard coefficients) are significant at * p<0.05, ** p<0.001.
Interestingly, wealth status unlike survival of preceding child and education significantly exerted strong influence on entry into the third birth. Relative to women of low wealth status, those in middle and high status were about 5 times at higher risk of having third births.

4.2 Fourth-to-Sixth Birth Order Transitions

Estimates of factors which influenced probability of moving to the next parity within the birth order interval four to six are reported in Table 4.2. Unlike transition to third births, sex of preceding child had no significant effects on the hazard rates of transition to sixth births. Instead, age at first birth and residence which had no statistically significant influence on transition to third births now had significant effects in this scenario.

On the other hand wealth status as was the case with transition to third births still remained statistically significant in determining transition to sixth births though its detectable strength attenuated while that of age at first birth markedly enhanced. However, unlike age at first birth whose direction of effect (i.e., increased risk) remained the same as it were previously in transition to third birth, that of wealth status (i.e., increased risk) in the present case reversed.

Women who had their fourth birth between ages 40 and 49 were nearly 7 times at higher risk of having sixth birth relative to those aged between 15-19 while women in middle and high wealth status were at 96 per cent lower risk of having sixth birth than their counterparts in low status.
Table 4.2: Cox regression model results for some determinants of transition between fourth and sixth birth orders.

<table>
<thead>
<tr>
<th>Covariate</th>
<th>4-6 Birth Order Transition</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>S.E</td>
<td>β (coefficient)</td>
<td>Exp(β) (Risk)</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>(Std. error)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Age at first birth</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(15-19)</td>
<td></td>
<td>0.177</td>
<td>0.191</td>
<td>1.930**</td>
<td>6.886</td>
</tr>
<tr>
<td>20-29</td>
<td></td>
<td>0.237</td>
<td>0.191</td>
<td>1.211</td>
<td></td>
</tr>
<tr>
<td>30-39</td>
<td></td>
<td>0.259</td>
<td>1.930**</td>
<td>6.886</td>
<td></td>
</tr>
<tr>
<td>40-49</td>
<td></td>
<td>0.191</td>
<td>1.211</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex of preceding child</td>
<td></td>
<td>0.184</td>
<td>0.231</td>
<td>1.260</td>
<td></td>
</tr>
<tr>
<td>(Female)</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Survival of preceding child</td>
<td></td>
<td>0.110</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>(Living)</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residence</td>
<td></td>
<td>0.226</td>
<td>1.822**</td>
<td>6.186</td>
<td></td>
</tr>
<tr>
<td>(Urban)</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Province</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(Nairobi)</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td></td>
<td>0.115</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Coast</td>
<td></td>
<td>0.162</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Eastern</td>
<td></td>
<td>0.178</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Nyanza</td>
<td></td>
<td>0.179</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Rift valley</td>
<td></td>
<td>0.199</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Western</td>
<td></td>
<td>0.304</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>North Eastern</td>
<td></td>
<td>0.322</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Education</td>
<td></td>
<td>0.145</td>
<td>-3.330**</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>(No education)</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td></td>
<td>0.109</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Secondary +</td>
<td></td>
<td>0.138</td>
<td>0.000</td>
<td>1.000</td>
<td></td>
</tr>
<tr>
<td>Wealth Status</td>
<td></td>
<td>0.156</td>
<td>-3.330**</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>(Low)</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td></td>
<td>0.145</td>
<td>-3.330**</td>
<td>0.036</td>
<td></td>
</tr>
<tr>
<td>High</td>
<td></td>
<td>1.000</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Notes: Reference categories are in parentheses. The parameter estimates (hazard coefficients) are significant at * p<0.05, ** p<0.001.
Additional factor that influenced probability of moving to sixth birth was residence. In contrast to women residing in rural areas, those in urban areas were 6 times at higher risk of having a sixth birth. However, in transition to eighth birth the effect of this factor drastically diminished to a point where its directional risk effect reversed. On the other hand, mortality of the fourth child, province of residence and education had no statistically detectable influences on transition to sixth birth.

A major difference between the covariates influencing entry into third and sixth births was that place of residence now became a significant factor while sex of preceding child ceased to be significant.

4.3 Seventh-to-Eighth Birth Order Transitions

In Table 4.3, estimates of covariates which had statistically detectable effects on transition to eighth birth are displayed. Interestingly, except for residence all the other covariates are not statistically important predictors of transition to parity eight. Although age at first birth points to detectable influence on transition to eighth birth, its impact is not statistically significant. However, this table should be read with caution due to depletion of the sample size.

Women who resided in rural areas were at 99 per cent higher risk of having an eighth child than their counterparts in urban areas. This suggested that women urbanites were virtually at no risk of becoming pregnant for an eighth child in contrast to their rural counterparts. This thus, established the weakening of both socio-economic and demographic factors in determining inter-birth transitions as women progressed from lower to higher parities.
Table 4.3: Cox regression model results for some determinants of transition between seventh and eighth birth orders.

<table>
<thead>
<tr>
<th>Covariate</th>
<th>7-8 Birth Order Transition</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>S.E (Std. error)</td>
</tr>
<tr>
<td><strong>Age at first birth</strong></td>
<td></td>
</tr>
<tr>
<td>(15-19)</td>
<td>0.178</td>
</tr>
<tr>
<td>20-29</td>
<td>0.237</td>
</tr>
<tr>
<td>30-39</td>
<td>0.252</td>
</tr>
<tr>
<td>40-49</td>
<td>0.269</td>
</tr>
<tr>
<td><strong>Sex of preceding child</strong></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>0.184</td>
</tr>
<tr>
<td>Female</td>
<td></td>
</tr>
<tr>
<td><strong>Survival of preceding child</strong></td>
<td></td>
</tr>
<tr>
<td>(Living)</td>
<td>0.110</td>
</tr>
<tr>
<td>Dead</td>
<td></td>
</tr>
<tr>
<td><strong>Residence</strong></td>
<td></td>
</tr>
<tr>
<td>Urban</td>
<td>0.278</td>
</tr>
<tr>
<td>(Rural)</td>
<td></td>
</tr>
<tr>
<td><strong>Province</strong></td>
<td></td>
</tr>
<tr>
<td>(Nairobi)</td>
<td></td>
</tr>
<tr>
<td>Central</td>
<td>0.115</td>
</tr>
<tr>
<td>Coast</td>
<td>0.162</td>
</tr>
<tr>
<td>Eastern</td>
<td>0.178</td>
</tr>
<tr>
<td>Nyanza</td>
<td>0.179</td>
</tr>
<tr>
<td>Rift valley</td>
<td>0.199</td>
</tr>
<tr>
<td>Western</td>
<td>0.304</td>
</tr>
<tr>
<td>North Eastern</td>
<td>0.322</td>
</tr>
<tr>
<td><strong>Education</strong></td>
<td></td>
</tr>
<tr>
<td>(No education)</td>
<td></td>
</tr>
<tr>
<td>Primary</td>
<td>0.109</td>
</tr>
<tr>
<td>Secondary +</td>
<td>0.138</td>
</tr>
<tr>
<td><strong>Wealth Status</strong></td>
<td></td>
</tr>
<tr>
<td>(Low)</td>
<td></td>
</tr>
<tr>
<td>Middle</td>
<td>0.130</td>
</tr>
<tr>
<td>High</td>
<td>0.143</td>
</tr>
</tbody>
</table>

Notes: Reference categories are in parentheses. The parameter estimates (hazard coefficients) are significant at * p<0.05, ** p<0.001.
CHAPTER FIVE

DISCUSSION, CONCLUSION AND RECOMMENDATIONS

5.1 DISCUSSION

5.1.1 Age at first birth

Many studies have confirmed that among other determinants of fertility, age at first birth and duration of birth interval both reflected length of exposure to the risk of childbearing. For example, in developing countries with low or inefficient contraceptive utilization early childbearing was often followed by shorter earlier birth intervals and hence high completed fertility (Trussell et al., 1985; Menken et al., 1981).

Tables 4.1 and 4.2 indicate that age at first birth was consistently significant for transitions to third and sixth births (p<0.05 and p<0.001 respectively). The chance of having next birth in the two cases by women of reproductive age was lower at lower ages but rose at higher ages. For instance, the hazard of having the next child increased by 35 per cent and over 6 times for transition to third and sixth births respectively for all women at the other ages compared to those aged 15-19.

Therefore, Tables 4.1, 4.2 and 4.3 show that the hazard of having the next child increased for all ages relative to age 15-19 and peaked at age 40-49 on the sixth birth order. As a result of this, age at first birth was the most significant explanatory variable affecting birth order transition in this study.
5.1.2 Sex of preceding child

As Table 4.1 shows, sex of preceding child was only significant for transition to third birth. In all transitions to higher order births, the risk of having next child was lower for transition to third order birth, higher for transition to sixth order birth and non-existent for transition to order eight if the preceding child was male. Thus, women whose second child was male were at 98 per cent lower risk of having a third child than their counterparts whose second child was female. This observation was consistent with Da Vanzo et. al., (1995) finding that sex composition of children already born had an influence in determining the birth intervals of second and third births. However, in the present study this trend reversed in transition to sixth birth though the effect was not statistically significant.

Mace et. al., (1997) while analyzing data on birth spacing from Gabbra pastoralists of northern Kenya found that birth intervals after boys were longer than those after girls. Low (1991) found that birth intervals ending with a boy were significantly lower in Sweden. Swenson et. al., (1993) while using a more heterogeneous sample of Vietnamese women with lower fertility than the Gabbra of Kenya found birth intervals after boys longer in the first and second births but not in higher parity women.

The effect of this predictor remained insignificant thereafter for the rest of the transitions thus indicating that the overall effect of this covariate on timing of next birth among women was marginal.
5.1.3 Survival of preceding child

It is often postulated that infant and child mortality have a direct effect on fertility either because mothers tend to consciously replace their children who have died or women whose children die at infancy have reduced periods of breastfeeding and amenorrhea. Both of these conditions tend to shorten birth intervals.

Studies have shown that the death of a preceding child leads to a shorter birth interval than when the preceding child survived. For example, when a child dies, mothers’ subsequent birth intervals are 60 per cent shorter, on the average, than when the child survives (USAID, 2002). Therefore, the death of the index child (i.e., the child initiating the interval under consideration) can also affect the likelihood of the timing of having a subsequent birth through its effects on breastfeeding, replacement behavior and the insurance motive.

In Tables 4.1, 4.2 and 4.3 survival status of the index child is not consistently significant at all birth order transitions. This implied that mortality of the preceding child did not determine the risk involved in progression to the next birth in each successive birth order.

5.1.4 Place of residence

Place of residence is one of the crucial socio-economic variables determining transition between birth orders. In Tables 4.2 and 4.3, this covariate was significant in transition to both sixth and eighth birth orders (p<0.001). Thus, at higher parities urban women were almost at no risk of having their next child compared to their rural counterparts. This implied that in transition to parity eight, urban women were
less likely to progress to this birth order than their rural counterparts. On the other hand, urban women were highly likely to progress to parity 6 (see table 4.2) than their rural counterparts. Unlike the former case in which urban women had longer inter-birth scenario, this latter case manifests a shorter inter-birth one. The reason for having shorter birth interval by urban women in transition to sixth order birth could be that their rural counterparts, who are majorly illiterate or semi-illiterate, breastfed their children for longer duration and intensity.

In nearly all developing countries almost all women breastfeed their new born children. However, breastfeeding differs among cultures both in duration and frequency. Among developing regions the duration of breastfeeding ranges from an average of 14 months in Latin America and the Caribbean to 21 months in Sub-Saharan Africa (USAID, 2002). Breastfeeding practices help determine how long women will remain amenorrheic (without menses) and thus less likely to get pregnant after giving birth.

Women who fully or nearly fully breastfeed their infants remain amenorrheic longer. Studies have established that breastfeeding is a principal determinant of the length of birth interval through hormonal suppression of ovulation after birth and thus inhibited fertility (Bongaarts et. al., 1983).

5.1.5 Province

In contrast to Nairobi, living in any other region seemed to increase the risk of having a third birth by 6 per cent in Central, Coast, Eastern and Nyanza, by 5 per cent in Rift Valley and Western, and by 3 per cent in North Eastern as far as statistical significance was not taken into account (see table 4.1).
Neither Table 4.2 nor Table 4.3 shows statistical significance of this socio-economic and socio-cultural variable in detecting magnitude of the risk involved in transition to either sixth or eighth birth order though these results should be read with caution due to low sample proportions at this point and sampling errors inherent in secondary data used in this study.

5.1.6 Education

Female education is strongly associated with fewer children and a lower probability of a recent birth and this partly operates through its effect on marital status (World Bank, 2007). Education is positively associated with birth spacing, that is, the higher the education the longer the interval between one birth and another (lower risk of pregnancy). Longer spacing may thus result in smaller completed family size and slower growth rate of population (Al-Nahedh, 1999).

However, in Tables 4.1, 4.2 and 4.3 there is no significantly detectable effect of education on transition to any birth order. This may be attributed to the fact that education is considered one of the most important socioeconomic factors having an indirect influence on birth interval length through its impact on one or more of the biological variables such as contraceptive use, breastfeeding practice, frequency of sexual intercourse and sexual abstinence. This view is supported by the findings of other studies (Foster; 1995, Trussell et. al.; 1985, Singh et. al.; 1993).
5.1.7 Wealth Status

This covariate constituted a wealth index created by computation on the basis of a household’s socioeconomic status. Therefore, a woman’s work status or labour force participation was perceived as a component of this index.

Many studies have found negative relationship between women’s labour force participation and fertility. Women with lower status, whether within the household or within the society and women who are not employed tend to have shorter birth intervals than women of higher status or who are employed. According to Trussell et al., (1985), women with greater socioeconomic status, assuming they work away from home, are better and longer users of contraception leading to longer waiting time to conception and birth interval.

As inter-birth intervals are known to be inversely correlated with the number of children ever born, keeping other factors constant (Stevenson et. al., 1994), a negative association was expected to exist between women’s wealth status and birth order. Table 4.1 and 4.2 both show that a woman’s wealth status was significant (p<0.001) for transition to third and sixth birth orders. For instance, whereas the hazard of having the next birth increased by about 5 times among women of both middle and high status in transition to third order births, that of women in the same status in transition to sixth order births decreased by 96 per cent compared to their counterparts in low status in either case.

In contrast to women in middle and high wealth status, those in low status were at lower risk of giving birth at lower parities and at higher risk at higher parities. These results are consistent with what has been found in other literature that the
probability of having one more birth was lower at lower birth orders but higher at higher orders (Otieno, 1999).

5.2 CONCLUSION
On the whole age at first birth continued to exert strong influences on higher order births and in the same direction as in lower ones. However, this statistically detectable influence disappeared in transition to eighth order births. Reasons for disappearance of strong age effects on entry into parity 8 are not clear but two explanations may be advanced.

First, women in the higher order births may already have had the desired family size or excess children. Alternatively, women under the age of 40 had a significantly greater risk of short birth interval than older women presumably because of greater frequency of intercourse and perhaps late marriage. But due to sample depletion at this point, fertility behavior of women with large families may be explained by purely cultural factors. In fact there is some indication that the only factor that was important in determining transition to eighth order birth was cultural – place of residence.

Significantly, sex of preceding child was statistically important predictor of transition to third birth only implying that this covariate had powerful effects at lower order births only. On the other hand, residential variations in family size did not come into the picture with regard to pace of childbearing until at much higher parities (birth orders 6 and 8). In this regard, it is noteworthy that for transition to sixth birth order, women from urban dwellings were the ones at higher risk of achieving higher parities than their rural counterparts. However, these positive residential effects reversed
during transition to eighth order birth with rural women now overtaking their urban counterparts.

It is important to recognize, however, that as a predictor, place of residence compounds at least two important determinants of fertility. First, as a geographical unit, place of residence speaks to some measure of urbanization or, at least, to a common perception in service availability and efficiency in the delivery of reproductive health and family planning services. Thus, the lower risk of giving birth among high parity women manifests in the better serviced and more secularized places than in the more traditional ones simply because women who chose to move to parity 6 in urban areas may be a group of particularly traditional women who frequent these areas visiting their working husbands.

Inferences around the relationship between social status of women and their fertility behavior may be anchored around the effects of their wealth status. With regard to the pace of childbearing, women in middle and high status had significantly detectable effects on birth order transitions up to order 6. However, transition times to the sixth birth order were reduced 3 times by a unit increase in wealth status thus confirming that effects of this predictor were positive at lower orders and negative at higher orders. This suggested that improved wealth status of women resulted in their more active participation in family decision-making leading to lower family sizes. This observation is consistent with USAID (2002) findings.

In a general sense, the study results supported the proposed hypotheses. Thus, women whose sex of preceding child was female were at higher risk of having another birth compared to those whose sex of the preceding child was male. On the
other hand, most of the covariates had significant detectable effects on birth order transition. However, the effects were not consistent.

This study has confirmed the importance of age, sex composition, place of residence and wealth status in influencing transitions between births. However, it is not clear why these covariates do not consistently impact all birth orders. In fact it is especially unclear why the effects of child mortality, region of residence (province) and education were not discernible in all transitions and why effects due to place of residence (urban / rural) were not initially detectable until sixth birth order. Similarly, it is unclear why the effects of age at first birth were slightly significant with the same magnitude across all the age brackets in lowering transition times to order 3 while age 40-49 sporadically and most significantly reduced transition time to order 6.

This study has also confirmed age at first birth as by far the most powerful predictor of birth order transitions. Of the seven covariates included in the analysis, place of residence notably follows closely as the next most important predictor followed by wealth status and then sex of preceding child in that order.

On the basis of consistence of present findings on sex of preceding child with those of other studies in the literature, absence of longer birth intervals after a male birth among higher parity women may be interpreted either as women having already attained desired number of sons or a breakdown of active reproductive decision-making.

To a larger extent, results of this study have attempted to answer the leading research questions put forward in the first part of this project:
• Hazards of giving birth have been determined in magnitude and found to significantly influence transition between births among women of reproductive age either by lowering or raising spacing between births. Higher risks of birth would be harmful to the health of both mothers and children whereas lower risks would portend reduced child and maternal mortality;

• Age at first birth, sex of preceding child, place of residence and wealth status were important demographic, socio-economic and socio-cultural determinants of inter-birth transitions.

5.3 RECOMMENDATIONS

Based on the above findings, the following recommendations for policy implications and further research are suggested:

5.3.1 For Policy Implications

• One of the study findings is that women of low wealth status were at higher risk of progressing to higher parities. Therefore, government and non-governmental organizations should develop wealth creation opportunities for women so that economic dependency and consideration of children as a source of income and old age security become low. By doing so, longer inter-birth transition times could be achieved.

• Child spacing and birth order progression are two essential aspects of fertility behavior for any population. Therefore, findings generated by this study can be used by the government and others in providing useful information for
guiding formulation of effective policies and development of programs to improve maternal and child health. At the program level, the dual aim should be to persuade women to prefer longer inter-birth transition times and underscore the importance of spacing after alive birth.

- Shorter transition between births adversely affects both the preceding and succeeding child. By lengthening inter-birth transition infant, child and maternal mortality could be averted. Therefore, educating women about the health risks associated with unfavorable reproductive patterns and providing access to modern methods of contraception could lengthen transition between births with positive results on overall country fertility and family well being.

- The significantly higher risk of a rural woman having a subsequent live birth than an urban woman at higher parities may suggest an interplay between traditional, non-contracepting and non-traditional, contracepting populations. Since women are the first to be affected by harmful traditional practices or cultural norms, governmental and non-governmental organizations should strongly work to strengthen information, education and communication (IEC) campaigns so as to increase awareness about the adverse consequences of harmful cultural norms.
5.3.2 For Further Research

- This study did not include some variables such as religion, ethnicity, exposure to media and contraceptive method appearing in the model. Therefore, it is better to conduct further research on these unexplained variables to gain a better insight into their spacing behavior.

- A male birth is preceded by a lower risk of pregnancy while a female birth is preceded by a higher risk of pregnancy. Further research is therefore recommended to establish the reasons behind this crucial demographic difference.

- Since the findings of this study do not provide a universal conclusion, it is recommended that other models be applied to uncover more and open up new exploratory avenues that the present study may not have addressed on account of its limitations.
REFERENCES


### Table A.1: Test for independence

<table>
<thead>
<tr>
<th>Variable Crosstabs</th>
<th>$\chi^2_{\text{computed}}$</th>
<th>Degrees of freedom (df)</th>
<th>$\chi^2_{\text{df, 0.05}}$</th>
<th>$\chi^2_{\text{df, 0.10}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age Vs Sex</td>
<td>0.093</td>
<td>3</td>
<td>9.348</td>
<td>7.815</td>
</tr>
<tr>
<td>Age Vs Survival</td>
<td>0.015</td>
<td>3</td>
<td>9.348</td>
<td>7.815</td>
</tr>
<tr>
<td>Age Vs Residence</td>
<td>0.037</td>
<td>3</td>
<td>9.348</td>
<td>7.815</td>
</tr>
<tr>
<td>Age Vs Province</td>
<td>0.282</td>
<td>21</td>
<td>35.479</td>
<td>32.671</td>
</tr>
<tr>
<td>Age Vs Education</td>
<td>0.035</td>
<td>6</td>
<td>14.449</td>
<td>12.592</td>
</tr>
<tr>
<td>Age Vs WealthStatus</td>
<td>0.023</td>
<td>6</td>
<td>14.449</td>
<td>12.592</td>
</tr>
<tr>
<td>Sex Vs Survival</td>
<td>0.002</td>
<td>1</td>
<td>3.841</td>
<td>2.706</td>
</tr>
<tr>
<td>Sex Vs Residence</td>
<td>0.001</td>
<td>1</td>
<td>3.841</td>
<td>2.706</td>
</tr>
<tr>
<td>Sex Vs Province</td>
<td>0.002</td>
<td>7</td>
<td>16.013</td>
<td>14.067</td>
</tr>
<tr>
<td>Sex Vs Education</td>
<td>0.001</td>
<td>2</td>
<td>7.378</td>
<td>5.991</td>
</tr>
<tr>
<td>Sex Vs WealthStatus</td>
<td>0.001</td>
<td>2</td>
<td>7.378</td>
<td>5.991</td>
</tr>
<tr>
<td>Survival Vs Residence</td>
<td>0.005</td>
<td>1</td>
<td>3.841</td>
<td>2.706</td>
</tr>
<tr>
<td>Survival Vs Province</td>
<td>0.042</td>
<td>7</td>
<td>16.013</td>
<td>14.067</td>
</tr>
<tr>
<td>Survival Vs Education</td>
<td>0.004</td>
<td>2</td>
<td>7.378</td>
<td>5.991</td>
</tr>
<tr>
<td>Survival Vs WealthStatus</td>
<td>0.005</td>
<td>2</td>
<td>7.378</td>
<td>5.991</td>
</tr>
<tr>
<td>Residence Vs Province</td>
<td>0.018</td>
<td>7</td>
<td>16.013</td>
<td>14.067</td>
</tr>
<tr>
<td>Residence Vs Education</td>
<td>0.001</td>
<td>2</td>
<td>7.378</td>
<td>5.991</td>
</tr>
<tr>
<td>Residence Vs WealthStatus</td>
<td>0.002</td>
<td>2</td>
<td>7.378</td>
<td>5.991</td>
</tr>
<tr>
<td>Province Vs Education</td>
<td>0.019</td>
<td>14</td>
<td>26.119</td>
<td>23.685</td>
</tr>
<tr>
<td>Province Vs WealthStatus</td>
<td>0.014</td>
<td>14</td>
<td>26.119</td>
<td>23.685</td>
</tr>
<tr>
<td>Education Vs WealthStatus</td>
<td>0.002</td>
<td>4</td>
<td>11.143</td>
<td>9.488</td>
</tr>
</tbody>
</table>
APPENDIX B

Figures 3.3, 3.4 and 3.5.

Figure 3.3: Survival curves for the first four covariates

![Survival curves for first 4 covariates](image)

Where,

- **age** – Age at first birth
- **sxpr** – Sex of preceding child
- **svpr** – Survival of preceding child
- **resd** – Residence

Proportion surviving

0.0 0.2 0.4 0.6 0.8 1.0

Months

0 10 20 30 40 50 60
Figure 3.4: Survival curves for the last three covariates

Survival curves for last 3 covariates

Where,

prov – province
educ – education
wstatus – wealth status
Figure 3.5: Survival curves for all the seven covariates

Survival curves for all 7 covariates

Proportion surviving

age
sxpr
svpr
resd
prov
educ
wstatus

Months
APPENDIX C

Table C.1: Model diagnostics for proportionality assumption (An application of cox.zph function)

<table>
<thead>
<tr>
<th>Variable</th>
<th>rho</th>
<th>chisq</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age20-29</td>
<td>-9.17x10^{-7}</td>
<td>3.85 x10^{-9}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Age30-39</td>
<td>-6.90x10^{-7}</td>
<td>2.16 x10^{-9}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Age40-49</td>
<td>9.16 x10^{-3}</td>
<td>3.82 x10^{-1}</td>
<td>0.5367</td>
</tr>
<tr>
<td>Sex of prec. child</td>
<td>-2.62 x10^{-2}</td>
<td>3.10 x10^{0}</td>
<td>0.0785</td>
</tr>
<tr>
<td>Survival of prec. child</td>
<td>8.72 x10^{-14}</td>
<td>3.42 x10^{-23}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Residence</td>
<td>-4.89 x10^{-3}</td>
<td>1.22 x10^{-1}</td>
<td>0.7272</td>
</tr>
<tr>
<td>Central province</td>
<td>8.65 x10^{-15}</td>
<td>3.51 x10^{-25}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Coast province</td>
<td>4.64 x10^{-13}</td>
<td>9.71 x10^{-22}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Eastern province</td>
<td>6.24 x10^{-13}</td>
<td>1.75 x10^{-21}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Nyanza province</td>
<td>6.27 x10^{-13}</td>
<td>1.77 x10^{-21}</td>
<td>1.0000</td>
</tr>
<tr>
<td>R.Valley province</td>
<td>5.82 x10^{-13}</td>
<td>1.52 x10^{-21}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Western province</td>
<td>3.18 x10^{-13}</td>
<td>4.55 x10^{-22}</td>
<td>1.0000</td>
</tr>
<tr>
<td>N. Eastern province</td>
<td>3.03 x10^{-13}</td>
<td>4.16 x10^{-22}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Primary education</td>
<td>-9.78 x10^{-13}</td>
<td>4.32 x10^{-21}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Secondary plus educ.</td>
<td>-7.63 x10^{-13}</td>
<td>2.63 x10^{-21}</td>
<td>1.0000</td>
</tr>
<tr>
<td>Middle wealth status</td>
<td>-1.27 x10^{-2}</td>
<td>1.03 x10^{0}</td>
<td>0.3102</td>
</tr>
<tr>
<td>High wealth status</td>
<td>-1.26 x10^{-2}</td>
<td>9.92 x10^{-1}</td>
<td>0.3192</td>
</tr>
<tr>
<td>GLOBAL TEST</td>
<td>NA</td>
<td>1.08 x10^{1}</td>
<td>0.8658</td>
</tr>
</tbody>
</table>

Where,

Rho – Correlation coefficient  
chisq – Chi-Square test  
p-value – Level of significance  
NA – For the global test there is no appropriate correlation  
GLOBAL TEST – A global Chi-Square test is done in addition to the per-variable tests

Reference categories were: age15-19, female sex, living (survival of preceding child), rural, Nairobi province, no education, and low wealth status.