"The Fertility Transition in Kenya: A Comparison of Factors in the Timing of Second and Third Births over the 1977-1989 and 1991-2003 Periods"

by David Ojakaa[1]

1. Introduction

A fertility transition has been underway in Kenya for about 40 years now, with the total fertility rate (TFR) declining from a high level of 8.2 births per woman in the late 1970s to 4.7 towards the end of the 1990s. However, the last two Demographic and Health Surveys (DHS) conducted in the country – in 1998 and 2003 - indicate that Kenyan fertility has broken away from this downward trend. Thus, based on fertility estimates for the 1998-2003 period, a Kenyan woman is expected to have a constant average of 4.8 births over her entire childbearing years (Figure 1). This study focuses on the changes in fertility during the early childbearing years - more specifically on the factors associated with the timing of the second and third conceptions which lead to live births. In pursuing this objective, the study seeks to make a contribution to a better understanding of the factors behind the changing pace of the fertility transition in the country during the period of the rapid fall in fertility (1977-1989) compared to that of the more moderate decline (1991-2003). Such an analysis might also provide useful insights into the recent levelling off in fertility.

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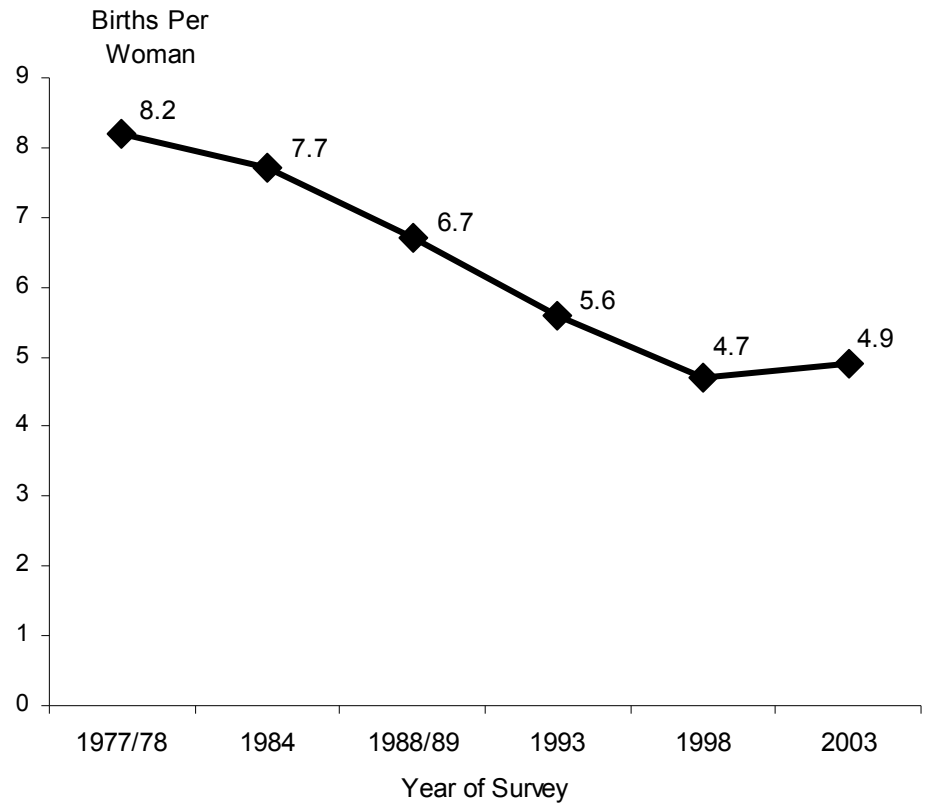
Figure 1: Kenyan Fertility Levels Off After Rapid Decline



2. Problem Statement and Study Justification

The question of the timing of the second and third births in Kenya is related to changes in fertility, and to that extent, picks up from research already conducted on the two aspects of the Kenyan fertility transition. The first group of pertinent studies is based on the recent levelling off in the fertility transition in the country – a development which has necessitated searching for new explanations as to why fertility varies (or remains constant) over time. At the aggregate level, it is found that lack of progress in socio-economic development is associated with those developing countries which registered a slow-down in their rate of fertility decline, Kenya and Ghana being examples of such states (Bongaarts 2006; Bongaarts 2007; Shapiro and Gebreselassie 2007). Analysis of several factors associated with change in fertility at the individual level also indicates

that rising infant and child mortality may be associated with this inflexibility in fertility change (Westoff and Cross 2006). In addition, it has been suggested that the spontaneous interruption in breastfeeding arising from increased child mortality that is related to HIV/AIDS needs to be considered as an explanatory factor for the constant, or resurgent, fertility in Kenya (Magadi and Agwanda 2007). Research on why the trend in Kenyan fertility has assumed the level of a plateau continues, with comprehensive explanations yet to be provided.

A second group of relevant studies examined the evidence for the fertility transition during the earlier declining stage which commenced in the late 1970s to early 1980s. Accordingly, three ideas that purport to explain the decline in fertility during that phase are illuminating. These are changes in proximate fertility determinants and in particular substantial increases in contraceptive prevalence in Kenya (Cross et al. 1991), attitudinal and behavioural changes resulting from balancing the costs and benefits of high fertility in the face of social and economic changes experienced in the country (Robinson 1992), and changes in reproductive culture within Kenyan society (Watkins 2000).

Common to these two sets of studies is their use of conventional fertility measures – notably the total fertility rate - as the dependent variables. Distinct from the emphasis on fertility outcomes in these studies, this paper seeks instead to answer the question: which characteristics of the groups of Kenyan women progressing from first to second - and from second to third - births help to explain the changes in fertility in the country over the 1991-2003 period compared to 1977-1989?

In as much as the majority of Kenyan parents might not have attained their family size desires with just one or two children, the transition to second and third births is expected to be almost universal. Nevertheless, studies that have used the birth-interval approach to examine the dynamics of the Kenyan fertility transition are rare. In addition, a study on the timing of the second and third births in Kenya is potentially illuminating for a number of reasons. First, since the late 1970s when the first set of data on birth intervals became available in the country, there have been systematic increases in the length of early birth intervals, as in that for intervals of higher parity (CBS 1980; NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). This would seem to imply that, over

the same period, there were changes in family building strategies, fertility, and investment in the quality of children – developments that are worthy of further examination as they are closely linked to changes in fertility. Secondly, the change from second to third births is closely related to the idea of replacement fertility. This is an issue of policy interest to population stakeholders, and in particular the Government of Kenya, which has as one of its goals the reduction of fertility to the near-replacement level of 2.5 births per woman by the year 2010 (NCPD 2000). It would be useful, for policy and program purposes, to examine which groups of the population are better disposed to the attainment of this goal, certain authors arguing that there is a threshold - which is determined by the interrelated factors of fertility preferences and child mortality - below which the total fertility rate in Kenya will not fall (Blacker 2002; White et al. 2006).

3. Theoretical Framework and Hypotheses

Two conceptual frameworks are useful in the analysis of the timing of the second and third births. The first is the traditional perspective of parity-specific fertility control (Knodel 1977) by which the high fertility recorded in Kenya during the late 1970s is explained by early family formation, close birth spacing, and late termination of reproduction (Ferry and Page 1984). According to this scheme, (early) birth intervals remain short until desired family size is reached; however birth intervals have on the contrary increased over time in the country. Given this observation, a second, modern perspective to the analysis of the timing of births and of specific birth intervals – the role of social processes, context, and contingency becomes important. Unlike the demographic concept of parity-specific fertility that emphasizes the amount of time in the reproductive life span, studies conducted in other parts of sub-Saharan Africa, and in the Gambia Republic in West Africa in particular have shown that the fragility of women's reproductive health and the uncertainty of the socio-economic environment count in explaining the time to the next birth (Bledsoe and Banja 2002). Similarly, studies conducted in the Republic of Cameroon show that the transition from the first to the second birth has much to do with uncertainties in contemporary social life, including the sometimes irreconcilable aims of education and reproduction (Johnson-Hanks 2004).

It is more this contextual approach to the analysis of the timing of modern-day births, rather than the older conceptual model, that is applied in this study.

The effects of these changing contexts are reflected in the spacing of the second and third births, and it is therefore useful to examine birth intervals more closely. The transition from the first to second, and from second to third, births is related to change in fertility through variation in two components of the birth interval: the annovulatory period following birth, and the waiting time to conception (Bongaarts 1978; Trussell et al. 1985; Preston et al. 2000). The two durations are in turn determined by variations in the length of breastfeeding and contraceptive use respectively. This study focuses on the time between birth and conception; and within the context of the supply-demand framework for fertility determinants (Easterlin and Crimmins 1985), socio-economic factors and child survival comprise possible predictors of this waiting time.

The effect of changing socio-economic conditions on fertility, and by implication on birth intervals, can be viewed from an economic perspective, in two ways. First fluctuations in economic conditions, which ultimately affect fertility, can come about in three ways. These are changes in the local natural environment e.g. effects of vagaries of the weather on household welfare and in turn fertility, enactment of domestic policies that affect fertility directly or indirectly, and external changes in the world economy which also impact on household decisions on fertility (Hill 1993). Some of these variations translate into increased costs associated with bearing and rearing children (child quantity and quality), and specifically, costs for children's education (Kelley and C. E. Nobbe 1990). In 1985, the Government of Kenya introduced the 8-4-4 system of education, with increasing costs of education being borne by households arising as one effect. "Free" primary education was subsequently introduced in the country in 2003 and this somewhat reduced the proportion of educational costs that households have to pay – for example through the abolition of primary school fees and levies imposed on parents, as well as through the provision of learning materials including textbooks. As a whole however, household budgets have been fixed - if not declining - in the country and under such conditions, the opportunity cost of childrearing is expected to be greatest among poor households (Michael et al. 1999). Households with higher disposable incomes would however be expected to invest more in the quality of their children, thereby

leading to reduced fertility. Secondly, fluctuations in economic conditions can also affect fertility through the idea of the household production of health. For example, the introduction of user fees in health facilities could reduce access to (reproductive) health services especially to the poorest sectors of society, and this could have implications on birth spacing and ultimately, fertility (DaVanzo and Gertler 1990).

As suggested above, infant and child mortality play an important role in the spacing of births - the death of a child can lead to shorter birth intervals through the physiological and supply effects (Lloyd and Ivanov 1988). In the physiological effect, which is more common in natural fertility populations, child loss interrupts the breastfeeding cycle and, given the contraceptive effect of lactation, reduces the waiting time to conception. The supply effect – prevalent in populations that practice fertility control - is a combination of replacement strategy, i.e. replacing a child who has passed away with additional births, and insurance strategy which consists of setting up extra fertility goals in expectation of child deaths. In the African continent, where infant and child mortality is already high, the advent of HIV/AIDS is expected to aggravate this effect of child loss on the length of the birth interval, as a study conducted in neighbouring Tanzania confirmed (Ainsworth et al. 1998).

With these changing socio-economic circumstances in mind, this study examines three hypotheses for both the second and third intervals. First, it is hypothesized that at the sub-national level, there are regional differences in the transitions to the second and third birth associated with differences in levels of development and culture. During the 1991-2003 period in contrast to 1977-1989, it is expected that rural areas in particular will show increased risk of transition to the second and third births. Secondly, during the six-year period of constant fertility (1998-2003), the risk of transition to the second or third birth should be equal to or higher than that for the six years earlier (1991-1997). During the corresponding six years of falling fertility (1983-1989) on the other hand, the reverse is expected to be true – the hazard of transition would be lower during the six years preceding the 1988/89 survey in comparison to the other six years further back. Thirdly, although increasing age at first birth is expected to be associated with lower risk of the second or third birth for both time-periods, it is predicted that this influence will attenuate during the 1991-2003 period in comparison to 1977-1989.

For the third birth interval, conclusions from studies in several African countries on the effects of the number and sex composition of surviving children are tested (Kuaté Defo 1998; LeGrand et al. 2003; Gyimah and Fernando 2004). In particular, it is predicted that the risks of transition to the third birth associated with only one surviving child relative to the situation whereby both children are alive will be higher during 1991-2003 compared to 1977-1989. Also, it is hypothesized that given the predominance of the patriarchal system in Kenyan society, transitions to the third birth will differ by gender of surviving children: higher for female children, as well as during the period 1991-2003.

4. Data and Methods

Data for this study come from the 1988/89 Kenya Demographic and Health Surveys (KDHS) that interviewed 7,150 women of reproductive age, and the 2003 KDHS that surveyed 8,195 women in the same age bracket. The basis for choosing the two datasets was the need to capture the periods when fertility was rapidly falling and socio-economic conditions relatively better (1977-1989), and when the pace of the fertility transition reduced and socio-economic development somewhat reversed (1991-2003). For purposes of comparability, parts of the country that were included in the 2003 survey but not covered during that for 1988/89 - North-Eastern and parts of Eastern and Rift Valley provinces – are excluded from the analysis.

The analysis of the factors associated with the transition to the second and third intervals was conducted by using two dependent variables – the duration in months of the waiting time to the second and third conceptions respectively. To arrive at this measure, nine months which represent the gestation period were deducted from the second and third birth intervals in turn. To select covariates to be included in the analysis, a number of issues were taken into account, problems of measurement and simultaneity of relationships between variables being among them. For example, one of the variables included in the analysis, ideal family size, is recognized as a biased estimate of fertility demand (Bongaarts 1990), and its effects are consequently analysed with this limitation in mind. Similarly, variables that are thought to be highly endogenous in the duration of birth intervals, such as contraception and breastfeeding, were excluded from

the analysis: addressing this issue adequately would have taken the study beyond its scope. Also, variables that are known to vary across time but were not captured as such in the surveys, for example occupation, were similarly not included in the analysis.

Taking these and other considerations into account resulted in the following covariates of the second and third conception: region of residence; period of first or second birth (where the observation period for all the first and second births that occurred twelve years before each survey was divided into two equal durations of six years each); age at first birth; educational level; survival status and sex composition of the first two births; having been ever-married or not by the time of first birth; household socio-economic status; ethnic group; religion; and ideal family size.

Data analysis is conducted using survival analysis, this method being preferred because of its ability to handle the problem of censoring which is inherent in data on the waiting time to conception (Cleves et al. 2004). Within survival analysis, a number of specific methods were employed. First, life table techniques were used to derive estimates of the median – and the 25^{th} as well as the 75^{th} percentiles - of the waiting times to the second and third conceptions. Secondly, the Kaplan-Meier estimator is used to estimate survivorship probabilities in the states of first and second birth. Thirdly, and as the main analytic method, the Cox semi-parametric and proportional-hazard regression model is applied to estimate the risks of progression to the second and third conceptions. The choice of the Cox model over parametric survival methods was based on the objective of the analysis – to determine the effect of the covariates of the conception interval without necessarily taking into account the shape of the baseline hazard function.

To determine the effects of covariates on the hazards of transition to the second and third conceptions, three models are developed. In model one, only three covariates – region of residence, period of first and second birth, and age at first birth - are included. In model two, other interesting explanatory variables are added into the basic model. Model three includes interactions: in addition to the basic and additional covariates, interaction terms between selected covariates and period of first or second birth respectively are integrated. The choice of covariates for interaction was based on tests of the proportionality assumption for the Cox regression model (Cleves et al. 2004).

Covariates that violated the assumption - those that showed significant results at the 5% or lower level when interacted with the logarithm of time during each of the two periods - were interacted with period of first or second birth. In so-doing, it was assumed that an additional effect of the interacted variable on the hazard is through the period of first or second birth, as appropriate.

5. Results

5.1 Univariate Analysis

5.1.1 Distribution of Covariates

The absolute and percentage distributions of covariates for the second birth interval are shown in Table I below, and the results indicate that the sample sizes are for the most part large enough for analysis. A number of observations for individual covariates are also in order. First, the table shows an increase in age at first birth from the 1977-1989 observation period to 1991-2003. Thus, the proportion of women having their first birth between ages 10 and 17 declined considerably; the percentage of those marrying after age 17 increased. Secondly, the table indicates a reduction in the level of illiteracy between the two periods, but an increase in the proportion of women with primary education. Thirdly, the increase in the proportion of women who reported getting married before their first birth is interesting, and may be related to better reporting on age at first marriage in the more recent survey KDHS survey (van de Walle 1993). Fourth, it is useful to note the substantial decline in reported family size desires over the period 1991-2003 as compared to 1977-1989. A corresponding distribution of covariates for the third birth interval is shown in Table II. For this interval, the distribution of both the first and the second child having passed away by the first month of second birth comprises only 19 cases each for the 1988/89 and 2003 datasets respectively.

Table I: Distribution of Women Having 1st Birth within 12 Years Preceding Survey

Observation Period	**1977-1989**		**1991-2003**	
Region:	Percentage	Number	Percentage	Number
Nairobi	9.3	252	10.6	316
Other Urban	11.9	325	15.7	472
Central Rural	13.9	378	12.5	374
Other Rural	65.0	1770	61.3	1835
Total	100.0	2725	100.0	2997
Period of First Birth:				
High Fertility (1977-1983)	47.5	1293		
Falling Fertility (1983-1989)	52.5	1432		
Start of Stagnation (1991-1997)			43.9	1316
Stagnation Underway (1997-2003)			56.1	1681
Total	100.0	2725	100.0	2997
Age at First Birth:				
10-17	36.3	988	26.9	807
18-24	59.4	1620	65.1	1951
25+	4.3	117	8.0	240
Total	100.0	2725	100.0	2998
Educational Level:				
None	13.6	369	6.9	206
Primary	58.5	1591	63.9	1913
Secondary+	28.0	762	29.3	878
Total	100.0	2721	100.0	2997
Survival of First Birth (by interview time):				
1 Girl	47.0	1280	45.0	1347
1 Boy	44.0	1199	47.0	1403
0 Survivor	9.0	246	8.0	247
Total	100.0	2725	100.0	2997
Ever Married at First Birth:				
First Marriage ≥ First Birth	31.0	703	26.4	687
First Marriage before First Birth	69.0	1560	73.6	1915
Total	100.0	2263	100.0	2602
Ethnic Group: Kikuyu	22.9	623	22.9	685
Luhya	17.4	475	15.7	470
Luo	14.8	402	12.2	366
Kalenjin	8.7	238	11.8	354
Other	36.2	987	37.4	1122
Total	100.0	2725	100.0	2997
Religion: Catholic	34.1	927	24.4	730
Protestant	57.8	1571	66.8	1999
Muslim	3.3	89	6.0	181
Other	4.8	131	2.8	83
Total	100.0	2718	100.0	2993
Ideal Family Size: ≤3	26.7	725	49.8	1493
4-5	56.4	1538	38.0	1138
≥6	14.6	398	8.4	251
Non-numerical	2.3	64	3.8	114
Total	100.0	2725	100.0	2997

Table II: Percentage Distribution of Covariates for the Third Birth Interval

Period of Observation	**1977-1989**		**1991-2003**	
Sex of Second Birth	Percentage	Number	Percentage	Number
Male	51.9	1280	49.9	1204
Female	48.1	1186	50.1	1209
Total	100.0	2465	100.0	2413
Survival of 2nd Child				
Yes	91.9	2265	91.2	2201
No	8.1	200	8.8	212
Total	100.0	2465	100.0	2413
Period of Second Birth				
High Fertility (1977-1983)	51.6	1193		
Falling Fertility (1983-1989)	48.4	1272		
Start of Stagnation (1991-1997)			43.2	1043
Stagnation Underway (97-2003)			56.8	1370
Total	100.0	2465	100.0	2413
Sex Composition of Surviving Children				
One son and one daughter	45.8	1130	44.4	1072
Two daughters	21.5	531	22.4	541
Two sons	21.9	540	22.1	534
One son	4.7	116	4.9	118
One daughter	5.3	130	5.4	130
All died	0.8	19	0.8	19
Total	100.0	2465	100.0	2413

Note: In the results presented in this table, survival of the second child is evaluated at the time of the interview, while that for the two children is at the beginning of the third birth interval. In the results of the Cox regressions for the second and third birth intervals (Tables VI and VII) however, survival status of the first and second births are considered as time-varying.

5.1.2 Waiting Time to Conception

The 25th, 50th, and 75th percentile distributions of waiting times to the second, third, fourth, fifth, and sixth conceptions were first estimated in order to compare the trends in the intervals between the two decades of falling and reduced pace of decline in fertility. These results are presented in Table III, the cumulative distributions having been estimated using life table techniques in order to take into account the censoring that arises from the experience of women who have not yet had their next pregnancy. Thus,

for each birth (first to sixth) that started no earlier than 12 years before the 1988/89 and 2003 KDHS surveys, the respective percentile duration to the (next) conception was estimated.

One striking contrast that can be observed in Table III relates to the 75th percentile duration of the fourth and higher conception intervals for the two observation periods. It can be observed that for the 1991-2003 period, fourth and higher intervals for the last cumulative quarter (the 75th percentile) comprises of very long intervals long intervals (at least 84 months). In contrast, for women who had their fourth and higher conceptions during the 1977-1989 period, the length of the last cumulative quarter of intervals is relatively shorter – around 40 months. This may be an indication of stronger stopping behaviour which implies contraceptive use in the case of the longer 75th percentiles observed above, associated with the more recent (1991-2003) period.

When the median conception intervals are considered, Table III shows that at the national level, the medians increased during the 12 years of a reduced pace of fertility decline (1991-2003) compared to those of falling fertility (1977-1989). Thus, for the 1977-1989 period, the median for the second conception interval was 21.7 months, increasing only marginally to 23 months by the sixth interval. For the 1991-2003 period, the median for the second interval was higher at 28.5; it increased by about three months to reach 31.2 by the sixth interval. This lengthening of the intervals is consistent with the decline in fertility between the two decades; however it is distinct from the constant fertility observed between 1998 and 2003.

In principle, change in two proximate determinants of fertility could explain the observed increase in the length of the conception intervals between the two decades – an increase in the period of post-partum amenorrhea due to a similar change in the duration of breastfeeding, as well as a rise in contraceptive use. Between these two, increased use of contraception is the more plausible, as prevalence of modern contraceptive methods increased from 4.3% in 1977/78 to 31.4% in 1998, and rose marginally to reach 33.4% in 2003. In contrast, the median durations for breastfeeding, post-partum amenorrhea, and sexual abstinence were 19.4, 10.8, and 2.6 months respectively in 1988/89. In 2003 however, they had only marginally changed to 20.1, 9.7, and 2.9 months respectively (NCPD 1989; NCPD 1994 ; NCPD 1999; CBS et al. 2004). Thus, these results indicate a

possible association between increased length of intervals and use of modern contraceptives for child-spacing purposes.

Table III: Percentile Distribution of Waiting Time to Conception in Kenya

Observation Period:	**1977-1989**			**1991-2003**		
	Percentile			Percentile		
Birth Interval:	P25	P50	P75	P25	P50	P75
Second	14.0	21.7	38.0	17.5	28.5	58.3
Third	14.9	21.8	37.5	17.7	30.6	70.1
Fourth	14.4	21.2	42.4	17.5	31.0	84.1
Fifth	15.2	22.9	42.3	20.1	34.7	94.1
Sixth	15.3	23.0	40.4	18.5	31.2	97.3

Notes: The specific percentiles (P) represent the duration in months in which the first 25, 50, and 75 percent of the women who gave a respective birth within twelve years of each survey took to proceed to the next conception.

Examination of the medians for the second and third intervals at the sub-national level (Table IV) shows an important change in rural Central Province. For the second interval, the medians and percentage change (from 1977-1989 to 1991-2003) are largest in Nairobi; the percentage change in rural Central Province being the second largest (81.6% against Nairobi's 82.6%). For the third interval however, rural Central Province registers the largest increase of 121.8% compared to 103.8% for Nairobi.

Table IV: Median Duration of Second and Third Waiting Times to Conception by Region

Interval	**Second**			**Third**		
	1977-1989	1991-2003	%Change	1977-1989	1991-2003	%Change
National	21.7	28.5	31.3%	21.8	30.6	40.4%
Nairobi	25.8	47.1	82.6%	28.9	58.9	103.8%
Other Urban	24.4	34.3	40.6%	25.5	39.3	54.1%
Central Rural	21.3	38.6	81.2%	20.2	44.8	121.8%
Other Rural	20.5	24.7	20.5%	20.9	25.3	21.1%

5.1.3 Survivorship in the States of First and Second Birth

The basic indicators obtained when setting up the data for survival analysis are shown in Table V below. Thus, out of the 7,150 women interviewed during the 1988/89 KDHS, 2,794 and 2,469 had their first and second births respectively within 12 years before the survey and were observed for the purposes of this study. Similarly, 2,887 and 2,225 women out of the 8,195 interviewed during the 2003 KDHS had their first and second births in the 12 years that preceded the survey. Other survival indicators – number of failures, analysis, and exit times are also presented in Table V; the longest exit time of 143 months is noted.

Table V: Distribution of Basic Survival Indicators for Second and Third Conception Intervals, Kenya

Observation Period	**1977-1989**		**1991-2003**	
Conception Interval	Second	Third	Second	Third
# Observations/subjects	2,794	2,469	2,887	2,255
Number of failures	1,963	1,740	1,756	1,326
Total analysis time	64,175.5	56,668	82,677.5	69,783.5
Last Exit (months)	141	141	141	143

Figure 2 below shows Kaplan-Meier (KM) survivor functions - the proportion of women who having given birth to the first child, have not yet progressed to the second conception. A similar curve, for the proportions that have not yet had the third conception, is represented by Figure 3. A question that arises is whether the curves are significantly different from each other or the apparent differences are merely due to random or systematic error. To answer this question, the Cox univariate test for survivor functions was first applied to the second interval. The results indicated that the chi-square values (for curves covering the periods 1977-1989 and 1991-2003 respectively) are highly significant ($p \leq 0.000$), so that we are led to reject the null hypothesis that the four survivor functions for region of residence are the same. Instead, we accept the alternative hypothesis that in fact the four curves are different.

Coupled with this significance, the survivor functions in Figure 2 also show that in comparison to the rural areas, residence in the city or other urban areas tends to reduce

the probability of progressing to the second conception, and this pattern strengthened during the 1991-2003 period. For both the 1977-1989 and 1991-2003 periods – when fertility declined rapidly and the fall was less rapid respectively, this widening in the probabilities is particularly apparent after the duration of 24 months. For births which occurred during the earlier period (1977-1989) particularly, this may be indicative of the importance of natural fertility factors (breast-feeding, amenorrhea, and abstinence), in both the urban and rural areas for birth intervals of less than twenty-four months. After the two years however, there might be more deliberate fertility control in terms of modern contraceptive use in the urban areas, and specifically in the city relative to other rural areas.

A similar partitioning is observed with regard to rural Central province and the two urban areas: upto about 48 months, the three curves are close to each other and the probability of not yet having had the second conception is way above that for other rural areas. Subsequently, the probabilities for rural Central province trail behind those for the urban areas but remain above those for other rural areas. It is possible that this divergence represents family building behaviour of two groups of women in rural Central province – one which is traditional and proceeds rapidly to have the second child, and the other which is modern which takes more time to transit to the second conception.

The test for equality of the survivor curves was similarly applied to the third interval: as for the second interval, the results implied that the four curves are very significantly different from one another. A comparison of the proportions remaining in the state of second birth in Figures 2 and 3 however shows marked contrasts. For second births that took place between 1977 and 1989, the grouping of the proportions into an urban block (Nairobi city and other urban areas), and a rural one (Central Province rural and other rural) is evident in Figure 3. If the grouping for second births occurring during the 1977-1989 period is between urban and rural areas, this is no longer true for the 1991-2003 period. Instead, the probability of not having progressed to the third conception has substantially risen in rural Central Province, joining the urban group of Nairobi city and other urban areas, but at the same time higher than probabilities for

other urban areas. In contrast, the proportions of women not having yet made the transition to the third conception lags in other rural areas.

Figure 2: Kaplan-Meier Survival Functions for Probability of Remaining in the Primiparous Sate by Region in Kenya

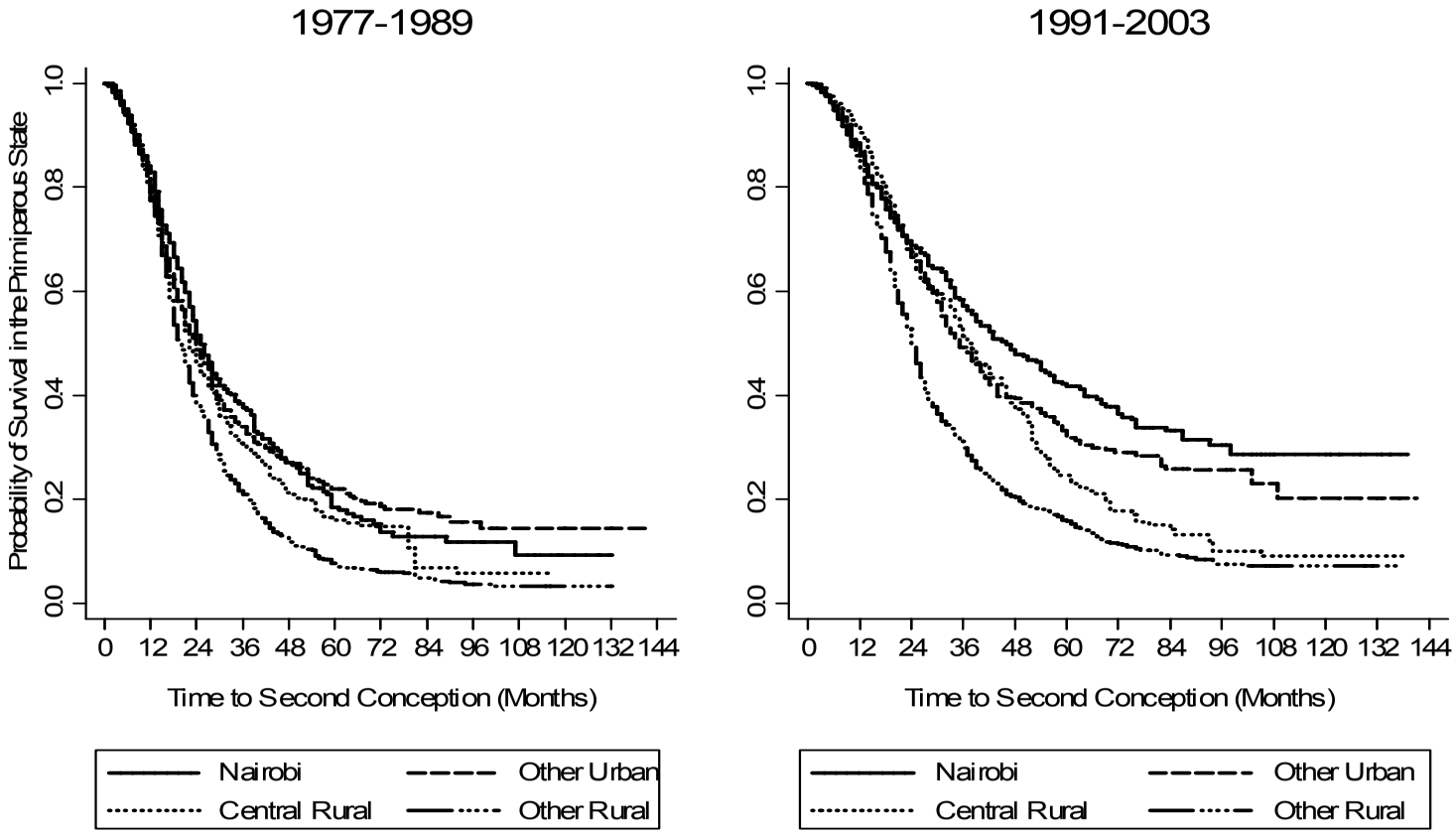
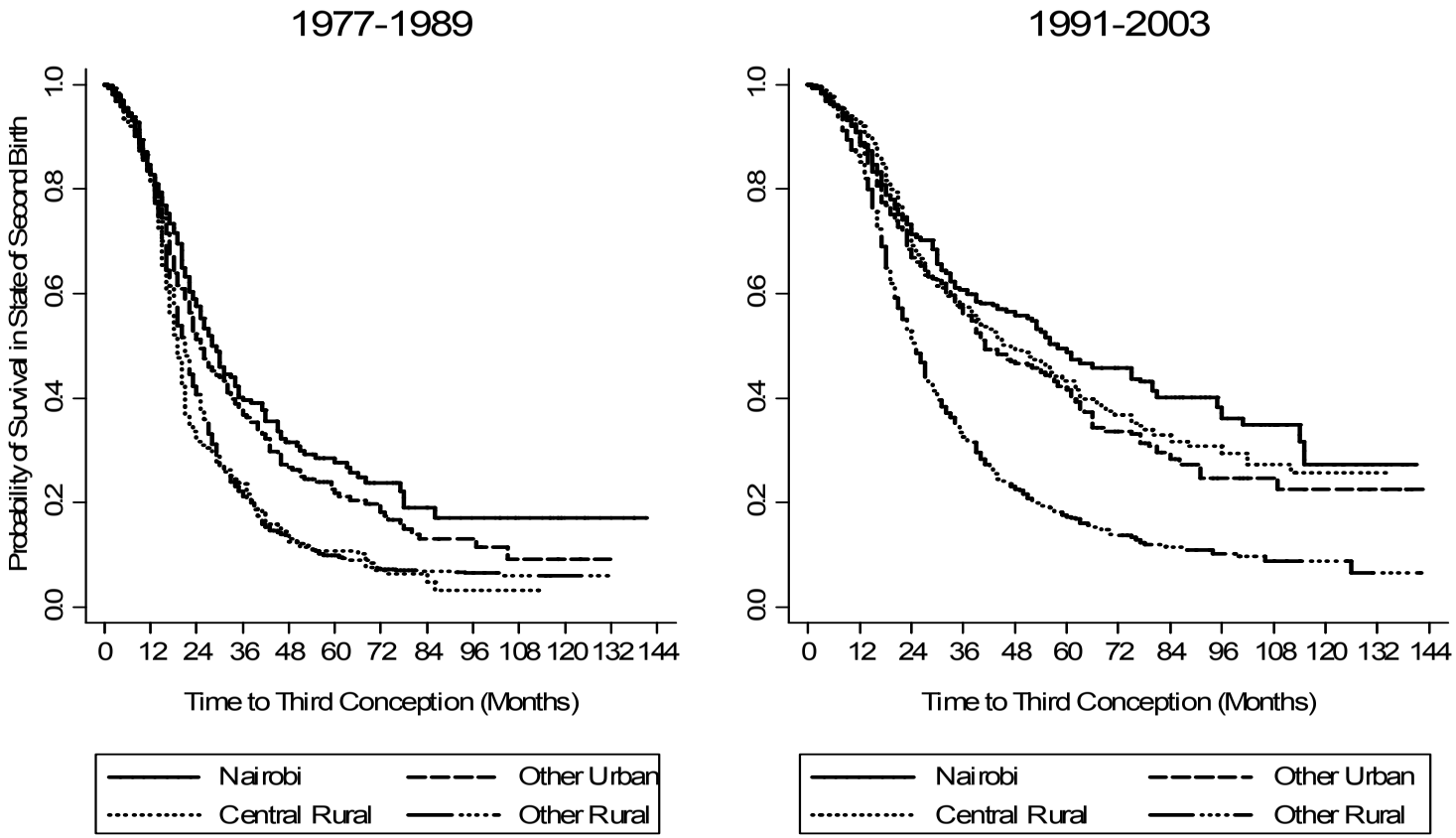


Figure 3: Kaplan-Meier Survival Functions for Probability of Remaining in Sate of Second Birth by Region, Kenya


1977-1989
1991-2003
Probability of Survival in State of Second Birth
0.0
0.2
0.4
0.6
0.8
1.0
0 12 24 36 48 60 72 84 96 108 120 132 144
Time to Third Conception (Months)
Nairobi
Other Urban
Central Rural
Other Rural

5.2 Multi-variate Analysis

5.2.1 Effects of Covariates for the Second Interval

The Effect of Region of Residence

Cox regression results for the relative risk of progressing to the second conception leading to a live birth are presented in Table VI below. For region of residence, it had been hypothesized that there would be differences in hazards between the regions, associated with variations between the provinces in the levels of development and culture, effects which would only be partially captured by other individual-level covariates. The results are partly as expected and show that for the observation period 1977-1989 first, Nairobi relative to other rural areas is associated with a significantly lower hazard ratio of a second conception, this difference widening and remaining highly significant during the 1991-2003 period. Thus, while the hazard ratio for Nairobi over 1977-1989 is 0.7 of that for other rural areas, during 1991-2003 it reduces further to 0.5, both results being very highly significant – at the 0.001 level. A similar trend can be observed with regard to other urban areas. Table VI also shows that this relationship persists in the two other models – when other explanatory variables are added into the initial model, and with the inclusion of the interaction of the period of first birth with three covariates (age at first birth, survival status of the first birth, and having been married).

Although the relative hazards for rural Central province are significant in the basic model, being 0.815 during 1977-1989 and reducing to 0.647 over 1991-2003, in models two and three (where more variables are added and interactions applied) they become non-significant. Considered together with results for urban areas (Nairobi and other urban), it is evident that while the introduction of additional factors slightly raises the hazard ratios for the urban areas, their effect on rural Central province is to render the relative hazard non-significant. This might imply that the relative hazards for the urban areas are not driven by the same set of factors that alter those for rural areas, such as rural Central province. In particular, it is apparent that while individual characteristics such age at first birth, educational level, child survival, and marriage might explain the differences in relative hazards between other rural areas and rural Central province, it is not these individual-level factors but others unique to urban areas (such as change in reproductive behaviour associated with distinct urban lifestyles and the consequent emergence of new family building strategies) that explain the changes therein.

An issue that needs to be clarified is that of the comparability of the relative hazards for the two time periods (1977-1989 and 1991-2003) for region of residence, and indeed for all other covariates. To the extent that these are hazard ratios which do not contain the baseline, the two are not absolute and cannot be compared side by side as such. These are also separate regressions, with two distinct datasets, which do not start from a common reference period. There is an intervening period that separates the two timeframes of observation – the years between 1989 and 1991 – whose events are not directly taken into account in the distinct regressions. Rather, it is the difference in the relative hazards (between the targeted category and the reference group) that can be assessed side by side for the two time periods. The description of Cox regression results for the remainder of the covariates and transitions (to second and third conceptions) are therefore presented in the light of this approach - of viewing the hazard ratios between the two time periods as differences in the relative risks – in mind. This clarification made, it is to be emphasized that the results show that the increased divergence in the relative hazards for region of residence (between the reference category, other rural areas, and the other regions) might be due to more rapid change in the urban areas and rural Central province.

Table VI: Cox Regression Hazards of Transition from First to Second Conception

Observation Period	**1977-1989**			**1991-2003**		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Region:						
Other Rural	1.000	1.000	1.000	1.000	1.000	1.000
Nairobi	0.700***	0.789**	0.790**	0.500***	0.675**	0.677**
Other Urban	0.714***	0.769**	0.770**	0.560***	0.726**	0.727**
Central Rural	0.815*	1.078	1.086	0.647***	1.102	1.105
Period of First Birth:						
1977-1983	1.000	1.000	1.000			
1983-1989	0.737***	0.774***	0.685**			
1991-1997				1.000	1.000	1.000
1997-2003				0.881	0.870*	0.933
Age at First Birth:						
10-17	1.000	1.000	1.000	1.000	1.000	1.000
18-24	0.964	0.920	0.960	0.977	0.998	0.998
25+	0.843	0.674*	0.689	0.654**	0.754	0.753
Age at First Birth x Period:						
10-17 x Earlier Period			1.000			
10-17 x Recent Period			1.086			
25+ x Recent Period			1.037			
Education:						
None		1.000	1.000		1.000	1.000
Primary		0.816*	0.814*		0.842	0.846
Secondary+		0.822*	0.822*		0.675*	0.681*
Survival of First Birth:						
1 Boy		1.000	1.000		1.000	1.000
1 Girl		1.063	1.074		1.033	0.867
0 Survivor		1.316*	1.502*		1.542**	1.374
Survival of First Birth x Period:						
1 Boy x Earlier Period			1.000			1.000
1 Boy x Recent Period			1.018			0.831
1 Girl x Earlier Period						1.176
No Survivor x Recent Period			0.809			
Socio-economic Status:						
Low		1.000	1.000		1.000	1.000
Medium		0.930	0.925		0.745**	0.743**
High		0.914	0.912		0.817*	0.813*
Religion:						
Catholic		1.000	1.000		1.000	1.000
Protestant		1.026	1.028		1.011	1.015
Muslim		0.922	0.919		1.258	1.261
Other		0.721*	0.725*		0.971	0.983
Ethnic Group:						
Kikuyu		1.000	1.000		1.000	1.000
Luhya		1.157	1.148		1.842***	1.842***
Luo		1.107	1.108		1.704***	1.707***
Kalenjin		1.116	1.121		1.555**	1.546**
Other		1.077	1.075		1.310*	1.312*
Ever Married: No		1.000	1.000		1.000	1.000
Yes		1.974***	1.809***		1.563***	1.449***
Ever Married x Period:						
Never Married x Earlier Period			1.000			1.000
Ever Married x Recent Period			1.169			1.132

Note: ***: p<0.001; **: p<0.01; *: p<0.05

The Influence of Period of First Birth

To test the possibility that there might be differences in the hazard ratios of progressing to the second birth even within the same period of observation, the twelve years (1977-1989 and 1991-2003) were divided into two equal (six-year) durations each. With such a division into two parts, the 12-year period now becomes a time-varying covariate, a task achieved by splitting the two observation periods in 1983 and 1997 respectively. This splitting conveniently assisted in testing the hypothesis about the risks of progressing to the second (and third) conception during the 1998-2003 period, when the change in fertility levelled off in the country.

For this time-varying covariate - period of first birth - results for the years 1977-1989 are clearly the most significant. The findings in Table VI show that the relative risk of transition to the second conception is always lower in the six years immediately preceding the 1988/89 survey relative to the earlier six year period; this result being true no matter which of the three models (basic, inclusion of other explanatory variables, and addition of interaction effects) is considered. This would be as expected: the period 1977-1983 was one of higher fertility. In contrast, over 1983-1989, fertility was falling rapidly in Kenya and so the relative risk of transition (to the second birth) would be lower relative to the earlier period when fertility was higher and presumably the risk of transition equally higher.

Consideration of 1991-2003, which brackets the time of constant fertility, on the other hand provides contrasting results. As can be seen in Table VI above, the risk of progressing to the second birth for the six years preceding the 2003 survey (the period when fertility decline levelled off) decreases significantly only in the model in which other explanatory variables are included. Thus, it appears that over the period of constant fertility (1997-2003), although couples proceeded to have their second child at a lower rate as compared to that when the levelling off in fertility started (1991-1997) this lower difference in relative risk was not as strong as that for the period 1977-1989. When the three models are compared, it is also apparent from Table VI (especially for the observation period 1977-1989) that the introduction of individual-level covariates does not change the relative hazards much. This is in line with the observation that the reduction in the relative hazards is not due to these individual covariates but possibly due to other determinants of birth interval length.

Age at First Birth

As Table VI shows, the effects of age at first birth on the risk of the second conception are weak and for the most part non-significant. Nevertheless, the significant results are restricted to women who are at least 25 years old at the time of the first birth relative to those who were aged 10 to 14 years when they had their first baby; the relative hazards (for both 1977-1989 and 1991-2003 periods) decreasing up to about 67.4% for this group, relative to women who are 10-17 years old at the time of first birth. For the 1977-1989 period, the relative hazard of transition to the second conception for women aged 25 years or more with reference to those aged 10 to 14 years at the time of their first birth is significant (at the 5% level) only in the model that comprises other explanatory variables; for the 1991-2003 period on the other hand, it is significant (at the 1% level) only in the basic model that contains two other covariates – region of residence and period of first birth. Thus, the results show that later age at first birth relative to early first birth is associated with a lower transition to the second conception, the relative hazard for 1991-2003 being more significant.

The Effects of Additional Explanatory Variables and Interactions

The effects of a number of interesting variables – education, socio-economic status, survival status of the first birth, ethnic group, and having been married before - entered in the second model provide further insights into the timing of second conceptions leading to live births during the periods 1977-1989 and 1991-2003. Relative to women with no education, the effects of primary and secondary or higher education respectively during the period of declining fertility (1977-1989) are to decrease the risk of progression to the second conception, both in the model with additional explanatory covariates as well as in the one with interaction terms. During 1991-2003 on the other hand, it is only among women with secondary-school or higher education that the relative risk of transition to the second conception is significant. Thus, during 1991-2003, for the model comprising interactions, the risk of transition to the second conception is 68.1% among women with at least secondary-level education, relative to those who have no education. For the 1977-1989 period on the other hand, the respective relative risks are 81.4% and 82.2% for women with primary and secondary education respectively.

For survival status of the first child, the child having passed away relative to one boy being alive is significantly associated with increased risk of transition to the second conception

during both periods, in model two (with additional variables). The significant relative risk for 1991-2003 is higher than that for 1977-1989: an increase of 54.2% in 1991-2003 as opposed to 31.6% over 1977-1989. Examination of the hazard ratios for another covariate, socio-economic status shows a number of results, the index of socio-economic status having been developed from a combination of dummy variables representing household access to safe water, type of floor of the household's dwelling unit, and ownership of durable goods which comprised electricity connection, radio, television, refrigerator, bicycle, and car. The effects of socio-economic status are only significant over 1991-2003, and in the downward direction. In addition, there is a big difference between the reference group (low socio-economic status) and the other two categories. The depressing effects of medium and high socio-economic status on the relative hazard of the second conception are also enduring even in the face of the addition of interaction terms, being 74.3% and 81.3% respectively of the reference category during 1991-2003.

For the ethnic groups, a surprising result is that the effects of belonging to ethnic groups other than Kikuyu are highly significant during the more recent period (1991-2003) and not the earlier period (1977-1989). Hailing from Luhya, Luo, and Kalenjin communities is each associated with a highly significant and increased relative hazard of progressing to the second conception, with other groups also being significant at the 5% level and in the same direction. There are also big differences between the reference risk group (being Kikuyu) and that for each of the ethnic groups. As can be seen from Table VI, the Luhya, Luo, Kalenjin, and other groups are associated with risks of progressing to the second conception that are 84.2%, 70.4%, 55.5%, and 31% above those for the reference community. This result may indicate the wide difference between the Kikuyu community and the others in terms of reproductive behaviour that is particularly related to the transition to the second conception. It is not clear what this reproductive behaviour might be, but given the higher contraceptive prevalence in rural Central Province, home to the Kikuyu community, that difference might be marked by the level of contraceptive use for spacing purposes.

Lastly, having been married by the time of the first birth not only significantly increases the relative risk of the second conception in both the model with additional variables and with interaction terms, the differences in relative risk are also big. Thus, for 1977-1989, having been married by the time of the first birth is associated with a significant relative risk that is almost

twice as high as that for women who have never been married by the time of their first birth. Similarly, for the more recent period, 1991-2003, the difference in risk, though reduced slightly is still high – about one and half times more than that for the reference category.

A number of variables were interacted with period of first birth. For the observation period 1977-1989, these were age at first birth, survival status of the first child, and having been married by the time of first birth. For 1991-2003 on the other hand, these were survival status of the first birth and ever-married by the time of first birth. None of these interactions turned out to be statistically significant.

Thus, what emerges from the above results for the transition to the second conception is that a number of variables, for the most part systematic and demographic, are important in increasing the relative risk of transition to the second conception during both periods of observation. First and foremost is the hypothesized covariate of residence. Others include child survival, ethnic group, and having been married by the time of the first birth. A number of covariates nevertheless have the opposite effect – reducing the risk of transition to the second conception. Secondary education, and belonging to the two socio-economic groups (medium and high), constitute the variables that contribute to this reduced relative risk of transition, with the effects of socio-economic status emerging only during the 1991-2003 observation period.

5.2.2 Effects of Covariates for the Third Interval

Effects of Region, Period, and Age at First Birth

As with the transition from the first birth to the second conception, the results for region of residence for the third interval (Table VII) are very highly significant and decreasing for the urban areas; they also show big differences between the reference category (other rural areas) and each of the two urban groupings. These findings are true for both periods of observation, and within each observation period, in general for all three models – the addition of covariates and interaction terms not changing the size of the relative risks much over 1977-1989 but somewhat slightly during 1991-2003. The second observation is that for rural Central province, the relative risks of progressing to the third conception are only significant during 1991-2003, and in the downward direction, like for urban areas. For example, in the model with interaction terms (column seven in Table VII below), for the 1991-2003 observation period, residence in

rural Central province with reference to other rural areas is associated with a 61.7% reduced risk of transition to the third conception.

The relative hazard for the period of second birth, on the other hand, is only significant when fertility was falling (1983-1989) - in the basic model, as well as with additional explanatory variables added. For example, in the model with additional covariates (column three of Table VII), having the second child during the six years preceding the 1989 survey is associated with a relative hazard of moving on to have the third conception that is equivalent to a decrease to 76% of the hazard in the earlier six-year period. For age at first birth on the other hand, it is only in the basic model, and during 1991-2003, that the regression results are significant. Furthermore, in this case, the difference in the relative hazard in the transition to the third conception decreases with age at first birth. Thus, having the first birth within the age group 18-24 and at age 25 or above with reference to having the first child between 10 and 14 years are both associated with decreases in the relative hazards of progressing to the third conception (82% and 60.3% of the value of the reference category respectively).

In the final analysis therefore, in the model with additional explanatory variables, period of second birth and age at first birth do not really matter in determining the relative hazard of progressing to the third conception. These are surprising results, particularly when it had been hypothesized that the relative hazard should vary over the years between 1991 and 2003, becoming more visible during the time when the levelling off in fertility was under way (1998-2003) as compared to the time when it was only beginning (1991-1997). In searching for explanations, it may be useful to bear in mind that fertility was constant beginning three years preceding the 1998 KDHS survey until the time of the 2003 KDHS. Thus, while during the two six-year periods, 1991-1997 and 1998-2003, constant fertility was registered, a number of socio-economic covariates may also not have changed much within this broad period, leading to no significant difference in the relative hazards.

Child Survival

It had been hypothesized that the survival status and gender of the first two children affect the relative risk of progressing to the third conception. Analysis of the data confirms this expectation for both periods in general, but more particularly during 1991-2003. For the 1977-1989 period, the results in Table VII below show that having only one surviving son, only one

daughter, or where all two children have passed away are all associated with highly significant increases in the relative hazard of transition to the third pregnancy, relative to the situation where the two children – a boy and a girl - are alive. These observations are particularly true for the model that incorporates additional explanatory covariates (model two). In the model with interaction effects on the other hand, the risk of progression to the third conception is only significant in the case of one surviving son – being 51.3% higher than the reference category.

The significance of the relative risks of the number and gender of surviving children in determining the transition to the third conception is clearer for the 1991-2003 period of observation. First, where all the two children have passed away contributes to a very highly significant increase in the relative hazard of transition to the third conception with reference to the situation where one boy and one girl are alive. Thus, in the model incorporating additional explanatory variables, the risk of having a third pregnancy is over two and a half times higher where all two children have passed away, as compared to the situation whereby both one male and one female child are surviving. Secondly, having two surviving daughters or one are also associated with highly significant and increased relative risks of transition to the third conception; these risks being 27% and 59.3% higher than the reference category for the case of two surviving daughters and one surviving daughter respectively. Thirdly, having only one surviving son is equally significant, representing an increased relative risk of 51.4% over the reference category.

To recapitulate, the results confirm the hypotheses about the positive influence of child mortality on the transition to the third conception - particularly during 1991-2003. Where one or both children have passed away, the relative risk of transition to the third conception is positive and increasing. In addition, the results also show some gender preference for surviving children. During the 1991-2003 period, having two surviving daughters is associated with a significantly higher relative risk of transition to the third conception. This is in contrast to the relative risks for two surviving sons, which are not significant during any of the two observation periods.

The Influence of Additional Explanatory Variables on the Hazard

Three additional covariates - level of education, socio-economic status, and ever-married status – turned out to be significant in the analysis of the effects of transition to the third conception, and their results are presented in turn. A surprising result regarding the level of

education is that during the 1977-1989 period, the relative risk of transition to the third conception for primary education – although being significant – is higher (by 28.5%) than that for the reference category of no education; the inclusion of interaction terms in the model not making a big difference in the relative hazard. Although this effect was unexpected, other studies conducted in the country and based on data for the early 1990s show similar results of an increase in fertility with some level of primary education (NCPD 1994 ; Westoff and Cross 2006). The other grouping for education - secondary or higher – has a significant relative risk only during 1991-2003. This time however, the risk of transition to the third conception for women with secondary or higher education decreases relative to the reference category, being about 60% of the reference category of no education, and again the addition of interaction terms not making any major difference to the relative hazard.

In contrast to education which is a significant determinant of the relative hazards of progressing to the third conception both over the 1977-1989 and 1991-2003 periods, the relative risk of socio-economic status (the distribution of the wealth index among households in the country) is statistically significant only during the 1991-2003 period. The details can be seen in column four of Table VII below. The significant and decreasing hazard occurs among women who hail from households of medium socio-economic status, being 77.6% of the risk of the reference category of women living in households bracketed in the low wealth index; the hazard in the model with interactions remaining practically unchanged.

Lastly, having been married by the time of the second birth is very significantly associated with a relative risk of going on to have the third conception. This is true over 1977-1989 as well as 1991-2003, in the model with explanatory variables as with interactions, the effect always being to increase the hazard. During the 1977-1989 observation period and for the model which embraces the additional explanatory variables, having been married by the time of the second birth leads to an increase of 63.1% in the relative hazard of transition to the third conception. For the time-period 1991-2003, the hazard also increases over the reference group, but at a slightly lower ratio of 59.1%, and remains very significant (at the 0.001 level).

Table VII: Cox Regression Hazards of Transition from Second to Third Birth

Year of Survey:	**1977-1989**			**1991-2003**		
	Model 1	Model 2	Model 3	Model 1	Model 2	Model 3
Region:						
Other Rural	1.000	1.000	1.000	1.000	1.000	1.000
Nairobi	0.619***	0.629***	0.628***	0.473***	0.629**	0.617**
Other Urban	0.725***	0.721***	0.717***	0.562***	0.700**	0.682**
Central Rural	1.084	1.154	1.153	0.471***	0.624**	0.617**
Period of Second Birth:						
1977-1983	1.000	1.000	1.000			
1983-1989	0.762***	0.760***	0.720			
1991-1997				1.000	1.000	-
1997-2003				0.936	0.905	-
Age at First Birth:						
10-17	1.000	1.000	1.000	1.000	1.000	1.000
18-24	1.051	1.042	1.042	0.820**	0.902	0.891
25+	0.826	0.868	0.861	0.603**	0.749	0.498
Educational Level:						
None		1.000	1.000		1.000	1.000
Primary		1.285**	1.288**		0.919	0.931
Secondary		1.135	1.139		0.570**	0.585**
Survival Status and Sex Composition:						
One Son and One Daughter		1.000	1.000		1.000	1.000
Two Daughters		1.097	1.103		1.270**	1.171*
Two Sons		0.979	1.107		1.013	1.082
One Son		1.486***	1.513***		1.514*	1.114
One Daughter		1.422**	1.451		1.593**	2.438***
All Died		2.193**	2.069		2.517***	3.722**
Socio-economic Status:						
Low		1.000	1.000		1.000	1.000
Medium		0.885	0.885		0.776**	0.780**
High		0.942	0.950		0.923	0.921
Religion:						
Catholic		1.000	1.000		1.000	1.000
Protestant		0.992	0.992		1.029	1.046
Muslim		0.947	0.924		0.908	0.903
Other		0.922	0.927		1.166	1.174
Ethnic Group:						
Kikuyu		1.000	1.000		1.000	1.000
Luhya		1.076	1.076		1.305	1.304
Luo		1.067	1.061		1.029	1.034
Kalenjin		0.870	0.873		1.188	1.173
Other		0.957	0.958		1.106	1.122
Ever Married:						
No		1.000	1.000		1.000	1.000
Yes		1.631***	1.640***		1.591***	1.956***
Ever Married x Period:						
No x Earlier Period						1.000
Yes x Recent Period						0.748

Notes: ***: p<0.001; **: p<0.01; *: p<0.05

Notes: 1. Interactions of survival status of children and period of second birth, as well as those for age at first birth and period of second birth are not shown; 2. The dash (-) in column seven above indicates that the main effects of period of second birth were dropped due to collinearity; nevertheless the effects of the interaction terms with period of second birth are provided in the regression results.

6. Discussion, Recommendations, and Conclusions

6.1 Recapitulation of Results

In this study, the factors associated with the transition from the first to the second, and from the second to the third conception were examined using Cox regression analysis. The observation periods for these analyses were the 12 years preceding the 1988/89 and 2003 KDHS surveys respectively. For the second interval, three suppositions were tested to address this question. First, it was hypothesized that there are regional differences in the transition to the second and third conception, secondly that there is a higher relative risk of progressing to the second and third conceptions during the period of a reduced pace of fertility decline, and thirdly that there are variations in the relative risk of progression to the second and third conception associated with age at first birth. In addition, for the third conception interval, it was hypothesized that the number and sex composition of the surviving children does influence the transition to the third conception. The results for each of these hypotheses are briefly presented again below.

First, the hypothesis of a lower relative risk of progressing to the second conception in the urban areas compared to other rural areas was confirmed for both the period of falling fertility (1977-1989) and during the time of a reduced pace of fertility decline (1991-2003). Surprisingly though, rural Central Province, a region of currently high contraceptive prevalence, had a relative risk of progressing to the second conception during 1991-2003 that was equal to or sometimes slightly lower than that for the urban areas.

Secondly, over the period of constant fertility (1997-2003), the hypothesis of an increased relative risk of transition to the second conception is not confirmed. Instead, the hazard is lower for the 1983-1989 period relative to 1977-1983, and only marginally so for the corresponding sub-division (into six years) of the 1991-2003 period. For the third interval, while the risk of having a third conception during this six-year period of rapidly falling fertility (1983-1989) is significantly lower than that for the six years earlier, for the 1991-2003 period, the hypothesized effect is non-significant.

Thirdly, the proposition that the risk of a second or third conception decreases with increasing age at first birth is corroborated for women who had their first birth when they were at least 25 years old relative to those who had their first child when 10 to 14 years old. For both intervals however, this significance in relative risk is only true in the basic model – containing

only the three hypothesized covariates of residential region, period of first or second birth, and age at first birth.

Fourth, the relationship between the number and sex of surviving children and the relative risk of progressing to the next conception is irrefutably confirmed. For the more recent period (1991-2003), death of all the two children, any one of the two, or having both surviving children as females leads to a significant increase in the relative hazard of transition to the third conception. In addition to this direct association between the number of child deaths and the risk of transition to the third conception, the results also provide evidence of a gender connection between the number of surviving female children and the relative hazard of transition. Having one surviving daughter is a significant predictor of an increased relative transition to the third conception during both the periods 1977-1989 and 1991-2003, the difference from the reference category however being larger for 1991-2003. Nevertheless, where both female children are alive, the increased comparative risk of transition to the third conception is only significant during the time-period 1991-2003. These results are next discussed in the light of other research evidence.

The lower (relative) risks of transition to the second and third conceptions in urban areas observed during the periods of falling fertility (1977-1989) and reduced pace of decline (1991-2003) are consistent with persistently higher fertility in the Kenyan country-side, and conversely lower fertility in the urban areas. To that extent therefore, the greatest contribution to a slowdown in the pace of fertility decline, and particularly the recent levelling off in fertility, would have come from the other rural areas. It had been hypothesized that transitions to the second and third conception would differ by region due to differences in the levels of development and culture. In a sense, the results that relate to this hypothesis, agree with this supposition, and two explanations can be suggested. First, the population in other rural areas, generally being more deprived in terms of socio-economic development would be expected to be relatively averse to limiting the number of children or investing more in their quality. This is coupled with more conservative cultural practices related to reproduction, including relatively longer practice of post-partum abstinence and breastfeeding (NCPD 1999). It is also more likely that change in attitudes towards fertility control in the urban areas outpaced similar changes in the rural areas.

When all the covariates are considered together, the effects of infant and child mortality emerge as the predominant factor in the reduced pace of fertility decline during the 1990s, including the period of constant fertility experienced in the country between 1998 and 2003; justification being based on at least two reasons. First, a number of hypothesized covariates associated with higher infant mortality (particularly region of residence) show higher hazard ratios of transition to the second or third conception during the 1991-2003 period. Secondly, the relative risks of progressing to the second or third conception due to child deaths are significant (and substantial) during the 1991-2003 period as compared to 1977-1989. Thus, the higher relative risks, for the period 1991-2003, coincide with the increase in infant and child mortality in the country since the 1990s.

Nevertheless, a question that arises is, "How is increased infant and child mortality, which was experienced since the 1990s in the country, related to a higher comparative risk of transition to the second and third conceptions over the same period of time?" The response seems to lie in the impact of HIV/AIDS on fertility, which at least three studies find to be relevant. First, in a study conducted in neighbouring Tanzania (Ainsworth et al. 1998) the effect of increased mortality among children aged under five years at the community and household levels was found to increase fertility. Secondly, the increased mortality in Kenya in the 1990s was most probably associated with the increase in the HIV/AIDS epidemic (Hill 2004). Thirdly, more recent investigations (Magadi and Agwanda 2007) indicate that by reducing the duration of breastfeeding and possibly increasing fertility preferences, the HIV/AIDS epidemic may have contributed to the observed constant fertility in the country between 1998 and 2003.

6.2 Policy Implications and Recommendations

Implications

The above findings identify a number of groups that contributed substantially to a rapid progression to the third conception (a level of fertility which is of policy interest) during the period when the pace of fertility decline reduced (1991-2003) as a whole, including the years of constant fertility (1998-2003). These groups comprise women residing in rural areas outside Central province, those who were married by the time of their first birth, mothers who have lost all or any one of their first two children, as well as those who have two surviving daughters.

Women having at least secondary education and those of medium socio-economic status however contributed to reduced risk.

From these results, the role played by infant mortality - which is documented to have increased considerably in the country during the 1990s - in the rapid progression to having the third child emerges as the area of focus. The sex of surviving children is equally of central importance; the two findings have the following implications for family-building (Lloyd and Ivanov 1988) beyond two children:

- Increased likelihood of third births during 1991-2003, associated with loss of both or any of the two children, may be a reflection of increased infant and child mortality. Couples in such a situation and environment, less developed rural areas in the country for example, might not consider the idea of family planning to be useful;
- Similarly, for the 1991-2003 period, cessation of breastfeeding following death of the second child – and hence loss of protection against the chance of pregnancy - adds to the need for family planning in those regions where it is not practiced;
- To cover the risk from high infant and child mortality, a risk implied by the increased possibility of the death of both or any one of the two children represents, couples may set excess fertility goals above desired family size. Family planning services may be needed to help parents stop further childbearing once the desired family size is attained;
- Partners may decide to replace each of the two children who have passed away. They may not do so immediately, meaning that there is need to enable such couples to space their births as they wait to compensate for the loss;
- Finally, the higher likelihood of a third birth over 1991-2003 associated with two surviving daughters implies that, other than for rising infant and child mortality, couples are likely to proceed to the third or higher parity because of the higher value placed on surviving sons. This highlights the need to consider the status of girls, particularly in rural communities with low socio-economic status and educational levels.

Policy Recommendations

Recommendation 1: Initiate family planning campaigns in disadvantaged rural areas.

Partly owing to high and rising infant and child mortality, couples in socially disadvantaged rural areas where access to basic development services including reproductive

health is problematic may not see family planning as meaningful. However, alongside child survival programs undertaken by the Ministry of Health, there is a need to introduce the idea of family planning among these populations. It is therefore recommended that with the leadership of the National Coordinating Agency for Population and Development (NCAPD), and with inputs from the Ministry of Health, and Non-Governmental Organizations (NGOs), community campaigns involving local institutions and community resources e.g. traditional Birth Attendants (TBAs) should be conducted in rural areas with high infant mortality (among the general population and young couples as well) in order to encourage the adoption of family planning. This proposed activity should be undertaken in the first two years (2008-2009) of the next national five-year development plan (2008-2012).

Recommendation 2: Equip facilities with a wide and appropriate range of family planning methods.

The research findings have identified two types of family planning users: spacers who would like to replace children who have passed away during their childbearing years, and limiters who would like to stop further childbearing once they have reached the desired size of family or for other reasons. It is therefore recommended that throughout the five-year period plan period (2008-2012), health facilities, including those in hard-to-reach rural areas, should be equipped (by the Ministry of Health or appropriate managing organizations) with adequate stocks of a wide range of family planning methods, including short-term methods for spacing births, as well as long-term and permanent methods for longer use and termination of childbearing.

Recommendation 3: Strengthen integrated post-partum family planning services including breastfeeding.

It was observed that cessation of breastfeeding after the death of a child reduces the birth interval. Similarly even with a surviving infant or child - where breastfeeding is not practiced frequently or intensely enough such as following breakdown of cultural proscriptions in rural areas and among working mothers- shorter intervals may result. It is recommended that during the next five-years of the national development plan (2008-2012), newly-delivered mothers and those already breastfeeding should be advised on the benefits of breastfeeding and encouraged to

continue doing so. To this end, both health-facility and community health workers including TBAs should be trained on counseling mothers about breastfeeding.

Recommendation 4: Enhance girls' education.

Findings from this study reveal that having only surviving daughters elicits desire among parents to have additional children. Related studies show that higher levels of girls' education are associated with lower fertility. It is therefore recommended that as a way of enhancing the status of women, access to education for girls, especially for those from rural and socially disadvantaged backgrounds, should be improved over the coming three years (2008-2010) by the Ministry of Education.

6.3 Study Limitations and Recommendations for Further Research

It is possible that these results, on the covariates of the second and third intervals, may suffer from bias because certain aspects were not taken into account. First, some proximate variables known to influence birth intervals, such as breastfeeding and contraceptive use (Trussell et al. 1985), were excluded from the analysis; this exclusion being justified for several reasons. The method applied in this study, survival analysis, requires the two to be time-varying covariates. Although the two covariates can be obtained in most DHS surveys as calendar data (Baschieri and Hinde 2007), doing so would have meant going beyond the scope of this analysis on the covariates of the second and third conceptions. Also, contraceptive use can be endogenous in the duration of birth intervals. This is illustrated by baffling results from some studies e.g. (Raajpoot 1996) which show that contraceptive users have a higher probability of a second birth than nonusers. One of the solutions to this problem of endogeneity is the use of simultaneous equations, and was also beyond the scope of the analysis. The failure to take into account this simultaneity may lead to bias in the estimated parameter coefficients. Finally, absolute comparisons in the risks of transition between the two time periods (1977-1989) and (1991-2003) would have required that the baseline hazards be included, an undertaking that was not attempted in this analysis, which is simply based on relative hazards in Cox regression.

A number of limitations of this study can be cited. First, in trying to determine the factors associated with the transition to the second and third conceptions, the area of research is very broad. A more narrow focus, such as the effects of infant and child mortality, or those associated

with education, might have been more appropriate and is suggested as a follow-up research. Secondly, examining the covariates of the second and third conceptions in regressions separated by a time-span misses out the intervening period. It is therefore equally recommended that further research be conducted on the determinants of birth intervals using several pooled datasets. This way, the total risks of transition, and not just relative hazards, from one period to another can be more comprehensively compared.

6.4 Conclusions

This study has examined the factors associated with transitions to the second and third conceptions, aspects which have a bearing on overall fertility. Nevertheless a pertinent question is the projection of fertility into the future. Suggestions on the possible future course of fertility in Kenya have been made before (Blacker 2002; White et al. 2006), and most conclude that it is unlikely Kenyan fertility will stabilize at a replacement level that is below three births per woman. Given the prominence of rising infant and child mortality - a major determinant of fertility - one is persuaded to agree that in the short run, Kenyan fertility, at the national level, might not fall below a level of three to four births per woman.

The findings of this study are relevant to the Government's goal of reducing fertility to the near-replacement point of 2.5 by the year 2010, from the current level of 4.7 births per woman. While the attainment of replacement fertility should either be a long-term goal or indeed a subject of debate, there is nevertheless much scope of what policy and programs can do immediately in order to reduce fertility further from the existing levels. The research results presented here draw attention to the family planning needs of the various groups of women and men affected by the passing away of all two or any one of the children; they also point out concerns about the status of girls. By endorsing the above policy recommendations, which focus on the provision of family planning information and services, as well as improving the education of girls, policy makers will be making a significant contribution towards the achievement of the population and development goal of improving the quality of life of the Kenyan population.

References

Ainsworth, M., et al. (1998). The Impact of AIDS on Individual Fertility: Evidence From Tanzania. From Death to Birth: Mortality Decline and Reproductive Change M. R. Montgomery and B. Cohen. Washington D.C., National Academy Press.

Baschieri, A. and A. Hinde (2007). "The proximate determinants and birth intervals in Egypt: an application of calendar data." Demographic research **16**(3): 59-96.

Blacker, J. (2002). Kenya's Fertility Transition: How Low Will it Go? Expert Group Meeting on Completing the Fertility Transition. Population Division, Department of Economic and Social Affairs, United Nations Secretariat. New York. UN/POP/CFT/202/CP/11. 14 February 2002

Bledsoe, C. and F. Banja (2002). Contingent Lives: Fertility, Time, and Aging in West Africa, University of Chicago Press.

Bongaarts, J. (1978). "A Framework for Analyzing the Proximate Determinants of Fertility." Population and Development Review **Vol. 4 No.1**(1): pp. 105-132.

Bongaarts, J. (2006). "The Causes of Stalling Fertility Transitions." Studies in Family Planning **Vol. 37** (No.1): pp. 1-16.

Bongaarts, J. (2007). "Fertility Transition in the Developing World: Progress or Stagnation?" Population Association of America 2007 Annual Meeting.

Bongaarts, J. M. F. (1990). "The Measurement of Wanted Fertility." Population and development review **16**(3): 487-506.

CBS (1980). Kenya Fertility Survey 1977-78: First Report. Vol 1. Nairobi, Central Bureau of Statistics. Ministry of Planning and National Development.

CBS, et al. (2004). Kenya Demographic and Health Survey. 2003 C. B. o. Statistics, Calverton, Maryland: CBS, MOH, and ORC Macro.

Cleves, M. A., et al. (2004). Introduction to Survival Analysis Using Stata, Stata Press.

Cross, A. R., et al. (1991). "Evidence of a Transition to Lower Fertility in Kenya." International Family Planning Perspectives **17**(1): 4-7.

DaVanzo, J. and P. J. Gertler (1990). Household Production of Health: A Microeconomic Perspective on Health Transitions, Rand Corp.

Easterlin, R. A. and E. M. Crimmins (1985). The Fertility Revolution: A Supply-demand Analysis, University of Chicago Press.

Ferry, B. and H. Page (1984). The Proximate Determinants of Fertility and their Effect on Fertility Patterns: An Illustrative Analysis Applied to Kenya. . World Fertility Survey (WFS). Scientific Reports No. 71, International Statistical Institute (ISI).

Gyimah, S. O. and R. Fernando (2004). "Intentional Replacement of Dead Children in sub-Saharan Africa: Evidence from Ghana and Kenya." Canadian Studies in Population **Vol. 3**(No. 1): Pp.33-53.

Hill, K. (2004). HIV and Increases in Childhood Mortality in Kenya in the Late 1980s to the Mid-1990s, Measure Evaluation.

Hill, K. H. (1993). Population Dynamics of Sub-Saharan Africa. Demographic Effects of Economic Reversals in Sub-Saharan Africa. Working Group on Demographic Effects of Economic and Social Reversals. Washington, D.C., National Academy Press

Johnson-Hanks, J. (2004). Uncertainty and the Second Space: Modern Birth Timing and the Dilemma of Education, European Journal of Population. Springer. **20:** 351-373.

Kelley, A. C. and C. E. Nobbe (1990). Kenya at the Demographic Turning Point? Hypotheses and Proposed Research Agenda. , World Bank Discussion Paper Number 107, Washington, D.C., The World Bank. .

Knodel, J. (1977). "Family Limitation and the Fertility Transition: Evidence from the Age Patterns of Fertility in Europe and Asia." Population Studies **31**(2): 219-249.

Kuaté Defo, B. (1998). Fertility Response to Child Mortality in Africa with Special Reference to Cameroon From Death to Birth: Mortality Decline and Reproductive Change. M. R. Montgomery and B. Cohen, Committee on Population, National Research Council. **:** Pp. 254-315.

LeGrand, T., et al. (2003). "Reassessing the Insurance Effect: A Qualitative Analysis of Fertility Behavior in Senegal and Zimbabwe." Population and Development Review **29**(3): 375-403.

Lloyd, C. B. and S. Ivanov (1988). "The Effects of Improved Child Survival on Family Planning Practice and Fertility." Studies in Family Planning **19**(3): 141-161.

Magadi, M. and A. Agwanda (2007). The link between HIV/AIDS and recent fertility patterns in Kenya. Measure Evaluation, Carolina Population Center, University of North Carolina **wp-07-92**.

Michael, P., et al. (1999). Introduction à la microéconomie moderne.(3 e édition) Éditions du Renouveau Pédagogique Site internet du cours sur WebCT: http://webct. usherbrooke. .

NCPD (1989). Kenya Demographic and Health Survey, 1989 National Council for Population and Development, Ministry of Home Affairs and National Heritage, and Institute for Resource Development/Macro Systems Inc. (IRD/Macro) Columbia, Maryland: NCPD and IRD/Macro.

NCPD (1994). Kenya Demographic and Health Survey 1993, National Council for Population and Development. Calverton, Maryland: NCPD, CBS, and Macro International

NCPD (1999). Kenya Demographic and Health Survey 1998. Nairobi, National Council for Population and Development; Central Bureau of Statistics; Office of the Vice-President and Ministry of Planning and National Development. Macro International Inc., Calverton, Maryland USA

NCPD (2000). National Population Policy for Sustainable Development. Sessional Paper No.1. Nairobi: National Council for Population and Development.

Preston, S. H., et al. (2000). Demography: Measuring and Modeling Population Processes, Blackwell Publishers.

Raajpoot, U. A. (1996). "An investigation into the spacing of births among a sample of ever-married women." Social Science Journal **33**(1): 69-82.

Robinson, W. C. (1992). "Kenya Enters the Fertility Transition." Population studies **46**(3): 445-457.

Shapiro, D. and T. Gebreselassie (2007). "Fertility Transition in Sub-Saharan Africa: Falling and Stalling." Population Association of America 2007 Annual Meeting.

Trussell, J., et al. (1985). "Determinants of Birth-Interval Length in the Philippines, Malaysia, and Indonesia: A Hazard-Model Analysis." Demography **22**(2): 145-168.

van de Walle, E. (1993). Recent trends in marriage ages. Demographic Change in sub-Saharan Africa National Research Council 117-152.

Watkins, S. C. (2000). "Local and Foreign Models of Reproduction in Nyanza Province, Kenya." Population and Development Review **26**(4): 725-759.

Westoff, C. F. and A. R. Cross (2006). The Stall in the Fertility Transition in Kenya, Measure/DHS. O RC Macro. United States Agency for International Development (USAID).

White, R. G., et al. (2006). "Period and Cohort Dynamics in Fertility Norms at the Onset of the Demographic Transition in Kenya 1978–1998." Journal of biosocial science: 1-12.