DHS Analytical Studies 2

Gap between Preferred and Actual Birth Intervals in Sub-Saharan Africa: Implications for Fertility and Child Health

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Gap between Preferred and Actual Birth Intervals in Sub-Saharan Africa: Implications for Fertility and Child Health

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Preface

One of the most significant contributions of the MEASURE *DHS+* program is the creation of an internationally comparable body of data on the demographic and health characteristics of populations in developing countries. The *DHS Analytical Studies* series and the *DHS Comparative Reports* series examine these data, focusing on specific topics. The principal objectives of both series are: to provide information for policy formulation at the international level, and to examine individual country results in an international context. Whereas *Comparative Reports* are primarily descriptive, *Analytical Studies* take a more analytical approach.

The *Analytical Studies* series comprises in-depth, focused studies on a variety of substantive topics. The studies are based on a variable number of data sets, depending on the topic under study. A range of methodologies is used, including multivariate statistical techniques. The topics covered are selected by MEASURE *DHS+* staff in conjunction with the MEASURE *DHS+* Scientific Advisory Committee and USAID.

It is anticipated that the *Analytical Studies* will enhance the understanding of significant issues in the fields of international population and health for analysts and policymakers.

Martin Vaessen
Project Director

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Executive Summary

Using Demographic and Health Surveys (DHS) data from 20 sub-Saharan countries, this article compares women's actual lengths of birth intervals to preferred lengths and assesses the implications of the difference for selected demographic and health indicators. The results show a clear pattern. Women prefer much longer birth intervals than they actually have in Comoros, Ghana, Kenya, Rwanda, and Zimbabwe, compared with women in the other 15 countries studied. As a consequence, the potential effects of spacing preferences on the level of fertility, as well as on the prevalences of short birth intervals (less than 24 months) and child malnutrition, are greatest in the same five countries. An explanation based on the observed sharp decline in fertility recently experienced by these five "forerunners" is offered for this pattern. The covariates of preferred birth interval lengths are also examined. In general, women who know, approve of, discuss, and use family planning prefer longer intervals than their counterparts. The educational attainment of husbands matters more than that of female respondents in determining spacing preferences. For nine countries that have conducted more than one survey, an average increase of six months in the length of preferred intervals is documented. Similarly, data from 12 countries that conducted a survey in the mid- or late 1990s show an increase in the actual lengths of birth intervals; the magnitude of the increase is higher in the most recent period studied (when intervals starting in the 1980s are compared with intervals starting in the 1990s). The policy and program relevance of these results is discussed.

1 Introduction and Background

Perhaps the most fundamental and important population policy guideline is the premise that individuals and couples should be enabled to realize their reproductive intentions and preferences, that is, to have the number and spacing of children they desire. This premise conventionally translates into the promotion of family planning and related reproductive health measures.

A considerable amount of research has now been accumulated to document the extent to which reproductive preferences are being exceeded. Estimates of unwanted fertility have been calculated for many countries (Adetunji, 1998; Bankole and Westoff, 1995; Westoff, 1991) and the desired number of children have been compared with the actual number born. The general conclusion of this research is that there is a significant amount of unwanted fertility throughout the developing world, which is particularly evident in the middle stages of the fertility transition when women are increasingly aiming for fewer children (Bongaarts, 1997). In sub-Saharan Africa, this fertility transition has only recently begun. Therefore, in this part of the world, significant levels of unwanted fertility are evident only in a few countries compared with other parts of the developing world.

However, few studies have examined the spacing component of reproductive intentions. One study of sub-Saharan Africa revealed the widespread desire of women to have longer birth intervals than they are currently having in the region. Between a quarter and a third of women reported that they had recently experienced a birth sooner than they wanted (Bankole and Westoff, 1995).

This reproductive preference for spacing instead of limiting is peculiar to sub-Saharan Africa. It raises the following important question: Do family planning program efforts, which have focused on birth spacing rather than on birth limiting in this region, have the potential for changing the dynamics of the region's population? We suspect that the answer to this question is positive for two main reasons. First, if people prefer to avoid short birth intervals, and if these aspirations are realized, mortality and morbidity will eventually reach lower levels given the well-documented detrimental effects of short birth intervals on the lives of women and children (e.g., National Research Council, 1989; Population Reference Bureau, 1995). Second, the desire to lengthen birth intervals could fuel the fertility transition, initially because extending the interval between births, i.e., delaying births, would lower the birth rate. The rate of population growth would be reduced as the length of the generation is increased. The demographic mechanism is similar to increasing the age at marriage, which would normally increase the age at first birth. Moreover, some of the postponed births would never occur.

In this study, we examine the extent to which the above hypothesis is true. More specifically, we compare the lengths of the birth intervals that women have with the birth interval lengths they would prefer to have. Then we assess the implications of the difference for the demography and health of sub-Saharan Africa. The question is the same as that which has guided the study of unwanted fertility: What would the fertility rate be if women's desired numbers of children prevailed? We restate the question in terms of birth spacing preferences and ask what birth intervals would result if women had their ideal spacing preferences and what implications their "preferred" intervals would have for fertility, child mortality, and child nutritional status. We also analyze the covariates of the preferred lengths of birth intervals in the region. Finally, we examine the trends in the preferred and actual lengths of birth intervals.

2 Data and Methodology

Data Source

Data for this study are from the Demographic and Health Surveys (DHS) carried out in sub-Saharan Africa. The DHS surveys are broadly comparable surveys that have been conducted since 1985 in many countries throughout the developing world, with funding mainly from the U.S. Agency for International Development (USAID). These surveys have collected extensive information on fertility, fertility preferences, child mortality, and maternal and child health indicators from nationally representative samples of women of reproductive age (15-49 years old). Thus, the surveys permit a comparative examination of birth spacing in a broad range of countries. We limit ourselves to the data collected in the region in the 1990s (DHS-II and DHS-III rounds). For countries where more than one DHS survey has been conducted during this decade, we use data from the most recent survey, with the exception of the analysis of trends. This research is based on data from 20 African countries (see Table 1 for general information regarding the data sources).

Table 1 Data sources and numbers of women, actual birth intervals (ABI), and preferred birth intervals (PBI) analyzed, by country

Country	Source of data	Year(s) of survey	Number		
			Women	ABI	PBI
West and Middle Africa					
Benin	DHS-III	1996	3,183	7,320	4,579
Burkina Faso	DHS-II	1992-93	3,735	8,335	7,190
Cameroon	DHS-II	1991	1,812	4,287	3,694
Central African Rep.	DHS-III	1994-95	2,522	5,832	3,652
Côte d'Ivoire	DHS-III	1994	2,936	5,835	4,678
Ghana	DHS-III	1993	2,358	5,130	2,976
Mali	DHS-III	1995-96	5,922	14,348	9,558
Niger	DHS-II	1992	3,801	9,448	8,918
Nigeria	DHS-II	1990	4,666	10,982	9,615
Senegal	DHS-III	1997	4,372	10,171	8,276
East and Southern Africa					
Comoros	DHS-III	1996	1,079	2,624	1,384
Kenya	DHS-III	1998	3,142	7,103	3,568
Madagascar	DHS-III	1997	2,991	7,160	3,945
Malawi	DHS-II	1992	2,446	5,842	4,326
Namibia	DHS-II	1992	1,511	3,449	2,824
Rwanda	DHS-II	1992	2,996	7,177	4,752
Tanzania	DHS-III	1996	3,792	8,592	6,851
Uganda	DHS-III	1995	3,640	8,818	6,117
Zambia	DHS-III	1996-97	3,655	8,592	7,228
Zimbabwe	DHS-III	1994	2,529	5,275	2,992

Measurement Issues

The measurement of birth interval preferences is as challenging as the measurement of unintended fertility and raises many of the same methodological questions (Rosero-Bixby, 1998). The subject of spacing preferences is represented in the DHS core questionnaire with three approaches, each with certain strengths and weaknesses:

1. **Best length for a birth interval.** All respondents were asked the following question: "What do you think is the best number of months or years between the birth of one child and the birth of the next child?" Answers to this question provide a first approximation of the length of the preferred birth interval (PBI) (Bankole and Westoff, 1995). The advantages of this approach are that it is direct and explicit; it focuses exactly on the topic of interest; and it was asked of all women, not just those who wanted another child. One disadvantage, however, is that it has the abstract quality of an ideal, which may or may not be relevant to the individual's situation. In this way, it is comparable to the standard question about the ideal number of children. Another drawback is that the responses to the question are stereotyped (most were reported in full years) and concentrated on two, three, and four years. In Niger, for example, 49 percent of responses are in the two-year category and 41 percent are in the three-year category (Bankole and Westoff, 1995). This distribution does not mean that the responses are meaningless, but they are less useful for purposes of further analysis.

2. **Preferred length for the next birth interval.** Women who said that they wanted another child and who were not pregnant at the interview were asked the following question: "How long would you like to wait from now before the birth of another child?" In this question, "now" refers to the date of the interview. Women who were in the same category but pregnant at the interview were asked the following: "How long would you like to wait after the birth of the child you are expecting before the birth of another child?" Answers to these questions measure the preferred length of the next birth interval, which can be considered a second estimate of the PBI (Bankole and Westoff, 1995). For a nonpregnant woman, the preferred length of the next interval is defined as the sum of the observed open interval (the months since the last birth) and the additional preferred waiting time. For a pregnant woman, it is derived from her answer to the question about the waiting period that she desires between her next two births. This approach has the advantage of focusing on the woman's personal perspective rather than on an ideal, and it also generates distributions that typically range across six 12-month intervals. However, the resulting PBI estimate is probably biased by selection effects. First, it is based only on the responses of women who want more children, who may on average desire shorter times between births. Second, it reflects the open birth interval, which tends to be longer than closed birth intervals. Another weakness of this approach, as well as of the following approach, is that the structure of the questions does not permit negative responses. For example, subfecund women may feel that they have already waited longer than they wanted, but the only response permitted to them is of the type "soon" or "now," which is classified as zero desired waiting time. Whereas the "best length of birth interval" measure is comparable to the "ideal number of children" variable, the "preferred length of the next interval" is analogous to whether women want more or no more children (Bongaarts, 1992).

3. **Preferred lengths for the past (closed) birth intervals.** Women who experienced a birth in recent years were asked the following question: "At the time you became pregnant with (name), did you want to become pregnant then, did you want to wait until later, or did you want no more children at all?" This information was obtained for all births occurring in the five- or three-year period preceding the survey, and previous studies have focused on women's reports of the planning status of their last birth to get a third estimate of the PBI. Bankole and Westoff (1995) proposed the

actual length of the last closed birth interval for women who reported that they had wanted their last birth *then*, that is, at the time it occurred, as a measure of PBI. Rosero-Bixby (1998) added the information provided by women who had wanted their last birth *later* to that provided by the group of women who had wanted their last birth *then* to derive an estimate for most women. Women who did not want more children are excluded. These two measures are attractive and empirically based. They have some weaknesses, however, including that (1) they are postfactum measures and are therefore subject to rationalization bias; (2) they are based on closed birth intervals and are therefore subject to selection bias; and (3) they represent only women who have had a birth in the past five or three years and exclude the preferences of those whose last birth was unwanted. This approach is analogous to the "wanted" and "unwanted" fertility rate calculations and shares some of the same types of problems (Bongaarts, 1990; Kulkarni and Choe, 1998).

All four measures yield plausible estimates of the length of the PBI. However, besides their drawbacks already mentioned, the estimates have the further disadvantage of not using all the available information collected in the DHS surveys. Each of the previous estimates is based on only one birth interval per woman even though estimates for more than one birth interval can be derived for many women. In this study, we propose a composite measure for the PBI, one that is based on all birth intervals (open and closed) starting in a prescribed period and for which a PBI length can be computed. This measure (whose method of computation is described in the next section) is more satisfactory for two reasons (1) it is based on a cohort or longitudinal analysis and is therefore free of selection effects (Rosero-Bixby, 1998); and (2) it combines women's spacing preferences on both their past and future intervals and is therefore representative of preferences over a long period.

Methods

The ideal cohort approach consists of following a cohort of women who just got married or who just gave birth and asking them, at that moment and at each subsequent interval they are about to start, about their preferences for the interval in question. The full birth history data collected by each DHS survey permits a retrospective simulation of this cohort approach by selecting subgroups of women who started an interval in a predetermined period. This procedure is equivalent to selecting all birth intervals that started in that period. As noted earlier, this cohort approach solves the selection bias problem, but the retrospective version proposed here still allows for the possibility of recall or rationalization biases (Rosero-Bixby, 1998).

Selection of the Actual Birth Interval (ABI) and Computation of Its Length

In this paper, we examine birth intervals that (1) started during the ten-year period preceding the survey and (2) ended within the five-year or three-year period (depending on the survey round) before the survey or were expected to end after the survey. The choice of the ten-year "starting" window was a compromise between including as many birth intervals as possible and minimizing the possibility of recall errors associated with more distant events. The choice of the five- or three-year "ending" window was dictated by the fact that retrospective fertility preferences were asked about only for children who were born during this period or who were expected to be born after the survey. Only birth intervals after the first birth are included because of the problems of dating the beginning of the first interval. There are problems with the accuracy of reporting dates of marriage or the beginning of informal unions, and these dates may be influenced by the pregnancy itself. Also, only birth intervals of currently married women are included to control for any differential preference by marital status. Because the birth intervals that are analyzed include both open (i.e., censored cases) and closed intervals (i.e., failures), we estimate the distribution of the actual length of these birth intervals with life table techniques.

Selection of the Preferred Birth Interval and Computation of Its Length

The algorithm used here includes only those birth intervals that ended with or were expected to end with a wanted birth. For closed intervals, if the birth closing the interval was wanted *then*, the PBI is equal to the ABI; if the birth closing the interval was wanted *later*, the PBI equals the ABI plus the additional time the woman reports that she would have wanted to wait. For open intervals, if the woman wanted a birth *now* or *soon*, the PBI equals the ABI; if she wanted a birth *later*, the PBI equals the ABI plus the desired waiting time till the next birth. Table 1 shows the numbers of actual and preferred birth intervals included for each country.

Measurement of the Implications of Birth Spacing Preferences

We analyze the implications of the realization of birth spacing preferences for three demographic and health measures. They are (1) child mortality, measured by the probabilities of dying from birth to age 1 month (neonatal mortality risks), to age 1 (infant mortality risks), and to age 5 (under-five mortality risks); (2) child nutritional status, measured by indicators of undernourishment according to three anthropometric indices (height-for-age, weight-for-age, and weight-for-height); and (3) fertility, measured by the total fertility rate (TFR). The procedure followed for assessing the effect of the realization of birth spacing preferences on child survival is to calculate the actual mortality rates for all births occurring in the ten years before the interview and then to relate these rates to the length of the preceding birth interval. Using this standard, we then adjust the distributions of the interval lengths to those preferred by the mothers and recalculate the expected mortality rates. The procedure followed for assessing the child nutritional status implications of preferred birth intervals is to calculate the percentages of children who are stunted, wasted, and underweight among all children whose height, weight, and age could be collected at the interview (these children are aged 0 to 59 months in the DHS-II data and 0 to 35 months in the DHS-III data). We classify these prevalences by length of the preceding birth interval. Using the resulting distributions as standards, we then adjust the distributions of the interval lengths to those preferred by the mothers and recalculate the expected malnutrition prevalences. Note that our implicit assumption here is that the malnutrition rates of children born in the ten-year period preceding the survey are the same as the malnutrition rates of surviving children born three or five years before the survey.

Model Definition for the Analysis of the Covariates of the PBI

The potential effects of the realization of birth spacing preferences will be more useful for policy purposes if we know the characteristics of women who prefer intervals of different lengths. In this analysis, we fit a multiple linear regression model to individual birth interval data to examine the covariates of the PBI. The dependent variable is the estimated length of the preferred birth interval expressed in months. To account for the clustered nature of the data, we compute robust standard errors for the regression parameters using Huber's method (StataCorp, 1997). The independent variables include the survival status of the child that opens the birth interval, the length (in months) of the previous birth interval, the woman's age (in years) at the interview (simple and squared), her number of surviving children, her desire for more children, her knowledge of a method of contraception, her use of a method of contraception, her approval of family planning, her discussion of family size with her husband, the number of mass media she is exposed to every week, her education, her type of residence and region, and her husband's education. We include the actual length of the birth interval as a control because the PBI is constructed from it. We also control for whether the interval is open (reference category) or closed. The survival status of the child opening the interval indicates whether that child was still alive at the conception of the next child (reference category). The desire for more children indicates whether or not the woman is infecund or sterilized or wants no more children (reference category). Knowledge of a method of contraception is a score variable whose values are 0 when the woman does not know any method, 1 when the woman knows at most a folk method (e.g., strings and herbs), 2 when the woman knows at most a traditional method (e.g., periodic abstinence and withdrawal), and 3 when the woman knows at least a modern method. Ever use of a method of contraception is also a score variable varying from 0 for women who have never used any method to 3 for those who have ever used a modern method. Approval of family planning indicates whether the woman does not approve of family planning (reference category) or approves. Discussion of desired family size indicates whether the woman has ever discussed it with her husband. The woman's and her husband's educational levels are score variables taking the values 0 if they are uneducated or illiterate, 1 if they have a primary level education, and 2 if they have a secondary or higher education level. The type of residence indicates whether the woman lives in an urban (reference category) or in a rural area.

3 Results

Differences between Actual and Preferred Length of Birth Intervals

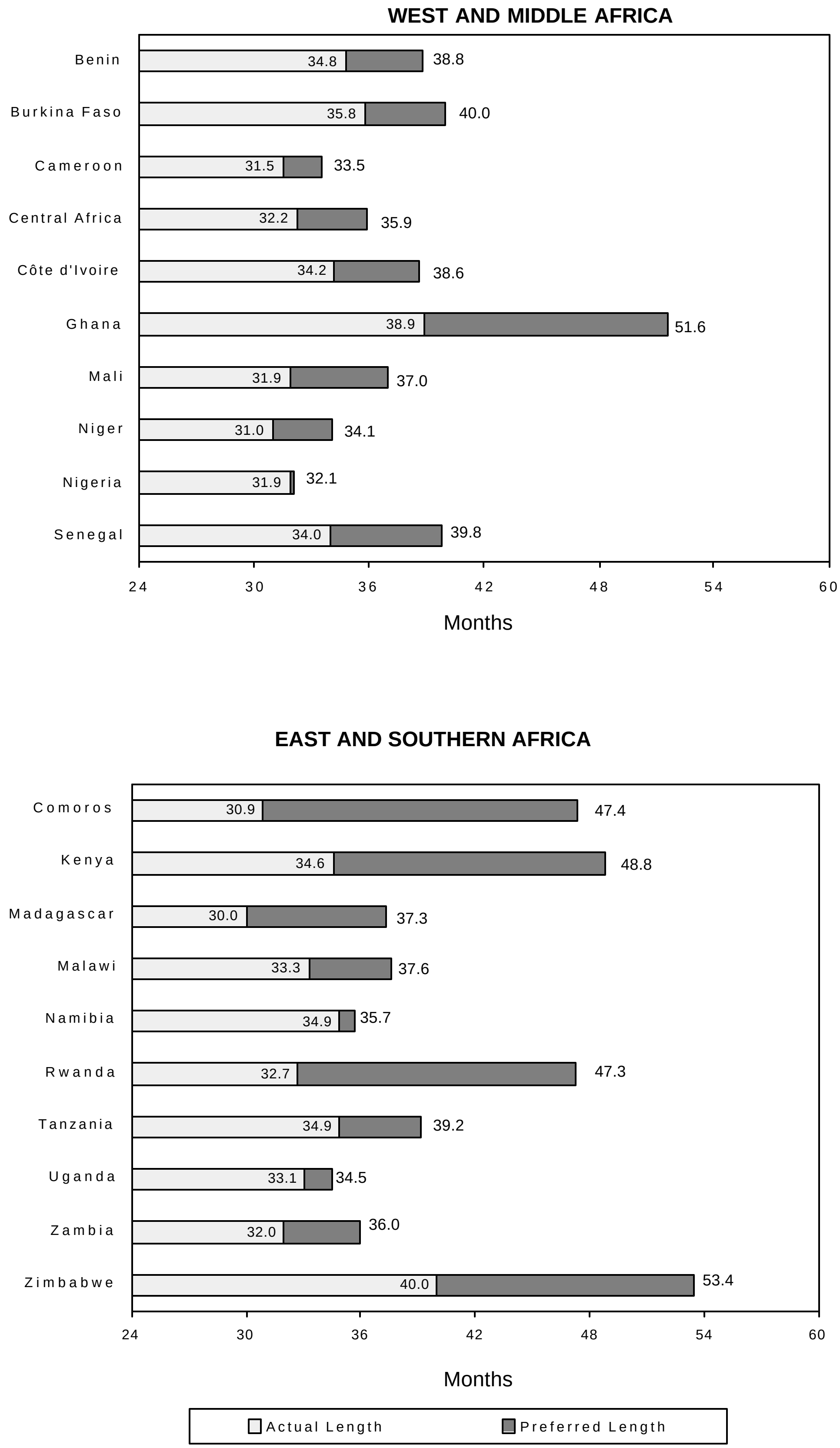
In the 20 sub-Saharan countries included in this study, the median length of actual birth intervals is 2.8 years (33.7 months) on average compared with almost 3.5 years (39.9 months) if preferences prevailed. Figure 1 shows that the median preferred length is at least 2.5 years in every country and as long as four years in five countries (Comoros, Ghana, Kenya, Rwanda, and Zimbabwe). Regional differences can be observed, with women in East and Southern Africa preferring longer birth intervals than those in West and Middle Africa. Because the actual median length does not vary across these two subregions, these differences imply a greater potential increase in length of birth interval in the first subregion. On average, birth intervals would increase by 24 percent in East and Southern Africa if women realized their preferences; in West and Middle Africa, they would be 13 percent longer, as shown in Table 2. The greatest differences between actual and preferred spacing of births are observed in the group of countries where women prefer the longest intervals. In Comoros, Ghana, Kenya, Rwanda, and Zimbabwe, birth intervals would increase by 33 percent or more if women's preferences were realized. Births occur more than one year sooner than women prefer in these countries. In the remaining 15 countries, the median PBI is three years on average, and the resulting potential increase in birth intervals is around 11 percent.

From the point of view of the potential reduction in neonatal and infant mortality, the critical consideration is the prevalence of short intervals, particularly intervals of less than two years. In sub-Saharan Africa, an average of 17 percent of actual birth intervals are "short" by this criterion. If women's preferences prevailed, this percentage would decline to 11 percent but would not drop to zero, which would

Table 2 Median lengths (in months) of actual and preferred birth intervals in sub-Saharan Africa, Demographic and Health Surveys, 1990-1998

Country	Actual birth intervals	Preferred birth intervals	Percent increase
West and Middle Africa			
Benin	34.8	38.8	11.5
Burkina Faso	35.8	40.0	11.7
Cameroon	31.5	33.5	6.3
Central African Rep.	32.2	35.9	11.5
Côte d'Ivoire	34.2	38.6	12.9
Ghana	38.9	51.6	32.6
Mali	31.9	37.0	16.0
Niger	31.0	34.1	10.0
Nigeria	31.9	32.1	0.6
Senegal	34.0	39.8	17.1
East and Southern Africa			
Comoros	30.9	47.4	53.4
Kenya	34.6	48.8	41.0
Madagascar	30.9	37.3	20.7
Malawi	33.3	37.6	12.9
Namibia	34.9	35.7	2.3
Rwanda	32.7	47.3	44.6
Tanzania	34.9	39.2	12.3
Uganda	33.1	34.5	4.2
Zambia	32.0	36.0	12.5
Zimbabwe	40.0	53.4	33.5

Figure 1 Median lengths of actual and preferred birth intervals in sub-Saharan Africa, Demographic and Health Surveys, 1990-1998



be considered ideal by many researchers in the health field. Table 3 shows that the potential reduction in the prevalence of short intervals would be greatest in Comoros (73 percent), and Ghana, Kenya, and Zimbabwe (almost 60 percent); it would be as much as 50 percent in Benin, Mali, and Rwanda.

Child Mortality Implications

There are various hypotheses about why a reduction of short birth intervals should be expected to result in lower mortality rates in the first years of life. These include the harmful effects of the early weaning of a child when another birth follows closely; "maternal depletion syndrome," which drains the mother's strength and can result in poor birth outcomes (low birth weight and prematurity) and poorer nutrition for children; and a variety of socioeconomic pressures resulting from the additional drain on household resources (Boerma and Bicego, 1992*)*. Whatever the mix of reasons, there is an unquestionably strong relationship between the length of birth intervals and the risk of child death (Hobcraft et al., 1985; Rutstein, 1984; Sullivan et al., 1994; Bicego and Ahmad, 1996). In a recent study of the effects of length of birth interval on infant and child mortality in 20 developing countries, Bicego and Ahmad (p. 25) concluded that "[s]hort preceding birth intervals are associated with a 58 percent higher risk of dying before the age of five while long birth intervals are associated with 28 percent lower risk of dying, compared with intervals 24 to 47 months in length." They further note that the greatest effects occur during the neonatal period.

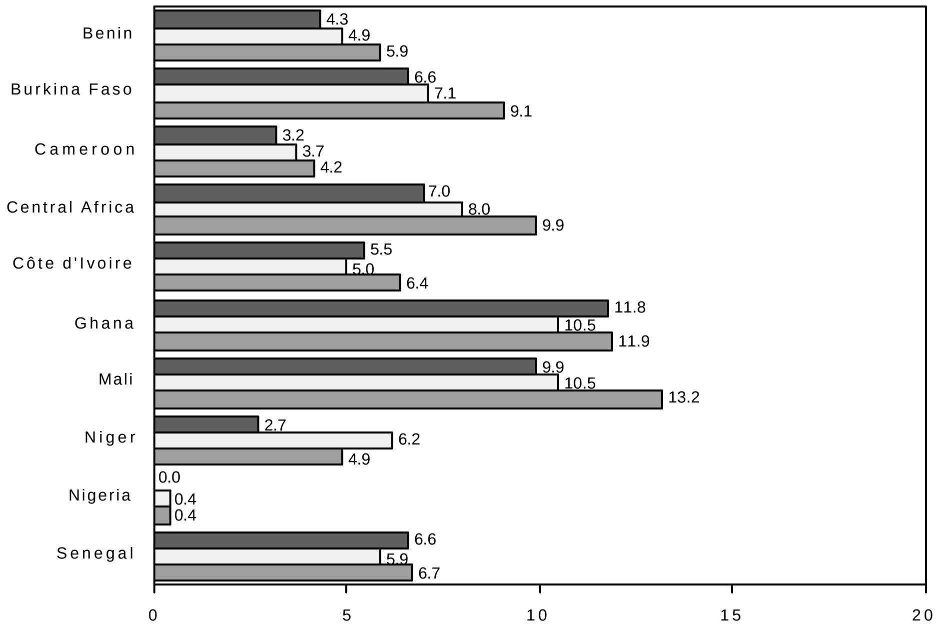
According to the results shown in Figure 2, the reduction in neonatal mortality rates that could be expected if birth interval preferences prevailed ranges from essentially zero in Nigeria and Zimbabwe to a high of more than 17 percent in Kenya. The average reduction is 7 percent. The potential reductions in infant and child mortality rates are of the same magnitude (7 percent and 6 percent, respectively).

Table 3 Actual and theoretical (if preferred birth intervals prevailed) percentages of birth intervals that are less than 24 months in sub-Saharan Africa, Demographic and Health Surveys, 1990-1998

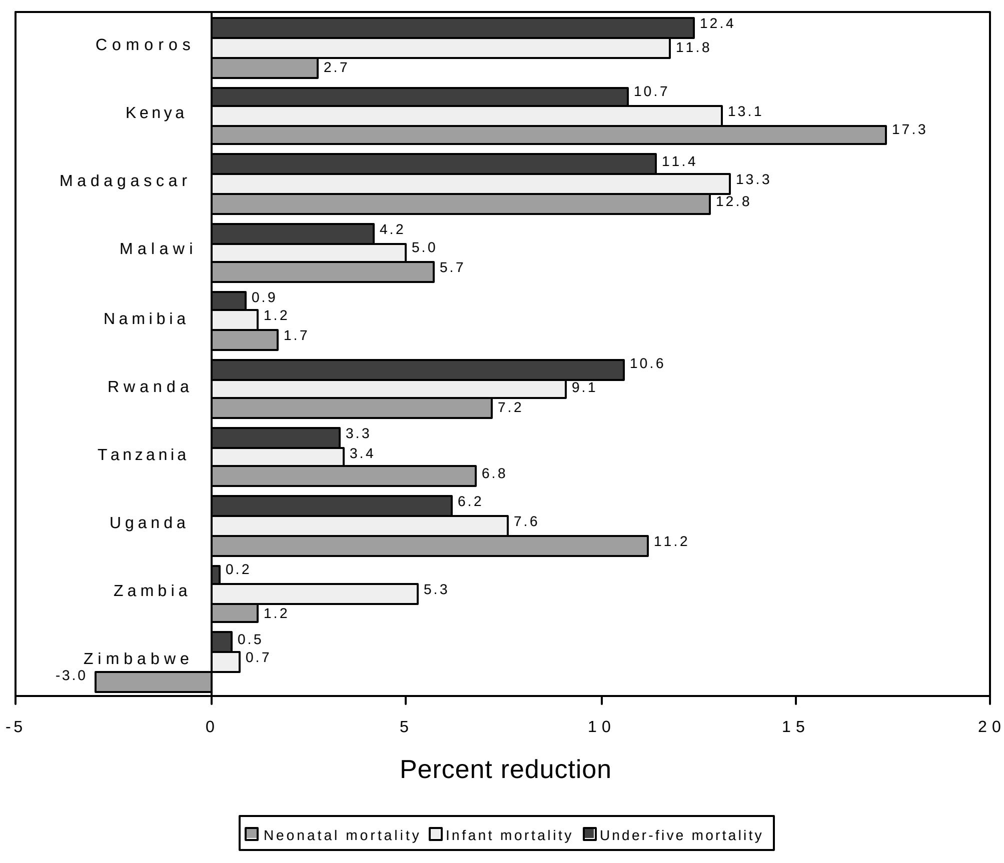
Country	Actual	If PBI prevailed	Percent decrease
West and Middle Africa			
Benin	12.8	6.3	50.8
Burkina Faso	10.8	8.0	25.9
Cameroon	18.7	15.1	19.3
Central African Rep.	20.1	12.4	38.3
Côte d'Ivoire	11.3	8.1	28.3
Ghana	11.4	4.8	57.9
Mali	20.9	10.7	48.8
Niger	20.6	15.1	26.7
Nigeria	21.3	20.1	5.6
Senegal	13.7	8.6	37.2
East and Southern Africa			
Comoros	26.9	7.4	72.5
Kenya	18.2	8.1	55.5
Madagascar	25.2	14.3	43.3
Malawi	16.7	10.2	38.9
Namibia	16.8	15.3	8.9
Rwanda	16.6	8.9	46.4
Tanzania	13.2	9.6	27.3
Uganda	24.1	14.9	38.2
Zambia	15.6	10.6	32.1
Zimbabwe	8.8	3.6	59.1

Figure 2 Estimated percent reductions in child mortality rates in sub-Saharan Africa if preferred birth intervals prevailed, Demographic and Health Surveys, 1990-1998

WEST AND MIDDLE AFRICA



EAST AND SOUTHERN AFRICA



These reductions in child mortality that would be realized if women's stated preferences for the lengths of birth intervals prevailed are rather modest. The main reason for this is that the expected reduction in the proportion of birth intervals of less than 24 months are small. As noted above, these proportions would decline from an average of 17 percent to 11 percent. If the proportion of short birth intervals were to drop to zero and these short intervals were to increase to 24 to 47 months duration, the expected reduction in infant mortality, for example, would be an average of 13 percent rather than 7 percent for these 20 countries. Such a reduction would largely exhaust the connection between the birth interval and mortality.

Child Nutritional Status Implications

We have also examined the implications of preferred longer birth intervals for the prevalence of malnutrition of children in these 20 African countries. The DHS data include anthropometric measures for each respondent's young child. These measures, which have been demonstrated to provide good summaries of children's nutritional status (World Health Organization, 1986, 1995), are height-for-age, weight-for-height, and weight-for-age. Following the recommendations of the World Health Organization (WHO), these measures are already standardized using the distribution of the U.S. National Center for Health Statistics (NCHS) reference population. Three indicators of malnutrition are commonly constructed from these measures; these are (1) an indicator of *stunting*, a condition reflecting chronic malnutrition and manifested by a low height-for-age; (2) an indicator of *wasting*, a condition reflecting acute or recent malnutrition and manifested by a low weight-for-height; and (3) an indicator of *underweight*, a condition reflecting chronic and/or acute malnutrition and manifested by a low weight-for-age. In this analysis, a child was classified as "stunted" if s/he was below minus two standard deviations (-2 SD) from the reference median in terms of height-for-age, as "wasted" if below -2 SD from the reference median in terms of weight-for-height, and "underweight" if of a low weight-for-age by the same criterion.

Of course, the relationship between short previous birth interval and child nutrition may be due to other common factors such as mother's education, family income, sex of the child, and birth order, some of which could also impinge on the association between the time since the preceding birth and infant and child mortality. The results even without such controls, however, show little association, except in Comoros, Ghana, Kenya, and Zimbabwe (see Table 4). In these four countries, the realization of preferred birth intervals would, on average, reduce stunting, wasting, and underweight by 7 percent, 10 percent, and 8 percent, respectively. In the remaining 16 countries, the expected reduction in the prevalence of malnutrition is less than 2 percent, on average.

Fertility Implications

The implications for the fertility rate of longer birth intervals should be significant in sub-Saharan Africa since contraception is used mostly for spacing (Westoff and Ochoa, 1991). The question is how much of a potential decline in fertility could be realized if women experienced their preferred intervals between births. If we assume that the risk of childbirth is constant, the theoretical effect on fertility is proportionate to the inverse of the increase in the length of the interval; that is:

$$PTFR/ATFR = 1/(PBI/ABI) \geq (ATFR-PTFR)/ATFR = 1 - [1/(PBI/ABI)],$$

where PTFR is the TFR value if preferred birth intervals were realized;
ATFR is the actual TFR;
PBI is the preferred length of birth interval;
ABI is the actual length of birth interval.

Table 4 Actual and theoretical (if preferred birth intervals prevailed) percentages of malnourished children in sub-Saharan Africa, Demographic and Health Surveys, 1990-1998

	Stunted			Wasted			Underweight		
Country	Actual	If PBI prevailed	Percent decrease	Actual	If PBI prevailed	Percent decrease	Actual	If PBI prevailed	Percent decrease
West and Middle Africa									
Benin	25.5	24.8	2.7	14.5	13.9	4.4	29.3	28.5	2.8
Burkina Faso	30.3	29.4	2.8	12.1	12.4	-2.4	29.4	28.7	2.6
Cameroon	22.8	22.9	-0.7	3.3	3.3	0.1	12.7	12.7	0.4
Central African Rep.	34.0	33.1	2.7	7.7	7.6	1.1	28.8	28.2	2.0
Côte d'Ivoire	23.4	22.4	4.7	8.4	8.4	0.8	23.3	22.3	4.2
Ghana	24.9	22.0	11.8	12.7	12.2	4.1	28.2	26.5	6.1
Mali	30.3	28.8	4.9	24.2	24.2	0.2	40.8	39.6	2.8
Niger	35.5	34.8	2.1	14.5	14.4	0.6	38.7	38.1	1.5
Nigeria	40.1	40.0	0.1	8.3	8.4	0.0	32.9	32.9	0.0
Senegal[a]	u	u	u	u	u	u	u	u	u
East and Southern Africa									
Comoros	34.5	33.5	2.9	8.1	7.0	13.6	26.3	24.8	5.8
Kenya	33.5	31.3	6.6	6.2	5.8	6.6	22.5	21.0	5.8
Madagascar	46.1	45.2	1.9	7.7	7.4	3.3	39.2	38.4	2.1
Malawi	45.7	45.1	1.2	4.5	4.3	3.4	24.8	24.6	0.9
Namibia	29.3	29.2	0.2	9.1	9.1	0.0	27.5	27.5	0.0
Rwanda	47.7	45.0	5.6	3.7	3.9	-6.3	29.4	28.8	2.2
Tanzania	44.0	43.2	1.7	7.2	7.3	-0.1	31.3	31.1	0.7
Uganda	35.1	34.9	0.7	5.2	5.2	0.0	23.3	23.2	0.7
Zambia	42.8	42.3	1.2	4.3	4.3	-0.1	24.4	24.3	0.2
Zimbabwe	23.0	21.7	5.5	5.2	4.5	14.0	16.1	14.4	10.6

[a] No data on children's height and weight were collected in the Senegal DHS-III
u = Unknown (not available)

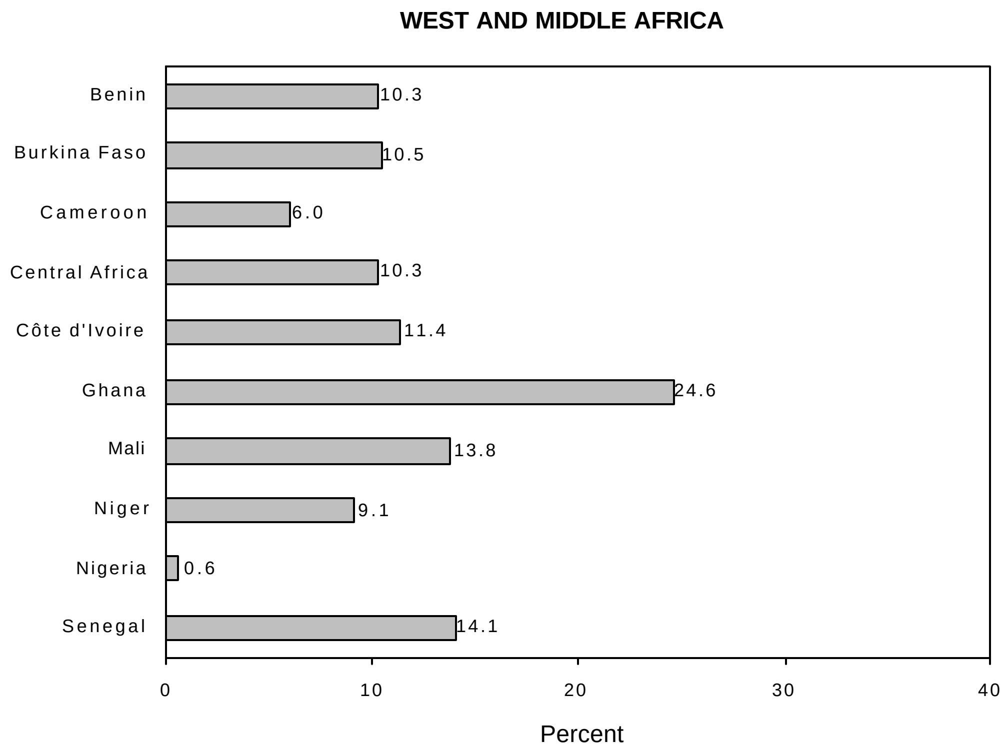
Because the birth intervals included in this analysis are based only on second and higher order events, the question arises whether the imputed effects of longer intervals should be confined to that part of the total fertility rate. The decision was reached to use the regular TFR including first births because even if measuring the first birth interval (that is, that between marriage and first birth) is difficult, all first births are not necessarily timed according to women's preferences (as many premarital conceptions and even births would seem to imply). The implicit assumption, therefore, is that the average preferences for longer subsequent intervals would also apply to first birth intervals.

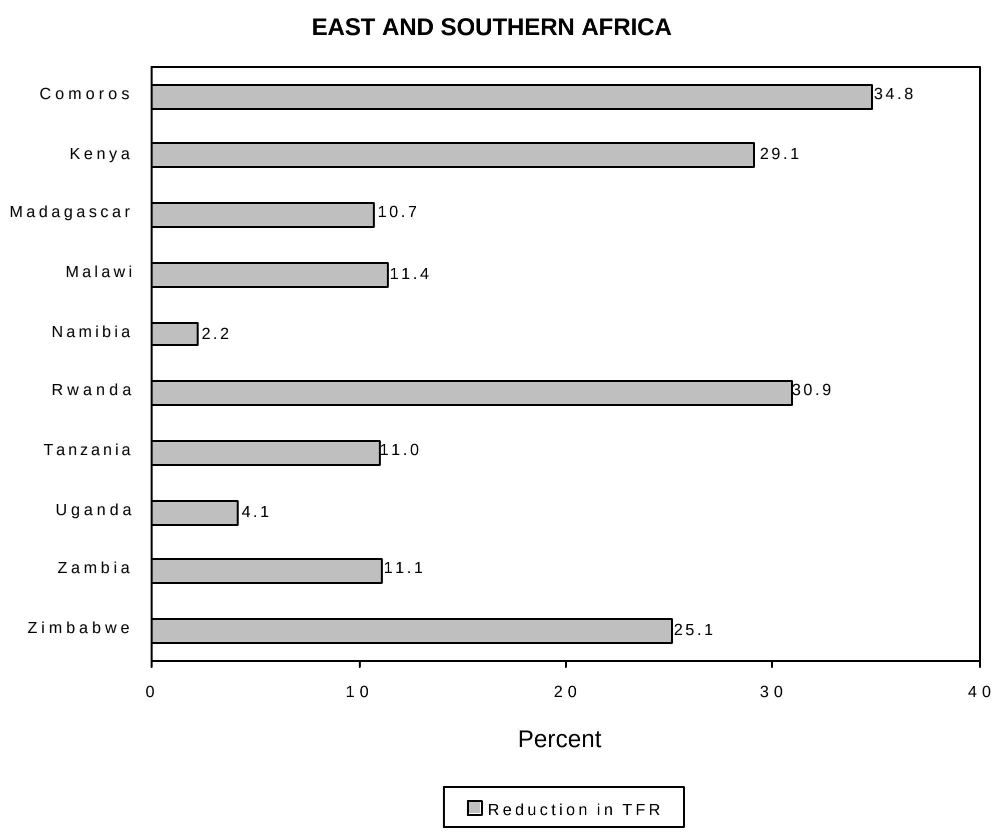
If the preferred intervals were realized, the TFR would decline by an average of 11 percent in West and Middle Africa and by 17 percent in East and Southern Africa (see Figure 3). There is a wide range of imputed effects. The TFR would potentially decline by one-third in Comoros, Kenya, and Rwanda, by a one-fourth in Ghana and Zimbabwe, and by an average of 9 percent in the remaining 15 countries. The theoretical effects on fertility are considerably greater than those on infant and child mortality.

These fertility effects should be considered upper limits because they do not take into account any fertility reducing factor (e.g., the use of contraception in each interval) that women might introduce to implement their preferences for longer birth intervals. Unfortunately, such information is not available in the DHS data.

In the future, it would be interesting to take into account the trends in contraceptive use for limiting because the effects of spacing desires on fertility will become weaker as the number of women using contraception for limiting increases.

Figure 3 Estimated percent reductions in fertility in sub-Saharan Africa if preferred birth intervals prevailed, Demographic and Health Surveys, 1990-1998





Covariates of Preferred Birth Interval Length

As shown above, the realization of birth spacing preferences has a nontrivial effect on fertility, a more modest effect on child mortality, and little effect on child malnutrition in sub-Saharan Africa. For policy and program purposes, it is useful to know what determines the variations in birth interval preferences. We have examined the covariates of preferred birth interval lengths by means of a multiple linear regression model. The results are presented in Table 5 in which, for each country, the effect of each variable is indicated by its sign and is only indicated if the effect in question is statistically significant at the 5 percent level.

Birth intervals in which the "opening" child died before the conception of the "closing" child have shorter preferred lengths than intervals whose opening child was alive at the conception of the next child. Also, birth intervals that are closed have shorter preferred lengths than do open intervals. The length of the preceding birth interval does not influence the preferred length of the actual interval. The preferred length of birth interval has a curvilinear relation with the woman's age: it increases with age, but the increase tapers off among older women (usually age 40 and over). The preferred length also increases with the number of surviving children.

The preferred length of birth interval increases with women's knowledge and use of contraception. Regression models in which the variables "woman knows a modern method of contraception" and "woman has ever used a modern method of contraception" have been substituted for the contraceptive knowledge and use variables for any traditional method show that women who know and/or have ever used a modern method prefer much longer birth intervals than their counterparts (regression results not shown). Women who approve of family planning and whose husbands are educated prefer longer birth intervals than their counterparts. Birth spacing preferences vary significantly by region of residence. This association is not shown in Table 5 because the regions are different from country to country.

Finally, women's desire for more children and rural residence are negatively associated with preferences in less than half the countries. Similarly, women's exposure to mass media, their educational attainment, and their having discussed family size with their husbands are positively associated with preferences in less than half the countries.

Trends in Preferred Birth Interval Length

With an increasing number of countries in the DHS program having repeated surveys over an average period of five years, it is possible to assess trends in the length of preferred birth intervals. An earlier examination (Bankole and Westoff, 1995) of this question was only able to include four sub-Saharan countries; there are now five more countries with repeat surveys.

The measure selected to evaluate this trend is the preferred length of the next birth interval. We compare its medians for the earliest and the latest surveys (Kenya and Senegal had three surveys over approximately a decade). On average, five years elapsed between surveys for the other seven countries.

The length of the preferred next birth interval has increased in all nine countries with an average increase of six months (see Table 6). The increase has been partitioned into two components: the length of the open interval (the duration since last birth) and the additional time women would prefer to wait for the next birth. With one exception (Zambia), the increase in the additional waiting time is the major component of the increase in the overall preference. On average, this component increased by five months while the open interval increased by only one month. One way of interpreting the difference in these two components is that the behavioral response reflected in the length of the open interval is changing less rapidly than the attitudinal dimension. The three countries that show the greatest increases in the length of the open interval (Ghana, Kenya, and Zimbabwe) have experienced the greatest increases in contraceptive use.

Table 5 Correlates of preferred birth intervals in sub-Saharan Africa (linear regressions), Demographic and Health Surveys, 1990-1998

Variable	Effect									
	BE	BF	CM	CA	CI	GH	ML	NI	NG	SN
West and Middle Africa										
Birth interval characteristics										
Actual length	+	+	+	+	+	+	+	+	+	+
Closed interval	-	-	-	-	-	-	-	-	-	-
Child opening the interval died before conception of next child	-	-	-	-	-	-	-	-	-	-
Length of previous interval	-			-				+		
Woman's demographic characteristics										
Age	+	+	+	+	+	+	+	+	+	+
Number of surviving children	+	+	+	+	+	+	+	+	+	+
Woman's knowledge and use of family planning										
Level of knowledge of contraceptive methods	+	+		+		+	+	+	+	+
Level of ever use of contraceptive methods			+	+	+	+	+	+	+	+
Approval of family planning	+	+	+	+	+	+	+	+	+	+
Woman's fertility preferences										
Desire for more children		-	-				-			-
Discussion of desired family size with husband		+		+	+		-		+	
Woman's socioeconomic status										
Number of mass media she is exposed to every week		+					+			
Educational level				+			+	+		+
Rural residence		-			-					
Husband's educational level	+				+	+	+	+	+	+

Variable	Effect									
	CO	KE	MD	MW	NM	RW	TZ	UG	ZM	ZW
East and Southern Africa										
Birth interval characteristics										
Actual length	+	+	+	+	+	+	+	+	+	+
Closed interval	-	-	-	-	-	-	-	-	-	-
Child opening the interval died before conception of next child	-	-	-	-	-	-	-	-	-	-
Length of previous interval		+								
Woman's demographic characteristics										
Age	+	+	+	+	+	+	+	+	+	+
Number of surviving children	+	+	+	+		+	+	+	+	+
Woman's knowledge and use of family planning										
Level of knowledge of contraceptive methods	+	+	+	+			+	+	+	+
Level of ever use of contraceptive methods	+	+	+	+	+	+	+	+	+	+
Approval of family planning	+	+	+	+	+		+	+	+	+
Woman's fertility preferences										
Desire for more children				-		-	-		-	
Discussion of desired family size with husband		+		+	-	+	+			+
Woman's socioeconomic status										
Number of mass media she is exposed to every week		+					+			+
Educational level					+	-	+	+		+
Rural residence					-		-	-	-	
Husband's educational level		+			+		+			

BE = Benin; BF = Burkina Faso; CM = Cameroon; CA = Central African Republic; CI = Côte d'Ivoire; GH = Ghana; ML = Mali; NI = Niger; NG = Nigeria; SN = Senegal; CO = Comoros; KE = Kenya; MD = Madagascar; MW = Malawi; NM = Namibia; RW = Rwanda; TZ = Tanzania; UG = Uganda; ZM = Zambia; ZW = Zimbabwe.

Table 6 Trends in (median) preferred lengths of next interval (in months) in sub-Saharan Africa, Demographic and Health Surveys, 1986-1998

Country	Year(s) of survey		Total			Open interval			Additional waiting time		
	t1	t2	t1	t2	difference	t1	t2	difference	t1	t2	difference
Ghana	1988	1993-94	49.0	56.5	7.5	15.1	17.6	2.5	33.9	38.9	5.0
Kenya	1988-89	1998	45.4	52.1	6.7	13.7	15.7	2.0	31.7	36.4	4.7
Madagascar	1992	1997	41.2	46.4	5.2	12.9	13.0	0.1	28.3	33.4	5.1
Mali	1987	1995-96	33.5	41.1	7.6	11.8	12.8	1.0	21.7	28.3	6.6
Senegal	1986	1997	35.1	44.3	9.2	13.9	14.3	0.4	21.2	30.0	8.8
Tanzania	1991-92	1996	41.8	46.0	4.2	14.3	14.8	0.5	27.5	31.2	3.7
Uganda	1988-89	1995	30.7	38.3	7.6	11.8	12.2	0.5	18.9	26.1	7.2
Zambia	1992	1996-97	37.6	38.5	0.9	12.3	13.2	0.9	25.3	25.3	0.0
Zimbabwe	1988-89	1994	49.7	57.5	7.6	16.4	18.4	2.0	33.1	38.9	5.8

Trends in Actual Birth Interval Length

Using the surveys carried out in the mid- and late 1990s, we also examine trends in the actual length of birth intervals. We do not include surveys conducted in the early 1990s to avoid early censoring of the birth intervals that start in the late 1980s and the early 1990s. Table 7, which contains the results for 12 countries show that birth intervals have been increasing over time, especially from the 1980s to the 1990s. The largest increases are observed in Benin, Côte d'Ivoire, Kenya, Senegal, and Zimbabwe.

Table 7 Trends in (median) actual length of birth intervals (in months) in sub-Saharan Africa, Demographic and Health Surveys, late 1990s.

Country	Year(s) of survey	Birth intervals starting in the:		
		1970s	1980s	1990s
Benin	1996	31.2	31.8	35.5
Central African Republic	1994-95	29.5	30.8	32.9
Comoros	1996	25.2	26.7	30.9
Côte d'Ivoire	1994	29.7	30.9	35.9
Kenya	1998	27.6	29.3	34.6
Madagascar	1997	25.8	28.7	30.2
Mali	1995-96	26.9	27.8	32.6
Senegal	1997	29.6	30.2	34.3
Tanzania	1996	29.5	32.7	35.2
Uganda	1995	27.3	28.3	29.5
Zambia	1996-97	28.4	30.8	32.2
Zimbabwe	1994	30.4	35.0	40.5

4 Conclusions and Discussion

The results of this analysis of birth spacing preferences in sub-Saharan Africa show that women in Comoros, Ghana, Kenya, Rwanda, and Zimbabwe prefer much longer birth intervals than those they actually have compared with women in the other 15 countries studied. If women's spacing preferences were realized, the level of fertility (and to lesser extents the levels of child mortality and malnutrition) in these five countries would be significantly reduced, unlike that of the remaining 15 countries. Using as a reference the TFR values published by the Population Reference Bureau (1998), we find that the hypothetical declines in fertility would translate into 2 children fewer per woman in Comoros and Rwanda, 1.5 fewer in Ghana and Kenya, 1 child fewer in Zimbabwe, and 0.5 fewer in the remaining countries, on average. The implications of spacing preferences for child survival are more modest, but not insignificant: on average, a 7 percent decrease in neonatal and infant mortality risks and a 6 percent decrease in under-five mortality risks are observed in the 20 countries. These potential reductions in child mortality are in line with the 10 percent or lower effects of most child survival interventions. The implications for children's nutritional status are small (less than 2 percent decrease in malnutrition rates, on average) except in Comoros, Ghana, Kenya, and Zimbabwe, where the realization of preferred birth intervals would, on average, reduce child stunting, wasting, and underweight rates by 7 percent, 10 percent, and 8 percent, respectively.

These results indicate that among the sub-Saharan countries studied, birth spacing preferences have potential demographic and health implications in Comoros, Ghana, Kenya, Rwanda, and Zimbabwe, but not in the other 15 countries, because women in the first five countries prefer much longer birth intervals than those they experience compared with women in the remaining countries. What might account for this finding? The major characteristic shared by these five countries is the sharp decline in fertility that they have recently experienced, declines which have been associated with significant increases in the use of contraception. In Kenya and Zimbabwe, where the DHS data have confirmed that the fertility transition effectively began in the late 1980s, the TFR declined by 20 percent and 22 percent, respectively, during the six-year period preceding their latest DHS (National Council for Population and Development et al., 1994; Central Statistical Office and Macro International Inc., 1995). Similar declines in fertility have been recorded in Comoros, Ghana, and Rwanda. For example, the TFR declined by 20 percent during the five-year period preceding the 1996 DHS in Comoros (Mondoha et al., 1997), and by 27 percent during the nine-year period preceding the 1992 DHS in Rwanda (Barrère et al., 1994). It could be that in these environments of rapidly falling fertility, women and couples are more aware that they can control the timing of their births to achieve smaller families. Because of this greater awareness, they may be more likely to exert such control and therefore more likely to react negatively when a birth occurs sooner than they would have liked, particularly if the birth occurs shortly after the previous one. Consequently, they may be more likely to report that a birth was mistimed in surveys.

Although this work establishes the existence of a gap between preferred and actual birth intervals in sub-Saharan Africa, the conclusions that are drawn are limited by the validity of the measure of the preferred birth interval. Several biases, some of which were enumerated at the beginning of this report, might affect our estimated PBI. First, rationalization bias is a concern because our estimation is based partly on postfactum measures. However, experimental studies conducted in Latin America have shown that questions about preferences of the type asked by DHS surveys minimize this problem by emphasizing the respondent's feeling at the time of each conception (Goldman et al. 1989; Westoff et al. 1990). A second concern is that the DHS questionnaire does not allow respondents to give negative responses regarding spacing preferences so that women who might have preferred shorter intervals than what they actually had were, in a sense, "forced" to report that they were satisfied with their interval lengths. Therefore, the estimated PBIs may be upwardly biased.

We suspect that this problem is more likely to affect long birth intervals, that is, those longer than four or five years. Also, the problem may be more important in countries with a high prevalence of secondary infertility, where many women have to wait much longer than they want to before getting pregnant. The magnitude of this bias can be assessed in the future by conducting a sensitivity analysis in which a certain proportion (for example, one-third or one-half) of birth intervals that are longer than 48 or 60 months and that women report as having been wanted *then* is assumed to have in fact been wanted some time earlier (for example, 3, 6, or 12 months). In the 20 countries examined in this study, the proportion of birth intervals longer than 48 months that were reported as being wanted *then* varies from 7 to 11 percent. For birth intervals longer than 60 months, the corresponding proportion varies from 3 to 5 percent. These percentages seem rather low to substantially alter our conclusions. A final concern is the exclusion of birth intervals that started in the period five (or three) to ten years before the survey and ended in the same period. The exclusion, which was performed because no information on spacing preferences was collected for such birth intervals, may have led to a selection of longer intervals. A way of addressing this potential problem is to restrict the window of analysis to the five-year period before the survey since all intervals included in that window have complete information. By doing so, we find that in the 20 countries, the median lengths of actual and preferred birth intervals are on average 33.4 months and 39.0 months, respectively. On average, the corresponding potential increase in birth interval length is 24 percent in East and Southern Africa and 12 percent in West and Middle Africa. These results do not differ greatly from our previous findings; thus, the conclusions should not be too sensitive to the choice of the window of analysis.

The failure to control for the strong association between birth interval length and birth order must also be acknowledged. Lower order births tend to have shorter birth intervals, and it has been shown that women tend to report as mistimed those births that are the result of shorter birth intervals (Adetunji, 1998; Montgomery et al., 1997). To check whether the overall gap that exists between actual and preferred birth intervals persists at each birth order, we computed the percentage increase in interval length if preferences were realized for intervals starting with first births, second births, and third or higher order births, respectively. The results are shown in Table 2. Before commenting on them, we report that on average, the median lengths of actual following birth intervals are 31.7 months, 32.6 months, and 34.3 months for first births, second births, and third and higher order births, respectively. The median lengths of preferred birth intervals are 38.3 months, 40.3 months, and 40.9 months, on average, for each category of birth interval. These results confirm that lower order births precede shorter intervals. The results shown in Table 2 reveal that the gap between actual and preferred birth intervals is generally greater for intervals starting with lower order births (first or second) than for intervals starting with higher order births. Thus, the magnitude of the gap depends on parity, and this relationship helps to explain why the gap is greater in countries with lower fertility such as Comoros, Ghana, Kenya, and Zimbabwe. In the future, it would be interesting to examine whether the implications of the gap between actual and preferred birth intervals for fertility and child health and survival also vary by birth order. Such an examination would certainly further illuminate the findings reported here.

Policy and Program Significance

Given the great emphasis on the promotion of family planning for purposes of birth spacing in the region, the results of this research are directly relevant to the public health and population policy rationales of government programs and international donor activities.

At the program level, it is useful to know how many women in the different populations actually prefer short intervals. Our estimate is that an average of 11 percent prefer their birth intervals to be shorter than 24 months. In the 20 countries included in this analysis, an average of 50 percent

(29 percent in the group of five “forerunners” and 57 percent in the remaining 15 countries) of currently married women whose last closed birth interval was shorter than 24 months reported that birth to have been wanted then, not later. If this is at all typical, there is something of a health education challenge. The point is not to demonstrate that short intervals have health implications but rather that short intervals are not preferred by most women, although some significant fraction continue to want such intervals. Thus, the dual aim should be to persuade some women to prefer longer birth intervals and to enable others who already prefer such intervals to achieve that objective.

Evidence has been found (Greene, 1998) that contraception as currently used for spacing births in sub-Saharan Africa has only a limited effect on the length of birth intervals, increasing the average interval by only a few months. There are many methodological problems with this observation including self-selection bias and the substitution of imperfect methods for postpartum protection, but the observation of little effect is unsettling and, if generalizable to more countries, should be on the agenda of program designers.

Related to this finding is the broader general question of how great of an effect on fertility the use of contraception for spacing versus the use of contraception for limiting has in sub-Saharan Africa. Examining this question involves estimating how much effect contraception actually has (it seems to be marginal) and how much effect it could have if spacing preferences were realized (which is the subject of this study). To the extent that family planning programs are focused on rates of population growth as well as on reproductive health, the answer to this question is an important policy issue.

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