Data and Perspectives

The Proximate Determinants of Fertility in sub-Saharan Africa

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As measured by most conventional indicators of socioeconomic development, sub-Saharan Africa remains the least developed region of the world. While standards of living in the poorest countries of Latin America and Asia, on average, have been rising, they actually declined in the low-income countries of Africa during the 1970s, when population growth exceeded the small rise in overall economic output. Even if this adverse trend is reversed in the coming decade, it is likely that large parts of sub-Saharan Africa will not be much better off than today for the foreseeable future.

These facts have caused increasing concern among African government officials and policymakers as well as in international agencies that deal with development issues. However, despite the important role rapid population growth has likely played in producing the poor economic conditions, few governments have expressed concern in the past about demographic developments. Measures to reduce rapid population growth such as those adopted by numerous Asian and Latin American countries have been absent in sub-Saharan Africa. This situation is now clearly changing and the search is under way for effective policies to reduce excessive fertility in order to effect a decline in the rates of population growth (United Nations Economic Commission for Africa, 1984).

The design and implementation of such policies would greatly benefit from a detailed understanding of the socioeconomic, cultural, biological, and environmental factors that determine fertility. This paper seeks to contribute to such understanding by providing an assessment of the proximate determinants of fertility levels and differentials for the region.

The demographic setting

According to recent United Nations estimates, sub-Saharan Africa\(^1\) had approximately 338 million inhabitants living in 37 countries in 1980 (United Nations,
1982). Over half the population lived in the five largest countries: Nigeria (77 million), Ethiopia (32 million), Zaire (28 million), Sudan (18 million), and Tanzania (18 million). The subcontinent’s share of the world’s population increased from 6.2 percent in 1950 to 7.6 percent in 1980.

The demographic characteristics of sub-Saharan Africa are unique because the population’s rate of growth and its birth and death rates are all higher than in any other continent or major region. This is not entirely unexpected since much of the rest of the world is relatively more developed and hence has progressed further into the demographic transition. It is surprising, however, that a substantial discrepancy between demographic indicators is still found if one restricts the comparison to low-income countries (using the World Bank’s definition, low-income countries in 1980 had an annual per capita GNP below $420; World Bank, 1982). The relevant data are plotted in Figure 1. For the
period 1975–80 the birth and death rates of low-income sub-Saharan Africa were 48 and 20 per thousand respectively, yielding an annual population growth rate of 2.8 percent. These figures are virtually the same for sub-Saharan Africa as a whole. In contrast, the low-income countries of Asia and Latin America had a birth rate of 29, a death rate of 11, and a growth rate of 1.8 percent. These statistics for non-African countries are heavily influenced by the remarkable declines in fertility and mortality that have occurred recently in China, but even if China is excluded, the discrepancies shown in Figure 1 would not disappear.

Another notable feature of Figure 1 is the difference in demographic trends between continents. The birth rate in sub-Saharan Africa is stable while it has been declining elsewhere. In fact, during the 1970s the birth rate in low-income Asia and Latin America declined faster than the death rate so that the growth rate is now also declining. This is not the case in Africa. The constant birth rate, combined with modest reductions in the death rate, has resulted in a population growth rate that is higher than ever and still rising. As a consequence, the population of sub-Saharan Africa is expected to reach 627 million in the year 2000 and 1.17 billion in 2025 (United Nations, 1982). Of course, some countries will grow even faster. Kenya, for the moment the world’s recordholder with an annual growth rate of 4 percent, is projected to grow from 16.5 million in 1980 to 82.3 million in 2025, a fivefold increase.

**Fertility levels and differentials**

The overall level of fertility in sub-Saharan Africa as measured by the total fertility rate is approximately 6.6 births per woman for the period 1975–80 (United Nations, 1982). This estimate is an average that conceals considerable variation in national fertility levels. In general, fertility is highest in the east and the west and lowest in the central regions (in Gabon, Cameroon, Central African Republic, and parts of Sudan, Zaire, and Congo). The total fertility rate ranges from a high of 8.1 in Kenya to 4.1 in Gabon. While this is an impressive range, it is not unusual: similar variations in fertility are found in Asia and Latin America. However, Africa is unique in that the lowest levels of fertility have not been achieved through declines in fertility. Countries with relatively low fertility in Latin America and Asia have experienced rapid declines in fertility that are correlated strongly with socioeconomic development and organized efforts to reduce the birth rate. In contrast, no country in sub-Saharan Africa has experienced a significant reduction in fertility, and there is no correlation between development indicators and fertility. The processes that give rise to fertility differentials in sub-Saharan Africa are therefore very different from those found elsewhere.

In addition to variation in fertility between nations, there are large fertility differences by geographic region and by ethnic and socioeconomic groups within countries. Figure 2 offers a few examples. The upper part of the figure shows that the total fertility rate in Cameroon is 50 percent higher in the West than in the Southeast. Similar and sometimes even larger regional or ethnic differences
in fertility have been found in other African countries (Frank, 1983b). The lower panels of Figure 2 demonstrate that better educated and urban women in general have lower fertility than their unschooled and rural counterparts. It should be emphasized, however, that more education or an increase in literacy is not necessarily associated with lower fertility. Thus, for example, the total fertility rate of women with no schooling is lower than that of women with 1–3 years of schooling (Figure 2, middle graph). This has very important implications because the large majority of women fall in these two categories. This subject will be addressed in greater detail later.

**FIGURE 2** Examples of fertility differentials by region and by level of schooling and urbanization in sub-Saharan Africa

<table>
<thead>
<tr>
<th>REGIONAL DIFFERENCES</th>
<th>IN CAMEROON</th>
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<tr>
<td>WEST</td>
<td></td>
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<tr>
<td>NORTH</td>
<td></td>
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<tr>
<td>SOUTHEAST</td>
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<table>
<thead>
<tr>
<th>EDUCATIONAL DIFFERENCES</th>
<th>(AVERAGE OF FIVE COUNTRIES)</th>
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<tbody>
<tr>
<td>NO SCHOOLING</td>
<td></td>
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<tr>
<td>1–3 YEARS</td>
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<tr>
<td>4–6 YEARS</td>
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<td>7+ YEARS</td>
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<tr>
<th>URBAN/RURAL DIFFERENCES</th>
<th>(AVERAGE OF FIVE COUNTRIES)</th>
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<tr>
<td>RURAL</td>
<td></td>
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<tr>
<td>URBAN</td>
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</tbody>
</table>

Total fertility rate


SOURCE: Frank (1983b) and Casterline et al. (1983).

Even greater variation in fertility is found among individual women. In all sub-Saharan African countries for which individual-level measures are available, the number of children ever born among women at the end of the reproductive period ranges from 0 to 14 or more. Figure 3 illustrates this with observations from Kenya and Ghana. Although Kenya's total fertility rate is substantially higher than Ghana's (8.1 vs. 6.7), the two distributions of completed parities of individual women overlap to a large extent. As a result, a large proportion of women in Kenya have smaller families than the average Ghanaian woman and, similarly, the average Kenyan family size is exceeded by the fertility of a substantial proportion of Ghanaian women.
Clearly, variations in national, subnational, and individual levels of fertility in sub-Saharan Africa are large. This is all the more remarkable since only a very small percentage of women deliberately control their fertility through contraception or induced abortion. Explanations for these findings must therefore be found largely elsewhere. This is the task we turn to next.

The determinants of fertility

Any detailed and comprehensive analysis of factors influencing fertility requires that a distinction be made between two classes of determinants: (1) proximate variables and (2) socioeconomic and environmental "background" variables. The latter include the social, cultural, economic, institutional, psychological, health, and environmental variables, and the proximate determinants consist of all biological and behavioral factors through which the background variables must operate to affect fertility (Davis and Blake, 1956; Bongaarts and Potter, 1983). The principal characteristic of a proximate determinant is its direct influence on fertility. In contrast, socioeconomic variables can affect fertility only indirectly by modifying the proximate determinants.
One of the most important advantages of including the proximate variables in the study of the fertility process is that it improves understanding of the operation of the socioeconomic determinants. In general a socioeconomic variable can have negative fertility effects through one set of proximate variables (such as education’s effect on use of contraception) and positive effects through another set (such as education’s effect on length of breastfeeding). The overall net effect of a socioeconomic variable on fertility can therefore be positive, negative, or insignificant depending on the relative contributions of the positive and negative effects of the proximate determinants. These offsetting effects of proximate determinants on fertility levels play an especially crucial role in sub-Saharan Africa, but before considering this subject further, it is necessary to discuss the proximate determinants in some detail.

The following is a complete list and a brief description of the proximate determinants:

_Proportion of women married or in sexual unions_  This variable measures the degree to which women of reproductive age are exposed to the risk of conceiving.

_Frequency of intercourse_  This determinant directly affects the probability of conceiving among ovulating women. Frequent or prolonged spousal separation has therefore a substantial fertility-reducing effect.

_Postpartum abstinence_  Prolonged abstinence from sexual relations while a newborn is breastfeeding is common in a number of societies, many of them in Africa.

_Lactational amenorrhea_  Following a pregnancy a woman remains unable to conceive until the normal pattern of ovulation and menstruation is restored (postpartum amenorrhea). When breastfeeding takes place, the duration of lactational amenorrhea is primarily determined by the duration, intensity, and pattern of breastfeeding.

_Contraception_  Any practice undertaken deliberately to reduce the risk of conception is considered contraception if its aim is to limit family size. Breastfeeding and postpartum abstinence, while they affect fertility by increasing child spacing, are not included as contraception because their aim is primarily the protection of maternal health and child development rather than regulation of the number of children born.²

_Induced abortion_  This includes any practice that deliberately interrupts the normal course of gestation.

_Spontaneous intrauterine mortality_  A proportion of all conceptions fail to end in a live birth because some pregnancies spontaneously terminate prematurely in a miscarriage or stillbirth.

_Natural sterility_  Only a small proportion of women are sterile at the beginning of the reproductive years, but this proportion increases with age and reaches 100 percent by age 50.

_Pathological sterility_  A number of diseases, especially gonorrhea, can cause primary or secondary sterility. Primary sterility results in childlessness because a sterilizing disease is contracted before a first birth. Secondary sterility
results in an inability to bear additional children, sometimes very early in the childbearing years, and is due to the onset of disease among women who already have borne offspring.

The importance of each of these proximate variables in determining fertility differentials in sub-Saharan Africa ranges from major (lactational amenorrhea, postpartum abstinence, and pathological sterility) to insignificant (spontaneous abortion and natural sterility). The review of the proximate determinants provided in the next section highlights the relative importance of these variables. 3

The proximate determinants and reproductive behavior

The high and constant level of fertility in sub-Saharan Africa overall and the often large differences that it subsumes must in the end be explained by a group of characteristics, behavioral and biological, that directly determine fertility through their combined effects. The behavioral characteristics include marriage patterns, patterns of sexual activity, duration of breastfeeding, and use of birth control through contraception and induced abortion, while the biological characteristics include fetal loss and both natural and pathological sterility.

Patterns of marriage and sexual unions

Although a woman could in principle bear children throughout her reproductive life, from the age of about 15 to about 45, this is rarely the case, because her overall exposure to childbearing is limited to the total amount of that time during which she is actually cohabiting or in a union (for simplicity, the word “marriage” as used here denotes any such regular sexual union). In any society, the total time spent in unions for all women depends on the age at first marriage, the proportion of women who never marry, the frequency of divorce and widowhood, the frequency of remarriage, and the age at which sexual activity comes to an end (if this occurs before menopause). These various factors are summarized by the proportions of all women married at any point in time. In considering the role of marriage in limiting the exposure of women to childbearing, some account must also be taken of the level of extramarital exposure, by young women before marriage and by older never-married and unmarried (divorced and widowed) women. Finally, even within marriage, the particular forms it takes can affect the translation of marriage into exposure to childbearing, principally through the patterns of sexual activity that tend to be associated with it. For example, arranged marriages tend to be associated with lower frequencies of intercourse than romantic marriages (Rindfuss and Morgan, 1983), and polygynous marriages tend also to be associated with lower sexual activity (of each woman) than monogamous ones.

All the marriage factors have relevance in the African context, and of the forms of marriage, polygyny is the more important to the explication of
fertility in sub-Saharan Africa. The role of polygyny, however, will be discussed under patterns of sexual activity.

**Age at first marriage** The average age at which women enter their first union varies regionally from below 17 years to around 22. Overall, age at marriage is at the low end of the range in west Africa, at the high end in parts of east Africa, and intermediate in central Africa and in the coastal areas around the Bight of Benin and the Gulf of Guinea in the west and the Indian Ocean in the east (see Figure 4). Age at marriage is higher in urban than in rural areas, in association with higher levels of education for urban women.

These differentials in age at first marriage seem to reflect true differences in regional and ethnic practices rather than a cross-sectional picture of a continental transition in the age at first marriage, since there is little evidence that age at marriage has substantially increased in African national populations over the last 20 or 30 years. An exception to this is Kenya, where relatively better data at several points in time show the average age at first marriage rising by more than a year and a half, from just over 18.5 to over 20 between 1962 and 1979. It is also possible that northern Sudan has experienced some increase in the average age at first marriage.

The sub-Saharan African range of age at first marriage is somewhat lower than the range in Asia as measured by the World Fertility Surveys in the mid to late 1970s, but the two regions also differ in two other important respects. First, no African population of significant size has as early an age at first marriage as Bangladesh in 1975 (about 16 years). Second, data for the large majority of Asian countries show that current levels of ages at first marriage result from fairly widespread increases in age at marriage since the 1950s.

**The proportion of women who never marry** Marriage is for all intents and purposes universal in sub-Saharan Africa. The proportion of women still unmarried is already only around 5 percent or less in the age group 25–29, and declines to 3 percent or less thereafter. The proportions of women who are single in the youngest age groups in Africa thus merely reflect the distribution around the average age at entry into their first marriage and bear no relationship to the very low probabilities of permanent celibacy.

**The frequency of divorce, widowhood, and remarriage** Marital instability due to both voluntary dissolution (divorce) and involuntary dissolution (widowhood) is high throughout sub-Saharan Africa by any standard. However, very high rates of remarriage and good accessibility to husbands through polygyny mean that few women are not in unions at any point in time relative to the incidence of marriage dissolutions. A standard schedule for six African countries shows the average proportions of first marriages ending in divorce or widowhood by duration of the first marriage for women currently below
FIGURE 4 Female age at first marriage (years) in sub-Saharan Africa, most recent national data

Younger than 16.7 years
16.7 to 17.9 years
18.0 to 19.6 years
19.7 years or older
No data

age 50. The schedule, given in Table 1, shows that the proportion of women’s first marriages ending in divorce ranges from over 7 percent for very short durations (0 to 4 years) to nearly 20 percent for the longest durations (30 or more years). The incidence of widowhood is much lower for shorter durations (when husbands are younger and have lower mortality), but increases rapidly and reaches the incidence of divorce in the longest durations of marriage. Among women married less than five years, some 8 percent have experienced the end of a first union, either through divorce or widowhood; among women married 30 years or more, the proportion is 40 percent. For all durations of first marriage except 30 or more years, which essentially applies to women past childbearing, divorce is by far the major cause of dissolution, and would therefore be the major reason for any time lost to childbearing associated with an unmarried state.

TABLE 1  Percent of first marriages ending in divorce, widowhood, and both by years since first marriage for women aged 15–49: average for 6 African countries, * 1977–79

<table>
<thead>
<tr>
<th>Years since first marriage</th>
<th>0–4</th>
<th>5–9</th>
<th>10–14</th>
<th>15–19</th>
<th>20–24</th>
<th>25–29</th>
<th>30+</th>
</tr>
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<tbody>
<tr>
<td>Divorce</td>
<td>7.4</td>
<td>13.9</td>
<td>16.7</td>
<td>17.1</td>
<td>18.0</td>
<td>18.3</td>
<td>19.5</td>
</tr>
<tr>
<td>Widowhood</td>
<td>0.8</td>
<td>2.1</td>
<td>4.6</td>
<td>8.0</td>
<td>11.5</td>
<td>15.0</td>
<td>21.0</td>
</tr>
<tr>
<td>Divorce and widowhood</td>
<td>8.2</td>
<td>16.0</td>
<td>21.3</td>
<td>25.1</td>
<td>29.5</td>
<td>33.3</td>
<td>40.5</td>
</tr>
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</table>

* Cameroon, Ghana, Kenya, Lesotho, Senegal, Sudan.

As a result of high rates of remarriage, however, comparatively few women are in fact currently widowed or divorced at any time. For the same six countries, only 5 to 10 percent of women aged 20–39, the entire range of peak childbearing years, will be found unmarried at any time. Taking into account dissolution of first and of subsequent marriages, remarriage after first and subsequent dissolutions, and considering all forms of conjugal unions, once they enter their first union, women in sub-Saharan Africa will spend over 90 percent of their remaining reproductive life in a union (see Table 2).

TABLE 2  Percent of all women currently widowed or divorced and mean percent of time since first marriage spent in sexual union by ever-married women by age: average for 6 African countries, * 1977–79

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</thead>
<tbody>
<tr>
<td>Percent currently widowed or divorced</td>
<td>2.4</td>
<td>5.1</td>
<td>5.6</td>
<td>7.7</td>
<td>10.3</td>
<td>13.9</td>
<td>n.a.</td>
</tr>
<tr>
<td>Percent of time spent in sexual union</td>
<td>96.8</td>
<td>95.6</td>
<td>95.2</td>
<td>94.2</td>
<td>93.7</td>
<td>92.7</td>
<td>91.4</td>
</tr>
</tbody>
</table>

n.a. = not available.
* For countries, see note to Table 1.
SOURCE: Same as Table 1.
Over time, the incidence of widowhood has probably declined steadily with reduced adult mortality. The risks of widowhood among African women are more sensitive to mortality declines at earlier ages of women than in many other regions of the world, because the age differences between spouses are typically large (van de Walle, 1968). For example, the median age gap ranges from about six to eight years for all once-married women married less than ten years, up to 15 to 20 years and more for those women who are second and third wives in polygynous unions (Casterline and McDonald, 1983). With any further reductions in adult mortality, the incidence of divorce, which already plays the major role in marital dissolution, will increasingly determine the incidence of marital dissolution, while the current incidence of remarriage will continue to maintain the proportion of unmarried women at a very low level.

**Exposure outside marriage** Exposure to childbearing outside marriage, particularly before first marriage, is appreciable in Africa, and must be considered alongside women’s formal exposure to childbearing as represented by the portion of their lives during which they are in one or another form of conjugal union. However, the incidence of extramarital exposure varies considerably. Although it is therefore difficult to characterize its level for the entire region, it is probable that around 5 to 10 percent of all births are contributed by unmarried women (Lesthaeghe, 1984).

In summary, one can characterize the role of African marriage patterns in relation to fertility as follows: women marry well after their reproductive life has begun, they virtually all marry by the peak childbearing years, they experience high rates of divorce and appreciable widowhood, but remarry frequently enough that the vast majority are in some form of conjugal union throughout their childbearing years. Childbearing is not entirely restricted to unions, however, and an appreciable proportion of all births occur to women when unmarried.

**Patterns of sexual activity**

In the previous section, we saw how total time spent in marriage was important in assessing the amount of time a married woman could bear children. Duration of married time, however, is not necessarily equivalent to the total duration of exposure to pregnancy within marriage. Within marriage, exposure to pregnancy depends on the pattern of sexual activity. The three most important factors here are frequency of intercourse during cohabitation of spouses, abstinence between cohabiting spouses, and separation of spouses.

**Frequency of intercourse** There is strong evidence that real differences in coital frequency are associated with marriage forms. Thus polygynously married women have lower fertility than monogamously married women, and lower frequency of intercourse is probably one important determinant. Poly-
Polygyny lowers fertility not only because time with the husband is shared, but also because polygynously married women beyond the first wife tend to have even older husbands than monogamously married women and because polygynously married women not infrequently each have separate households, sometimes at great distance from each other.

Polygyny is associated with two other factors that account for lower fertility of polygynous wives. First, they are more often infertile than monogamous wives, because a monogamously married man will more frequently take a second wife if his first wife is childless than if she is not. This will be discussed in greater detail later. Second, polygyny facilitates the practice of postpartum abstinence, or abstinence from intercourse following birth, which is a major proximate determinant of African fertility.

*Postpartum abstinence* Of the various possible types of sexual abstinence, postpartum abstinence is the most notable and widely practiced form in sub-Saharan Africa. Where long periods of abstinence are observed, their duration is generally tied to ongoing breastfeeding, which is recognized as essential to the health and normal development of the infant and young child.

It is possible that at one time a period of abstinence extending throughout lactation, sometimes beyond, was practiced in most of Africa. This is supported by frequent reports from groups observing short periods today that the practice was more prolonged in the past. From whatever levels declines in the duration of abstinence have occurred, considerable variation in the practice can be recognized in contemporary Africa from information on abstinence in the last 20 or 30 years. However, when mapped geographically by ethnic group, the different durations display a high level of consistency. Such a mapping has been carried out by Schoenmaeckers et al. (1981), who divide the variously reported durations for sub-Saharan Africa into three groups: durations not exceeding 40 days, to distinguish Islamicized groups following Koranic prescriptions; durations exceeding 40 days and up to one year; and durations exceeding one year. Complemented by other sources, the mapping of abstinence durations reveals fairly distinct patterns (see Figure 5).

Reported durations of 40 days or less cluster in the lake regions of eastern central Africa and in scattered parts of the Sahel (among some Islamicized west African groups) and of southeastern Africa. Reported durations exceeding 40 days and up to one year cluster remarkably in eastern Africa (generally east of the lake regions), but occur also in west Africa (Ghana). Finally, postpartum abstinence periods of greater than one year (and frequently of two years or more), comprising by far the largest proportion of all reports, are found throughout sub-Sahelian west Africa and central Africa.

The potential impact of postpartum abstinence on fertility depends critically on its duration in relation to the duration of lactational amenorrhea. In assessing the quantitative effect of postpartum abstinence on duration of exposure, it is useful to introduce the concept of the nonsusceptible period, which
equals the total duration of absence of risk of conception, whether the protection is provided by lactational amenorrhea or by abstinence. But it is then also necessary to analyze separately the effects at the level of the individual and of the population. For individual women, the duration of the nonsusceptible period equals the duration of abstinence or the duration of amenorrhea, whichever is longer. On the population level there is substantial variation around the mean durations of abstinence and amenorrhea, so that the average duration of the nonsusceptible period will be longer than the average duration of either abstinence or amenorrhea (Lesthaeghe, 1984).

Since breastfeeding in sub-Saharan Africa tends to be practiced far longer than a year in the majority of rural and traditional societies, it is the effect of
the longest durations of abstinence that has the greatest relevance to fertility. In fact, there is ample evidence that, among groups where abstinence exceeds one year, its duration is purposefully tied to the duration of breastfeeding and customarily lasts at least until weaning (in some groups, such as the Yoruba of Nigeria, abstinence exceeds breastfeeding at all durations). As a result, in the majority of societies practicing extended abstinence, women do not begin to be exposed to conception until after their most recent child is weaned, which can lead to a spacing between successive children of up to around four years.

Nevertheless, close scrutiny of the distribution of all durations of abstinence in sub-Saharan Africa, and, in particular, examination of the most recent surveys, reveal quickly that this distribution is not only related to differentials in customary practices, but also reflects the ongoing erosion of these practices, a process whose state of advancement varies across the continent. The near completion of the erosion process at a national level can be inferred in Tanzania, but its results are possibly best observed in Kenya. In Tanzania in the 1970s, reported durations show varying levels and mixed practices, but rarely exceed six months. In Kenya, the Fertility Survey of 1977–78 revealed an average duration of abstinence of about four months. The decline of the abstinence duration in Kenya can be presumed to have played a role in the country’s overall fertility increase, which will be examined later. Finally, often large differentials between rural and urban practices and between those of educational groups such as found in recent surveys portend other national transitions toward abandonment of the practice, if they indeed indicate (as is strongly suspected) the first step in the process.

**Spousal separation** Long periods of separation of spouses can appreciably reduce women’s overall exposure to conception. Such separations are principally due to male labor migration, and are particularly widespread in southern Africa. Labor outmigration is a phenomenon of considerable importance in west Africa also, but tends to involve longer term migration of unmarried men and consequently to have bolstered polygyny rather than to have resulted in widespread spousal separation. In southern Africa, polygyny is less common, and the majority of migrating married men will be absent for several months or even a few years, which could drastically reduce the overall frequency of intercourse in a married lifetime.

The impact on fertility of this reduction in exposure time can be strongly tempered by the timing of spousal separation. In some areas it is reported that husbands leave once their wives are pregnant and intend their period of absence to coincide with the pregnancy and the child’s early life. Unexpectedly long durations of postpartum abstinence were found in the Lesotho Fertility Survey of 1977, thus illustrating this timing effect on a national scale. Because of large-scale labor migration of males to the Republic of South Africa, the surprisingly long abstinence in all probability measures the customary absence of husbands in the postpartum period, rather than abstinence between cohabiting spouses per se.
Breastfeeding and lactational amenorrhea

Because the biological feedback from suckling effectively blocks ovulation for a period of time, the length and intensity of breastfeeding have a potentially large influence on the period of time that a woman is exposed to conception.

The length of time during which ovulation is blocked by lactation (lactational amenorrhea) falls short of the total duration of lactation, because frequency and intensity of suckling decline as weaning approaches, but lactational amenorrhea lasts for a major proportion of the period of breastfeeding at all breastfeeding durations. The relationship between the average durations of amenorrhea and lactation has been quantified by Bongaarts and Potter. According to their analysis of a large number of data sets, amenorrhea lasts for about two months following delivery in the absence of any lactation. The duration of lactational amenorrhea increases in proportion to the length of breastfeeding, lasting for about 60 to 70 percent of the duration of breastfeeding where breastfeeding durations are up to one to two years and more. For the longest breastfeeding durations, amenorrheic periods of up to two years occur (Bongaarts and Potter, 1983).

For all intents and purposes, breastfeeding is universal throughout sub-Saharan Africa. There is substantial variation in its duration between countries, however, reflecting ethnic differences in practice to a large extent, and the negative effects of modern influences to a measurable extent.

The mean duration of breastfeeding is about 19 months in Lesotho, 18 months in Ghana, and about 16.5 months in Sudan and Kenya. The average nonsusceptible periods due to amenorrhea for these breastfeeding durations are about 13 months in Lesotho, 12 months in Ghana, and 11 months in Sudan and Kenya. However, these are the minimal estimates of the average duration of nonsusceptibility since abstinence effects are not included (see the discussion above). To illustrate, the added effect of abstinence practice would raise the mean nonsusceptible period to 18 months in Lesotho, 17 months in Ghana, 12 months in Sudan, and 13 months in Kenya (Casterline et al., 1983).

Use of birth control

Birth control that is intended to limit family size includes both the use of contraception and the practice of induced abortion.

The use of contraception still plays a very limited role in determining fertility in sub-Saharan Africa. On the one hand, knowledge levels are very low: the proportion of ever-married women who report never having heard of any method to delay or avoid a pregnancy ranges from 12 percent in Kenya, 32 percent in Ghana, 35 percent in Lesotho, 40 percent in Senegal, and 49 percent in Sudan to 66 percent in Cameroon. On the other hand, even better levels of knowledge are not necessarily associated with higher use: current use of any method of contraception (including traditional methods and sterilization) among all currently married women ranges from about 9.5 percent in Ghana...
to 5–6 percent in Kenya, Nigeria, Sudan, and Lesotho, and below 5 percent in Senegal. Taking account only of women who are currently exposed to conception, the proportions are higher—12.4 percent in Ghana, 9.2 percent in Kenya, 7 percent in Lesotho, 6 percent in Sudan and in Nigeria, and 5.2 percent in Senegal—but a third or more of the respondents are using inefficient methods (in Senegal, the majority).

Data on induced abortion are very rare in sub-Saharan Africa. Overall, abortion is probably used in a number of urban areas among the very youngest women before marriage, but otherwise the practice appears to be infrequent. The urban phenomenon is reported variously to represent an increasing problem of public health, but at the regional level induced abortion has a negligible effect on fertility levels.

**Fetal loss**

Intrauterine mortality includes both spontaneous abortions, which comprise the bulk of pregnancy losses, and stillbirths (mortality after the 28th week of pregnancy).

There are good reasons to believe that overall intrauterine mortality is similar in all human populations—probably around 20 percent (Bongaarts and Potter, 1983). Stillbirths, while they may be more frequent in Africa than elsewhere, constitute so small a proportion of intrauterine mortality as to have a negligible effect on the total.

There is evidence that epidemic malaria may be associated with higher levels of intrauterine mortality, and since malaria is widespread in Africa, it could affect the overall levels of intrauterine mortality. However, malaria is highly endemic in much of Africa, and its transmission is stable, which may result in a lower overall effect on fetal loss in contrast to regions where it is epidemic. Notwithstanding the absence of data to make a better determination, the effect on fertility is deemed negligible relative to the order of magnitude of expected levels of fetal loss (Lancet, 1983).

**Sterility**

Sterility arises from both natural and pathological causes. In this discussion the prevalence of sterility is measured by its result, that is, the level of infertility.

**Natural infertility** The natural maximum duration of reproductive life in women is from menarche to menopause. Both terms denote a process rather than a well-defined event. The onset of first menstruation is followed by a period during which anovulatory or otherwise incomplete cycles occur with decreasing frequency so that populations of women experience a period of naturally occurring relative infertility for a number of years in the earliest portion of the reproductive span, the actual years of age involved depending on the age at menarche. Average age at menarche has been found to range in the 1960s and 1970s from about 12 to 19 years for various populations for which there are relevant data. Existing data for Africa range nearly as widely
in the same time period: from about 13 years among affluent or urban groups in Uganda and Nigeria to over 17 among rural Hutu in Rwanda. Average age at menarche evidently depends on a number of both genetic and nutritional factors, although the role of any one factor is not well known (Gray, 1979).

The natural infertility of the early reproductive life of women is relatively less important to fertility than the natural infertility of the later years, since much of its effect is lost through nonexposure and because late age at menarche tends to be associated with later age at marriage.

Menopause is the final point in a process of several years’ duration whereby the frequency and regularity of ovulation decline until ovulation ceases. Evidence from a number of studies suggests that in a population of women the process begins in the 30s, half of the women are menopausal at the end of their 40s, and all women are menopausal by the middle to end of the 50s. However, it is clear that the onset of infertility precedes menopause by a number of years. This is because in addition to irregular and infrequent, even rare, ovulation, aging of the reproductive system is associated with a higher frequency of early spontaneous abortions, and older women tend to have a lower frequency of intercourse. Most importantly, therefore, the process translates into a mean age at last birth of about 40 in populations that do not intentionally stop childbearing at an earlier age (Bongaarts and Potter, 1983).

Although this pattern of onset of menopause is derived from other populations, it is applicable to sub-Saharan Africa. The resulting pattern of natural infertility with age provides us with a lower bound for probable levels of infertility that is essential to the analysis of pathological infertility in Africa. Thus, the age at which natural infertility is at its lowest level, 3 percent in the early 20s, provides us with the lowest proportion of women we would expect to be childless for life in a society where virtually all women are exposed to conception in those years. This standard level of childlessness is confirmed by the lowest proportion of ever-married women ending their reproductive years childless (around 3 percent) in a number of populations.

Pathological infertility The prevalence of gonorrhea occasions both primary and secondary infertility in many parts of sub-Saharan Africa. For any level of primary infertility or childlessness, there is an accompanying larger proportion of women who have incurred secondary infertility: these women are unable to have additional children, sometimes very early in their childbearing life. The proportion of women childless after the end of childbearing (say, ages 45–49) allows us to gauge the ultimate weight of primary infertility, and to gain a good indication of the extent of accompanying secondary infertility (see Frank, 1983b).

The highest levels of infertility (20 percent or more of women aged 45–49 childless) are found across a large area of central Africa. Lower levels (between 12 and 20 percent of women 45–49 childless) are found in interspersed areas of central Africa and in east Africa. In general much lower levels, but still exceeding expected infertility (3 to 12 percent of women 45–49 childless),
are found across west Africa, although higher infertility is found among a number of Sahelian groups of upper west Africa and in some coastal areas. The relationship between childlessness at the end of the reproductive years and total fertility in 18 sub-Saharan countries shows that infertility accounts for about 60 percent of variation in total fertility and that each 9 percentage point increment in the proportion of women 45–49 who are childless translates into a drop in total fertility of one live birth. Childlessness among women in 21 countries of sub-Saharan Africa for which data are available averages 12 percent: this means that, after discounting natural infertility of 3 percent, women in these countries have on average a shortfall of one live birth due to pathological infertility (Frank, 1983a).

Summary and prospects

The principal proximate determinants of the levels and differentials of fertility in sub-Saharan Africa are lactational amenorrhea due to breastfeeding, decreased exposure to conception due to postpartum sexual abstinence, and pathological, involuntary infertility due to gonorrhea (Frank, 1983b).

These three proximate determinants depend on behaviors that are susceptible to modern influences in Africa, especially those of education and urbanization. Thus, educated, urban women, although they tend to marry later, generally abstain sexually for shorter periods after delivery and tend to replace breastfeeding earlier or altogether with alternative milk or solid foods. Recourse to contraception could compensate for the positive effects these changes have on fertility, but acceptance of contraception is clearly lagging. In Kenya, for example, fertility is in effect increasing among young, educated, married urban women. The same phenomenon has been observed in several studies in Nigeria, and the Nigeria Fertility Survey confirms that current fertility is higher among women with primary education compared to women with less or none, and among women with an urban residence (Federal Republic of Nigeria, 1983). Broad extension of education for women in rural areas could bring about these effects at national levels, but some erosion of abstinence and breastfeeding durations can be expected to occur even in the absence of substantial increases in women’s education.

Urbanization and education may affect infertility in very different ways. Rapid urbanization without concomitant development of health infrastructure could foster increased infertility, because the incidence of gonorrhea is increased by the greater sexual mobility, exogamy, and incidence of prostitution in metropolitan areas. On the other hand, the mere greater availability of antibiotics could reduce infertility in some rapidly urbanizing areas with even highly inadequate infrastructure. Women with low levels of education generally have higher levels of fertility than women with no education at all, which may be in part due to lower infertility. While higher levels of education begin to show various other effects on fertility behavior, infertility per se can be expected to decline fairly systematically as women have increased access to health resources, and make more effective use of these resources with their increased
educational exposure. For the majority of rural populations experiencing pathological infertility, however, these changes are probably occurring only at a slow rate.

Fertility and the proximate determinants

Estimating the fertility-inhibiting effects of the proximate determinants

A convenient approach to quantifying the effect of the proximate determinants is to consider them as inhibitors of fertility. In other words, delayed entrance into the first sexual union, marital disruption, breastfeeding, postpartum abstinence, and infertility are all factors that reduce fertility to levels below those that would prevail in the absence of the effects of these proximate variables. Their consequences for overall reproductive performance can be substantial. For example, prolonged breastfeeding may result in a period of lactational amenorrhea of 18 months. In a population with a mean birth interval of three years (not unusual for Africa), this means that half the birth interval and hence half the married life of nonsterile women could be spent within amenorrheic periods. The impact of breastfeeding in this example is clearly important, but in order to compare it with the fertility effects of other proximate variables, it is necessary to use a mathematical model that quantifies the relationship between fertility and its proximate determinants. A detailed description of the model used here can be found in Bongaarts and Potter (1983). This model basically translates a measure of each proximate variable into its proportional effect on fertility as measured in the total fertility rate.4

To illustrate an application of this model, we use the following fairly typical values for the principal proximate determinants in sub-Saharan Africa:

- Proportion of reproductive years not living in union (weighted average): 0.15
- Proportion practicing contraception among women in union: 0.05
- Duration of postpartum nonsusceptible period: 16 months
- Proportion childless at end of the reproductive years: 0.10 (an indicator of the incidence of pathological sterility)

From these measures the model can estimate the percent increase in fertility that would occur if the fertility-inhibiting effect of each of these proximate variables were removed. The results, plotted in Figure 6, indicate that the elimination of breastfeeding and postpartum abstinence would produce a rise of 72 percent in fertility. The effects of the other variables are much smaller: 18 percent for time spent outside unions, 12 percent for pathological sterility, and 5 percent for contraception. Expressed in births per woman, the average observed total fertility rate of 6.6 would increase to 11.4 without breastfeeding and postpartum abstinence; and if the inhibiting effects of nonexposure to unions, pathological sterility, and contraception were also
removed, fertility would reach over 15 births per woman. Obviously, the proximate variables, especially the postpartum nonsusceptible period, have a powerful negative effect on fertility in sub-Saharan Africa.

**FIGURE 6** Estimated percent increase in fertility associated with removal of fertility-inhibiting effect of various proximate variables, by continent

![Graph showing estimated percent increase in fertility associated with removal of fertility-inhibiting effect of various proximate variables, by continent.]

Figure 6 also contains estimates of the fertility-inhibiting effects of the proximate variables from sets of Asian and Latin American countries. A comparison with the estimates for sub-Saharan Africa indicates that the effects of marriage or union exposure and of contraception are considerably greater in Latin America and Asia. On the other hand, in sub-Saharan Africa the fertility-inhibiting effects of postpartum nonsusceptibility and of pathological sterility substantially exceed those observed elsewhere.

**Differentials in fertility and the proximate variables**

By definition, the variations in fertility among countries, among regions and socioeconomic strata within countries, and among individual women are due to the effects of one or more of the proximate variables. If accurate measures
of all proximate variables as well as a complete model were available, all variance in fertility could be explained. Unfortunately, measures of some proximate variables are unavailable or incomplete. As a consequence, it is not possible here to provide a detailed and comprehensive explanation of the sources of the national, subnational, and individual variations in fertility. Instead, a few examples will be given to illustrate the principal causes of some fertility differentials.

**National differentials** As noted earlier, total fertility rates of countries in sub-Saharan Africa range from 8.1 in Kenya to 4.1 in Gabon. Two crucial clues as to the cause of the gap in fertility between these two countries were provided in the earlier discussion of the proximate determinants: Kenya has one of the shortest durations of the postpartum nonsusceptible period found in sub-Saharan Africa and Gabon has very high levels of childlessness, which is indicative of a high prevalence of pathological sterility. To determine to what extent these two factors can account for the difference in fertility between Kenya and Gabon, a simple two-step calculation is made with the model used in the previous section. First, an estimate is made of the decline in total fertility that would occur if Kenya's nonsusceptible period were lengthened from its current duration of 13 months to a more typical 16 months. Second, the increase in Gabon's fertility following the elimination of pathological sterility is estimated. The results are plotted in Figure 7. The rise in the nonsusceptible period in Kenya reduces its total fertility rate from 8.1 to 7.4, while Gabon's total fertility rate rises from 4.1 to 7.3 after correcting for the higher prevalence of childlessness. These simple adjustments have cut the fertility difference between Kenya and Gabon from 4 to a negligible 0.1 births per woman. Although there are undoubtedly differences in other proximate determinants between these two countries, it appears safe to conclude that the relatively short duration of the nonsusceptible period in Kenya and the high incidence of pathological sterility in Gabon are the principal proximate determinants of the large gap in observed total fertility rates between these two countries.

**Subnational differentials** To carry out a similar exercise on the subnational level requires more detailed measures of the proximate determinants than are currently available, but a few generalizations about the differentials plotted earlier in Figure 2 can be made:

(1) The regional differences in Cameroon are largely caused by variation in levels of childlessness, which ranged (in the 1960s) from 29 percent in the Southeast to 7 percent in the West (Frank, 1983b). The elimination of pathological sterility would, according to the model, raise the total fertility rate from 4.3 to 7.1 in the Southeast and from 6.5 to 6.9 in the West. Thus, after adjusting for the effect of pathological sterility, fertility levels in these two regions of Cameroon are virtually equal.

(2) The lower fertility rates among better educated and urban women are primarily caused by later age at first union and by higher prevalence of
contraceptive practice. However, higher levels of education and urban residence are also associated with shorter durations of postpartum abstinence and breastfeeding and perhaps with lower levels of pathological sterility. This tends to offset the fertility-inhibiting effects of later marriage and greater extent of contraceptive practice. In fact, this offsetting effect can be so large as to result in a rise in fertility with increasing education in some strata. This is the most likely explanation for the higher fertility among women with 1–3 years of schooling than among women with no schooling (see Figure 2).

**Individual differences** As on the national and subnational levels, the proximate determinants are responsible for the very large variations in children ever born among individual women. The simple fertility model used thus far on the aggregate level is inadequate to account for individual differences. Instead, an analysis with highly complex computer simulation models would be required to study this topic in detail, a task that falls outside the scope of this paper (see Bongaarts and Potter, 1983, for applications of such models). A few relevant observations can be made, however. In general, both behavioral and biological factors are involved in determining the number of children a woman will have. Behavioral variables include the age at first union, the use of contraception, the pattern and duration of breastfeeding, and the frequency of intercourse. These behavioral factors account for some of the individual variation in fertility, but in the absence of differences in behavior, the number of children ever born would still range from zero to over ten. This points to the crucial role played by biological factors at the individual level. For example, natural sterility, which at the aggregate level has little explanatory power, is a major cause of variation among individuals, because a woman who is sterile when she enters her first union will remain childless, while a woman who remains fertile until age 50 will have several decades of reproductive life,
which is sufficient to produce ten or even 15 births. In addition, the spacing between births ranges from about a year to several years even among women with the same breastfeeding and intercourse patterns, because durations of lactational amenorrhea, occurrences of spontaneous abortions, and waiting times to conception are to a large extent randomly determined. The role played by chance is one of the most important causes of the large range in the number of children ever born among individual women at the end of the reproductive years.

**Implications for future trends in fertility**

The preceding analysis constitutes a basis from which some implications for future fertility trends can be derived. Naturally, any discussion of the demographic future of sub-Saharan Africa has to be in large part speculative due to the absence of reliable measures of current and past trends in fertility and the proximate determinants. The fact that the outlook for economic development is very unclear adds further uncertainty, but we will assume here for simplicity that sub-Saharan Africa will (slowly) follow the general pattern of modernization and development found elsewhere in the world.

Future trends in fertility are entirely determined by trends in the proximate determinants. The proximate determinants can be divided into two general classes: those that can be expected to exert upward pressure on fertility in the future and those that will tend to reduce fertility:

- Fertility-enhancing trends: shortening of breastfeeding and postpartum abstinence; decline in pathological sterility
- Fertility-reducing trends: rise in age at first union; higher prevalence and effectiveness of contraception

These are the main variables that are likely to determine the overall trend in fertility even though some other proximate determinants (e.g., induced abortion, frequency of intercourse) may play a significant role in some societies or subgroups. Whether fertility will rise or fall in the near future therefore depends on the balance of the fertility-enhancing and fertility-reducing trends in the proximate determinants.

Past fertility trends in sub-Saharan Africa provide an important indication of what might lie ahead. Although most countries have not experienced a significant change in fertility in recent decades, there is one important exception: Kenya. According to UN estimates, the total fertility rate in Kenya has risen from 6.6 in 1950–55 to 8.1 in 1975–80. Although it is possible that the estimate for the earlier period is not entirely accurate, there can be little doubt that fertility has increased significantly. This increase occurred despite a rise in age at marriage because the postpartum nonsusceptible period was shortened due to reductions in traditionally long periods of breastfeeding and postpartum abstinence. Kenya’s fertility is bound eventually to decline below its present
very high level, but if its past experience is any guide to what lies ahead for other countries, then a rise in fertility in many countries of sub-Saharan Africa may be inevitable. This is especially true in countries where the durations of breastfeeding and postpartum abstinence are still long or where the prevalence of pathological sterility is high. Moreover, the mere presence of infertility in a society will impede the acceptance of contraception, because the risk of becoming sterile makes childbearing uncertain, which in turn tends to weaken individuals’ interest in controlling their fertility.

Support for a possible upward trend in fertility is found in cross-sectional studies that correlate socioeconomic indicators of regions with levels of fertility and the proximate variables. For example, Lesthaeghe has collected estimates of three proximate variables (marital exposure, contraception, and postpartum nonsusceptibility) for a large set of regions for which a measure of literacy was also available. As expected, marital exposure and duration of postpartum nonsusceptibility were lowest and the prevalence of contraception was highest in regions with the highest levels of literacy. Using a model to estimate the fertility effect of these trends, fertility in the least literate regions was found to be less than that of regions with higher degrees of literacy for most of the observed range. Only after literacy reached levels above 70 percent of women of reproductive age did fertility decline as the effect of increasing contraception and later age at first union outweighed the effect of shorter breastfeeding and postpartum abstinence (Lesthaeghe, 1984). Although, as Lesthaeghe notes, one cannot simply use such cross-sectional analysis to predict trends over time, this finding confirms that there is a potential for a significant rise in fertility in sub-Saharan Africa.

Another demonstration of the formidable changes in reproductive behavior that will be required to achieve declines in fertility can be made with a model that projects future fertility levels from trends in the proximate determinants. To simplify this exercise, we will examine the effect on marital fertility of two proximate determinants crucial to the reduction of fertility, the postpartum nonsusceptible period and the prevalence of contraception. Table 3 provides an illustration of two projections of the levels of contraceptive prevalence required to reach specified reductions in fertility by the year 2000. In the first projection, it is assumed that current contraceptive prevalence among married women of reproductive age is 5 percent and that the duration of the nonsusceptible period is 16 months. The second column of Table 3 provides estimates of the contraceptive prevalence levels needed to reduce marital fertility by 10, 20, and 30 percent respectively, assuming no change in breastfeeding or postpartum abstinence. For example, a 20 percent reduction will require a contraceptive prevalence of 26 percent in the year 2000. The last column of Table 3 gives the required levels of contraceptive prevalence if the duration of the nonsusceptible period were reduced to eight months (this may well happen in substantial parts of Africa by the year 2000). In this second projection, contraceptive prevalence will have to rise to 29 percent just to prevent an increase in marital fertility. A modest 20 percent reduction in marital

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A dramatic rise in contraceptive prevalence is unlikely to occur in most of sub-Saharan Africa before the end of the century. Desired family size is higher in sub-Saharan Africa than anywhere else in the world, and there is no evidence that traditional reproductive norms are changing. What little contraceptive use exists is found predominantly among older, high-parity women; only a very small proportion of low-parity women deliberately want to stop childbearing. Large declines in fertility will not occur until these traditional patterns of reproductive behavior are modified. It is worth noting, however, that overall fertility could be reduced significantly even if only high-parity women were to stop childbearing. This is due to the fact that a large proportion of women reach very high parities by the end of their reproductive years, as is evident from Figure 3. Eliminating births of the highest orders would be a first step toward a sustained fertility decline whose effect could be substantial. For example, if Kenya were to adopt a stop-at-six policy, this would, if completely successful, reduce fertility by 34 percent. While this still leaves the total fertility rate at 5.4, it would have an important moderating effect on the rate of population growth.

In sum, there are no clear prospects for an early and substantial decline of fertility in sub-Saharan Africa. Reductions in fertility will occur only in populations or strata where increases in contraceptive use and in age at marriage are sufficiently large to outpace the effects of the shortening of breastfeeding and the abandonment of postpartum abstinence as well as any declines in pathological sterility. Urban and well-educated women in the more developed African countries are more likely to use contraception or to delay marriage, and they are therefore also more likely to experience fertility declines. On the other hand, the large majority of women have little or no education and live in rural areas, and their prospects for rapid increase in contraceptive prevalence are not good, at least in the near future. Factors that are obstacles to a rapid change in contraceptive behavior are high levels of illiteracy and of infant and child mortality, the large numbers of children desired, the high prevalence of

<table>
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<tr>
<th>Percent reduction in marital fertility by the year 2000</th>
<th>Required contraceptive prevalence in 2000 (percent)</th>
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<tr>
<td></td>
<td>NSP = 16 months</td>
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<tr>
<td>0</td>
<td>5</td>
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<td>10</td>
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TABLE 3  Model estimates of levels of contraceptive prevalence required to achieve specified reductions in marital fertility by the year 2000, for two durations of the nonsusceptible period (NSP)
pathological sterility (in some societies), and the lack of access to health and family planning services.

Notes
This analysis was prepared as a background paper for a World Bank study of population strategies for sub-Saharan Africa.

1 Sub-Saharan Africa is defined here to include all countries in continental Africa except Egypt, Libya, Tunisia, Algeria, Morocco, and the Republic of South Africa.

2 Since the practices of breastfeeding and postpartum abstinence are usually not a function of achieved parity and are applied with minor variation to all birth intervals, they are considered consistent with natural fertility. Natural fertility is defined by Henry as fertility in the absence of deliberate birth control that is “bound to the number of children already born and is modified when the number exceeds the maximum which the couple does not wish to exceed” (Henry, 1961).

3 Unless otherwise stated the data for six African countries to which reference is made in the following discussion derive from analyses of World Fertility Surveys of African countries carried out by Lesthaeghe (1984). The six countries and the survey dates are Cameroon (1978), Ghana (1979), Kenya (1977–78), Lesotho (1977), Senegal (1979), and Sudan (1979). Full citations are provided in the references.

4 The existing version of this model quantifies the proportional fertility-inhibiting effects of four proximate variables: the marriage pattern, contraception, induced abortion, and postpartum infecundability. In the present analysis a fifth proximate variable, pathological sterility, is introduced. Its effect on fertility is measured with an index, \( I_p \), which is estimated from the percent childless among women at the end of the reproductive years \( s \) using the equation \( I_p = (7.63 - 0.11 \times s)/7.30 \). This equation is based on the results of a regression of the total fertility rate on proportion childless presented by Frank (1983a).

References


