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The Fertility Impact of Traditional and Changing Childspacing Practices in Tropical Africa

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Abstract

The childspacing practices of postpartum abstinence and lactation, which are widespread in tropical Africa, prevent conception for prolonged periods following birth. Demographers and policymakers have expressed the concern that fertility will increase as these traditional child-spacing practices are abandoned with urbanization and modernization. In this paper the fertility-enhancing effect of a shorter postpartum infecundable period is quantified with an analytic model. It is demonstrated that a decline in the duration of postpartum infencundability can lead to very substantial increases in fertility in populations with child-spacing patterns typical of tropical Africa and that a high prevalence in contraceptive use is required to offset this rise in fertility. Policy conclusions that can be derived from this analysis are briefly outlined in a concluding section.

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In tropical Africa the large majority of women are not at risk of conceiving for prolonged periods after they have given birth. This postpartum infecundability results from the practice of lactation and postpartum abstinence from sexual relations. While the prevalence and duration of lactation is not very different from that in traditional societies in other parts of the developing world, postpartum abstinence is practiced more widely and for much longer durations than is usually found in areas outside sub-Saharan Africa. Average durations of abstinence exceeding two years have been documented in several populations. The primary reason given by African women for abstinence is their concern for the health of the child. A new pregnancy soon after a child is born will interrupt lactation and remove the child's most important source of nutrients. To assure an adequate period of lactation, sexual relations are typically not resumed until the time the child is to be weaned. In some societies, however, such as among the Yoruba in Nigeria, abstinence lasts significantly longer than lactation.

The existence of the custom of postpartum abstinence has been known to anthropologists for decades, but it has only recently become a focus of interest for demographers and policymakers. This interest is stimulated by a concern with the demographic consequences (i.e., effects on fertility and mortality) of a breakdown of the traditional postpartum taboos as societies or parts thereof undergo modernization. The importance of the fertility-inhibiting effect of postpartum abstinence may be surmised from the fact that women typically abstain for one-third to one-half of their married reproductive lifetimes. Any shortening of the abstinence period could lead to a substantial increase in the levels of completed fertility which are already high (5-8 births per woman). Declines in the durations of abstinence and lactation in urban areas can explain why in some sub-Saharan populations urban fertility is higher than rural fertility, contrary to the usually observed negative

relationship between urbanization and fertility.[1] Although less well documented for Africa, existing biomedical and demographic studies suggest that a shortening of lactation and abstinence periods could have significant deleterious consequences for the breastfed child and its mother. Early interruption of breastfeeding is especially problematic in Africa due to the low nutritional quality of food available to the infant after weaning.

The primary purpose of this paper is to estimate the fertility-inhibiting effect of postpartum infecundability. A general analytic framework for studying the relationship between fertility and its direct determinants—the intermediate fertility variables—will be outlined first. This framework will then be used to make quantitative estimates of the variations in the level of marital fertility that result from changes in the duration of postpartum infecundability, both in the presence and in the absence of contraception.

A Framework for the Analysis of the Intermediate Fertility Variables

The simple mathematical model used in this paper to study the fertility effects of childspacing practices has been described in detail elsewhere.[2] Only a summary of the model and the principal variables and concepts on which it is based will be presented here.

The level of fertility in a population is directly determined by a set of biological and behavioral factors called the intermediate fertility variables[3] or the proximate determinants of fertility. These factors are, in turn, a function of socioeconomic, cultural and environmental variables which are the indirect determinants of fertility:

Indirect determinants		Direct determinants		
Socioeconomic, cultural, environmental variables	→	Intermediate fertility variables	→	Fertility

Our concern here is the quantification of the relationship between the intermediate fertility variables and fertility. In this analysis the following set of eight intermediate fertility variables grouped into three categories will be used:

I. Exposure factors

1. Proportion of reproductive period spent in marriage*

II. Deliberate marital fertility control factors

2. Contraception

3. Induced abortion

III. Natural marital fertility factors

4. Postpartum infecundability

5. Frequency of intercourse

6. Sterility

7. Spontaneous intrauterine mortality

8. Duration of viability of ova and sperm

The meaning of categories I and II are self-evident. Category III requires explanation. As defined by Louis Henry, the term "natural fertility" applies to a population in which couples do not practice deliberate fertility control dependent on the number of children they have.[4] Practices that are independent of parity are considered to be natural fertility factors. An example would be the practice of postpartum abstinence to space births for the benefit of the health of mother and child.

Variations in any of the eight proximate determinants cause changes in fertility. On the individual level, women (couples) typically differ with respect to all of these factors, and, as a result, there are wide variations in the number of births per woman at the end of the reproductive years. On the

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*The term marriage is used here to refer to any stable sexual union.

population level, however, it has been demonstrated that in most populations only the first four intermediate fertility variables (i.e., proportion married, contraception, induced abortion and postpartum infecundability) are of importance in the analysis of fertility changes or trends because the variations in the population averages of the other factors are not large enough to have a substantial impact on fertility differences.[5] This finding considerably simplifies the quantitative model since half of the intermediate fertility variables can be excluded for most applications.

A convenient approach to the analysis of fertility effects of the intermediate fertility variables would be to consider each factor as an inhibitor of fertility. Observed fertility is well below its theoretical maximum as a result of celibacy, the use of contraception and induced abortion, the practice of postpartum abstinence and lactation, the incidence of sterility and spontaneous intrauterine mortality, a moderate frequency of intercourse, and short viable periods of ova and sperm. The magnitude of these fertility-inhibiting effects is clearly demonstrated using a simple numerical example. If all restrictions on fertility are absent, women could bear a child approximately once every ten months. Over a reproductive period of thirty years this would imply a total of 36 children per woman even ignoring confinements resulting in multiple births. No population has even come close to this theoretical level of fertility. In fact, observed population averages are, with very few exceptions, between one and eight births per woman at age 50.

The fertility-inhibiting effects of the intermediate fertility variables are estimated from the levels of fertility in the presence and in the absence of the inhibition caused by each factor. Figure 1 illustrates the results of this exercise. With the inhibiting effects of all intermediate fertility variables present, a population's actual level of fertility is observed as measured by the total fertility rate, TFR. (The total fertility rate and

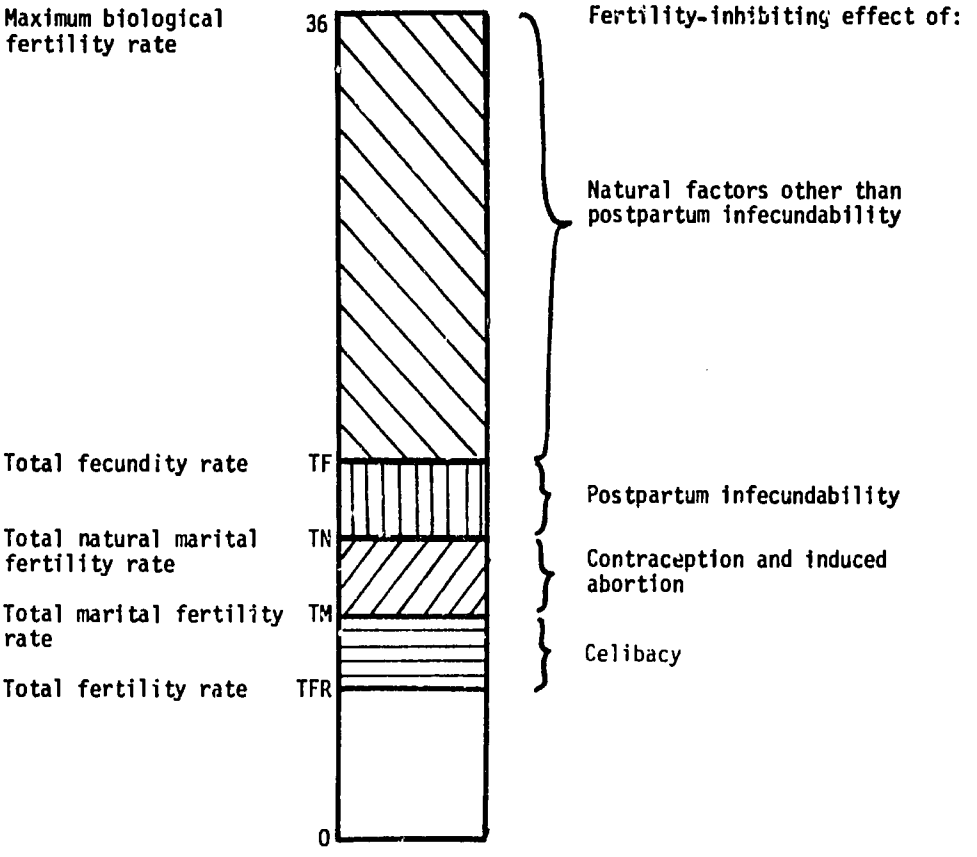

Figure 1: Diagram illustrating the relationships between the fertility-inhibiting effects of intermediate fertility variables and various measures of fertility (in number of births per woman).

other fertility rates discussed in this paper are expressed in births per woman at the end of the reproductive period.) If the fertility-inhibiting effect of celibacy is removed, fertility will increase to a level TM, the total marital fertility rate. If all practice of contraception and induced abortion is also eliminated, fertility will rise further to a level TN, the total natural marital fertility rate. Removing, in addition, the practice of lactation and postpartum abstinence further increases fertility to the total fecundity rate, TF. The difference between TF and the theoretical maximum fertility rate of 36 is determined by the frequency of intercourse, the incidence of sterility and intrauterine mortality, and the durations of the viable periods. While the fertility rates TFR, TM and TN vary widely among populations, the total fecundity rates are virtually the same because the population averages of the last four intermediate fertility variables show relatively little variation. In an earlier study, an estimate of 15.3 was derived for the total fecundity rate, with a standard error of approximately five percent.[6] This estimate should be acceptable in many populations, but adjustments are required in special circumstances—for example, if diseases causing sterility are widespread or if prolonged spousal separations are common.

The fertility impact of the four most important intermediate fertility variables, proportion married, contraception, induced abortion and postpartum infecundability, are measured in the model by four indexes. The indexes can only take values between 0 and 1. When there is no fertility-inhibiting effect of a given intermediate fertility variable, the corresponding index equals one; if the fertility inhibition is complete, the index equals zero. The four indexes are defined as follows:

C_m = index of proportion married (equals 1 in the absence of celibacy and 0 in the absence of marriage)

C_c = index of contraception (equals 1 in the absence of contraception and 0 if all fecund women use 100 percent effective contraception)

C_a = index of induced abortion (equals 1 in the absence of induced abortion and 0 if all pregnancies are aborted)

C_i = index of postpartum infecundability (equals 1 in the absence of lactation and postpartum abstinence and 0 if the duration of infecundability is infinite)

Each index or set of indexes equals the proportionate reduction in fertility it causes:

$$C_m = \frac{TFR}{TM} \quad (1)$$

$$C_c \times C_a = \frac{TM}{TN} \quad (2)$$

$$C_i = \frac{TN}{TF} \quad (3)$$

The indexes can be estimated directly from measures of the intermediate fertility variables with the following equations[7]:

$$C_m = \frac{\Sigma\, m(a) \times g(a)}{\Sigma\, g(a)} \quad (4)$$

$$C_c = 1 - 1.18 \times u \times e \quad (5)$$

$$C_a = \frac{TFR}{TFR + 0.4 \times (1+u) \times TA} \quad (6)$$

$$C_i = \frac{20}{18.5 + i} \quad (7)$$

where

m(a) = age-specific proportions of women currently married

g(a) = age-specific marital fertility rates

u = average proportion of married women currently using contraception

e = average use-effectiveness of contraception *

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*This variable measures the reduction in the monthly probability of conception. For a discussion of the concept of use-effectiveness see (15) and (16).

TA = total induced abortion rate (abortions per woman)

i = mean duration of postpartum infecundability (in months)

With the independent estimates of the indexes derived from these equations, estimates of the different fertility rates can be made, assuming that TF = 15.3:

$$TN = 15.3 \times C_i \quad (8)$$

$$TM = 15.3 \times C_i \times C_c \times C_a \quad (9)$$

$$= TN \times C_c \times C_a$$

$$TFR = 15.3 \times C_i \times C_c \times C_a \times C_m \quad (10)$$

$$= TN \times C_c \times C_a \times C_m$$

$$= TM \times C_m$$

In summary, a typical application of the model outlined here involves three steps: first, estimates of the variables m(a), g(a), u, e, TA and i are obtained (e.g., from survey data); second, the indexes C_m, C_c, C_a and C_i are estimated with the equations (4) to (7); and third, the fertility effect of the indexes is assessed with the aid of equations (8), (9), and (10).

Application of the Analytic Framework to African Populations

The model for the relationship between the intermediate fertility variables and fertility summarized in the previous section will now be applied to the Nigerian city of Ibadan which is one of very few places in Africa for which data on intermediate fertility variables have been published. The levels of intermediate fertility variables and fertility of Ibadan are within the range of values believed to prevail in much of tropical Africa. To allow comparison of this African population with other populations, the model is also applied to the Hutterites (marriages 1921-1930), who show a very high observed fertility level and the U.S. (1973) with a fertility level much below that of the city of Ibadan.

Table 1 presents data on the intermediate fertility variables required for the calculation of the indexes. With equations (4), (5), (6) and (7), the indexes of proportion married, contraception, induced abortion and postpartum infecundability are estimated from these data and the results presented in the upper panel of Table 2. The values of the indexes in Table 2 give a concise summary of the levels of intermediate fertility variables in the three populations:

Index of proportion married, C_m:

- The highest level of proportion married is found in Ibadan, where marriage is early and nearly universal. The proportion married among the Hutterites is less than in Ibadan despite universal marriage because of a higher age at first marriage. The high rate of marital disruptions and a relatively late age at first marriage are the major causes of the low value of this index in the U.S.

Index of contraception, C_c:

- With a prevalence of current contraceptive use near ten percent among married women in Ibadan, the index C_c equals 0.9. The virtual absence of contraception among the Hutterites yields a C_c of 1.0, while in the U.S., where contraceptive use is widespread, C_c equals 0.31.

Index of induced abortion, C_a:

- In the absence of significant use of induced abortion, this index equals 1.0 in Ibadan, as well as in the Hutterite population. In the U.S., with a total abortion rate of 0.13, the index is reduced to 0.95.

Index of postpartum infecundability, C_i:

- This index is lowest in Ibadan City which has a mean duration of postpartum infecundability of about twenty months. But in the U.S., where this period is short (about three months), the index equals 0.93.

From these indexes the total natural marital fertility rate TN, the total marital feritility rate TM, and the total fertility rate TFR can be calculated with equations (8), (9) and (10), under the assumption that the total fecundity rate TF equals 15.3. The results are presented in the bottom panel of Table 2:

Table 1. Estimates of the intermediate fertility variables for Ibadan City 1973 compared with estimates for the Hutterites (marriages 1921-1930) and the United States 1973

Estimates of intermediate fertility variables	Ibadan 1973	Hutterites 1921-1930	United States 1973
1) m(a), age specific proportions married			
15-19	0.39	0.05	0.26
20-24	0.88	0.66	0.54
25-29	0.98	0.92	0.77
30-34	0.97	0.96	0.80
35-39	0.95	1.00	0.82
40-44	0.94	1.00	0.81
45-49	0.84	1.00	-
2) g(a), age specific marital fertility rates			
15-19	N.A.[1]	300	150
20-24		550	199
25-29		502	140
30-34		447	66
35-39		406	25
40-44		222	6
45-49		61	-
3) u, proportion currently using contraception	0.10	0	0.70
4) e, contraceptive effectiveness	0.85[2]	0.9[2]	0.95
5) TA, total induced abortion rate	0	0	0.13
6) i, duration of postpartum infecundability (months)	20	6	3

Sources: see notes 8, 9 and 10.

[1]Age specific marital fertility rates of the Hutterites were used for the calculation of C_m.

[2]Estimated by the author. At low levels of contraceptive use the fertility estimates are rather insensitive to errors in e.

Table 2. Estimates of the Indexes of proportion married, contraception, induced abortion and postpartum infecundability, and the total natural marital fertility rate, the total marital fertility rate and the total fertility rate for Ibadan City, 1973, compared with estimates for the Hutterites (marriages 1921-1930) and the United States 1973.

	Ibadan 1973	Hutterites 1921-1930	United States 1973
A. Estimates of indexes			
Index of proportion married, C_m	0.88	0.79	0.57
Index of contraception, C_c	0.90	1.0	0.22
Index of induced abortion, C_a	1.0	1.0	0.95
Index of postpartum infecundability, C_i	0.52	0.82	0.93
B. Estimates of fertility rates			
Total fecundity rate, TF	15.3	15.3	15.3
Total natural marital fertility rate, $TN = C_i \times TF$	8.0	12.5	14.2
Total marital fertility rate, $TM = C_c \times C_a \times TN$	7.2	12.5	3.0
Total fertility rate, $TFR = C_m \times TM$	6.3	9.9	1.7

Total natural marital fertility rate, TN:

In Ibadan, the long duration of postpartum abstinence produces a large reduction in the natural fertility level, yielding a TN equal to 8, but in the U.S., the total natural marital fertility rate is close to the fecundity rate because the postpartum infecundability period is short.

Total marital fertility rate, TM:

The modest difference between TN and TM in Ibadan reflects the low level of contraceptive use. In the U.S., however, TM is only a fraction of the natural fertility rate due to the high prevalence of contraception.

Total fertility rate, TFR:

The variations in the total fertility rate combine the impact of all the intermediate fertility variables. The highest fertility is found among the Hutterites, a group which does not practice contraception and shows intermediate levels of postpartum infecundability and marriage. Ibadan's fertility is lower than that of the Hutterites primarily because its period of postpartum infecundability is much longer. Despite a short period of postpartum infecundability the TFR of the U.S. is lowest because of the powerful impact of contraception.

The values of TN, TM and TFR given in Table 2 are estimates derived from the model. These estimates can be compared with the following observed rates: Hutterites,[8] TM = 12.4 and TFR = 9.8; Ibadan,[9] TFR = a little over 6; and U.S.,[10] TFR = 1.7. The close agreement between these observed rates and the estimated fertility rates in Table 2 provide an indication of the validity of the model.

The foregoing applications of the model are relatively simple; nevertheless, they require a moderate amount of calculations. In applications where a slight loss of accuracy is acceptable, most of these calculations can be omitted by using Figure 2. This figure represents equations (4) to (10) in graphic form. It allows the graphic estimation of the fertility rates TN, TM and TFR if the values of the intermediate fertility variables or indexes are known. The estimation procedure consists of tracing a pattern (one for each population) through the four quadrants of the figure, starting in the upper

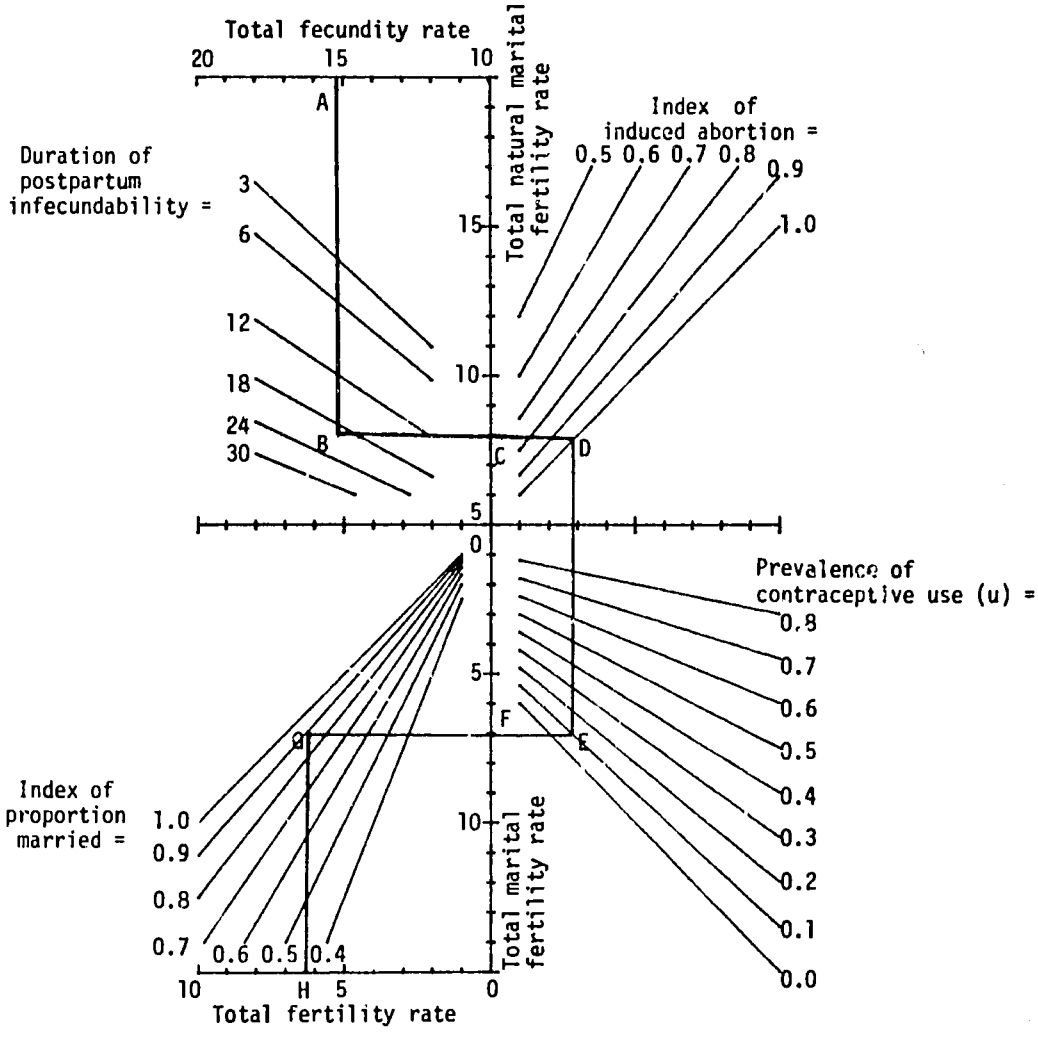

Figure 2. Graphic summary of the model for the interrelationships between intermediate fertility variables and various fertility rates. The case of Ibadan is illustrated with the line A-B-C-D-E-F-G-H. (For further discussion see text.)

left quadrant and ending in the lower left quadrant. To illustrate this procedure, the case of Ibadan is traced with line A-B-C-D-E-F-G-H. The line begins at point A, with the selection of a total fecundity rate (15.3 in this case). From point A, a vertical line is drawn down until the graph is reached that represents the observed duration of postpartum infecundability (i=20). From this point B, a horizontal line is drawn to the right to the appropriate graph in the upper right quadrant (point D), representing the level of the index of induced abortion. The line B-D crosses the main vertical axis of the figure at point C, which gives the estimated level of TN=8. The procedure is continued with the vertical line D-E into the lower right quadrant. Point E is located on the graph for u=0.1, the level of contraceptive use in Ibadan. From point E, the horizontal line to point G crosses the vertical axis of the figure again, now at point F, yielding the estimate of TM=7.2. Finally the vertical line G-H produces an estimate of the total fertility rate, 6.3 in this case. Although this graphic procedure allows quick estimation of the various fertility rates, it still requires the calculation of the indexes C_m and C_a, and of C_c in case e is not equal to 0.85 (the values of u given in the lower right quadrant apply only if e=0.85).

Fertility Impact of Changes in Postpartum Infecundability

In this section, the role of variations in the duration of postpartum infecundability will be analyzed further. To simplify this task only the effects on marital fertility will be studied so that any confounding influences of changes in proportion married can be ignored. In addition, since abortion is not considered an acceptable form of birth control in tropical Africa,[11] it will be assumed absent.

A decrease in the period of postpartum infecundability causes an increase in marital fertility if no compensating changes in the other intermediate fertility variables (i.e., contraception) take place. Quantitative

estimates of this increase in marital fertility are easily obtained from the index of postpartum infecundability because the index equals the proportionate reduction in fertility that is the consequence of postpartum infecundability. A shortening of the postpartum infecundability interval i results in an increase in the index C_i (as can be seen from equation 7), and a corresponding rise in natural marital fertility. Assuming no variations in contraceptive practice, any proportional changes in natural marital fertility lead to the same proportional changes in marital fertility.

The exact magnitude of the change in marital fertility does not only depend on the extent of the change in the period of postpartum infecundability, but also on the absolute duration of this period, as is demonstrated in Figure 3, which summarizes the relationships among these variables. The number of months of decline in the postpartum infecundability interval is plotted along the horizontal axis. The vertical axis gives the percent increase in natural marital fertility resulting from this decline. (This percentage increase also applies to the marital fertility level and to the total fertility rate if all other intermediate fertility variables remain constant.) Four graphs are plotted, representing different durations of the postpartum infecundability period before the decline. It is clear from the figure that the increase in marital fertility is positively related to the magnitude of the decline in the interval and is negatively related to the absolute duration of i. Large increases in natural marital fertility ranging from about 30 to 50 percent can be obtained for a twelve-month reduction in the duration of postpartum infecundability. Table 3 contains the same information as Figure 3 and allows direct estimation of marital fertility changes in specific populations or subpopulations (with linear interpolation as needed). For example, in a population in which the postpartum infecundability interval is eighteen months, a decline of nine months would produce an increase in marital fertility of approximately 32.7 percent according to Table 3.

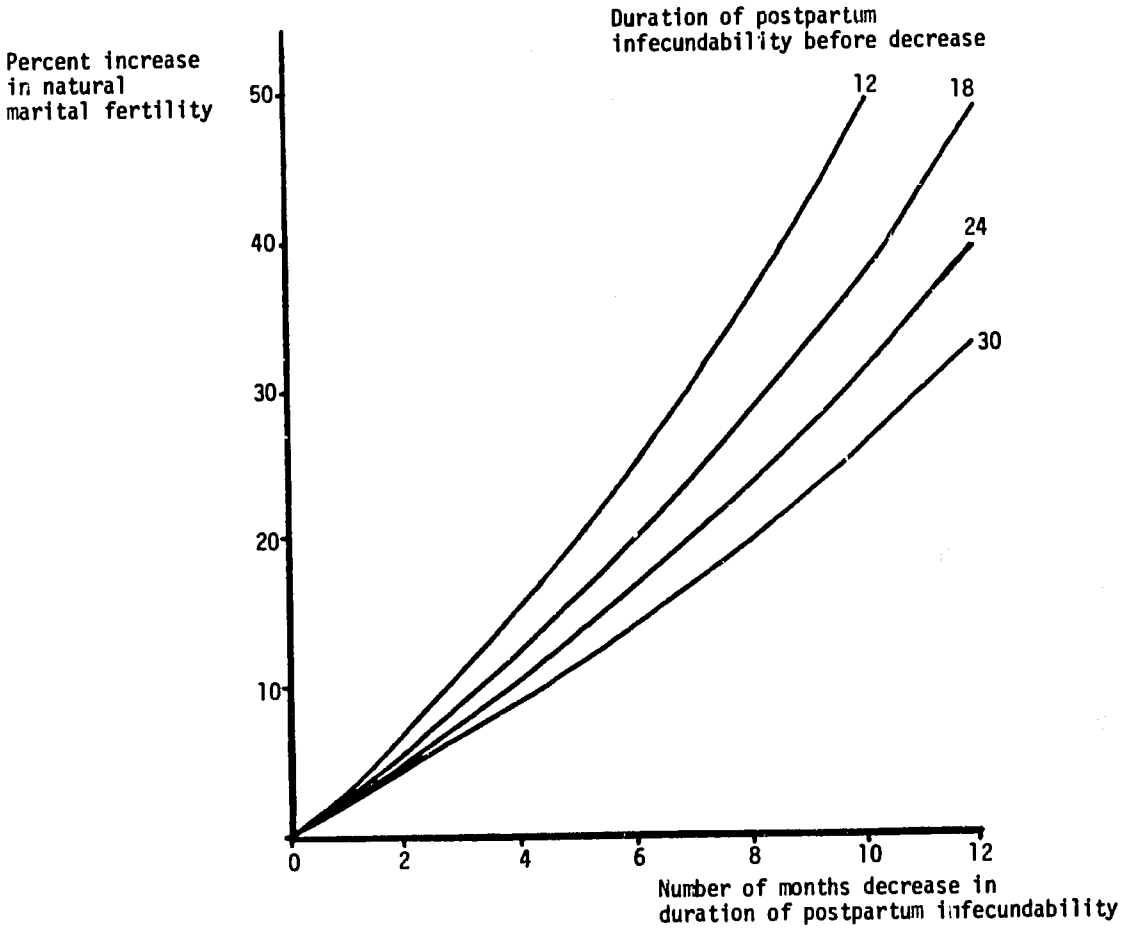

Figure 3. Estimated percent increase in natural marital fertility following a decrease in the duration of postpartum infecundability.

Table 3. Estimated percent increase in natural marital fertility following a decrease in the duration of postpartum infecundability, by duration of infecundability before the decrease

Decrease in duration of postpartum infecundability (in months)	Duration of postpartum infecundability before decrease (in months)			
	12	18	24	30
3	10.8	8.9	7.4	6.8
6	24.4	19.7	16.3	14.3
9	41.8	32.7	26.8	22.8
12	52.4	48.9	39.3	33.0

The validity of this last estimate can be put to a test with data from Senegal. Figure 4 presents the relationship between the duration of lactation and the mean birth interval as observed in Senegal.[12] The strong fertility-inhibiting effect of lactation is clearly present; the birth interval more than doubles in length as the lactation period increases from 0 to 36 months. Through extrapolation the mean birth interval in the absence of postpartum infecundability is estimated at 17 months.[13] For each duration of lactation the difference between this 17-month interval and the observed birth interval gives an estimate of the duration of postpartum infecundability, thus allowing the estimation of the fertility impact of changes in the duration of infecundability. For example, when i=18 months, the mean birth interval equals 35 months (point B in Figure 4), while for i=9 months, the mean birth interval is 26 months (point A in Figure 4), representing a 25.7 percent decline. With an inverse relationship between the mean birth interval and fertility, this 25.7 percent decline yields a 34.6 percent increase in fertility which agrees well with the 32.7 percent change in marital fertility calculated earlier (from Table 3) for a nine-month decrease in i.

In the discussion up to this point the term postpartum infecundability has been used in a general way to refer to the period after a birth when a woman is not at risk of conceiving. No attempt has been or will be made here to separately analyze the determinants of postpartum infecundability (i.e., lactational amenorrhea or abstinence). This issue has been addressed in a study by Adegbola and Page[14] who divide the index C_i into two subindexes, one (C_{amen}) representing the fertility impact of lactational amenorrhea and the other (C_{abst}) giving the impact of prolonged abstinence. They estimate the former as 20/(18.5 + amen), where amen is the mean duration of amenorrhea, and the latter as (18.5 + amen)/(18.5 + amen + abst) where abst is the mean number of

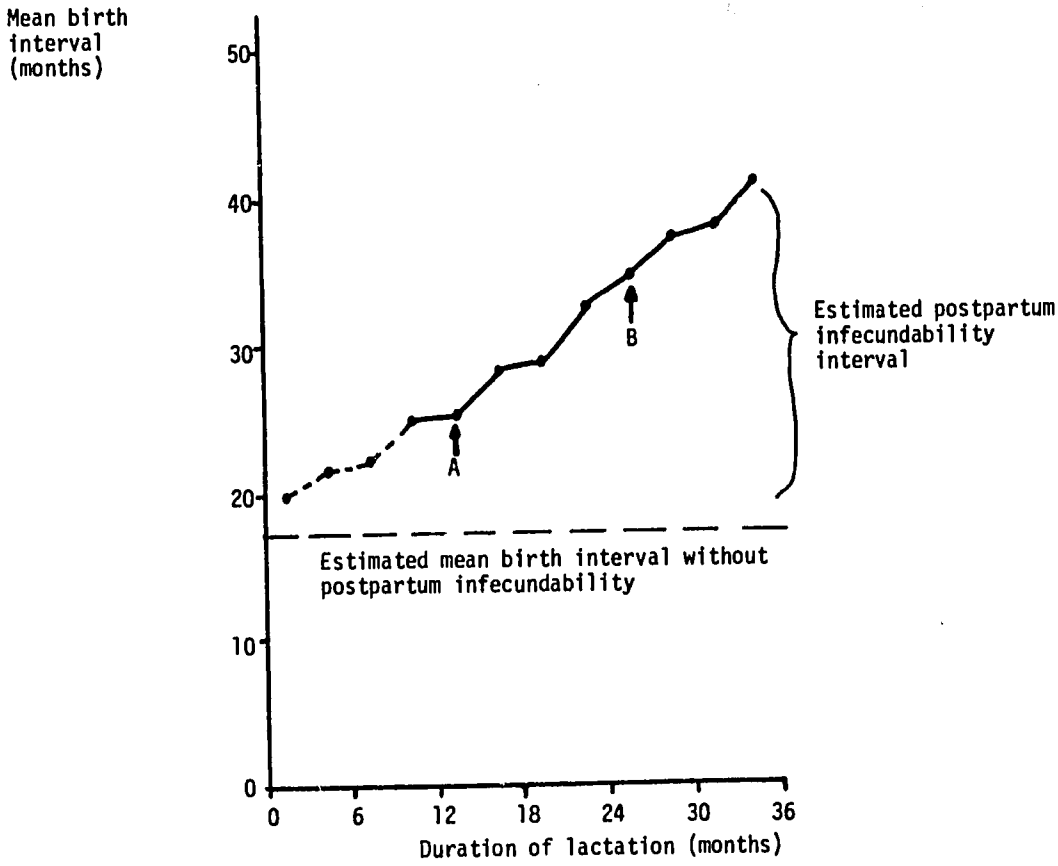

Figure 4. Mean birth interval by duration of lactation as observed in Senegal. (The dashed part of this graph gives the mean birth interval by the age at death of infants.)

Source: See note 12.

months by which abstinence exceeds amenorrhea. It then follows that $C_i = C_{amen} \times C_{abst}$. This breakdown of the overall effect of postpartum infecundability into its two determining components is particularly valuable in tropical Africa where the period of abstinence in many cases is substantially longer than the amenorrhea interval.

A topic often studied in conjunction with changes in postpartum infecundability is the impact of variations in infant mortality. The duration of the interval i used in the above analyses is an average of all periods of postpartum infecundability, including those in which the infant dies early. Since an early infant death interrupts the period of abstinence or lactation, a decrease in infant and early child mortality results in a lengthening of the average interval i. This, in turn, decreases marital fertility. The exact calculation of the impact of changes in infant mortality is difficult, but the following simple procedure yields a good approximation.

Define:

i_e = mean duration of postpartum infecundability if the child survives.

i_d = mean duration of postpartum infecundability among women who experience an infant death during the infecundable period.

d = proportion of all births that result in a death while the mother is still infecundable.

In that case:

$$i = i_d \times d + i_e \times (1-d) \qquad (11)$$

That is, the mean interval i is the weighted average of the intervals i_d and i_e. If we further define the shortening in the average postpartum infecundable interval due to infant and child mortality as S, then $S = i_e - i$. Equation (11) can now be rewritten to yield:

$$S = d(i_e - i_d) \qquad (12)$$

From this equation the impact of changes in infant and early child mortality rate, d, are easily estimated. For example, if in a population, i_e=21 and i_d=6, then S, the shortening of the postpartum infecundable interval, equals 3 months if d=0.2. Cutting infant and early child mortality in half, i.e., changing d from 0.2 to 0.1, reduces S from 3 to 1.5 months. In other words, this large (50 percent) reduction in infant and child mortality lengthened the average postpartum interval by only 1.5 months. Using Table 3, it can further be estimated that this increase in i produces only about a 4 percent decrease in marital fertility. From this and other examples with variable levels in the range observed in tropical Africa, it can be concluded that large changes in infant and early child mortality result in only rather small changes in marital fertility (assuming that the only effect on fertility operates through the truncation of i).

The Combined Impact of Contraception and Postpartum Infecundability

If variations in the prevalence of contraceptive use are introduced in addition to the variations in the duration of postpartum infecundability already studied, the analysis becomes somewhat more complex since there are now two intermediate fertility variables that influence marital fertility (induced abortion is again ignored). The marital fertility level associated with different combinations of these two intermediate fertility variables are calculated with equation (9). It is assumed that contraceptors and noncontraceptors have the same mean duration of infecundability. The results are presented in Table 4 and Figure 5 (solid lines). As expected, the total marital fertility rate has a wide range and is negatively related to the prevalence of contraceptive use and to the duration of postpartum infecundability. An increase in u from 0 to 0.50 reduces marital fertility by 50 percent for all durations of infecundability, and a shortening of i from 24 to 3 months doubles marital fertility independent of the level of contraceptive use.

Table 4. Estimated total marital fertility rate[1] as a function of the duration of postpartum infecundability and the prevalence of contraceptive use

Duration of postpartum infecundability (in months)	Prevalence of contraceptive use[2]					
	u = 0.0	u = 0.1	u = 0.2	u = 0.3	u = 0.4	u = 0.5
3	14.2	12.8	11.4	10.0	8.5	7.1
6	12.5	11.2	10.0	8.7	7.5	6.2
9	11.1	10.0	8.9	7.8	6.7	5.6
12	10.0	9.0	8.0	7.0	6.0	5.0
15	9.1	8.2	7.3	6.4	5.5	4.6
18	8.4	7.5	6.7	5.9	5.0	4.2
21	7.7	7.0	6.2	5.4	4.6	3.9
24	7.2	6.5	5.8	5.0	4.3	3.6
27	6.7	6.1	5.4	4.7	4.0	3.4
30	6.3	5.7	5.0	4.4	3.8	3.2

[1]Total fertility rates can be calculated from this table by multiplying the total marital fertility rates by the index of proportion married.

[2]Contraceptive effectiveness is assumed to equal 0.85.

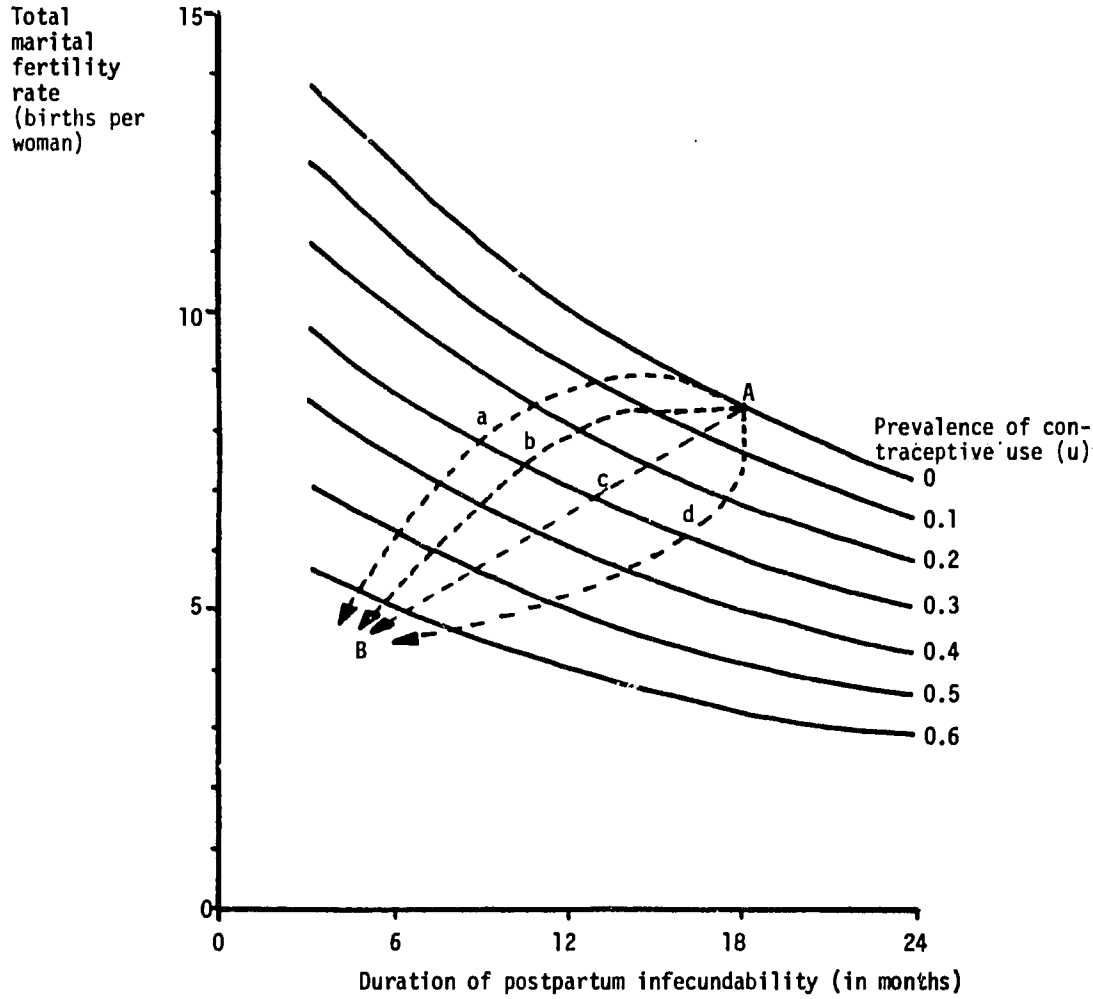

Figure 5. Total marital fertility rate as a function of the duration of postpartum infecundability and the prevalence of contraceptive use, u. (For further discussion see text.)

(Total fertility rates corresponding to the total marital fertility rates presented in Table 4 can be obtained through multiplying by the index of proportion married, C_m.)

During the course of demographic transition, a population's marital fertility declines. This decline is usually accompanied by large increases in contraceptive use and a shortening of the postpartum infecundability interval. In Figure 5, this transition is represented by a move from a point in the upper right corner to a point in the lower left corner. As an example, the transition from point A (TM=8.4, u=0, i=18) to point B will now be considered, with emphasis on the processes in the early phase of the transition. In Figure 5, four types of possible transition paths from A to B are plotted.

—Path a: The first part of this path follows the graph u=0, because only the duration of postpartum infecundability is assumed to change. The result is a temporary increase in marital fertility. Later in the transition, marital fertility declines as contraceptive use increases.

—Path b: The initial phase of this transition is characterized by a decline in postpartum infecundability accompanied by a compensatory rise in contraceptive use, resulting in a constant marital fertility level during this period.

—Path c: The prevalence of contraception, the duration of postpartum infecundability and the level of marital fertility all change gradually throughout this transition.

—Path d: In this case, no change takes place initially in the duration of postpartum infecundability, so that the entire early decline in marital fertilty is attributable to the increase in contraceptive use.

It is clear from these examples that not all demographic transitions necessarily have a continuous decline in marital fertility. A temporary increase in marital fertility early in the transition is possible if contraceptive use does not increase rapidly enough to offset the positive fertility effect of a decline in the practices of lactation or postpartum abstinence. The amount of contraceptive use needed to compensate for a shortening of the postpartum infecundability interval can be estimated from Table 4. For example, a population with pretransition levels of u=0 and i=18 would have a total

marital rate of approximately 8.4 according to Table 4. If, in this population, the duration of postpartum infecundability were shortened to 9 months, 25 percent all women of reproductive age would have to be using contraception (u=0.25) to prevent a rise in marital fertility.

The preceding analysis indicates that postpartum infecundability, caused by the traditional African childspacing practices of lactation and postpartum abstinence, is a powerful inhibitor of fertility. In tropical Africa average periods of postpartum infecundability ranging from two to two and a half years are common. In a population with an infecundability interval of two years, fertility can be expected to rise 40 percent if this period is reduced to one year, and 75 percent if infecundability is reduced to a half year. It is likely that in the coming decades the traditionally very long periods of postpartum sexual abstinence and lactation will be shortened, especially in the urban areas, as the process of westernization and modernization proceeds. There is, as a consequence, the potential for substantial increases in marital fertility which can be reduced or eliminated only by compensatory increases in contraceptive use (or induced abortion, a much less attractive alternative). In a number of urban areas in Africa contraceptive use is indeed on the rise, but fertility is still high and it is unclear (for lack of data) whether fertility is being reduced. The calculations in the preceeding sections, summarized in Table 4, show that large increases in the prevalence of contraceptive use are required to counteract the fertility-enhancing potential of decreasing postpartum infecundability. For example, the prevalence of contraceptive use would have to rise from 0 to nearly 30 percent just to prevent an increase in marital fertility in a population in which the duration of the postpartum infecundability is shortened from two to one year.

If an increase in the rate of population growth (which may be already very rapid) is not socially desirable and/or if earlier patterns of childspacing

(as distinct from the means through which they were achieved) are not to be abandoned because of potential deleterious effects on the health of mother and child, two important policy implications follow from this discussion. First, attempts should be made to discourage--prevent or delay—the abandonment of the traditional child-spacing practices of lactation and postpartum sexual abstinence and, second, public policy should insure the rapid spread of knowledge about and access to contraception, not only as a means to assure satisfaction of family limitation desires, but also as an alternative means for obtaining the desired spacing between births. In fact, it is likely that in many African situations the latter rationale for the use of contraception is by far the most important one, both on the societal and the individual level.

The preceding analysis also has clear implications for demographic research in tropical Africa. Since the importance of postpartum infecundability as a determinant of fertility can now be considered well established, future fertility studies should include an analysis of the practices of postpartum abstinence and lactation and their impact on fertility. Increased efforts should be made to obtain more detailed information (e.g., from demographic surveys) about the prevalence and duration of postpartum abstinence and lactation in different populations in tropical Africa.

NOTES

[1]O. Adegbola, M. Page, and R, Lesthaeghe, "Breastfeeding and Postpartum Abstinence in Metropolitan Lagos," paper presented at the annual meeting of the Population Association of America, 1977.

[2]J. Bongaarts, "A Framework for Analyzing the Proximate Determinants of Fertility," Population and Development Review 4, no. 1:105-132.

[3]K. Davis and J. Blake, "Social Structure and Fertility: An Analytic Framework," Economic Development and Cultural Change 4, no. 4:211-235.

[4]L. Henry, "Some Data on Natural Fertility," Eugenics Quarterly 8, no. 1:81-91.

[5]See note 1.

[6]See note 1.

[7]See note 1.

[8]J. Eaton and A. Mayer, Man's Capacity to Reproduce: The Demography of a Unique Population, Glencoe, Illinois: Free Press, 1954.

[9]J. Caldwell and P. Caldwell, "The Role of Marital Sexual Abstinence in Determining Fertility: A Study of the Yoruba in Nigeria," Population Studies 31, no. 2:193-217.

[10]See note 1.

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[12]P. Cantrell and H. Leridon, "Breastfeeding, Mortality in Childhood and Fertility in a Rural Zone of Senegal," Population Studies 25, no. 3:505-533.

[13]See note 12.

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[16]C. Tietze, "Effectiveness of Contraceptive Methods," in E. Diczfelnsy and U. Borell (eds.), Control of Human Fertility, (Proceedings of the 15th Nobel Symposium, Lidingo, Sweden, 1970), New York: Wiley, 1971.

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