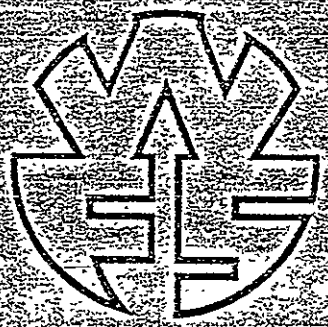
WORLD FERTILITY SURVEY CONFERENCE



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SOCIO-BIOLOGICAL FACTORS IN EXPOSURE TO CHILD-BEARING: BREASTFEEDING AND ITS FERTILITY EFFECTS

by

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I. INTRODUCTION

Fertility is directly influenced by a set of sociobiological factors. These factors are often called intermediate fertility variables (Davis and Blake 1956) because they are in turn influenced by various economic, social, cultural, and environmental variables (which are the indirect or background determinants of fertility). A recent study of the fertility effects of the intermediate fertility variables has demonstrated that nearly all variance in the fertility levels of populations are due to differences in just four factors: (1) the proportions married among females; (2) the prevalence of contraceptive use; (3) the incidence of induced abortion and (4) the fertility inhibiting effect of breastfeeding (Bongaarts 1980). The first two of these variables are covered in other papers presented at this conference. Questions about the incidence of induced abortion were not included in the World Fertility Surveys. The remaining factor, breastfeeding, will be analyzed in this paper.

The importance of breastfeeding in regulating individual fertility behavior has been a matter of interest for many years. The lack of availability of uniform data for more than one country has, so far, limited the scope of the cross-cultural analysis of breastfeeding and its determinants. The data generated through the World Fertility Survey provide us with a unique opportunity to understand the behavior of women with respect to breastfeeding and its influence on fertility on a cross-cultural comparative basis. This paper will address the following questions:

1. What is the prevalence and duration of breastfeeding?

2. Is the preference for male children supported by differential breastfeeding patterns for male and female children?

3. How does the duration of breastfeeding vary among different subgroups classified by age, parity, women's education, residence etc.?

4. What are the key determinants of breastfeeding?

5. Do women use breastfeeding deliberately to space or limit the number of children?

6. What is the effect of breastfeeding on fertility?

II. THE DATA

The data for this study are taken from the core questionnaires of the World Fertility Surveys conducted around 1976 in eight countries: Bangladesh, Indonesia, Sri Lanka, Jordan, Peru, Guyana, Colombia, and Panama. Data tapes for these countries were made available to the authors, and SPSS and other special programs written by Robert Sendek were used in this analysis. The limited data on breastfeeding included in the First Country Reports are not comparable to the information presented here and, therefore, are not included in this paper.

Information on the prevalence and duration of breastfeeding were collected for the two live births immediately preceeding the interview. Among currently pregnant women, breastfeeding data for the next to the last birth were not available. Only data for the last-but-one live birth are used here for studying the determinants of breastfeeding and its influence on fertility. This is done because the interview truncated the women's reproductive history, and the information about breastfeeding in the open birth interval was not complete. We have, however, used this information to estimate the mean and median duration of breastfeeding in the open birth interval (see Appendix).

The unavailability of data for some women made it necessary to limit analysis to women who were married at interview, had two or more live births, had reported the duration of breastfeeding, were not pregnant at interview, and had their last-but-one live birth between three and fifteen years preceeding the date of interview. The last restriction is used to minimize the effects of truncation and memory biases on the reported duration of breastfeeding and the length of the birth interval. It would have been preferable to further restrict this period to perhaps 3-8 years, but that would have further reduced the number of women included in the analysis. With the current restrictions, the analysis based on the information about the last-but-one live birth refers to 28 percent of women included in the original surveys in Guyana and Colombia; 42 percent in Bangladesh, Indonesia, Jordan, and Panama; and 49 percent in Peru and Sri Lanka. This limited sample will be referred to as all women in the rest of this paper.

The effect of breastfeeding on fertility is measured by using the last closed birth interval as the proxy for the fertility level. The last closed birth interval is defined as the period in months between the last-but-one live birth and the last live birth preceeding the interview. Since, the World Fertility Surveys did not collect information about the date of resumption of menstruation, this study can not analyze the mechanisms through which breastfeeding affects the length of the birth interval.

The results presented below are necessarily influenced by the biases associated with the retrospective nature of the data collection. The magnitude of the bias in reporting the duration of breastfeeding is likely to differ from country to country and from one subgroup to another within the same country. There is a strong tendency to report the duration of breastfeeding in multiples of six months in all countries. In the absence of any such tendency, one-sixth or about 16 percent of the women are likely

to report the duration of breastfeeding in multiples of six months. In comparison, this percentage is about 34 in Panama and Colombia; 45 percent in Guyana, Peru, and Jordan; about 60 percent in Sri Lanka and Indonesia; and about 86 percent in Bangladesh. There may be cultural preferences or norms to breastfeed a child for twelve or twenty four months. In that case, the difference between the observed and the expected percent of women who reported the duration of breastfeeding in multiples of six months can not be attributed entirely to the digital preferences. Allowing for some cultural preferences, the bias in reporting the months of breastfeeding does not seem to be serious in Panama and Colombia, whereas it is quite considerable in Bangladesh, Indonesia, and Sri Lanka. The differences in the percent distribution of women by months of breastfeeding reflect the variations in the reporting biases (see Figure 1). Given the magnitude of the bias, we did not estimate the duration of breastfeeding by year of birth of the child, and did not estimate the time-trends in prevalence or duration of breastfeeding.

The eight countries included in this study are not a random selection of countries and, therefore, the result of this study can not necessarily be generalized. Some of the findings may need to be modified as similar studies for other countries become available. No African country could be included, but the eight countries are quite heterogeneous in many respects, for example, geographic area, religion, culture, fertility, and level of development.

In Table 1 we show the percentage distributions of all women by selected social and demographic factors (Table 2 shows similar information for nonusers of contraception). The composition of women differ markedly from country to country. For example, 77 percent of all women in Bangladesh had no education in comparison to only 4 percent in Guyana; 78 percent of all women in Bangladesh lived in rural areas as compared to 31 percent in

Jordan; and about 85 percent of the women in Bangladesh and Jordan were classified as "did not work" since marriage as compared to 35 percent in Indonesia and Peru. The differences between countries in the composition of women with respect to the social factors are more pronounced than those in regard to the demographic factors. The effects of these differences on the duration of breastfeeding will be studied in a later section.

III. PREVALENCE AND DURATION OF BREASTFEEDING

Table 3 shows various indices measuring the prevalence and the duration of breastfeeding. These indices are separately shown for the last live birth (open birth interval) and for the last-but-one live birth (the last closed birth interval). Countries are arranged in the decreasing order according to the average duration of breastfeeding for the closed birth interval.

In all the eight countries, a large majority of women breastfed their last as well as their last-but-one child. Women who did not breastfeed their last child ranged from 2 percent in Bangladesh to 18 percent in Panama.

In all countries, the average duration of breastfeeding for the last child is higher than the corresponding average for the last-but-one child. The difference between the two averages is unlikely to be caused by an increase in the duration of breastfeeding over time. It is more likely to reflect the biases in reporting the duration of breastfeeding in the closed birth interval, and to some extent an improvement in infant mortality and perhaps differences in samples.

There is a great deal of variation between countries with respect to the duration of breastfeeding. Women in Bangladesh breastfed their last child for about 29 months in comparison to about 9 months in Panama (24 vs. 8 months for the last-but-one child). The longer duration of breastfeeding

in Bangladesh is also reflected by the fact that 61 percent of these women reported to be breastfeeding their last child at interview in comparison to only 15 percent in Panama.

IV. DETERMINANTS OF BREASTFEEDING

A. Influence of Sex and Survival Status of Last-But-One Live Birth

In Table 4, we show the average duration of breastfeeding by (1) sex of the last-but-one child, (2) whether or not s/he survived until the interview, and (3) the use of contraception in the last closed birth interval.

It is believed that in some developing countries, female children are neglected because of a strong preference for male children. If it exists, one would expect that this neglect results in shorter breastfeeding and higher infant and child mortality among females. Results presented in Table 4 do not support this hypothesis. The average duration of breastfeeding for male children is about the same as for female children in all the eight countries. There was also no sex differential in the average duration of breastfeeding for those children who survived up to the time of interview (results not shown here). These children were at least three years old at the time of interview. Any sex differentials in child care practices beyond breastfeeding are of course not reflected in these results.

Death of a child curtails the period of breastfeeding. Results presented in Table 4 confirm this hypothesis. The average duration of breastfeeding for those who died in infancy was much shorter than those who died at a later age or those who were alive at the time of interview. In all countries except Colombia, the reported duration of breastfeeding is not consistent with the reported age at death for those who died at age 0 month. This inconsistency reflects reporting error and is especially serious

in Bangladesh and Jordan. For children who were alive at interview, the average duration of breastfeeding is slightly higher than the corresponding averages for all children.

B. Use of Contraception

The reported use of contraception during the last closed birth interval varies from 6 percent in Bangladesh to 40 percent in Panama. Among women who did not use contraception, the average duration of breastfeeding varies from 10 months in Panama, Colombia and Guyana to 24 months in Bangladesh. The average duration of breastfeeding among those who used contraception is generally lower than among those who did not use contraception during the last closed birth interval. This relationship between use of contraception and duration of breastfeeding will be explored in more detail later on.

C. Influence of Age and Parity

In earlier studies, mother's age has been found to have a positive influence on the duration of breastfeeding. (For example, see Jain et. al., 1970, for Taiwan; Potter et. al., 1965, for Punjab, India; Chen et. al., 1974, for women in Bangladesh.) If breastfeeding is used deliberately to limit family size, its duration should be affected by the number of children already born (see Henry, 1961). For Taiwanese women, however, Jain et. al. (1970) found that in a multiple regression analysis, women's parity did not have any significant effect on the duration of breastfeeding after controlling for the effects of such factors as women's age, education and place of residence.

For the eight countries included in this analysis, the effect of age and parity is not important (age is measured at the beginning of the closed

birth interval). There is no consistent pattern, i.e., the direction as well as the magnitude of these effects depend upon the country of residence. Mother's age and parity, among those who did not use contraception, explain less than one percent of the variation in the duration of breastfeeding in Indonesia, Sri Lanka, Jordan, and Guyana. It is about 2 percent in Bangladesh, Peru and Colombia. Only in Panama is the percent variation explained by age and parity slightly more than 5 percent (Panel II, Table 5). The partial regression coefficients indicate that the net effect of mother's age on the duration of breastfeeding, among those who did not use contraception, is not statistically significant for Guyana and Panama. In Sri Lanka, the net effect of age is negative whereas in the remaining five countries the net effect of age is positive. In all countries, however, the net effect of age on the duration of breastfeeding is small. For example, in Bangladesh, about three years increase in mother's age adds about one month to the duration of breastfeeding, and in Peru, about 8 years increase in mother's age adds about one month to the duration of breastfeeding. The net effect of parity, on the other hand, is not statistically significant in Jordan, Peru and Colombia; it is negative in Bangladesh and Indonesia, and it is positive in the remaining three countries—Sri Lanka, Guyana, and Panama.

The results of Multiple Classification Analysis are shown in Tables 6 and 7. The category means are expressed as deviations from the grand mean. The unadjusted deviations indicate the gross effect and the adjusted deviations indicate the net effects. The magnitudes of adjusted deviations are again very small. For example, the difference in adjusted deviations between any two consecutive categories of age rarely exceeds two months. The maximum difference between any two categories is about four months. The results presented so far indicate that the duration of breastfeeding is

virtually independent of parity. It is therefore likely that breastfeeding in these eight countries is not used deliberately to limit family size.

D. Influence of Social Factors

Four social factors included in this study are: mother's education, place of residence, her work place since marriage, and husband's occupation. The results are shown in Tables 8, 9, 10, and 11. Except in Table 9, the net effect of any one of the four social factors is the effect of that social factor (for example education) on the duration of breastfeeding after adjusting the effects of the remaining three social factors (residence, work place, and husband's occupation) and two demographic factors - age and parity.

1. Education and Residence

In all eight countries, education and urban residence is associated with a shorter duration of breastfeeding. A similar result was obtained for the Taiwanese women (see Jain et. al., 1970). The adjusted deviations in Table 8 show that the difference in the average duration of breastfeeding between women with no education and those with at least 7 years of schooling (secondary +) is from 4 to 6 months for all countries except Sri Lanka, where the difference is about two months. The difference between the rural and urban areas, on the other hand, is of the order of two to four months, except in Colombia, where the difference is less than one-half month.

In Table 9, we show the average duration of breastfeeding by mother's education separately for rural and urban areas. It can be seen that both the place of residence and education have independent negative effect on the duration of breastfeeding. The average duration of breastfeeding is longest for women who have no education and live in rural areas, and it is shortest

for those who live in urban areas and have at least seven years of schooling. The remaining women fall in between these two extremes.

2. Women's Work Place Since Marriage

The variable measuring women's work place since marriage has been classified by WFS into five categories. This standard classification combines two dimensions of work place: (1) farm vs. non-farm; and (2) home vs. outside the home. However, there must have been considerable variation across countries in the definition or interpretation of "work", because the percent of women who were classified in the "did not work" category varies in an implausable way across countries: about 35 percent in Peru and Indonesia; between 51-62 percent in Guyana, Panama, Colombia, and Sri Lanka; and about 87 percent in Jordan and Bangladesh (see Table 1). If modernization implies a decrease in the duration of breastfeeding (as indicated by the effects of mother's education and place of residence) then one would expect that women who worked away from home in non-farm setting would have the shortest duration of breastfeeding and those who worked at family farm would have the longest duration of breastfeeding. However, the net effects, shown in Table 10, indicate that the independent effect of the work status or the place of work on the duration of breastfeeding is very small. We can not ascertain whether this lack of effect is real or it is due to some problems in the definition or the interpretation of "work" and "the place of work."

3. Husband's Occupation

We have regrouped 8-10 standard WFS categories of husband's occupation into five categories as shown in Table 11. Among these, the first four categories are of particular interest. These four categories in general can

be arranged in increasing order according to the observed average duration of breastfeeding: (1) Professional and Clerical, (2) Sales and Services, (3) Skilled and Manual, and (4) Farmers and Agricultural. The unadjusted deviations show that the observed differences between the average duration of breastfeeding for women whose husband's occupation fell in the first and the fourth category is about 4 to 7 months. A large proportion of the differences is accounted for by the association between husband's occupation and wife's characteristics such as her education. (The adjusted deviations are much smaller than the unadjusted deviation.) Nevertheless, husband's occupation seems to have a consistent independent effect on the breastfeeding behavior of the women in these countries.

D. Multiple Regression Analysis

The effects of seven demographic and social factors on the duration of breastfeeding are summarized in Table 12 by using multiple regression analysis. Two multiple regression equations are shown: one for all women and another only for those who did not use contraception during the closed birth interval. Mother's age is measured in single years and parity in single number of live births. The remaining factors are included as dummy variables. (Infant death is assigned a value of one if the child died before reaching age one year, it is assigned the value zero otherwise. Seven years or more of schooling is assigned a value of one and 0-6 years of schooling is assigned the value zero. Living in urban areas is assigned a value of one and living in rural areas is assigned the value zero. The male child is assigned a value of one and the female child is assigned the value zero. "Work" since marriage is assigned a value of one and "did not work" is assigned the value of zero. Women who did not breastfeed are assigned the value zero for breastfeeding.)

A simple additive model without any interaction term is used. The relationship between duration of breastfeeding and social and demographic factors is expressed in terms of a constant (intercept), a series of partial regression coefficients, and an error term. The results of the multiple regression analysis are shown in Table 12. The salient features are these:

1. The percent variation in the duration of breastfeeding explained by the seven factors varies from about 4-5 percent in Guyana and Bangladesh to about 27 percent in Peru and 31 percent in Indonesia.

2. In all countries, the duration of breastfeeding is shortened if the child dies before reaching one year of age. This is shown by the negative partial regression coefficient for infant death.

3. In all countries, women with higher education or those who live in urban areas breastfed their children for shorter periods than others. This is shown by the negative partial regression coefficients for education and residence.

4. In all countries, the sex of the child does not imply differential lengths of breastfeeding even after adjusting for the effects of the other six factors. The partial regression coefficients for the sex of the child indicate that the differences in breastfeeding between male and female children are less than one month and are not statistically significant.

5. Whether or not women worked since marriage does not have an important effect on the duration of breastfeeding.

6. As reported earlier, mother's age and parity do not show consistent effects on the duration of breastfeeding. The partial

regression coefficients are either not significant statistically or their magnitudes are small in comparison to the effects of social factors such as education and residence.

F. Influence of Social and Demographic Composition on Differential Breastfeeding

To what extent can the variations in breastfeeding between countries be explained by differences in social and demographic composition of women? To answer this question, we have selected wife's education, residence, and husband's occupation, the three most important determinants of breastfeeding. We have shown earlier that differences in the use of contraception, and differences in infant and child death do not explain the differences in the average duration of breastfeeding between the eight countries included in this study. This was indicated by the fact that the country specific average duration of breastfeeding varied to a great extent even among women who did not use any contraception or among women whose child was alive at interview—at least three years after his/her birth. We have also shown that mother's age, parity, the work place, or sex of the child do not make a significant difference in the duration of breastfeeding. This leaves mother's education, her place of residence, and husband's occupation.

The following table compares the observed average duration of breastfeeding for each country with the estimated averages. The estimated values for each country are obtained by using the education-residence or husband's occupation specific averages for that country and a common distribution of women which was obtained by taking the average for all the eight countries. With few exceptions, the estimated average durations of breastfeeding are within one month of the observed averages. These comparisons clearly show that the observed differences between countries in the average duration of

breastfeeding can not be accounted for by the differences in the social and demographic composition of women.

AVERAGE DURATION OF BREASTFEEDING - OBSERVED & ESTIMATED

Average Duration of Breastfeeding	Bangla-desh	Indo-nesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
Observed	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
Estimated: Education and Residence	22.2	17.7	15.8	13.0	12.8	11.3	9.6	10.4
Husband's Occupation	23.4	18.4	15.5	13.8	11.6	10.0	8.6	9.1

V. INFLUENCE OF BREASTFEEDING ON FERTILITY

The effect of breastfeeding on fertility is suggested by a number of existing studies in which it is shown that, in the absence of contraception, the period of survival of a child is positively associated with the birth or pregnancy interval in which the death occurs (for example, see Henry, 1961; Henripin, 1954; Knodel, 1968; Jain 1969). It is assumed that the death of the child truncates the duration of breastfeeding; this in turn leads to an early resumption of menstruation and ovulation and to an earlier conception.

There is a growing body of literature which provides more direct evidence for a positive association between the duration of breastfeeding and the length of the birth interval. A birth interval can be divided into three main components: (1) postpartum amenorrhea, (2) menstruating interval, and (3) gestation period. It is now well established that breast-

feeding is the principal determinant of the duration of postpartum amenorrhea. In the absence of breastfeeding the menses return shortly after birth (Salber et al., 1966, Pascal 1969, Perez et al., 1971, Chen et al., 1974, Malkani, 1960, Bonte et al., 1974, Potter et al., 1965). As the duration of breastfeeding increases, so does the amenorrhea interval—approximately one additional month of amenorrhea for each two months increment in breastfeeding duration (Leridon, 1977, Corsini, 1979). With long lactation, mean amenorrhea intervals from one to two years are observed, in developing as well as in developed countries (Chen et al., 1974, Singarimbun, 1976, Huffman, 1978, Cantrelle et al., 1978, Kippley, 1972).

A recent analysis of breastfeeding patterns (25 subpopulations from 9 countries in a W.H.O. Collaborative Study), demonstrated that after fitting curves with four parameters at any given time postpartum, variation in breastfeeding proportions explained about 85 percent of between populations variance in the proportions of menstruating women (Billewitz, 1979). Similarly, other studies have found high levels of correlation between mean breastfeeding and amenorrhea durations when comparing populations (Corsini, 1979, Lesthaeghe et al., in press) or subpopulations within countries (Salber, et al., 1966, Pascal, 1969, Perez et al., 1971, Malkani, 1960, Cantrelle et al., 1978 Jain et al., 1970). However, on the individual level the correlation between lactation and amenorrhea intervals, while still highly significant, is lower. For example, lactation explained about 20.7 percent of the variation in the postpartum amenorrhea periods among Taiwanese women, which was 92 percent of the total variation explained by women's age, parity, education, place of residence, ownership of modern objects, and lactation (Jain and Sun, 1972). The most plausible explanation for the lower correlation —aside from measurement error—is that women differ not only with respect to the duration of breastfeeding, but also with

respect to the type and pattern of breastfeeding (Solien de Gonzalez, 1964, Winikoff, 1978). It has been demonstrated that women who fully breastfeed have a lower probability of resumption of menses than women whose infants receive supplemental food such as fluids by bottle or solids (Perez et al., 1971, Malkani, 1960, Huffman, 1978, McKeown and Gibson, 1954). The ovulation and menstruation inhibiting effect of breastfeeding as well as the differential impact of breastfeeding types, are believed to be due to a neurally mediated hormonal reflex system initiated by the suckling stimulations of the breastnipple (Tyson et al., 1977, Delvoye et al., 1976).

There is also some empirical evidence that the continuation of breastfeeding beyond the resumption of menstruation supresses the probability of conception (Jain et. al., 1979). In some societies, breastfeeding is associated with postpartum abstinence which, if continued beyond the resumption of ovulation, will affect the length of the birth interval independent of the physiological effects of breastfeeding (see Lesthaeghe and Page 1981). In the present study we will not be able to decompose the effect of breastfeeding on the birth interval because the information about the resumption of menstruation and postpartum abstinence were not collected in the fertility surveys conducted in the eight countries included in this analysis. The available evidence from other studies indicate that the effect of breastfeeding on birth interval operates primarily by delaying the resumption of ovulation after birth.

In Table 13, we show the average duration of the last closed birth interval (in months) by use of contraception and the duration of breastfeeding. For all women, the average birth interval is found to vary from 29 months in Guyana to about 38 months in Bangladesh, Indonesia, Sri Lanka, and Peru. The average birth interval was about 35 months in Jordan, Colombia, and Panama. The use of contraception generally increases the length of the

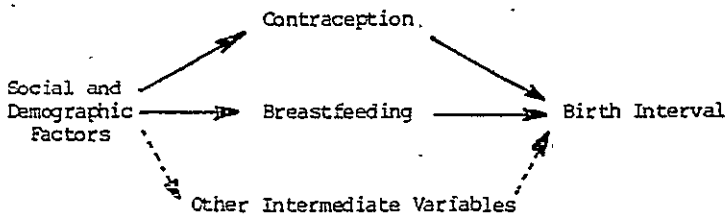
birth interval. The magnitude of this increase varies with the country of residence. Among women who did not use contraception, the average length of the birth interval increases with prolonged breastfeeding. For women who did not use contraception and did not breastfeed their last-but-one child, the average birth interval is found to vary from about 24 months in Panama to 37 months in Sri Lanka. These birth interval estimates are much longer than one would expect in the absence of breastfeeding and use of contraception. Other studies have found this interval to be about 20 months (Leridon, 1977). The longer birth intervals found here could possibly reflect differences with respect to average fecundability, temporary separation between spouses, abortion, and unreported use of contraception; but they are most likely due to reporting errors.

The effect of breastfeeding on the length of the birth interval varies among countries. For non-users, the differential effect of breastfeeding on the length of the birth interval is shown by the zero-order-correlation coefficients as well as by partial regression coefficients (see Table 14). On average, one month of breastfeeding adds about 0.7 months to the birth interval in Sri Lanka; 0.5 months in Indonesia; about 0.45 months in Colombia and Panama; about 0.4 months in Bangladesh and Peru; and 0.3 months in Jordan and Guyana. This is the net effect of breastfeeding after adjusting for the effects of other seven demographic and social factors included in the multiple regression analysis. These effects are less than those found in other studies. For example, in a rural zone of Senegal, the interval between two births was found to increase by about 9 months for one year increase in the age of the child at weaning, i.e., one month of breastfeeding added about 0.75 months to the length of the birth interval (Cantrelle and Leridon, 1971). In Taiwan also, it was found that one month of

breastfeeding added about 0.74 months to the birth interval (Jain et. al., 1979).

A. Breastfeeding, Use of Contraception, and Birth Interval

In order to trace the effects of social and demographic factors on the birth interval and to assess the relative importance of contraception, breastfeeding and other intermediate variables, we used the following model. The arrows to and from other intermediate variables are shown in broken lines because these variables are believed to be less important.



Using this model we will test three premises: (1) the length of the birth interval is primarily determined by the duration of breastfeeding and the use of contraception; (2) the effects of other demographic and social factors on the birth interval are transmitted primarily through the use of contraception and the duration of breastfeeding, but could also be transmitted through other intermediate factors such as fecundability, intrauterine mortality, and separation between spouses; and (3) there is no direct relationship between the use of contraception and the duration of breastfeeding.

The last premise needs a further explanation. If breastfeeding is not used deliberately to increase the interval between two births, but contraception is used deliberately for this purpose, then the two forms of

behavior should be independent of each other. In that case, the observed correlation between the two should be entirely due to their joint associations with the preceding social and demographic factors. For example, modernization (as indicated by mother's education and her place of residence) can simultaneously result in a decrease in the prevalence and duration of breastfeeding and in an increase in the use of contraception. Under these circumstances, the observed correlation between contraception and breastfeeding would be spurious. We have shown earlier that breastfeeding was not used deliberately to limit the number of children because its duration was not parity dependent. An empirical test for the third premise, mentioned above, will show whether or not breastfeeding is used deliberately to increase the interval between two births.

In Table 15, we show the regression results for all women to test the underlying assumptions of the above model. The correlation and the partial regression coefficients indicate that there is a positive association between the duration of breastfeeding and birth interval and between the use of contraception and birth interval (except Bangladesh); but the magnitudes of these effects vary between countries.

Breastfeeding and contraception (and in a few countries induced abortion) have been shown to be the two most important factors that account for the differences between populations in their marital fertility levels (Bongaarts, 1978, 1980). On the individual level it is very difficult to explain a large proportion of the variance in birth intervals because of the stochastic nature of the reproductive process. As the regression results indicate, the percent variation in the birth interval explained by breastfeeding, contraception, and seven social and demographic factors varies from about 5 percent to 15 percent. A large majority of this explained variance is due to just two factors—breastfeeding and use of contraception (compare

the values of R^2 in the two regressions with and without social and demographic factors). This implies that other intermediate variables play a small role. This is further substantiated by the partial regression coefficients for seven social and demographic factors which indicate that in most cases, the independent effects of these factors are either small or are not statistically significant.

The observed negative association between the use of contraception and the duration of breastfeeding (as indicated by the zero order correlation coefficients between the two) is not entirely accounted for by their joint relationships with the seven social and demographic factors such as women's age, parity, education and residence. The partial correlation coefficients vary in magnitude and direction but are statistically significant for all countries except Indonesia. For women in Bangladesh and Sri Lanka, the partial correlation coefficient is positive and for the remaining five countries, it is negative. It is possible that this remaining association is in part due to some other factors not included in the regression equation and in part due to reporting errors. The negative partial correlation coefficients may also indicate that women in some countries are aware of the fertility inhibiting effect of breastfeeding and use it for spacing purposes.

B. Relative Contributions of Breastfeeding and Contraception to Birth Interval

The values of partial regression coefficients of breastfeeding and use of contraception do not indicate their relative contributions to the increase in the interval between two births. These two partial regression coefficients are not directly comparable. The coefficient for breastfeeding indicates the average number of months added to the birth interval by one

month of breastfeeding. The coefficient for the use of contraception indicates the average number of months added to the birth interval by one user of contraception. The differences among countries in the partial regression coefficients for the contraception variable could be due to differences in the months of contraceptive use per user or to differences in the effectiveness of the contraceptive methods used.

The relative contributions of breastfeeding and contraceptive use to the interval between two births are shown in Table 16. The number of months added by breastfeeding is obtained by multiplying the average duration of breastfeeding and its partial regression coefficient. The number of months added by use of contraception is estimated by multiplying the proportion of women who used contraception and its partial regression coefficient. These results clearly show the importance of breastfeeding in extending the interval between two births at the macro level. For example, the prevalence of breastfeeding in Bangladesh, Sri Lanka and Indonesia added about 9-10 months to the average birth interval. This is about 25 percent of the length of the birth interval. The use of contraception in these countries, in comparison, added less than one month to the birth interval. In the remaining five countries, breastfeeding practices added less than 5 months to the length of the birth interval, which is 8-12 percent of the average birth interval in these countries.

A decrease in the prevalence and duration of breastfeeding would decrease intervals between two births and, therefore, would increase marital fertility unless compensated by a simultaneous increase in the use of contraception. The magnitude of this decrease in the length of the birth interval varies from about 8-10 percent in Colombia, Panama and Jordan to about 28 percent in Sri Lanka. We have shown earlier that the duration of breastfeeding is negatively associated with social indicators. In the

absence of adequate compensation for shortened breastfeeding by the use of contraception, the better educated women, for example, will have shorter birth intervals than others. This is the case in Bangladesh, Indonesia, Sri Lanka, Peru and Guyana. In these countries, the zero-order correlation coefficients between mother's education and the length of the birth interval is small but negative ranging from -.018 to -.049. In the remaining three countries—Jordan, Colombia, and Panama—the zero-order correlation coefficient between mother's education and the interval between two births is positive ranging from .034 to .074. In these countries, about 35-40 percent of women used contraception and this contraceptive use added about 3-5 months to the length of the last closed birth interval.

Unfortunately there are good reasons to believe that some of the figures presented in Table 16 are not accurate. As already mentioned, the mean duration of the birth interval in the absence of breastfeeding and contraception (estimated by the "constant") is substantially higher than the 20 months or so typically found in other studies. Furthermore, the time added by breastfeeding is probably substantially longer in some countries than estimated in Table 16. This interval should at least equal the increment in postpartum amenorrhea caused by breastfeeding, because breastfeeding also may be expected to have some effect on the menstruating interval. To check the validity of the estimates derived from the regression equation, they can be compared with independently obtained estimates of increments in postpartum amenorrhea using the results of a study by Lesthaeghe and Page (1980). Based on a large number of data sets they estimated the expected duration of postpartum amenorrhea for any duration of breastfeeding up to 30 months. Based on this relationship, Table 16 gives the median duration of amenorrhea in the open and closed birth intervals as well as the increment in postpartum amenorrhea in the closed birth interval. The

average durations of breastfeeding needed to obtain these estimates were taken from Table 3. A comparison of the alternative measure of the breastfeeding effect on the closed birth interval (last line in Table 16) with the regression results clearly shows that the latter underestimate the fertility impact of breastfeeding in Bangladesh, Indonesia and Jordan. Whether and to what extent the fertility impacts of breastfeeding are underestimated in the remaining five countries is difficult to determine, because no general estimates of the effect of breastfeeding on the menstruating interval are available. That the effect of breastfeeding is underestimated in Bangladesh is further confirmed by studies which have measured postpartum amenorrhea directly and estimate this interval at about 18 months (Chowdhurry, 1978).

The discrepancies discussed in the above paragraph reflect the effect of errors in reporting the ages of children and the duration of breastfeeding. It is known that the measurement errors in the dependent and the independent variables could bias the estimates of the constant term and the regression coefficient in the regression equation. The nature and the magnitude of these biases depend upon the mean and the variance of the measurement error, and correlation between the true value and the measurement error. For example, assuming that the measurement errors and the true values are uncorrelated, any random error in the independent variable in a regression causes a downward bias in the regression coefficient (see Johnston, 1972). This means that any reporting error in the duration of breastfeeding will underestimate its impact on the birth interval.

The extent to which the observed differences between countries in the estimated effect of breastfeeding on the birth interval are due to differences in reporting errors or are due to differences in other factors such as use of contraception, can not be ascertained in this study.

VI. SUMMARY

In this paper we have analyzed the patterns of breastfeeding and its influence on the last closed birth interval in eight countries: Bangladesh, Indonesia, Sri Lanka, Jordan, Peru, Guyana, Colombia, and Panama. The data were taken from the standard recode tapes made available to the authors by WFS. The results are briefly summarized below:

1. The large majority of women in all eight countries breastfed their last two children. The proportion of women who did not breastfeed their last child ranged from 2 percent in Bangladesh to 18 percent in Panama.

2. The average duration of breastfeeding (including those who did not breastfeed) varied from 9 months in Panama to about 29 months in Bangladesh.

3. The key determinants of breastfeeding are: Women's education, place of residence, husband's occupation, and the survival status of the child. The effects of these factors are consistent in all eight countries. The results indicate that women with higher education or those who live in urban areas breastfeed their children for a shorter period than those who have lower education or live in rural areas. In all countries, the duration of breastfeeding is shortened if the child dies before reaching one year of age.

4. The sex of the child does not imply differential lengths of breastfeeding. Mother's age and parity did not show consistent effects on the duration of breastfeeding. Whether or not women worked since marriage did not show an independent important effect on the duration of breastfeeding.

5. The differences between countries in the average duration of breastfeeding are not due to the differences in the composition of women with respect to the social and demographic factors included in this study.

6. Breastfeeding is not used for limiting the family size, but, we can not rule out the possibility that it might have been used to some extent for increasing the interval between births.

7. The average length of the last closed birth interval increases with prolonged breastfeeding in all the eight countries. On average, one month of breastfeeding adds about 0.4 months to the birth interval. There is a considerable variation between countries in the average effect of breastfeeding. On average, one month of breastfeeding adds about 0.3 months to the birth interval in Guyana, Jordan, and Panama; 0.4 months in Bangladesh, Peru, and Colombia; 0.5 months in Indonesia; and 0.7 months in Sri Lanka. The effects of breastfeeding on the birth interval are underestimated due to reporting errors in the duration of breastfeeding, especially in Bangladesh, Indonesia, and Jordan. Whether and to what extent the differences between countries in the fertility impact of breastfeeding are due to the differences in reporting errors or are due to differences in other factors, could not be determined.

Appendix Estimation of average breastfeeding duration in the open birth interval

Women who had at least one birth were asked how long they breastfed their last child unless they were still breastfeeding at the time of the interview. Taking the average value of these reported durations of breastfeeding yields a mean that is biased downward, because women who tend to breastfeed for short periods have a higher than average chance of being included in the estimate.

A simple method exists for obtaining an unbiased estimate of the mean duration of breastfeeding (Bongaarts 1978, Lesthaeghe and Page 1980, Page 1979). This technique is called the current status method because it relies solely on the breastfeeding status at the time of the interview. Let B(t) be the number of women still breastfeeding at the time of the interview among all women who gave birth between t and t+1 months before the interview date, and let N(t) be the number of births that occurred between t and t+1 months before the interview date (including births before that last). The mean duration of breastfeeding, b, is estimated from:

$$b = \sum_{0}^{m} \frac{B(t)}{N(t)}$$

The upper limit of summation, m, should be set high enough to cover the longest occurring breastfeeding duration, (48 months in this study). The median duration of breastfeeding is given by the month in which the ratio B(t)/N(t) equals 0.5 (after smoothing as needed).

TABLE 1: PERCENT DISTRIBUTION OF ALL WOMEN BY SELECTED DEMOGRAPHIC AND SOCIAL CHARACTERISTICS

Demographic and Social Characteristics		Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
TOTAL:	N	2660	4064	3399	1521	2711	1276	1537	1556
1. Age of Wife	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Years									
15-19		25.6	15.4	8.4	7.1	9.2	10.2	13.0	10.4
20-24		27.2	25.1	23.5	18.1	24.0	27.4	26.2	32.6
25-29		19.9	25.2	29.5	24.5	23.6	27.4	26.5	28.5
30-34		16.9	21.9	25.1	28.5	24.0	19.5	19.0	17.7
35-39		9.0	10.4	12.2	18.5	15.0	12.6	13.0	9.2
40+		1.4	2.0	1.4	3.3	4.1	2.9	2.3	1.5
2. Parity									
2-3		29.2	32.9	31.4	15.8	28.3	27.3	32.8	37.0
4-6		38.3	40.8	39.4	28.7	35.3	39.5	33.3	38.1
7+		32.5	26.3	29.2	55.6	36.4	33.2	33.9	24.9
3. Wife's Education									
None		76.8	60.2	23.0	62.5	33.6	4.2	17.0	8.6
Primary		19.2	30.2	40.5	27.6	48.4	76.0	68.6	57.0
Secondary +		4.0	9.7	36.5	9.9	18.0	19.8	14.5	34.4
4. Residence									
Rural		77.8	68.7	74.4	31.0	36.5	67.9	35.4	47.9
Urban		22.2	31.3	25.6	69.0	63.5	32.1	64.6	52.1
5. Work Place of Wife									
Since marriage									
Family farm		.5	23.6	11.6	4.5	22.4	7.0	2.6	1.8
Other farm		.9	13.8	3.0	1.2	3.2	2.9	2.0	.4
At home		3.9	10.2	3.6	3.5	17.9	6.7	11.8	5.8
Away from home		7.4	17.8	19.8	5.3	21.4	29.7	22.6	40.8
Did not work		87.4	34.7	62.0	85.4	35.2	53.7	61.0	51.1
6. Husband's Occupation									
Professional & Clerical		9.9	12.1	11.6	18.1	14.9	15.3	9.8	15.6
Sales & Service		14.6	19.0	15.6	21.0	14.4	4.8	16.4	17.7
Skilled & Manual		22.3	18.9	18.9	31.0	18.7	33.2	33.5	34.2
Farmer & Agricultural		50.8	49.1	41.4	10.8	42.3	36.8	36.7	28.9
Other		2.4	.9	12.5	19.2	9.7	10.0	3.7	3.6

TABLE 2: PERCENT DISTRIBUTION OF WOMEN WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL BY SELECT DEMOGRAPHIC AND SOCIAL CHARACTERISTICS

Demographic and Social Characteristics		Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
TOTAL:	N	2483	3241	2772	993	1876	1041	994	993
1. Age of Wife (Years)	%	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
15-19		25.5	16.5	8.6	7.5	9.1	10.2	12.7	11.2
20-24		27.2	24.2	23.1	14.5	19.9	26.2	22.2	26.8
25-29		19.5	24.0	28.8	21.4	21.6	26.2	24.1	27.2
30-34		17.2	22.4	25.3	30.8	25.9	20.4	21.6	22.1
35-39		9.2	10.8	12.6	22.0	18.5	13.6	16.2	10.8
40+		1.4	2.1	1.6	3.8	5.1	3.4	3.1	1.9
2. Parity									
2-3		29.0	32.4	29.4	14.2	24.1	25.0	26.8	31.4
4-6		38.1	39.9	39.4	26.3	33.8	38.7	32.9	38.2
7+		32.9	27.7	31.2	59.5	42.1	36.3	40.3	30.4
3. Wife's Education									
None		79.2	64.3	26.0	77.2	42.3	5.0	23.4	11.3
Primary		18.4	29.4	41.7	19.8	46.3	78.4	69.4	64.6
Secondary +		2.4	6.3	32.3	3.0	11.4	16.6	7.2	24.1
4. Residence									
Rural		79.8	70.8	75.8	42.3	45.5	71.8	44.1	57.4
Urban		20.2	29.2	24.2	57.7	54.5	28.2	55.9	42.6
5. Work Place of Wife									
Since marriage									
Family farm		.4	23.3	11.9	6.6	28.3	8.0	3.4	2.4
Other farm		.9	14.8	3.5	1.9	3.9	3.4	2.7	.4
At home		4.0	10.0	3.1	2.7	17.2	6.5	10.3	6.3
Away from home		7.2	17.0	19.9	2.0	17.2	26.9	20.4	32.8
Did not work		87.5	34.9	61.6	86.8	33.4	55.2	63.1	58.1
6. Husband's Occupation									
Professional & Clerical		8.5	9.4	10.1	11.6	10.2	12.5	5.2	11.1
Sales & Service		13.8	19.1	15.2	21.0	11.6	4.5	14.0	16.9
Skilled & Manual		22.6	19.7	17.8	29.0	16.4	33.2	30.8	30.8
Farmer & Agricultural		52.7	50.8	44.0	15.3	52.5	38.9	45.9	37.3
Other		2.3	1.0	12.9	23.1	9.3	10.9	4.1	3.9

TABLE 3: SELECTED STATISTICS ON BREASTFEEDING IN OPEN AND LAST CLOSED BIRTH INTERVAL

Statistics	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
Open Birth Interval								
Percent who did not breastfeed	2	4	5	8	10	N.A.	9	18
Mean	28.8	23.2	22.0	13.1	14.2	N.A.	10.0	9.0
Median	29	21	21	14	14	N.A.	11	10
Percent currently breastfeeding	61	41	36	39	32	N.A.	19	15
N*	3230	5245	4411	2311	3742	1912	2035	2071
Closed Birth Interval								
Percent who did not breastfeed	4	4	6	8	10	N.A.	10	16
Mean	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
S.D.	11.7	10.8	11.2	9.4	8.9	8.6	8.1	8.6
N**	2660	4064	3399	1521	2711	1276	1537	1556

Women who did not breastfeed are assigned the value zero in calculating mean and standard deviation of breastfeeding.

* Number of currently married women with 2 or more live births, excludes unknown BF.

** Number of currently married women with 2 or more live births, excludes unknown BF, excludes if CBI + OBI $\leq$ 36 or $\geq$ 180 months, or if currently pregnant.

TABLE 4: AVERAGE DURATION OF BREASTFEEDING BY SEX AND SURVIVAL STATUS OF THE CHILD AND USE OF CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
	Average Duration of Breastfeeding (months)							
TOTAL AVERAGE:	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
1. Sex of Child								
- Male	23.9	18.7	15.6	12.8	11.7	10.0	8.7	8.7
- Female	23.3	19.3	15.8	12.2	11.7	10.0	8.5	7.7
2. Survival Status								
- Dead: Age -								
0 months	14.9	2.2	2.9	5.8	1.3	1.7	0.6	2.2
≤ 1 year	14.0	4.1	3.5	5.5	3.3	3.6	2.1	3.2
≥ 1 year	*	19.2	15.6	*	14.5	*	10.2	10.6
- Alive:	24.5	20.4	16.4	13.1	12.3	10.3	9.0	8.5
3. Use of Contraception								
- No method	23.6	19.2	15.7	14.1	12.8	10.7	9.5	9.8
- Inefficient method	25.9	20.3	17.3	9.9	10.8	6.3	7.7	8.6
- Efficient method	21.8	17.0	13.5	9.5	6.5	7.0	6.3	5.1
	Percent Distribution of Women							
1. Sex of Child								
- Male	51	51	51	55	50	54	51	53
- Female	49	49	49	45	50	46	49	47
2. Survival Status								
- Dead: Age -								
0 months	7	4	3	4	4	2	3	3
≤ 1 year	2	4	2	3	4	3	3	1
≥ 1 year	*	6	3	*	4	*	4	1
- Alive:	91	86	92	93	88	95	90	95
3. Use of Contraception								
- no method	94	80	82	65	69	82	65	60
- Inefficient method	3	9	12	11	21	2	15	11
- Efficient method	3	11	6	24	10	16	20	29

* Included in Alive-category.

TABLE 5: SUMMARY OF MULTIPLE REGRESSION ANALYSIS USING THE DURATION OF BREASTFEEDING AS THE DEPENDENT VARIABLE FOR ALL WOMEN AND FOR THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL FOR EIGHT COUNTRIES

Demographic Characteristics	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
I. ALL WOMEN								
A. Correlation Coefficient								
Age	- .026	.017	- .005	.121	.143	.050	.171	.190
Parity	- .101	- .031	.039	.104	.153	.106	.155	.275
B. Partial Regression Coefficient								
Intercept	22.10	17.15	17.00	8.05	7.41	9.31	3.47	3.91
Age	.299*	.151*	- .112*	.137*	.090*	- .063	.155*	.0
Parity	-1.09*	- .426*	.341*	.070	.308*	.423*	.165	.880*
R^2	.020	.005	.003	.015	.025	.012	.031	.076
II. WOMEN WHO DID NOT USE CONTRACEPTION								
A. Correlation Coefficient								
Age	- .027	.007	- .009	.084	.123	.033	.159	.170
Parity	- .104	- .041	.031	.036	.108	.070	.124	.233
B. Partial Regression Coefficient								
Intercept	22.14	17.72	16.99	10.03	8.47	10.20	4.29	5.54
Age	.304*	.140*	- .106*	.179*	.125*	- .046	.178*	.019
Parity	-1.115*	- .446*	.291*	- .176	.109	.293*	.042	.688*
R^2	.021	.005	.003	.009	.016	.006	.026	.054

* Regression Coefficient is greater than twice its standard error.

TABLE 6: EFFECT OF WIFE'S AGE ON DURATION OF BREASTFEEDING, UNADJUSTED AND ADJUSTED THROUGH MULTIPLE CLASSIFICATION ANALYSIS FOR THE EFFECTS OF WIFE'S EDUCATION, PLACE OF RESIDENCE, WORK PLACE, AND HUSBAND'S OCCUPATION, FOR ALL CURRENTLY MARRIED WOMEN AND FOR THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

I. ALL WOMEN	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
GRAND MEAN, months of breastfeeding	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
Wife's Age (Years)	A. Deviations from Grand Mean (Unadjusted)							
15-19	.6	.5	.3	-1.3	- .8	.5	- .9	- .8
20-24	- .3	- .6	.2	-1.6	-1.4	-1.4	-1.7	-1.6
25-29	- .2	- .1	- .7	- .8	-1.0	.5	- .2	- .5
30-34	.4	.2	.7	1.2	.8	.1	1.1	2.2
35-39	- .6	.7	- .5	1.4	2.8	1.2	2.6	3.3
40+	-2.8	- .2	1.1	- .2	1.0	.4	3.0	4.6*
	B. Deviations from Grand Mean (Adjusted)							
15-19	.7	.0	- .1	- .8	- .2	1.4	- .6	- .5
20-24	- .2	- .4	.4	- .5	- .1	-1.0	-1.1	-1.0
25-29	- .2	.3	- .3	- .3	- .1	.3	- .0	- .1
30-34	.3	.1	.5	- .7	- .1	- .3	.6	1.3
35-39	- .8	.2	- .9	.5	1.0	.7	1.6	1.6
40+	-3.4	-1.4	- .7	-1.6	-2.0	- .1	2.2	1.7*
II. WOMEN WHO DID NOT USE CONTRACEPTION								
GRAND MEAN, months of breastfeeding	23.7	19.2	15.6	14.1	12.8	10.6	9.6	9.8
Wife's Age (Years)	A. Deviations from Grand Mean (Unadjusted)							
15-19	.7	.6	.2	-1.5	-1.2	1.1	-1.3	-1.2
20-24	- .4	- .7	.4	-1.1	-1.2	-1.7	-1.6	-1.3
25-29	- .5	.1	- .7	- .7	- .9	.8	- .5	.9
30-34	.7	- .0	.7	.7	.5	- .1	1.2	1.4
35-39	- .6	.5	- .6	1.1	2.2	.9	1.7	3.4
40+	-2.8	- .4	1.0	- .6	.3	0	2.9	3.2*
	B. Deviations from Grand Mean (Adjusted)							
15-19	.7	.3	- .2	-1.1	- .6	2.0	-1.2	- .7
20-24	- .3	- .5	.6	.6	- .1	-1.3	-1.1	-1.0
25-29	- .4	.2	- .4	- .7	- .1	.6	- .3	- .5
30-34	.5	.1	.5	.6	- .1	- .4	.9	1.0
35-39	- .7	.3	- .9	.8	1.1	.5	1.1	2.2
40+	-3.2	-1.0	- .7	-1.2	-1.6	- .2	2.3	1.6*

* Less than 25 cases.

TABLE 7: EFFECTS OF PARITY ON DURATION OF BREASTFEEDING, UNADJUSTED AND ADJUSTED THROUGH MULTIPLE CLASSIFICATION ANALYSIS, FOR THE EFFECTS OF WIFE'S AGE, EDUCATION, PLACE OF RESIDENCE, WORK PLACE AND HUSBAND'S OCCUPATION, FOR ALL WOMEN AND FOR THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

I. ALL WOMEN	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Columbia	Panama
GRAND MEAN, months of breastfeeding	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
Parity	A. Deviations from Grand Mean (Unadjusted)							
2-3	1.1	- .0	-1.3	-2.8	-2.7	-1.6	-1.8	-2.8
4-6	.2	.5	.6	- .5	.7	.2	.1	.4
7+	-1.2	- .7	.5	1.1	1.5	1.1	1.6	3.5
	B. Deviations from Grand Mean (Adjusted)							
2-3	2.4	.7	- .5	-1.6	- .4	- .8	- .3	-1.4
4-6	.3	.4	.6	- .1	.9	.1	.2	.4
7+	-2.5	-1.6	- .2	.5	- .6	.6	.1	1.4

II. WOMEN WHO DID NOT USE CONTRACEPTION								
GRAND MEAN, months of breastfeeding	23.7	19.2	15.6	14.1	12.8	10.6	9.6	9.8
Parity	A. Deviations from Grand Mean (Unadjusted)							
2-3	1.2	.2	-1.4	-2.6	-2.3	-1.1	-1.6	-2.7
4-6	.1	.4	.9	.1	.5	.1	- .1	0
7+	-1.2	- .8	.2	.6	.9	.7	1.2	2.8
	B. Deviations from Grand Mean (Adjusted)							
2-3	2.4	.9	- .8	-1.6	.2	- .7	- .2	-1.6
4-6	.2	.3	.9	.1	.8	0	.3	.1
7+	-2.4	-1.5	- .4	.3	- .7	.4	- .1	1.5

TABLE 8: EFFECTS OF WIFE'S EDUCATION AND PLACE OF RESIDENCE ON DURATION OF BREASTFEEDING, UNADJUSTED AND ADJUSTED THROUGH MULTIPLE CLASSIFICATION ANALYSIS, FOR PLACE OF RESIDENCE OR EDUCATION AND FOR WIFE'S AGE, PARITY, WORKPLACE, AND HUSBAND'S OCCUPATION, FOR ALL WOMEN AND FOR THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

Wife's Education and Place of Residence	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
I. ALL WOMEN								
GRAND MEAN, months of breastfeeding	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
A. Deviations from Grand Mean (Unadjusted)								
Education of Wife								
None	.4	1.5	1.6	1.7	3.8	4.3	3.1	6.0
Primary	- .2	- .4	1.5	-1.7	- .4	.4	.1	1.5
Secondary+	-6.7	-8.3	-2.7	-8.0	-6.1	-2.6	-3.9	-4.0
Residence								
Rural	.8	2.4	1.0	2.9	3.8	1.2	2.1	2.7
Urban	-2.7	-5.2	-2.9	-1.3	-2.2	-2.6	-1.1	-2.5
B. Deviations from Grand Mean (Adjusted)								
Education of Wife								
None	.2	.8	.9	.9	2.4	3.5	2.1	3.2
Primary	0	- .1	1.0	- .8	- .2	.2	0	.7
Secondary+	-4.6	-4.8	-1.7	-3.8	-4.0	-1.4	-2.5	-2.0
Residence								
Rural	.6	1.3	.6	1.4	1.5	.8	.3	.5
Urban	-2.0	-2.8	-1.7	- .6	- .9	-1.8	- .2	- .5
II. WOMEN WHO DID NOT USE CONTRACEPTION								
GRAND MEAN, months of breastfeeding	23.7	19.2	15.6	14.1	12.8	10.6	9.6	9.8
A. Deviations from Grand Mean (Unadjusted)								
Education of Wife								
None	.3	1.0	1.4	.7	2.8	3.9	2.1	4.3
Primary	- .3	- .5	1.2	-1.5	-1.0	.2	- .3	.8
Secondary+	-6.3	-8.1	-2.7	-7.0	-6.5	-2.1	-4.3	-4.2
Residence								
Rural	.7	1.9	1.0	1.7	3.0	.9	1.6	2.1
Urban	-2.6	-4.5	-3.0	-1.2	-2.5	-2.4	-1.2	-2.8
B. Deviations from Grand Mean (Adjusted)								
Education of Wife								
None	.1	.6	.8	.2	1.7	3.2	1.4	2.2
Primary	.0	- .3	.7	- .3	- .6	.1	- .2	.3
Secondary+	-4.0	-5.1	-1.6	-4.5	-3.8	-1.3	-2.8	-1.8
Residence								
Rural	.5	1.0	.6	1.0	1.4	.7	.1	.7
Urban	-2.1	-2.5	-1.9	- .7	-1.2	-1.8	- .1	- .9

* = less than 25 cases; 0 = less than .05.

TABLE 9: AVERAGE DURATION OF BREASTFEEDING (MONTHS) BY WIFE'S EDUCATION AND PLACE OF RESIDENCE FOR ALL WOMEN

Place of Residence	Education	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
	Total	24.4	21.4	16.7	15.5	15.6	11.1	10.6	11.0
Rural	None	24.5	21.8	17.6	15.9	16.8	14.4	12.1	15.1
	Primary	24.2	21.0	18.1	14.9	13.8	11.2	10.1	11.0
	Secondary+	20.7*	15.8	13.8	--	10.7	9.3	8.9	5.2
	Total	20.9	13.8	12.8	11.2	9.5	7.4	7.5	5.8
Urban	None	21.9	16.3	15.7	13.2	13.2	15.8*	11.2	10.3*
	Primary	21.2	13.8	13.7	10.4	10.3	7.9	7.8	7.9
	Secondary+	15.8	9.5	11.7	6.4	5.5	6.0	4.4	4.1
	Total	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
Total	None	24.0	20.5	17.3	14.2	15.5	14.3	11.7	14.3
	Primary	23.4	18.6	17.2	10.8	11.3	10.4	8.7	9.8
	Secondary+	16.9	10.7	13.0	6.5	5.6	7.4	4.7	4.3

* Less than 25 cases.

TABLE 10: EFFECTS OF WIFE'S WORK PLACE ON DURATION OF BREASTFEEDING, UNADJUSTED AND ADJUSTED FOR WIFE'S AGE, PARITY, EDUCATION, PLACE OF RESIDENCE, AND HUSBAND'S OCCUPATION, FOR ALL WOMEN AND FOR THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

I. ALL WOMEN	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
GRAND MEAN, months of breastfeeding	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
Wife's Work Place Since Marriage	A. Deviations from Grand Mean (Unadjusted)							
Family farm	6.0*	3.8	3.4	2.4	3.4	2.1	2.1	9.2
Other farm	- .1*	2.3	- .2	3.5*	3.6	1.6	3.0	3.6*
At home	2.3	-1.0	2.6	0	- .5	- .3	-1.4	.8
Away from home	-1.3	-2.1	-1.1	-4.6	-2.7	-1.5	-1.0	-2.5
Did not work	0	-2.2	- .4	.1	- .6	.5	.4	1.6
	B. Deviations from Grand Mean (Adjusted)							
Family farm	4.8*	.9	1.6	- .7	.1	.6	- .6	4.2
Other farm	-1.3*	- .2	-2.0	- .2*	1.1	.3	.9	-1.3
At home	1.9	.1	3.0	.5	- .2	.2	- .8	.5
Away from home	-1.0	- .3	-1.4	- .1	0	- .4	- .1	- .8
Did not work	0	- .4	.1	0	- .1	.1	.2	.5
II. WOMEN WHO DID NOT USE CONTRACEPTION								
GRAND MEAN, months of breastfeeding	23.7	19.2	15.6	14.1	12.8	10.6	9.6	9.8
Wife's Work Place Since Marriage	A. Deviations from Grand Mean (Unadjusted)							
Family farm	5.4*	3.2	3.2	.6	2.5	1.3	1.4	8.3*
Other farm	- .1*	1.7	- .2	1.9*	2.1	1.3	2.5	-1.0*
At home	2.1	-1.4	1.2	- .6	- .6	- .7	-1.6	1.1
Away from home	-1.3	-1.5	-1.4	-2.6*	-3.2	-1.0	-1.0	-2.7
Did not work	0	-1.7	- .2	0	- .4	.3	.4	1.1
	B. Deviations from Grand Mean (Adjusted)							
Family farm	4.2*	.8	1.6	-1.2	0	.2	- .5	4.6*
Other farm	-1.2*	- .4	-1.8	- .3*	.6	.3	1.0	-5.4
At home	1.8	- .3	1.6	- .2	0	0	- .9	.7
Away from home	-1.1	- .1	-1.9	1.5*	- .4	- .1	- .1	-1.0
Did not work	0	- .3	.3	.1	.1	0	.2	.3

* = less than 25 cases; 0 = less than .05.

TABLE 11: EFFECTS OF HUSBAND'S OCCUPATION ON DURATION OF BREASTFEEDING UNADJUSTED AND ADJUSTED THROUGH MULTIPLE CLASSIFICATION ANALYSIS FOR WIFE'S AGE, PARITY, EDUCATION, PLACE OF RESIDENCE AND PLACE OF WORK SINCE MARRIAGE, FOR ALL WOMEN AND THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

I. ALL WOMEN	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
GRAND MEAN, months of breastfeeding	23.6	19.0	15.7	12.5	11.7	10.0	8.6	8.3
Husband's Occupation	A. Deviations from Grand Mean (Unadjusted)							
Professional & Clerical	-3.5	-5.4	-4.8	-3.5	-5.1	-2.1	-3.4	-3.3
Sales & Services	- .7	-2.5	-1.6	- .2	-2.1	-1.1	-1.6	-1.3
Skilled & Manual	.3	-2.6	- .8	- .4	-1.7	- .6	- .7	-1.8
Farmers & Agricultural	.8	3.3	2.0	4.3	3.4	1.5	2.3	4.6
Others	- .7	-2.4	1.0	1.8	- .6	.4	- .4	.7
	B. Deviations from Grand Mean (Adjusted)							
Professional & Clerical	-1.8	-1.9	-2.8	1.6	-1.9	- .5	-1.0	-1.0
Sales & Services	0	-1.0	-1.2	- .3	- .6	- .7	-1.0	- .5
Skilled & Manual	.2	-1.3	- .4	- .4	- .6	- .5	- .5	-1.2
Farmers & Agricultural	.2	1.4	1.1	2.4	1.2	.8	1.2	2.2
Others	- .1	-1.4	1.0	1.1	- .4	- .2	- .7	.3
II. WOMEN WHO DID NOT USE CONTRACEPTION								
GRAND MEAN, months of breastfeeding	23.7	19.2	15.6	14.1	12.8	10.6	9.6	9.8
Husband's Occupation	A. Deviations from Grand Mean (Unadjusted)							
Professional & Clerical	-3.2	-4.6	-4.3	-3.7	-5.7	-1.4	-4.0	-2.7
Sales & Services	- .6	-1.9	-2.0	- .5	-2.8	-1.5	-2.0	-1.4
Skilled & Manual	.1	-2.7	-1.2	- .4	-2.0	- .8	-1.1	-2.5
Farmers & Agricultural	.7	2.6	1.9	3.0	2.5	1.3	1.8	3.4
Others	- .5	-2.0	.9	.8	- .9	.2	- .2	.4
	B. Deviations from Grand Mean (Adjusted)							
Professional & Clerical	-2.0	-1.6	-2.4	-2.6	-2.5	- .2	-1.8	- .3
Sales & Services	0	- .6	-1.5	- .5	-1.1	-1.0	-1.5	- .5
Skilled & Manual	.1	-1.6	- .8	- .2	- .7	- .6	- .9	-1.4
Farmers & Agricultural	.3	1.2	1.2	2.1	1.0	.7	1.3	1.4
Others	.1	-1.4	.9	.7	- .2	- .3	- .3	.7

* = less than 25 cases; 0 = less than .05.

TABLE 12: SUMMARY OF MULTIPLE REGRESSION ANALYSIS USING THE DURATION OF BREASTFEEDING (MONTHS) AS THE DEPENDENT VARIABLE FOR ALL WOMEN AND FOR THOSE WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL FOR EIGHT COUNTRIES

Independent Variables	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
				Partial Regression Coefficients				
I. ALL WOMEN								
Intercept	24.1	20.4	20.0	13.0	13.7	11.2	7.2	8.7
Age	.31*	.13*	- .06	.14*	.10*	- .04	.15*	.06
Parity	- 1.16*	- .34*	.07	- .09	- .01	.21	.08	.52*
Infant death	(-14.09*)	-17.69*	(-13.45*)	- 9.28*	-10.74*	(- 5.60*)	- 8.18*	- 6.93*
W-Education	- 5.99*	- 6.58*	- 3.75*	- 5.47*	- 5.90*	- 1.95*	- 3.67*	- 3.38*
Residence	- 2.73*	- 6.28*	- 3.14*	- 3.44*	- 4.67*	- 3.10*	- 2.46*	- 2.70*
Sex of child	- .61	.12	- .22	- .46	.01	.16	- .32	- .78
W-Work place	- .12	1.05*	.27	.02	.36	- .12	- .01	- 1.06*
R^2	.057	.316	.122	.123	.262	.059	.137	.193
II. WOMEN WHO DID NOT USE CONTRACEPTION								
Intercept	23.7	21.0	20.7	13.0	13.3	11.6	7.5	9.2
Age	.31*	.11*	- .06	.18*	.12*	- .04	.16*	.07
Parity	- 1.15*	- .30*	.09	- .23	- .06	.15	.04	.45*
Infant death	-13.28*	-17.16*	-13.20*	-10.02*	-11.02*	- 5.72*	- 8.76*	- 7.53*
W-Education	- 5.38*	- 6.49*	- 3.38*	- 6.34*	- 5.72*	- 1.58*	- 4.16*	- 2.68*
Residence	- 2.76*	- 5.53*	- 3.52*	- 2.59*	- 4.47*	- 2.86*	- 2.48*	- 3.18*
Sex of child	- .44	- .01	.69	- .38	.23	.28	- .19	- .73
W-Work place	- .15	- .78*	- .21	- .24	.08	.04	.22	- .80
R^2	.049	.307	.125	.089	.266	.040	.148	.165

( ) Age at death coded differently, figures are not comparable.

* Regression Coefficient is greater than twice its standard error.

TABLE 13: AVERAGE DURATION OF LAST CLOSED BIRTH INTERVAL BY USE OF CONTRACEPTION IN THE LAST CLOSED BIRTH INTERVAL AND BY DURATION OF BREASTFEEDING FOR THOSE WHO DID NOT USE CONTRACEPTION

	Bangladesh	Indonesia	Srilanka	Jordan	Peru	Guyana	Colombia	Panama
Birth Interval	2660	4064	3399	1521	2711	1275	1537	1556
Mean	38.2	38.4	37.9	35.4	37.6	29.4	35.7	35.3
S.D.	16.9	19.8	20.9	18.3	21.4	18.2	21.9	21.2
Use of Contraception								
No	38.2	37.6	37.0	32.7	35.6	28.6	31.9	30.7
Inefficient Methods	40.3	42.5	43.2	36.5	41.7	33.8	37.9	41.2
Efficient Methods	35.8	41.8	39.8	42.3	43.3	32.9	46.0	42.4
Duration of Breastfeeding (non users)								
NBF	31.8	33.5	36.7	27.8	32.1	—	27.7	24.5
0-2 months	36.7	29.7	31.3	33.6	31.8	25.0	29.4	30.5
3-5	39.7	31.0	30.7	28.8	31.6	27.7	27.2	30.3
6	36.3	29.5	33.1	28.5	30.1	29.0	27.7	28.5
7-8	30.1	33.0	32.0	26.4	31.7	26.3	30.2	24.8
9-11	31.2	34.3	29.0	29.7	33.9	29.8	32.7	31.8
12	34.3	35.4	32.5	33.4	35.8	28.3	35.3	31.6
13-17	31.2	33.4	27.5	31.4	33.3	28.6	35.2	29.5
18	33.7	33.4	36.0	33.4	36.7	31.7	36.5	39.3
19-23	38.8	34.6	32.1	32.4	37.8	30.0	33.7	31.5
24	39.9	41.3	42.1	34.8	41.8	32.1	36.8	33.6
25+	43.8	45.8	54.8	44.7	46.7	34.5	43.6	45.5

TABLE 14: SUMMARY OF MULTIPLE REGRESSION ANALYSIS USING THE LAST CLOSED BIRTH INTERVAL AS THE DEPENDENT VARIABLE FOR WOMEN WHO DID NOT USE CONTRACEPTION DURING THE LAST CLOSED BIRTH INTERVAL

Independent Variables	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
Correlation Coefficient	.270	.270	.366	.157	.194	.123	.205	.194
			Partial Regression Coefficients					
Intercept	35.37	30.22	29.47	33.59	29.35	32.74	27.87	21.23
Breastfeeding	.386*	.525*	.712*	.297*	.388*	.274*	.451*	.464*
Age	- .05	- .02	.02	.02	.16	- .22	.10	.21
Parity	- .61*	- .73*	- .72*	- .50	- .53*	- .16	- .42	- .39
Infant death	(13.75*)	2.28	(5.70*)	- 1.58	- 1.39	(17.93*)	.25	1.53
W-Education	- 2.66	- 1.97	- 1.21	2.53	- 5.02*	- 3.28*	- 3.45	1.09
Residence	- .11	1.98*	- .28	- .91	.56	.87	- 1.19	.53
Sex of child	- 1.16	.01	- .11	- 1.16	- .44	- 1.19	.07	- .17
W-Work Place	- .72	1.53*	- .14	1.33	1.33	3.92*	.57	2.52
R^2	.092	.085	.145	.038	.046	050	.048	.048

( ) Figures coded differently and not comparable.

* Regression Coefficient is greater than twice its standard error.

TABLE 15: SUMMARY OF MULTIPLE REGRESSION ANALYSIS USING THE LAST CLOSED BIRTH INTERVAL AS THE DEPENDENT VARIABLE FOR ALL WOMEN FOR EIGHT COUNTRIES

Independent Variables	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
				ALL WOMEN				
CORRELATION COEFFICIENTS:								
Birth Interval & Breastfeeding	.273	.255	.360	.077	.136	.100	.092	.070
Birth Interval & Use of Contraception	- .004	.082	.094	.204	.143	.093	.234	.260
Breastfeeding & Use of Contraception	- .008	- .025	.012	- .250	- .173	- .170	- .157	- .210
				Partial Regression Coefficients				
Intercept	28.86	29.60	27.32	33.27	33.76	27.36	33.53	33.82
Breastfeeding	.395*	.465*	.674*	.168*	.327*	.212*	.250*	.174*
R^2	.074	.065	.130	.006	.018	.010	.008	.009
Intercept	28.87	28.65	26.47	28.46	30.48	25.96	28.47	27.59
Breastfeeding	.395*	.469*	.672*	.298*	.399*	.253*	.359*	.323*
Use of Contraception	- .150	4.34*	4.83*	9.17*	7.95*	5.34*	11.68*	12.47*
R^2	.074	.073	.138	.059	.047	.023	.072	.084
Intercept	34.93	30.97	29.46	33.74	29.71	30.48	26.77	24.19
Breastfeeding	.396*	.514*	.702*	.298*	.380*	.288*	.372*	.384*
Use of Contraception	- .01	4.12*	4.58*	8.98*	7.83*	4.85*	11.30*	11.65*
Age	- .04	- .10	.0	.02	.07	- .23*	.01	.12
Parity	- .59*	.53*	- .66*	- .53*	- .37	- .08	- .18	- .30
Infant death	(11.09*)	2.31	(5.56*)	- 1.04	- 1.22	(12.30*)	- .10	.19
W-Education	- 1.56	- .72	- .82	- 1.28	- 1.83	- 2.98*	- .64	.70
Residence	.11	2.84*	- .16	- .30	.48	2.23	.85	.67
Sex of child	- 1.88	.15	.08	- 1.28	.57	.08	1.10	- .53
W-Work place	- .49	1.61*	- .35	2.01	.82	3.27*	.77	3.35*
R^2	.090	.085	.147	.069	.050	.046	.074	.093
Partial correlation between breastfeeding & use of contraception controlling for other independent variables	.043*	- .002	.047*	- .145*	- .065*	- .126*	- .085*	- .100*
				Partial regression co-efficient = standard form.				
Breastfeeding	.273	.258	.359	.137	.166	.120	.132	.131
Use of contraception	.002	.088	.090	.238	.172	.114	.255	.288

( ) Age at death coded differently, figures are not comparable.

* Regression coefficient is greater than twice its standard error.

TABLE 16: AVERAGE NUMBER OF MONTHS ADDED BY BREASTFEEDING AND USE OF CONTRACEPTION TO THE LAST CLOSED BIRTH INTERVAL

Components of Birth Interval	Bangladesh	Indonesia	Sri Lanka	Jordan	Peru	Guyana	Colombia	Panama
				Average Number of Months				
Constant	28.87	28.65	26.47	28.46	30.48	25.96	28.47	27.59
Breastfeeding	9.32	8.91	10.55	3.73	4.67	2.53	3.09	2.68
Contraception	0	0.87	0.87	3.21	2.46	0.96	4.09	4.99
Birth Interval:								
Estimated	38.19	38.43	37.89	35.40	37.61	29.45	35.65	35.26
Observed	38.2	38.4	37.9	35.4	37.6	29.6	35.7	35.3
				Percent Distribution				
Constant	75.6	74.6	69.9	80.4	81.0	88.1	79.8	78.2
Breastfeeding	24.4	23.2	27.8	10.5	12.4	8.6	8.7	7.6
Contraception	0	2.2	2.3	9.1	6.6	3.3	11.5	14.2
Total	100	100	100	100	100	100	100	100
				Estimated Median Duration of Postpartum Amenorrhea*				
Open birth interval	17.5	14.3	14.0	8.9	8.6	N.A.	5.1	4.7
Closed birth interval	15.2	12.8	10.1	6.6	5.8	4.3	3.5	3.3
				Increment in Median Duration of Postpartum Amenorrhea				
Closed birth interval	13.6	11.2	8.5	5.0	4.2	2.7	1.9	1.7

Note: Various components of birth interval are estimated as follows:

$$BI = a + b_1 (BF) + b_2 (CP)$$

Average Birth Interval = Constant + b_1 (Average breastfeeding) + b_2 (% contraceptive users). The values of the constant 'a' and b_1 and b_2 are taken from Table 15; the values of average breastfeeding and of % contraceptive users are taken from Table 4.

* Based on Lesthaeghe and Page 1980, Estimated from Average Duration of Breastfeeding shown in Table 3.

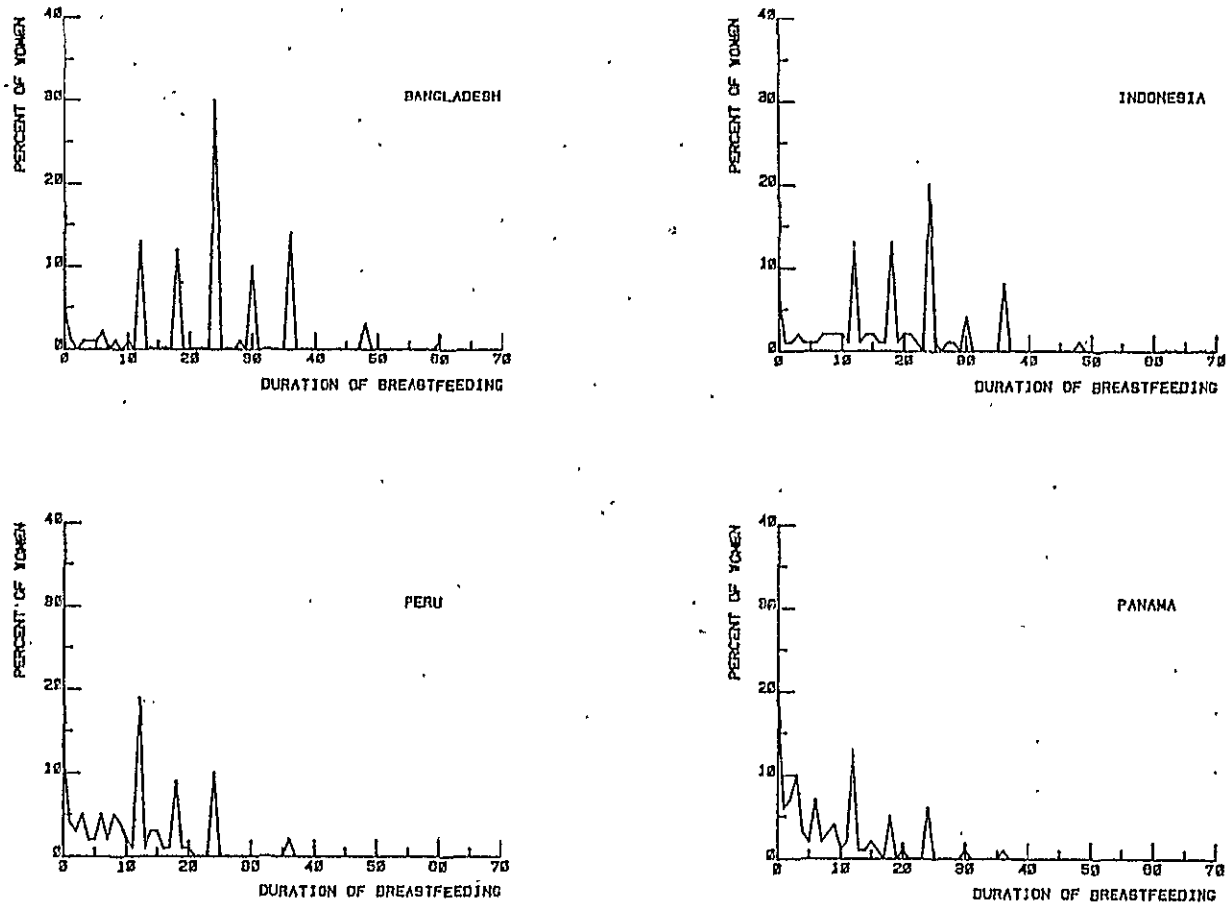


FIGURE 1. PERCENT DISTRIBUTION OF WOMEN BY DURATION OF BREASTFEEDING FOR SELECTED COUNTRIES

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