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Differential Pattern of Birth Intervals in Bangladesh (Demographers' Notebook)

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Differences in a country's fertility levels can be attributed to the differences in the length of the reproductive life of women and differences in the length of time between births when women are exposed to the risk of conception. Analysis of those factors influencing the span and those affecting the spacing of fertility has proven useful, since in many cases they appear to vary quite substantially across populations (Rodriguez and others, 1984). In recent years, policy makers and planners have focused a great deal of attention on the birth interval and its determinants. The reasons are that not only does the number of births a women may have during her reproductive span depend on the spacing between the births but also there is a significant link between birth spacing and maternal and child health (Miller and others, 1992). Thus, the spacing of births through a deliberately prolonged interval between births and a delay in child bearing following marriage could be logical alternative strategies for fertility control.

Different studies have examined this issue and identified different risk factors contributing to the length of birth intervals. Rodriguez and others (1984) compared results of identical structural models for nine countries and found that a woman's education, age and previous birth interval had substantial effects on the subsequent birth interval. Analysing World Fertility Survey (WFS) data from Indonesia, Malaysia and the Philippines, Trussell and others (1985), unlike Rodriguez and her colleagues, found that socio-economic factors do not have any independent effect on the birth interval; rather, these factors mainly extend their influence through biological or proximate determinants of the birth interval such as breastfeeding behaviour, contraceptive use, coital frequency and induced abortion. The positive association between breastfeeding and the length of post-partum amenorrhoea is well documented from the experience of many countries (Chen and others, 1974). A study of child spacing in Asia by Rindfuss and others (1984) revealed that ethnicity, age at birth and urban experience have a substantial effect on birth spacing. Very few studies have been conducted so far in Bangladesh on birth interval dynamics; those that do deal with typical data and do not represent the whole country. Most of these studies are based on data from Matlab, a rural area of Bangladesh. This paper analyzes nationally representative data, and makes an attempt to evaluate the effect of some selected determinants of the birth interval.

Data and methods

This study uses data from the 1989 Bangladesh Contraceptive Prevalence Survey (CPS), a nationally representative sample survey conducted by Mitra and Associates during the period March-August 1989. Sampled were 11,607 ever-married women under age 50. Details of the survey procedure and design are described elsewhere (Mitra and others, 1990).

In this paper, we have analysed the closed as well as the open birth intervals initiated by birth during the five-year period 1984-1989, because complete birth and death histories are available only for those births occurring after 1984. In the study, closed birth intervals are defined as the length of the interval between the birth of the index child and the birth of the subsequent child; open birth intervals, the length of a birth interval of about five years. Total subsequent birth intervals in this five-year period amounted to 11,034 intervals, of which 3,959 (36 per cent of the total) were closed intervals. Six explanatory variables for birth spacing have been selected for evaluation. These variables are maternal age at birth of the index child, birth order of the index child (parity), survival status of the index child (i.e. the one who started the interval), mother's education, sex of the index child and the place of residence. The variables and categories used are given in table 1. Although it is realized that the duration of breastfeeding and family planning practice, and foetal deaths, natural or induced, are very important factors in birth interval dynamics, these variables could not be used in our analysis because of the non-availability of information on these variables, except for the most recent birth, which corresponds to the last open birth interval. It should be mentioned, however, that breastfeeding is almost universal in Bangladesh, with the average duration of breastfeeding exceeding 30 months (Mitra and others, 1990).

At the first stage of the analysis, we have presented the distribution of closed subsequent birth intervals for different subgroups of explanatory variables and then examined the differentials. At the second stage of the analysis, the product limit (P-L) approach is used. This technique is particularly appropriate for the analysis of birth intervals because all intervals, those closed as well as open, can be included in the analysis, thereby avoiding the bias towards short intervals if only closed intervals are examined. The estimate of the proportion of women not having another child within any given period subsequent to a live birth was obtained by using the product-limit method. The estimates for mean birth intervals were then obtained on the basis of P-L estimates for the survival function to take account of censoring (open birth intervals).

The P-L method of the survival function may be obtained as follows:

$$\hat{S}(t_i) = \prod_{j=1}^{i} (1 - d_j/n_j)$$

where dj is the number of women having births at time tj and nj is the number of women just prior to time tj exposed to the risk of having a birth and tj denotes the time since the previous birth of a child to that woman. Hence S(ti) represents the probability of a woman surviving at time ti (since the previous birth) without giving birth to a child, and 1-S(ti) denotes the proportion of women having given birth to a child during the period (0,t).

The advantage of using the P-L method is that censoring is taken into account in estimating the survivor functions. The P-L method is utilized in this study to take account of the issue of censoring in birth intervals. The problem of censoring makes other life table techniques inadequate for estimating the mean birth intervals in the presence of closed and open birth intervals. By contrast, the P-L method considers each observation separately and identifies whether the observation is complete (uncensored) or incomplete (censored). Hence, the P-L estimates provide better estimates than the life table or actuarial estimates of the mean birth interval. Based on the P-L estimates of S(ti), the mean birth intervals can be estimated as follows (Lee, 1992):

$$\hat{\mu} = \sum_{i=1}^{k} \hat{S}(t_i)(t_i - t_{i-1})$$

where S(t0) = 1 and t0 = 0. This expression gives good results if the last observation is uncensored. If the largest observation is censored, then this expression underestimates the mean birth interval. We can interpret the mean birth interval based on the 1989 CPS data as the estimated birth interval limited to 60 months where 60 months is the largest birth interval.

Table 1: Variables and categories explaining birth spacing in Bangladesh

Variables	Categories	Number of intervals in these categories
Maternal age	<=24 years	6,490
	25-34	3,777
	35+	958
Parity	<=2 children	4,577
	3-5	4,148
	6+	2,500
Survival status of index child *	Died during infancy	1,069
	Survived through infancy	9,968
Mother's education	None	7,155
	Primary	2,026
	High school+	2,044
Sex of index child *	Boy	5,776
	Girl	5,261
Residence	Rural	8,813
	Urban	2,412

* Note: Information on survival status and sex of the index child for 166 cases is missing because in the survey these questions were asked only for the child born after January 1984; however, other information, including mother's characteristics and child's birth date, was collected for all children.

Results and discussion

The differential patterns of birth intervals by selected demographic and socio-economic characteristics are displayed in table 2, which considers only closed birth intervals. The selected characteristics are mother's age at the birth of the index child, place of residence, parity, survival status of index child, mother's education and sex of the index child.

Table 2 shows that about three-fourths of the birth intervals for the age groups below 35 years re within the intervals 13-24 and 25-36 months; the proportions are slightly higher for birth intervals of 25-36 months. On the other hand, for older women, i.e.

those aged 35 years or older, about two-thirds of the birth intervals are observed in these intervals (13-24 and 25-36 months). A substantial proportion (19-24 per cent) of children are spaced more than three years apart. Similar observations are evident for place of residence, parity, education of mother and sex of index child. However, a major deviation from the above observations is demonstrated for survival status of the index child. About one-fourth of the births took place within 12 months' duration for women who had experienced the death of a child during infancy as compared with only about 5 per cent doing so among women whose previous child survived infancy. Similarly, about one-half of the women experienced a subsequent birth during the period 13-24 months after the previous birth that resulted in infant death. This implies that an infant death results in a subsequent birth with a relatively shorter duration between the births. This has been well documented in the literature as the "replacement effect". Other than the variable survival status of the index child, all other variables show a similar pattern for different categories; for instance, a lower level of education does not imply a large proportion of women in lower birth intervals. Similarly, the sex of the previous child does not influence the birth interval differently.

Table 2: Percentage distribution of closed birth intervals by different demographic and socio-economic characteristics

Characteristics	Level	Number	Birth interval (in months)				
			0-12	13-24	25-36	37-48	49-60
Mother's age at birth of the index child	<=24 years	2,547	7.42	34.71	38.79	15.55	3.53
	25-34	1,226	>7.75	34.01	38.25	15.91	4.08
	35+	186	9.68	31.72	34.95	19.89	3.76
Residence	Rural	3,169	7.73	34.21	38.78	15.62	3.66
	Urban	790	7.22	34.94	37.09	16.84	3.92
Mother's education	None	2,625	7.54	33.75	38.21	16.91	3.58
	Primary	724	8.15	36.33	38.81	12.98	3.73
	High school+	610	7.38	34.59	39.02	14.75	4.26
Survival status of index child	Died during infancy	585	24.62	47.86	21.54	5.47	0.51
	Survived through infancy	3,374	4.68	32.01	41.38	17.66	4.27
Parity	<=2 children	1,712	6.43	36.39	37.68	15.60	3.91
	3-5	1,498	8.28	31.38	40.39	16.62	3.34
	6+	749	9.08	35.65	36.32	14.95	4.01
Sex of index child	Boy	1,960	7.70	32.91	40.51	15.36	3.52
	Girl	1,863	7.78	36.34	36.55	15.94	3.38

Analysis of closed birth intervals and life table estimates both show that age of the mother at the birth of the index child is one of the important determinants of the birth interval. Age at birth is not only an index of fecundity, but it also indicates birth cohort and a variety of sociological and life-cycle processes; it may also represent a number of unmeasured variables directly related to other intermediate variables of fertility (Bumpass and others, 1986) and indirect effect on birth spacing (Anderson and others, 1986).

In our study, maternal age at birth also shows a consistent positive relationship with birth spacing. Table 3 shows that for women under 25 years of age, about 70 per cent (70.1) had a subsequent child within 48 months (see figure 1). By contrast, only 35.6 per cent of women over the age of 35 had a subsequent birth within 48 months. Differences in birth spacing by age of mother at the birth of the child are relatively small in the early interval, as would be expected in Bangladesh, because virtually universal breastfeeding suppresses fecundity for most women regardless of their age (Shah and Khanna, 1990).

The birth order of the index child that initiates the birth interval could also be an important determinant of the birth interval. However, special caution is needed in interpreting the effect of birth order on birth interval since parity may also represent the mother's age at the child's birth and a variety of other sociological factors may affect birth spacing. In our study, the results show weaker but positive association between birth order and subsequent birth interval. While 68.5 per cent of women having two or fewer children had their subsequent birth within 48 months, a low proportion of women (50 per cent) having six or more children had their subsequent birth within that interval. The birth spacing pattern of women with children 3-5 years of age is quite similar to that of lower parity women (see figure 2).

Figure 1: Estimated proportions of women in Bangladesh not having a subsequent birth within a given interval by mother's age at the birth of index child

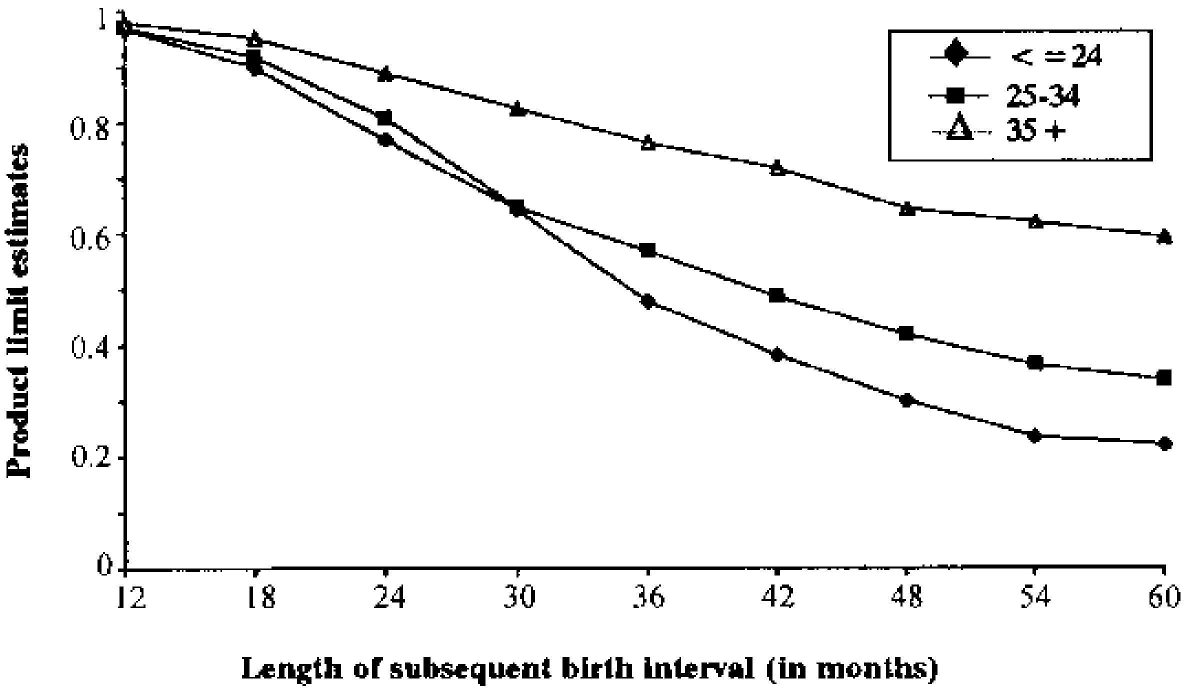
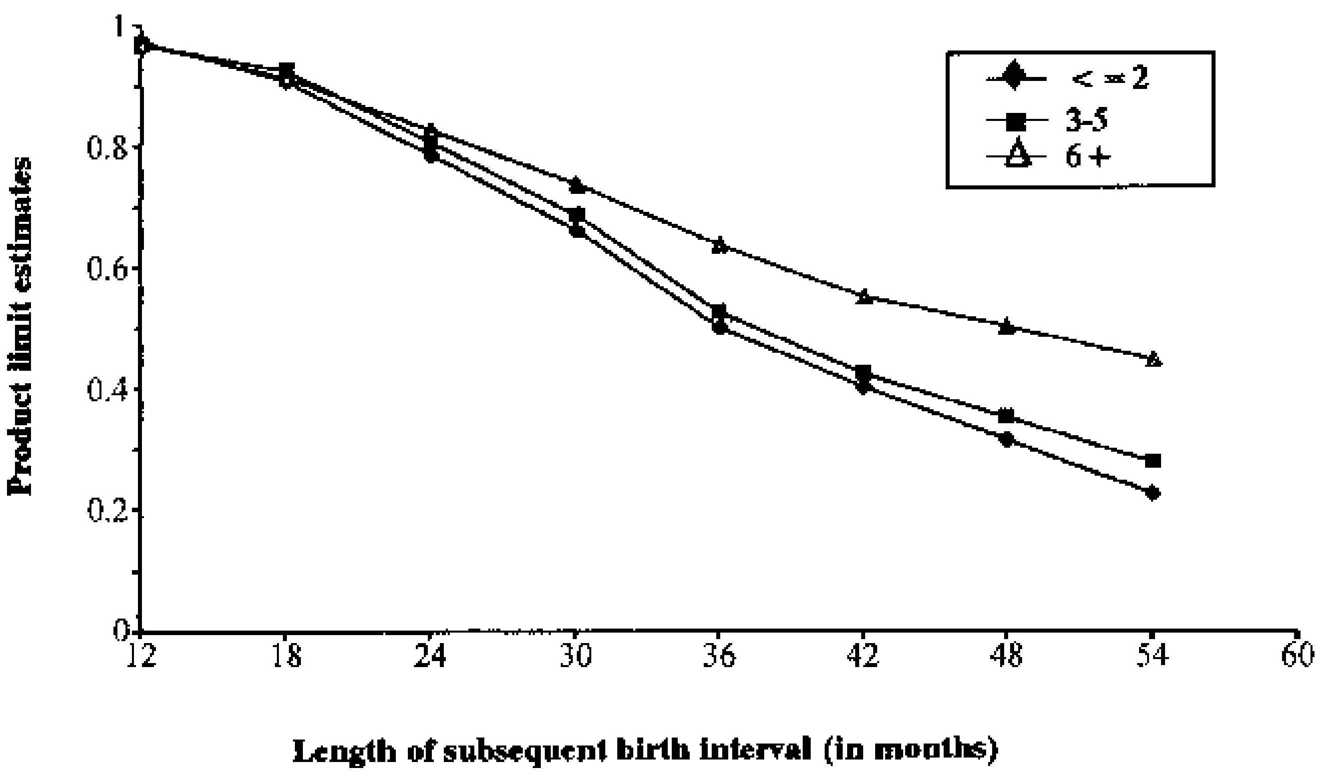


Figure 2: Estimated proportions of women in Bangladesh not having a subsequent birth within a given interval by parity

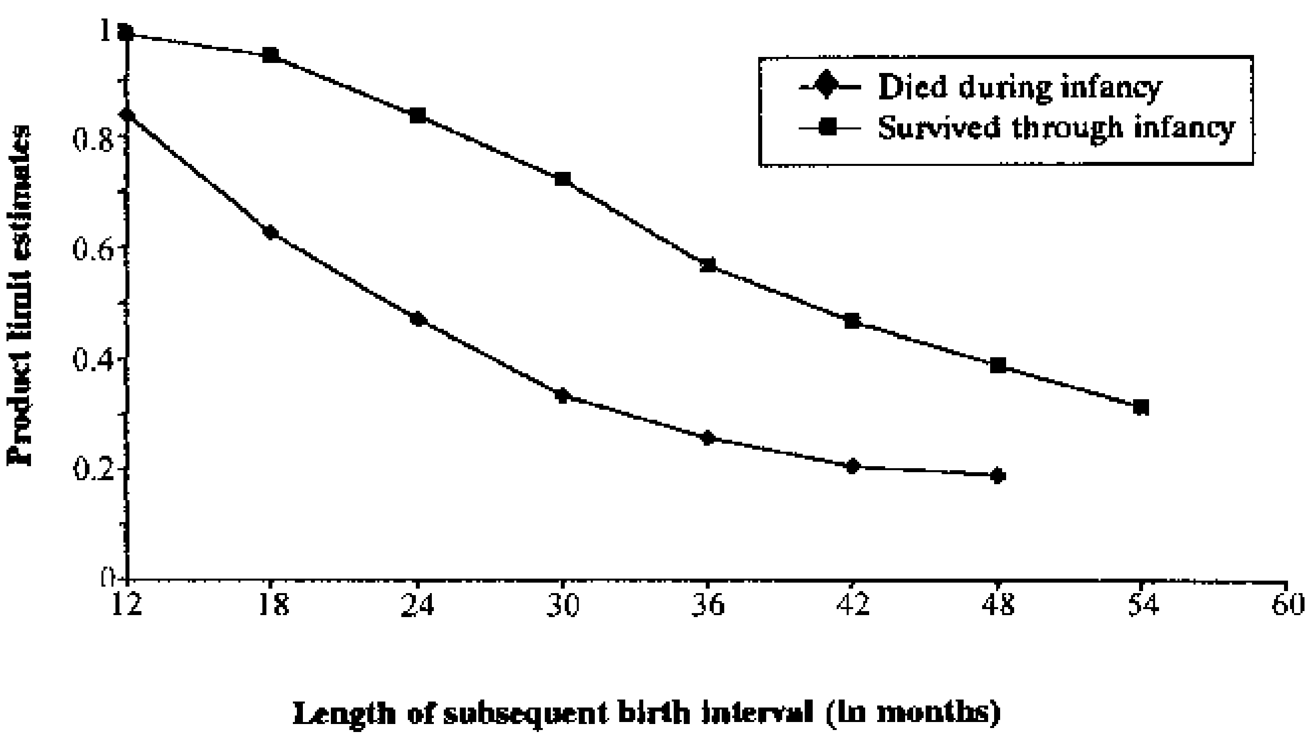


One of the most important determinants of the birth interval as found in several studies is the survival status of the index child (Koenig and others, 1990). Infant and child mortality have an impact on the subsequent birth interval for both social and biological reasons. The social reason is that couples who have experienced the loss of a child at infancy or in early childhood avoid contraception or other means of fertility control that they would otherwise have used. Biologically, the death of the infant or young child interrupts breastfeeding, leading to an early return of ovulation and, in the absence of contraception, increased likelihood of an early subsequent conception. Our study also provides strong evidence of the negative impact of child loss on birth spacing. The P-L estimates of the proportion of women not having a subsequent birth within 48 months show that death of a previous child during infancy is a strong determinant of a short subsequent birth interval (table 3). While 81 per cent of women who experienced the death of a previous child during infancy had a subsequent birth within 48 months, only 61 per cent of women with a surviving child had their subsequent birth during that interval. As can be seen from figure 3, this difference is quite substantial with regard to the subsequent birth interval within an 18-24-month period where 37-53 per cent of women experiencing the death of their previous child had a subsequent birth compared with 5-16 per cent of women whose child survived beyond infancy.

Table 3: Product limit estimates of the proportion of women in Bangladesh not having a subsequent birth within a given interval by different demographic and socio-economic characteristics

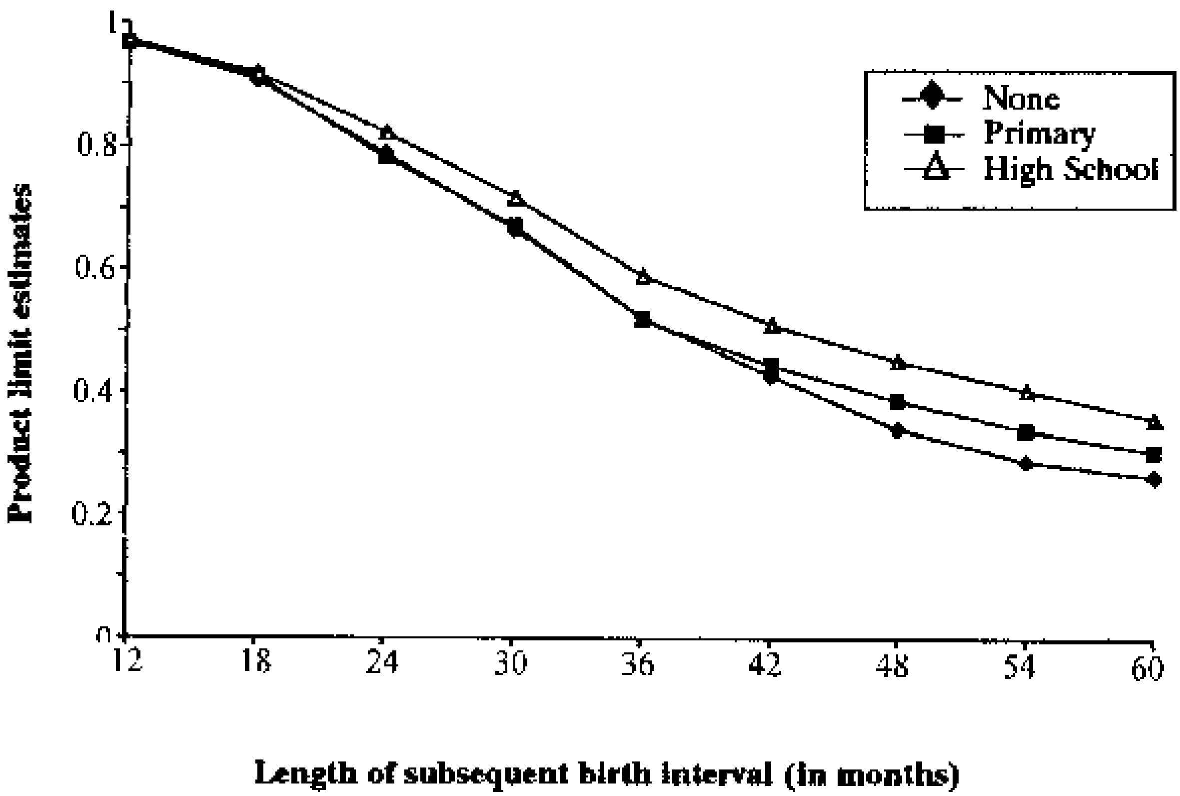
Characteristics	Level	Number	Length of the subsequent birth interval (in months)								
			<=12	<=18	<=24	<=30	<=36	<=42	<=48	<=52	<=60
Mother's age at birth of index child	<=24 years	6,418	.9659	.9003	.7698	.6426	.4788	.3825	.2991	.2404	.2201
	5-34	3,695	.9709	.9189	.8089	.6468	.5682	.4857	.4171	.3717	.3369
	35+	921	.9790	.9530	.8893	.8252	.7623	.7172	.6439	.6162(<=55)	.598(<=59)
Residence	Rural	7,256	.9680	.9136	.7945	.6787	.5284	.4362	.3586	.3111(<=52)	-
	Urban	2,005	.9741	.9156	.8270	.7181	.5798	.4737	.4204	.3949(<=49)	-
Mother's education	None	7,043	.9678	.9079	.7883	.6660	.5215	.4284	.3411	.2904	.2656
	Primary	1,989	.9668	.9133	.7807	.6713	.5197	.4451	.3872	.3389	.312(<=59)
	High school	2,002	.9738	.9199	.8227	.7186	.5903	.5129	.4522	.4054	.374(<=58)
Survival status of index child	Died during infancy	885	.8391	.6283	.4715	.3355	.2580	.2076	.1932	-	-
	Survived through infancy	8,376	.9834	.9448	.8370	.7252	.5703	.4700	.3912	.3417(<=52)	-
Parity	<=2 children	3,833	.9729	.9059	.7843	.6604	.4994	.4020	.3150	.2547(<=52)	-
	3-5	3,383	.9665	.9235	.8054	.6861	.5243	.4231	.3517	.3029(<=52)	-
	6+	2,045	.9672	.9135	.8259	.7363	.6341	.5498	.5015	.4830(<=50)	-
Sex of index child	Boy	4,824	.9700	.9143	.8162	.6984	.5523	.4644	.3845	.3339(<=52)	-
	Girl	4,437	.9686	.9137	.7858	.6754	.5263	.4225	.3592	.3215(<=51)	-

Figure 3: Estimated proportions of women in Bangladesh not having a subsequent birth within a given interval by survival status of the index child



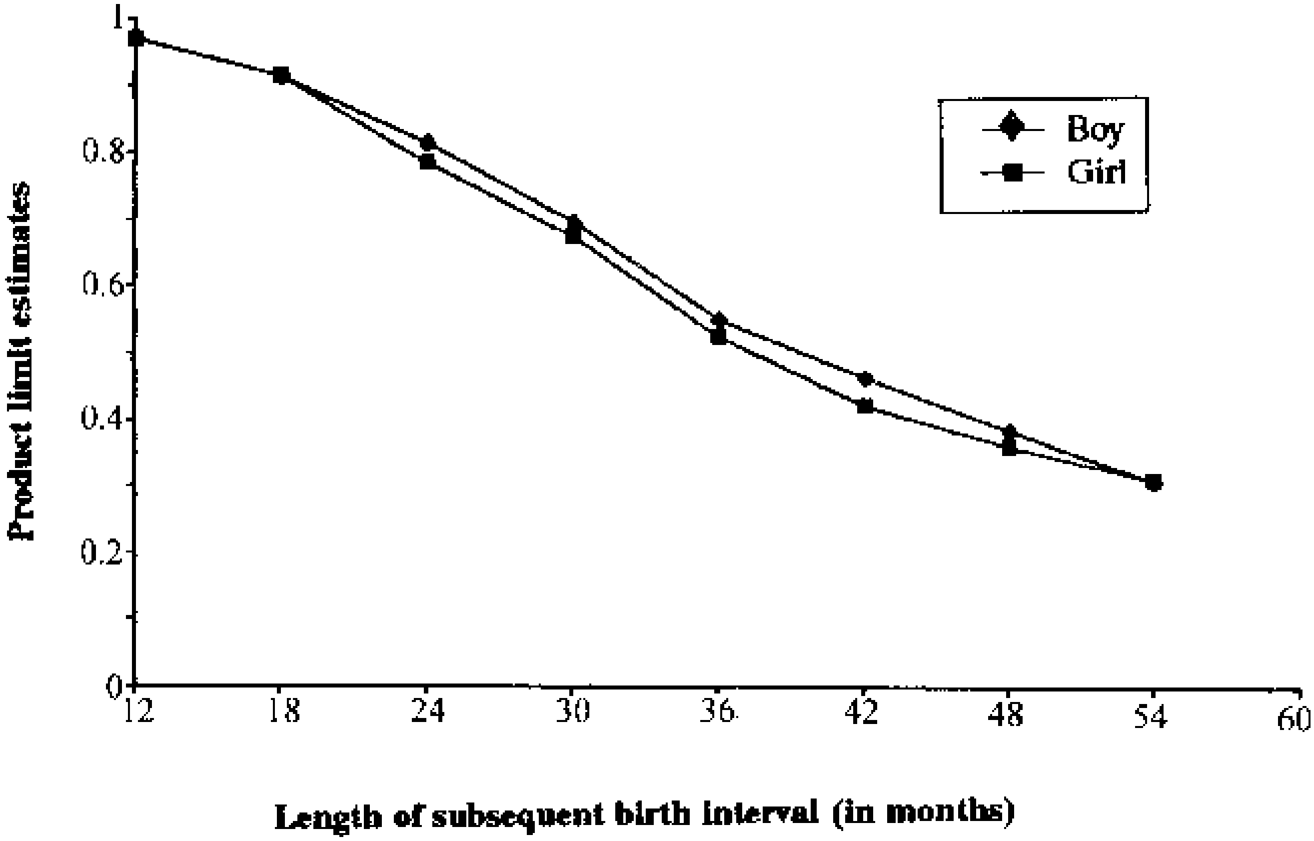
Education is a key variable in explaining birth interval differentials. Education is expected to have a negative impact on fertility and birth spacing through a change in the socio-cultural and reproductive behaviour of married women including child loss, knowledge and practice of contraception as well as through changes in family size norms. To some extent, other findings also agree with this proposition. In the "no education" category, 66 per cent of the women had their subsequent birth within 48 months as compared with 55 per cent of women with a high school or higher level of education having such births. However, there is not much difference in birth spacing between the "no education" and the "primary education" categories (see figure 4).

Figure 4: Estimated proportions of women in Bangladesh not having a subsequent birth within a given interval by the mother's education



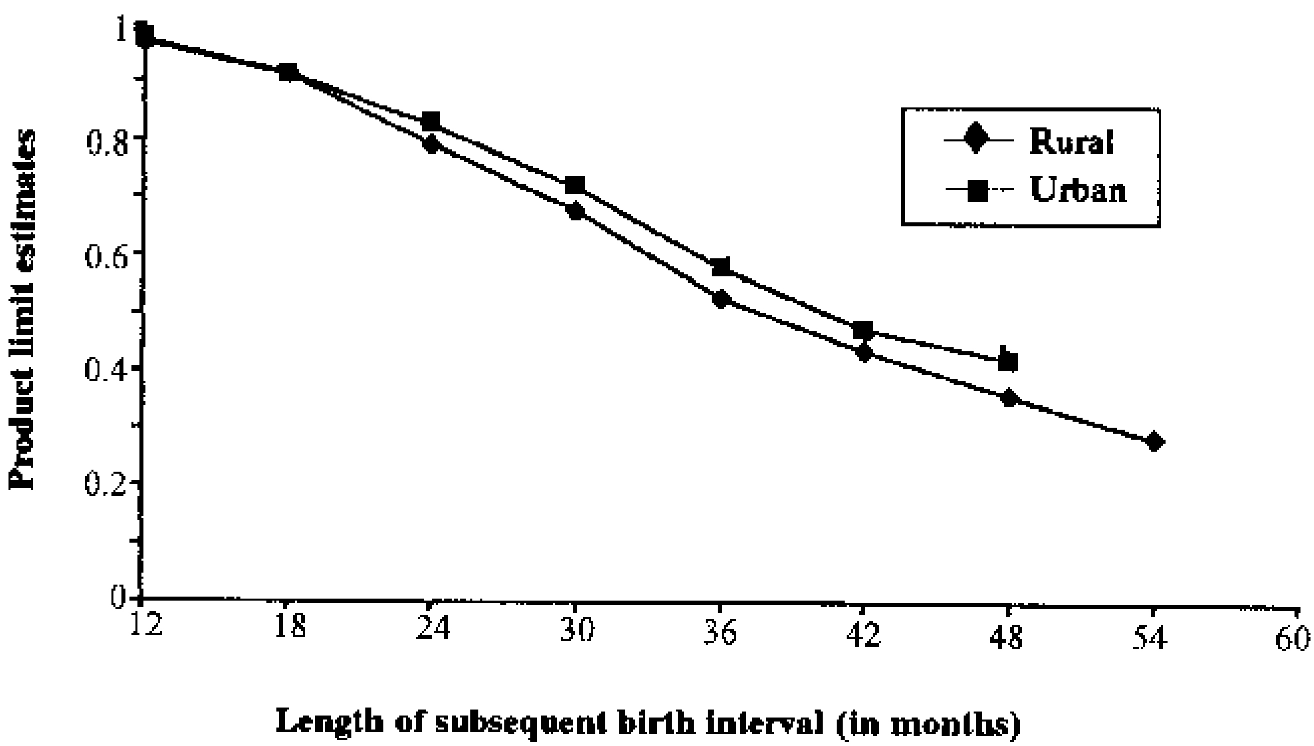
The strong preference for having at least one living son in Bangladesh is well known (Ahmed, 1981; Islam, 1991; Rahman and others, 1992). In a society such as Bangladesh, where parents typically highly value a son as an economic asset and old-age insurance as well as the bearer of the family name, it is less likely that they will accept contraception or other methods of fertility control until they have had at least one son. Thus, the sex of the index child could be regarded as a determinant of the birth interval. The P-L estimates also show a similar pattern of longer birth spacing among women having a son as the index child. About 62 per cent of women with a son had their subsequent birth within 48 months while a slightly greater proportion (64 per cent) of women with a daughter as the index child had their subsequent birth within 48 months (see figure 5). These results are based on sons or daughters as the index child; hence, any comment regarding son preference based on these findings cannot be justified.

Figure 5: Estimated proportion of Women in Bangladesh not having a subsequent birth within a given interval by sex of index child



Place of residence is also found to have an important impact on the birth interval. The urban environment provides new ideas, a technological setting altering the costs and benefits of children, and usually provides greater access to modern health care and family planning services. The results of our study also show an expected pattern of shorter birth intervals for rural women than that for urban women. Sixty-four per cent of women in rural areas gave birth to a subsequent child within 48 months as compared with 58 per cent living in urban areas doing so (see figure 6).

Figure 6: Estimated proportions of women in Bangladesh not having a subsequent birth within a given interval by residence of the respondent



Mean birth intervals are estimated on the basis of closed and open birth intervals using the P-L method. The advantage of using the P-L method in estimating the mean birth interval is obvious. Instead of using only closed birth intervals by excluding the censored observations (open intervals), we employed all the intervals to avoid any underestimations. The reference period does not cover all the events that could have taken place if we had allowed more time. A natural choice then is to assume that the open birth intervals would have ended with a subsequent birth, because the time of each of the reference periods, as the proportion of those who have completed such intervals after remaining without having any birth for the period would be equal to the open birth intervals. The results are presented in table 4. The difference between mean birth intervals for the youngest and the oldest age groups is evident. The mean birth interval for mothers less than 25 years of age is estimated to be 37.4 months as compared with about 48 months for women aged 35 years or older. The difference in the mean birth interval for mothers with different education levels appears to be less pronounced, i.e. about 38.8 months for the no education group and 41.2 months for those with a high school or higher level of education. Similar comments are applicable for parity, place of residence and sex of the index child. However, survival status of the index child shows a marked variation in the mean birth interval. Women who experience the loss of an infant tend to have a much shorter birth interval (25.3 months) than those whose children survive through infancy (39.1 months). This finding supports the well-known theory of the "replacement effect".

Table 4: Mean birth interval (using both open and closed birth intervals) by different demographic and socio-economic characteristics based on P-L method, Bangladesh

Characteristics	Level	Number	Mean	Standard deviation
Mother's age at birth of index child	<=24 years	6,418	37.4428	.2586
	25-34	3,695	40.7468	.3641
	35+	921	47.8970	.6713
Residence	Rural	7,256	37.6762	.2216
	Urban	2,005	37.7859	.3667
Mother's education	None	7,043	38.7848	.2534
	Primary	1,989	39.2708	.4753
	High school+	2,002	41.2209	.4755
Survival status of index child	Died during infancy	885	25.3322	.5181
	Survived through infancy	8,376	39.1517	.1993
Parity	<=2 children	3,833	36.7967	.3032
	3-5	3,383	37.5991	.3221
	6+	2,045	39.5526	.3747
Sex of index child	Boy	4,824	38.3845	.2703
	Girl	4,437	37.1738	.2718

Conclusion

This study provides some empirical evidence for association between some selected explanatory variables and subsequent birth interval. The main strength of this study is that it is based on nationally representative data. Among the six explanatory variables that are examined, the survival status of the index child seems to have a very strong effect on birth spacing. The death of the index child during infancy and early childhood has been found to be strongly related to a shorter subsequent birth interval. However, the impact of child death in later childhood appears to be weaker. The next explanatory variable that seems to have a strong effect on birth spacing is the age of the mother at the birth of the child, showing an increasing mean birth interval by the age of the mothers. Other explanatory variables, such as education of the mother, sex of the index child, residence and birth order, do not seem to have much influence on birth spacing.

Although our study is limited to the bivariate relationship between selected variables and birth intervals, a number of policy implications emerge from the findings of this study: (a) the Government should strengthen its maternal and child health care activities in order to reduce the level of infant mortality; (b) antenatal and postnatal care service facilities should be provided to all pregnant women so that neonatal and postnatal deaths can be prevented or at least reduced; (c) because most deliveries take place at home and trained or skilled birth attendants do not attend most of these deliveries, improved health care utilization by women could result in lower infant mortality, which might contribute to a longer birth interval; (d) once parents get some assurance that child mortality is declining, their perceived fear of child loss during infancy will be alleviated and they will be motivated to accept contraceptive methods to limit their family size; (e) great attention should also be given to the delivery of family planning services to women, particularly younger ones, and to provide them with motivational messages about the health benefits of child spacing.

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