Canadian Studies in Population, Vol. 15 (1), 1988, pp. 101-117

FERTILITY ESTIMATES FOR BANGLADESH BASED ON BIRTH-HISTORY DATA

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Résumé – Estimations de fécondité pour le Bangladesh selon les données de l'historique de naissances. Nous examinons les niveaux et tendances de fécondité au Bangladesh et analysons l'effet de divers types d'erreurs à base des données de l'historique des naissances selon l'enquête sur la fécondité de 1975-76. La fécondité était forte jusqu'en 1970, avec un abaissement important pour la période 1971-75. Cet abaissement reflète la guerre de libération de 1971 et la famine de 1974. Cet abaissement était probablement de durée limitée. L'indice sythètique de fécondite était de 5,9 pour la période 1971-75. La fécondité pour la période de 5 à 10 ans avant l'enquête semble surestimée à cause du déplacement des événements. Les nivaux de fécondité pour les périodes dépassant 15 ans avant l'enquête semblent être erronnés en fonction des fausses déclarations d'âge, d'omissions, et de déplacements d'événements.

Abstract – This paper attempts to estimate the levels and trends in fertility for Bangladesh and to study the effects of various response errors on these estimates using the birth history data from the Bangladesh Fertility Survey, 1975-76. Fertility in Bangladesh remained high up to 1970. A substantial decline in fertility was found to have occurred during the period 1971-75. The observed dip in fertility has reflected the effects of the 1971 war of liberation and the 1974 widespread famine in

Bangladesh. This dip in fertility was probably temporary and it may revert to its previous level. The total fertility rate for Bangladesh was estimated to be 5.9 during the period 1971-75. Reported fertility in the 5-10 years before the date of the survey was exaggerated which, perhaps could be associated with the errors in the data resulting from the misplacement of events over time. Fertility rates beyond the 15 years preceding the survey were found to be substantially affected by age misreporting, omission and misplacement of events.

Key Words – **Lexis diagram, cohort-period fertility**

Introduction

Estimation of the levels of and trends in fertility for Bangladesh has been difficult, particularly because the system of vital events registration representative of its population is still non-existent and the data collected from censuses and demographic sample surveys suffer from various reporting errors. Although several studies have attempted to derive estimates of the levels of and trends in fertility for Bangladesh using the data from censuses and demographic sample surveys, some of them revealed contradictory results while some of them were of limited value due to the inadequacy of data (for example, Amin and Faruqee, 1980; Brass, 1981; Brass and Rashad, 1980; Chen and Chowdhury, 1977; Khan, 1973b; Sirageldin *et al.*, 1975). Moreover, most of the studies are too out of date to reflect the changes that have occurred, particularly those due to the social disruptions caused by the war of liberation in 1971 and the widespread famine in 1974.

A wide range of techniques have so far been developed in order to estimate fertility levels for countries where demographic data collected from censuses and surveys are deficient or unreliable. These include, for example, the stable population technique based on observed age distribution and intercensal growth rate (United Nations, 1967), the reverse survival method based on age-sex distribution from two consecutive censuses (United Nations, 1967), the Brass technique using the reports on births during a 12-month period preceding the survey (Brass *et al.*, 1968), the own-children method using the age distribution of children in the household who are not living away from home (Cho and Feeney, 1978), methods based on model fitting (Brass, 1981; Coale and Trussell, 1974), and the method based on birth-history data (Bogue and Bogue, 1970; Brass, 1977; Potter, 1977; Verma, 1980)

It has been suggested that the retrospective surveys in which birth histories are recorded would not only substitute the traditional systems of obtaining data from a combination of vital events registration and census; but also would be far superior to the traditional systems which are "subject to inconsistencies in the classification of flows and stocks by various demographic criteria" (Shryock and Siegel, 1973:832). In the absence of adequate data of the traditional type, Brass (1977) has noted that the retrospective surveys that collect birth histories might be the most promising means for studying the trends in fertility, and this approach could be more reliable to derive the levels of fertility at different periods of time than the repeated surveys. The purpose of this paper is to estimate the levels of and trends in fertility for Bangladesh, based on the retrospective birth-history data collected in a specially designed national sample survey. Attempts will also be made to study the effects of various response errors on the estimates of fertility derived by employing the direct method of birth-history analysis.

Data and Methods

Data for this study were derived from the Bangladesh Fertility Survey (BFS) which was conducted during 1975-76 under the auspices of the World Fertility Survey. The BFS was based on a three-stage sample design of non-institutional households for both the rural and urban strata. A sample was drawn independently in all three stages. All ever-married women below 50 years of age who had slept in the household the night preceding the household interview were selected as eligible respondents for the individual interview. Among the successfully interviewed women, 5,024 were from rural areas and 1,497 from urban areas. An oversampling in the urban areas was purposely done to obtain the reasonably large sample required for carrying out a separate study for urban women. Sample weights were assigned with a view to allow for this oversampling. Weights assigned to the rural and urban samples were 1.194 and 0.347, respectively (Bangladesh, 1978:31). In order to obtain the national estimates of fertility, these weights were used.

Details of all pregnancies experienced by the selected women were recorded in a chronological order. A single integrated history of all pregnancies was obtained, probing for pregnancies not resulting in live births in each interval bounded, as appropriate, by marriage and first live birth, first live birth and second live birth, and so on until the open interval. This segmental approach was designed to help the respondents minimize memory lapse and misplacement in the location of events of their reproductive lives. Dates of birth of

the respondents and their children were imputed in the cases where these were not available in months and years (see Bangladesh, 1978).

Information obtained from birth histories can be used to generate fertility estimates by transforming these into two matrices, one for the numerator and the other for the denominator. The numerator matrix is formed for each live birth classified simultaneously according to the calendar year in which it occurred and the age of the mother at the time of birth. The denominator matrix is formed for each woman, classified simultaneously according to the calendar year and the person years by the age of the women. Thus, from the above two matrices, age-specific fertility rates can be calculated for a long period (for example, 35 years if the age of the oldest respondent is 49 years at the time of interview) in the past. This procedure provides fertility rates both in the cohort and cross-sectional contexts, which, for conventional five-year periods, may be explained with the help of the Lexis diagram (Figure 1) as follows.

The exact ages of women separated into five-year cohorts, determined by age at interview, are represented on the vertical axis. Periods before the survey, relative to the date of interview in five-year intervals, are represented on the horizontal axis. Each cell in the form of a parallelogram centered on exact five-year age groups up to age 50 in the Lexis diagram (Figure 1) and represents fertility rates specific to both the cohort and the period.

Cross-sectional fertility rates over different periods preceding the date of the survey can be obtained by reading through the columns. Diagonals give the cohort fertility rates. To study the change in cross-sectional fertility, different cohorts can be compared for the same age of women at the time of interview. For instance, to examine the change in fertility of women aged 35-39 (age at end of period) in the 15 years before the date of survey, the shaded parallelograms in the Lexis diagram (Figure 1) corresponding to women aged 35-39, 40-44, and 45-49 years at interview, in 0-5, 5-10, and 10-15 years before the survey respectively are to be compared.

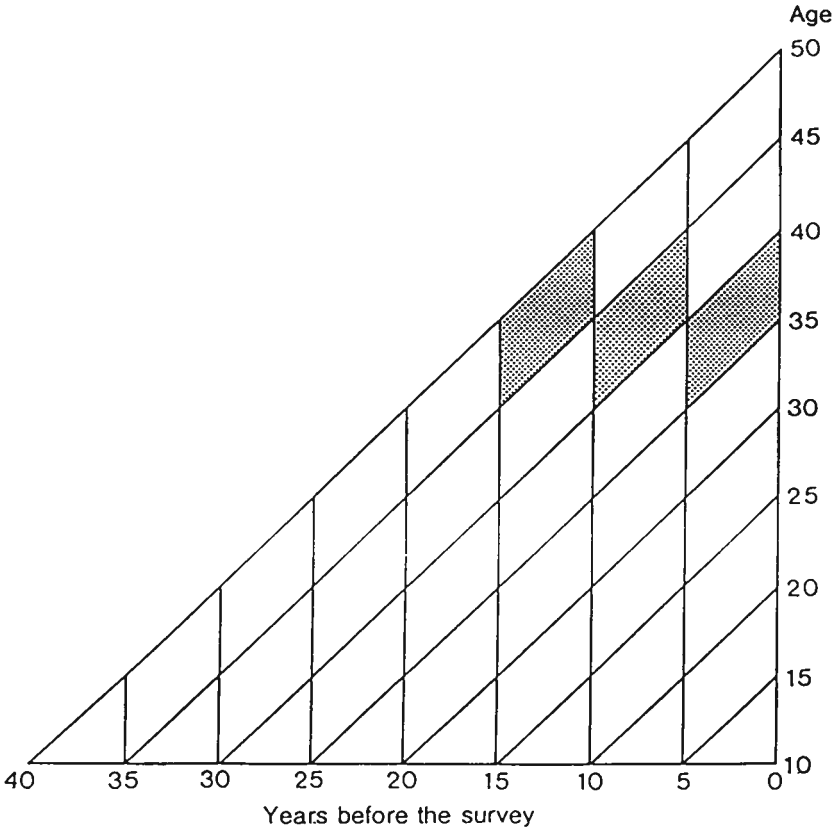
Results

Current Levels of Fertility

Current levels of fertility can be studied by age-specific fertility rates for the period of five years preceding the survey. Table 1 presents the age-specific fertility rates for Bangladesh by single years from 1971 to 1975. In order to minimize the effects of sampling variation and to examine the overall levels

of current fertility, five-year-average age-specific fertility rates for the period 1971-75 were also computed.

The total fertility rate for Bangladesh was found to have declined, though not consistently, from a level of 7.3 to 5.2 over the period of five years from



Note

Shaded parallelograms to be compared in measuring the change in fertility of women aged 35-39 (age at end of period) in the 15 years before the date of survey.

FIGURE 1. BIRTH COHORT AND CROSS-SECTIONAL FERTLITY USING LEXIS DIAGRAM

TABLE 1. AGE-SPECIFIC FERTILITY RATES FOR BANGLADESH, 1971-75†

Age Group	Year					
	1971	1972	1973	1974	1975	1971-75
15-19	0.220	0.190	0.196	0.190	0.194	0.198
20-24	0.368	0.310	0.318	0.301	0.283	0.315
25-29	0.322	0.264	0.286	0.243	0.250	0.271
30-34	0.258	0.213	0.200	0.212	0.181	0.212
35-39	0.196	0.131	0.125	0.108	0.091	0.129
40-44	0.065	0.050	0.049	0.036	0.035	0.046
45-49	0.018‡	0.018	0.000	0.015	0.006	0.008
Total Fertility Rate	7.3	5.9	5.9	5.6	5.2	5.9

Source: Computed from the BFS, 1975-76.

† Computed by multiplying age specific marital fertility rates for ever married women with the proportion ever married found in the 1974 Bangladesh Population Census.

‡ Assumed to be the same as the corresponding rate for 1972.

1971 to 1975 as revealed by the single-year rates. The marked decline in fertility in the year 1972 may be explained by a number of factors. The 1971 social disruption caused by the war of liberation presumably influenced some of the intermediate variables, such as proportion married among females, voluntary or involuntary abstinence, and frequency of coitus, all of which in turn

affected the reproductive performance of couples. During the period of social disruption, the number of persons entering reproductive life might have been reduced because of the temporary postponement of marriages. A large exodus of about 16 per cent of the population (Curlin *et al.*, 1976) to neighbouring India as refugees might have contributed to the reduction in conception either by voluntary or involuntary separation of spouses. Due to psychological stress or the desire to postpone pregnancy, coital frequency might have been reduced. Reduction in the number of births in 1972 (a year after the war of liberation) presumably reflected the depressing effects of the above intermediate variables on fertility during the period of social disruption.

A similar decline in fertility a year after the war of liberation was also found from the reasonably complete vital registration data in Matlab Thana (Chen and Chowdhury, 1977; Curlin *et al.*, 1976). Although this finding was limited to a relatively smaller area and might not be representative of all Bangladesh, it might be taken to support the evidence of the marked decline in fertility a year after the war of liberation.

The post-conflict "compensatory" rise in fertility was found in Matlab Thana in 1973 resulting from the desire to replace the lost children and to make up for the postponed marriages (Chen and Chowdhury, 1977). The present study, however, does not show such a rise in fertility. Event misplacement in birth-history data produces an exaggerated decline towards the date of survey (Potter, 1977). This is found to be more pronounced a year before the date of survey (McDonald *et al.*, 1976). This may account for the apparent decline in fertility in Bangladesh in the year 1974.

The 1974 famine in Bangladesh, resulting from the severe monsoon flooding that caused almost total crop failure of the major annual rice harvest, might have decreased the nutritional status of a vast majority of women. Maternal malnutrition has resulted in the reduction in fecundity and lengthening of the period of temporary infertility (Chowdhury and Curlin, 1979). These biological factors may have contributed to the highest decline in fertility in the year 1975. Chen and Chowdhury (1977) also found a sharp decline in fertility in Matlab Thana a year after the 1974 famine, which may be responsible for the decline in fertility in Bangladesh during the year 1975.

The total fertility rate (TFR) for Bangladesh during the period 1971-75 is found to be 5.9, which is not out of line with that of 6.3 (longitudinal registration estimate) for 1963-65 obtained from the Population Growth Estimation Experiment (Farooqui and Farooq, 1971) and of 6.0 in 1966-68 derived from the National Impact Survey data (Sirageldin *et al.*, 1975). However, the estimate of TFR for the year 1974 obtained in this study is considerably lower than that of 7.2 derived from the 1974 Bangladesh Retrospective Survey of

Fertility and Mortality using the Coale-Trussell (1974) fertility model based on the assumption of constant fertility in the past (Bangladesh, 1977). This assumption though generally valid for Bangladesh, might be less realistic for recent years (Bangladesh, 1978).

Trends in Fertility

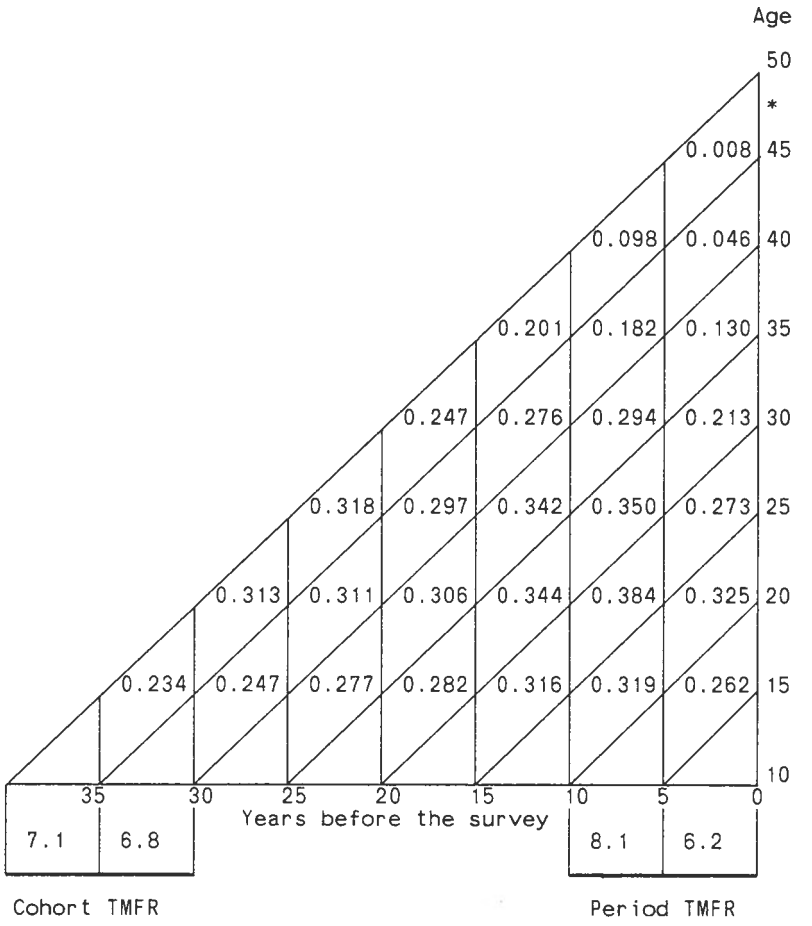
Age-specific marital fertility rates for ever-married women are used to study the trends in fertility. These rates for Bangladesh, in five-year periods for the 35 years preceding the date of survey, are presented in Table 2. The table provides both the cross-sectional and cohort fertility rates as explained earlier.

The cross-sectional marital fertility rates in all age groups of women have shown a sharp decline in the period 0-5 years before the survey. Table 2 also shows that the cross-sectional marital fertility rates were the highest during the period 5-10 years before the survey, except for the women aged 35-39 years at interview. Probably due to reporting errors, the cross-sectional fertility rates for ever-married women do not reveal a clear trend over time, particularly beyond the 15 years preceding the survey. The cohort aged 40-44 at interview (women born in the period 1931-35) had the lowest fertility in all age groups, except for the age groups 30-34 and 20-24 during the period 5 to 25 years before the survey. This feature seems to be implausible, as there is no external evidence that the fertility contributed in part by this cohort of ever-married women was lower in the period 5 to 25 years prior to the survey.

A comparison of adjacent age cohorts, to detect the change in marital fertility, reveals that in the 25 years before the date of survey the women in the age group 15-19 belonging to the youngest cohort (aged 15-19 at interview) have experienced a lower fertility. For other cohorts in the age group 15-19, the older the cohort the lower the fertility. This feature appears to be quite contradictory to what one would expect.

Reported total marital fertility rates (TMFRs) of 7.1 and 6.8 for ever-married women aged 45-49 and 40-44 years at interview, respectively, compare well with the mean parity of 6.9 for ever-married women aged 40-44 years at interview. However, the reported TMFR of 8.1 for the period 1966-70, compared to that of 6.2 for the period 1971-75, appears to be an overestimate of the actual fertility situation.

TABLE 2. AGE COHORT AND CROSS-SECTIONAL MARITAL FERTILITY RATES FOR EVER-MARRIED WOMEN IN BANGLADESH



Source: Computed from the BFS, 1975-76.

* Age specific fertility rates for the oldest age cohort (aged 45-49 at the time of interview) are based on 4 year average.

Age Patterns of Fertility

The age curves of fertility for Bangladesh from various nationally representative sources are plotted in Figure 2. With the exception of the two fertility schedules obtained from the Population Growth Estimation (PGE) experiment, all the fertility schedules follow the United Nations' (1963) "early peak" pattern (maximum fertility in age group 20-24). The shape of the fertility schedule drawn from the Bangladesh Fertility Survey data and the National Impact Survey data was found to be almost similar except for the age group 15-19. It may be pointed out that both the surveys used birth-history data. The discrepancy in the age group 15-19 may be explained in part by the married proportion employed in the two surveys.

The fertility curve drawn from the Bangladesh Retrospective Survey of Fertility and Mortality has tapered off abruptly from the age group 25-29 and has depicted an "older" fertility schedule. On the other hand, the Chandrasekar-Deming estimate from the PGE experiment has demonstrated a "younger" fertility schedule. Thus, it appears that different estimation procedures employed in various surveys – confounded by the differential inaccuracy of data – may have caused differences in the shape of the age curves of fertility in Bangladesh.

Effects of Reporting Errors on Fertility Estimates

In Bangladesh, where a vast majority of the respondents are not calendar-year-conscious and are even ignorant of their own date of birth, fertility estimates derived from birth history data are likely to suffer from various errors. (Of the respondents of the Bangladesh Fertility Survey in 1975-76, approximately 99 and 88 per cent could not report their own date of birth and the dates of birth of their children, respectively, in calendar years and months (Chidambaram *et al.*, 1980:31).) Until now, no direct method of detecting the effects of various response errors on fertility estimates has been available. The alternative is to inspect the observed fertility rates for apparent distortions in light of available evidence. In addition to response errors, it is suspected that the observed fertility rates might have been affected by the procedure of imputing the dates of birth of a vast majority of respondents and their children that were not reported in calendar years and months.

It was pointed out earlier that in the age group 15-19 corresponding to various age cohorts of women other than the youngest cohort (aged 15-19 years at interview), the older the cohort the lower was the fertility in Bangladesh. As there is evidence of a slightly rising age at marriage in Bangladesh during

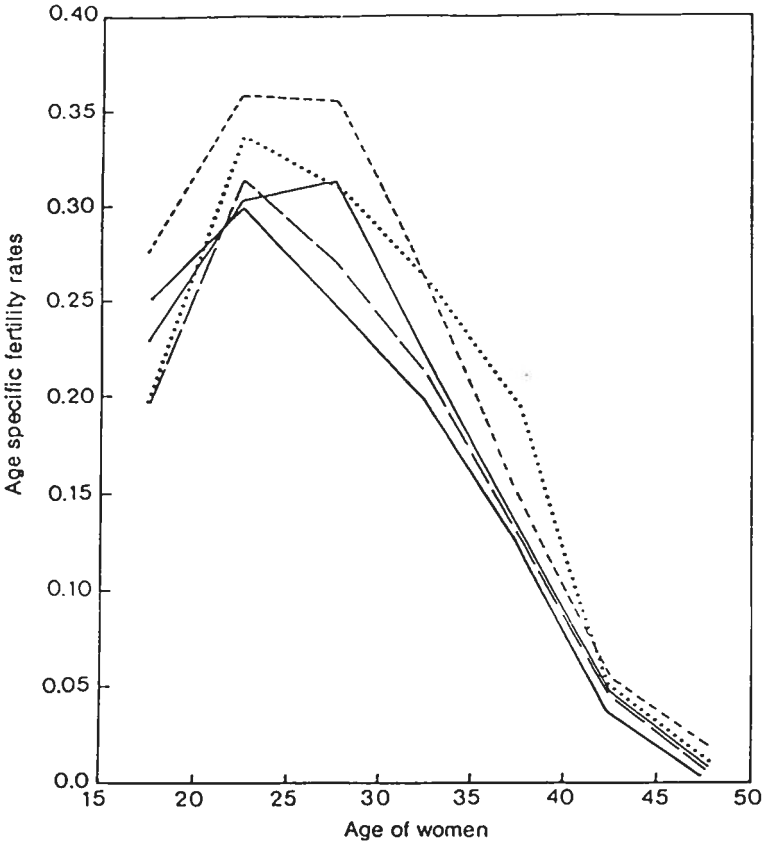


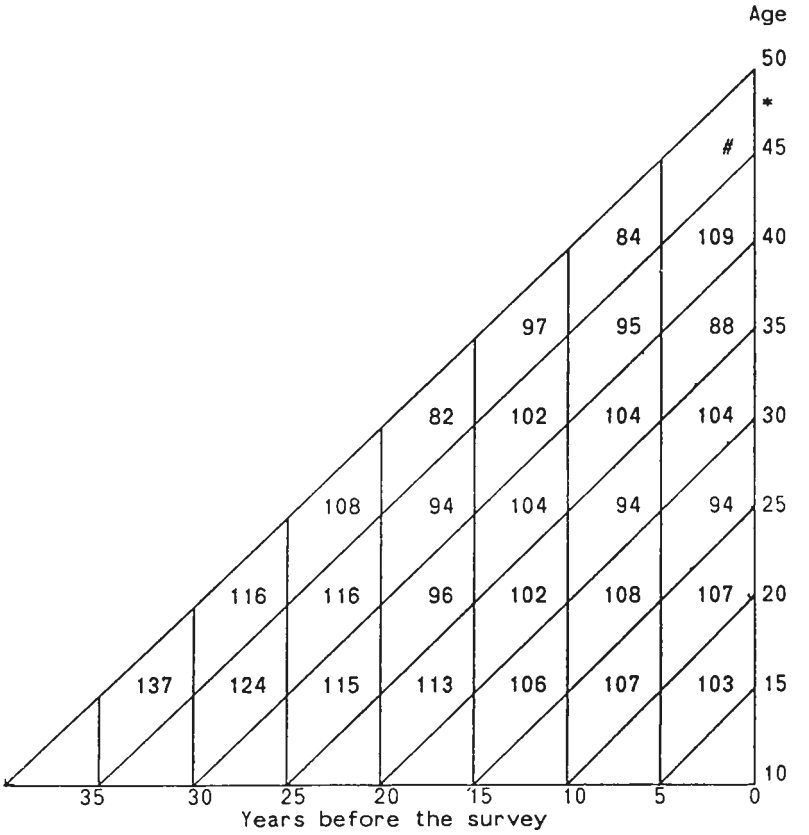
FIGURE 2. AGE CURVES OF FERTILITY FOR BANGLADESH

the 35 years before the survey (Bangladesh, 1978), one would normally expect that the older the cohort the higher would be the fertility in the age group 15-19. The contradictory situation observed for all age cohorts, other than the youngest cohort, indicates that a substantial number of response errors have crept into data on fertility. Effects of omission of births may be examined from the observed fertility rates, particularly for the older age cohorts of women. The cohort of women born in the period 1931-35 (aged 40-44 years at interview) generally reported lower fertility rates as compared to those reported by other age cohorts of women (Table 2). This provides evidence of a substantial omission of births by older women. Age misreporting and event misplacement among older women may also partly account for the reported lower fertility.

One of the internal consistency checks for the possible effects of the response errors on the observed fertility rates is to examine the patterns of the reported sex ratio at birth by various age cohorts of women. A clear time trend beyond the period 15 years prior to the survey is found in the reported sex ratios at birth per 100 females for various age cohorts of women in the age group 15-19 (Table 3). This is indicative of sex-selective reporting errors in the early years of childbearing. The reported sex ratios at birth have deviated markedly from the expected range of 102-107 births per 100 females, with a few exceptions for various age cohorts of women. Misplacement of births over time might partly be attributed to the observed patterns of sex ratios at birth.

Event misplacement in the form of pushing the earlier births forward and the recent births backward over time affects the fertility rates derived from birth histories. If such misplacement of live births should occur, the cross-sectional fertility rates in the most recent period (0-5 years before the survey) would be understated and the rates corresponding to the period 5-10 years prior to the survey would be inflated (Brass and Rashad, 1980). A decline in cross-sectional fertility in the period 0-5 years before the survey and an apparent overstatement of fertility in the period 5-10 years preceding the survey (Table 2) indicate the existence of event misplacement errors. However, as discussed earlier, there might have been a fertility decline in Bangladesh during the five-year period immediately preceding the survey due to the social disruptions caused by the war of liberation in 1971 and the widespread famine in 1974. A gradual decline in the proportion of ever-married women in Bangladesh (see Bangladesh, 1978), particularly before age 20, might also contribute to a reduction in fertility in the 0-5 years before the survey. There has been no evidence of a substantial fertility decline in Bangladesh during the 1940s and 1950s, except that there was a slight fertility decline in the early to mid-1940s due

TABLE 3. SEX RATIO AT BIRTH PER 100 FEMALES BY AGE OF MOTHER AND YEARS BEFORE THE SURVEY IN BANGLADESH



Source: Birth history data, Bangladesh Fertility Survey, 1975-76.
Less than 30 births.
* Sex ratios for the oldest age cohort (aged 45-49 at interview) are based on 4 year average.

to the 1943 Bengal famine (Khan, 1973a). The observed lower cross-sectional marital fertility rates, in general, corresponding to the different five-year periods beyond the 15 years preceding the survey, indicate that these rates were affected by errors due to the omission of births, the misreporting of the age of mothers and the misplacement of births over time.

Summary and Conclusions

Fertility in Bangladesh is found to have declined substantially during the period 1971-75. The social disruptions caused by the 1971 war of liberation and the widespread famine in 1974 might have been the reasons for this decline. However, the observed dip in the levels of fertility are probably only temporary, and fertility may revert to its previous roughly constant trend (Amin and Faruqee, 1980). Evidence from the former Cholera Research Laboratory vital registration data in Matlab Thana has indicated that the total fertility rate has been increasing since the year 1975. (Total fertility rates for Matlab Thana were found to be 4.3, 6.2 and 6.7 in the years 1975, 1976 and 1977, respectively (Chowdhury and Sheikh, 1980).) It was observed that fertility in the period 5-10 years before the survey (1966-70) was somewhat exaggerated, a feature mainly associated with the misplacement of earlier births forward and the recent births backward in time while reporting the events. Observed fertility rates beyond 15 years prior to the date of survey have been very doubtful because the birth-history data in the relatively distant past are more likely to be affected by various response errors, especially the omission and misplacement of events. Interviewing the respondents from the most recent to the earliest event for collecting birth-history data as suggested by Potter (1977:364) "would minimize the potential for distorting recent trends in fertility."

The observed national estimate of TFR of 5.9 for the period 1971-75 derived in the present study – which agrees closely with that of 6.2 (unadjusted) obtained by Rodriguez and Cleland (1980) for the same period of time and using the same source of data – was about 15 and 27 per cent lower than the corresponding estimate found by the application of the Gompertz relational model and the P/F ratio method, respectively. It should be pointed out that Brass and Rashad (1980) have adjusted the TFRs for Bangladesh in the period 1971-75 to be 7.5 and 7.4 using the P/F ratio method and Gompertz relational model, respectively. Again, Brass (1981) – applying the Gompertz relational model to the same set of data with a slightly modified fitting procedure – adjusted the TFRs for Bangladesh during the periods 1961-65, 1966-70 and 1971-75 to be 7.4, 7.3 and 6.8, respectively. It seems that the adjustment procedures probably have provided a satisfactory representation of trends but not of levels of fertility in Bangladesh, where the response errors have affected the data substantially. Brass (1980) was also doubtful about the levels of fertility during the period 1971-75 as obtained by applying the adjustment procedures.

Finally, it was realized that the birth-history data used in this study were not well reported and well imputed. This has caused some distortions in the reported levels of and trends in fertility. Nevertheless, this study has provided

a fair idea about the levels and trends in fertility in Bangladesh. It may be suggested that the analysis of fertility from birth-history data for a developing country such as Bangladesh should not extend beyond the 15 years before the date of survey. Further research should be carried out to study the possible effects and interactions of various response errors on the estimates of fertility.

Acknowledgments

This paper is based on the author's M.A. thesis submitted to the Australian National University, Canberra, Australia. An earlier version of this paper was presented at the annual meeting of the Canadian Population Society in Vancouver, Canada, during June 1983. The author is grateful to Professors P. Krishnan, Wayne W. McVey and Dr. N.M. Lalu of the University of Alberta, Edmonton, Canada, for their critical review of an earlier draft and their helpful suggestions.

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Received March, 1986; revised September, 1986.