EAST-WEST CENTER
PROGRAM ON POPULATION

ASIA-PACIFIC POPULATION RESEARCH REPORTS

111084

Number 5 June 1995

What can we say about fertility trends in Bangladesh? An evaluation of the 1991 population census

Andrew Kantner, Charles Lerman, and Mohammed Yusuf

Andrew Kantner, a senior fellow in the Program on Population of the East-West Center, is a sociologist specializing in demographic methods, reproductive health, and social development. Charles Lerman, a Population Development Officer with USAID, specializes in contraceptive logistics and local family planning program management. Mohammed Yusuf, a former UNFPA census advisor to the Bangladesh Bureau of Statistics, specializes in demographic statistics and sample survey methodologies.

This Research Report is based on a detailed analysis of population trends in Bangladesh by Andrew Kantner, "Evaluation of final results from the 1991 population census: Implications for demographic change in Bangladesh" (East-West Center Working Papers, Population Series, No. 75, October 1994).

Evidence from several sources indicates that fertility has fallen substantially in Bangladesh, but actual fertility levels remain uncertain. This report discusses fertility trends derived from the 1991 population census, officially released in December 1993, and other recent sources of information on the Bangladesh population. Several indices suggest that age reporting in the 1991 census was highly unreliable. A comparison with forward projections from the 1981 census, as well as other surveys, suggests that the 1991 census may have substantially overenumerated young children and underenumerated adolescent girls and young women. The low number of women aged 15–24 implies that the total fertility rate, deduced from the number of children aged 0–4, could be around 5.0 children per woman as of 1989–91—considerably higher than generally estimated. By contrast, the 1991 Contraceptive Prevalence Survey and 1991 Vital-Registration System statistics both report a total fertility rate of 4.2 for 1991, and preliminary results from the 1993/94 Bangladesh Demographic and Health Survey indicate a fertility drop to 3.4 for the period 1991–1993/94. In other words, survey findings imply a reduction in fertility of at least 40 percent since 1981. Unfortunately, nearly all demographic reporting systems in Bangladesh may be subject to error, and demographers must carefully consider all evidence before drawing conclusions as a basis for policy decisions.

Bangladesh is emerging as one of Asia's most interesting family planning success stories. In a traditional agricultural economy characterized by extremes of poverty and population density, contraceptive use has increased steadily since the late 1970s, resulting in a dramatic decline in fertility. This trend is unique because it has occurred in the absence of significant economic development or social change.

Several factors have contributed to the fertility decline in Bangladesh.

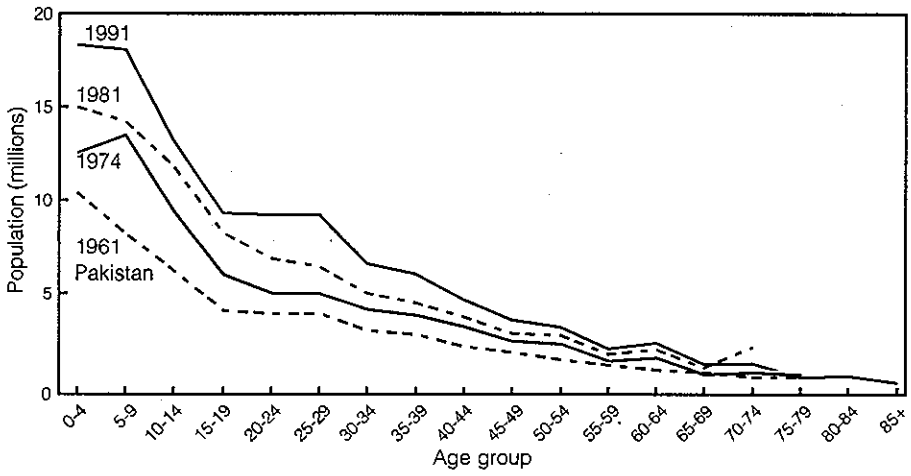

Figure 1. Five-year age distribution of Bangladesh census population, adjusted for undercounting

Note: In 1961 Bangladesh was part of Pakistan.

Among the most important has been an increasingly effective family planning program that provides contraceptives through government facilities, nongovernment organizations (NGOs), and commercial outlets. This highly pluralistic service-delivery system is unique in South Asia.

Although Bangladesh has not experienced the rapid economic growth of neighboring countries in Southeast Asia, significant ideational changes appear to have lowered fertility and improved the status of women. Education may be growing in importance, especially within agrarian communities increasingly dependent on off-farm employment. The expansion of women's employment, for example in the fast-growing Bangladeshi textile industry, and the increasing acceptability of women working outside the home also constitute significant changes in the social fabric of the country.

Population censuses, national demographic and health surveys, sample vital-registration statistics, and small-area project data—these all provide information on levels and trends in fertility and mortality in Bangladesh. National-level results from the 1991 population census, officially released on 23 December 1993, provide the principal source of current information on population size, distribution, and growth. By using census information on the age-sex distribution of the population, it is possible to analyze levels and trends in vital rates (fertility and mortality) and migration. To assess the reliability of these estimates, it is first necessary to evaluate the overall quality of the census enumeration.

BACKGROUND

Over the past two decades, attempts to measure the size and growth of the Bangladesh population have generated considerable controversy. Results from Bangladesh's first national population census, conducted in 1974 (BBS 1977), were in doubt because census coverage levels could not be adequately assessed. The 1981 population census (BBS 1984) was conducted in more settled times and with more technical sophistication. The results (even after being adjusted for a 3.1 percent undercount) produced an annual population growth rate over the 1974–81 period of 2.3 percent. Some demographers found this figure incompatible with rates of natural population increase derived from national and regional surveys and local-area project data, which suggested a higher growth rate. Controversy also surrounded the generation of national population estimates from the 1987 economic census, which reported surprisingly low population totals and generated speculation that the 1981 population census may have actually overcounted the population.

Past efforts to estimate levels and trends in fertility, mortality, and international migration in Bangladesh have been seriously compromised by the inconsistent quality of much demographic information. For example, evidence of serious age misreporting and coverage error in previous censuses led some demographers to conclude that "it is doubtful whether methods for estimating demographic parameters from population age distributions should be applied in Bangladesh" (NAS 1981, 18). Sample vital-registration statistics (VRS) that have been collected by the Bangladesh Bureau of Statistics (BBS), while possibly becoming more complete over time, "almost certainly suffer from underenumeration of vital events" (Huq and Cleland 1990, 10).

Despite the uncertainty surrounding available data, demographic opinion in Bangladesh has not always been characterized by disagreement. In fact, until very recently, there was a growing consensus on fertility estimates and the performance of the national family planning program. National surveys during the 1980s reported substantial reductions in fertility. For example, the 1989 Bangladesh Fertility Survey (BFS) suggested that the total fertility rate (TFR)—the average number of children

that a woman will bear over her entire reproductive life span—fell from 6.7 in 1981 to 4.8 in 1987. Birth histories collected by the 1989 and 1991 Contraceptive Prevalence Surveys (CPS) suggested that fertility declined from 5.6 in 1984 to 4.2 in 1991. Preliminary findings from the 1993/94 Bangladesh Demographic and Health Survey (BDHS) indicate that fertility could have fallen to 3.4 between 1991 and 1993/94 (NIPORT, Mitra and Associates, and Macro International 1994). This most recent result requires further diagnostic study, but it suggests that Bangladesh may be experiencing a rapid transition in reproductive behavior.

These recent fertility trends are indeed impressive. Nevertheless, it is sobering to remember that surveys conducted during the 1960s and 1970s (e.g., the 1961–62 Demographic Survey of East Pakistan, the 1968–69 National Impact Survey, and the 1975 Bangladesh Fertility Survey) also reported falls in fertility. Unfortunately, considerable undercounting of births combined with age misreporting (especially the overstatement of children's ages) produced fertility estimates that were too low and fertility trends that proved largely nonexistent (NAS 1981, 2). Some demographers worry that more recent surveys could also be misrepresenting actual levels and trends in fertility.

A CLOSER LOOK AT THE 1991 CENSUS

In the final national results from the 1991 census, the BBS reported an unadjusted enumerated population as of March 1991 of 106.3 million. This figure was corrected for a net undercount of 4.6 percent, obtained from the 1991 postenumeration survey, giving a final adjusted total of 111.4 million. An undercount of 4.6 percent is not an exceptionally high level of omission, although reported coverage errors were somewhat greater in the 1991 census than in the census of 1981.

According to the two censuses, the total population of Bangladesh grew from 89.9 million in 1981 to 111.4 million in 1991. This implies that the annual rate of population growth fell from 2.32 percent during 1974–81 to 2.15 percent during 1981–91. Nevertheless, the population growth rate produced by the 1991 census is still high: an annual population growth rate of 2.15 percent, if held constant, generates a doubling of population in just 32.3 years.

Results from the 1991 postenumeration survey suggest that underenumeration was greatest in urban areas, a problem also encountered in previous censuses. The 1991 census had the highest undercounts for infants aged 0–1 (that is, those under one year of age), adolescent girls aged 15–19, and the adult population over age 60. In general, females were more likely to be undercounted than males. However, a somewhat surprising finding was that infant boys were undercounted more than infant girls.

A comparison of age distributions for the 1961 population census of East Pakistan (reported in BBS 1992) and the 1974, 1981, and 1991 Bangladesh censuses (Figure 1) implies that the 1991 enumeration may have some excess population in the 0–4 and 5–9 age groups. This possibility is supported by national survey and local-area project data (e.g., from the International Centre for Diarrhoeal Disease Research, Bangladesh—ICDDR,B) that report substantial falls in fertility over the past decade. In addition, a comparison of age distributions in the four censuses provides evidence of a 1991 shortfall of men and women aged 15–19 and of women above age 60 (Kantner 1994, figures 1–7).

Preliminary assessments of census age distributions suggest that the 1991 census was subject to considerable age misreporting. Single-year age distributions show that many respondents had a digit preference for ages ending in 0, 2, 5, and 8. The extreme level of such "age heaping" is highlighted by the fact

The 1991 census may have overenumerated girls in the 5–9 age group.

Table 1. Age and sex ratios: Bangladesh 1991 population census, adjusted for the undercount obtained from the postenumeration survey

Age group	1991 Census adjusted population (million)		Age ratio		Sex ratio (males per 100 females)
	Males	Females	Males	Females	
0–4	9.482	9.213	na	na	102.9
5–9	9.505	8.886	1.141	1.148	107.0
10–14	7.175	6.267	1.002	0.924	114.5
15–19	4.819	4.681	0.836	0.830	102.9
20–24	4.356	5.009	0.931	1.042	87.0
25–29	4.537	4.934	1.156	1.187	92.0
30–34	3.495	3.302	0.884	0.856	105.9
35–39	3.367	2.782	1.120	1.009	121.0
40–44	2.519	2.215	0.946	0.995	113.7
45–49	1.958	1.669	0.931	0.890	117.3
50–54	1.687	1.537	1.097	1.198	109.8
55–59	1.117	0.898	0.760	0.674	124.4
60–64	1.251	1.128	1.413	1.597	110.8
65–69	0.653	0.515	0.672	0.613	126.9
70–74	0.691	0.549	1.494	1.559	125.9
75–79	0.273	0.190	u	u	143.2
80+	0.430	0.365	u	u	u
Total	57.314	54.141	u	u	105.9
Overall age-ratio score for males		17.6			
Overall age-ratio score for females		21.1			
Overall sex-ratio score		9.8			

na—not applicable.
u—data unavailable.

that more women were reported to be 25 than any other single age.

Summary diagnostic measures (for instance the Whipple, Myers, and Bachi indices) suggest that the quality of single-year age reporting was essentially similar in the 1974, 1981, and 1991 censuses, and somewhat more reliable in the 1961 census. (For detailed descriptions of the Whipple, Myers, and Bachi measures, see Shryock and Siegel 1976, 114–19.)

The quality of age reporting can also be assessed through age-ratio scores. These are derived by combining census results into five-year age groups. Age-ratio scores tend to be low when the reported age distribution falls in a smooth, regular progression (i.e., there is no evidence of a major surplus or deficit of population across five-year age groups). Age-ratio scores of 2–3 connote reasonable accuracy, whereas values of around 8–9 are conventionally considered to indicate inaccurate age reporting. In this context, the 1991 census age-ratio scores of 17.6 for males and 21.1 for females imply unreliable age reporting (Table 1).

Age-ratio scores from past censuses show that the quality of age reporting may have deteriorated somewhat in the 1991 census. The 1981 census had age-ratio scores of 13.8 for males and 16.2 for females, whereas the 1961 census had surprisingly low scores of 4.5 for males and 4.9 for females. This last result may suggest that part or all of the 1961 census age distribution could have been "smoothed," that is, adjusted to fit a normal distribution across age groups.

AGE RATIOS

Age-ratio calculations show how a population is distributed across age groups. If the results of a census or survey show an age distribution that is quite different from what would be expected in a normal population, this could be an indication that certain age groups are under- or overenumerated, that ages have been misreported, or that migration patterns have altered expected age distributions.

Table 1 shows the population reported in Bangladesh's 1991 census divided into five-year age groups. To determine age ratios, each group is compared with the groups just above and below it. For example, the table shows 9.505 million boys in the 5–9 age group (which we may designate as A), 7.175 million boys aged 10–14 (B), and 4.819 million boys aged 15–19 (C). To assess how B fits into the progression between A and C, we divide B by the average of A and C: $7.175/[(9.505 + 4.819)/2] = 1.002$. This result, which is very close to 1.000, shows that B comes nearly half way between A and C, indicating a smooth progression among these three age groups. This suggests that the number of boys enumerated in the 10–14 age group may be fairly accurate.

By contrast, compare girls in the 0–4 (A), 5–9 (B), and 10–14 (C) age groups. The age ratio for B compared with the two closest groups is $8.886/[(9.213 + 6.267)/2] = 1.148$. The calculation shows that the group of girls 5–9 is unusually large compared with the groups just older and younger. This result suggests that girls in this age group may have been overenumerated or that older and younger girls may have been wrongly assigned to this group.

Similarly, compare girls and women in the 10–14 (A), 15–19 (B), and 20–24 (C) age groups. In this case, the age ratio for B compared with the two closest groups is $4.681/[(6.267 + 5.009)/2] = 0.830$, suggesting that adolescent girls may have been underenumerated, that their ages may have been misreported, or that they may have disproportionately emigrated from the country.

The overall age-ratio scores are the averages of the variations from a score of 1.000 for all age groups.

Table 2. Age and sex ratios adjusted for a net undercount of 4.6 percent (BBS-1) and adjusted and smoothed by Sprague Multipliers and moving averages (BBS-2): Bangladesh 1991 population census

	1991 census adjusted (BBS-1) (millions)			1991 census adjusted/smoothed (BBS-2) (millions)		
Age group	Males	Females	Total	Males	Females	Total
0–4	9.482	9.213	18.695	9.482	9.213	18.695
5–9	9.505	8.886	18.391	9.505	8.886	18.391
10–14	7.175	6.267	13.443	6.770	6.486	13.256
15–19	4.819	4.681	9.500	5.823	5.671	11.494
20–24	4.356	5.009	9.364	4.671	4.608	9.279
25–29	4.537	4.934	9.472	3.942	3.944	7.886
30–34	3.495	3.302	6.797	3.501	3.474	6.975
35–39	3.367	2.782	6.149	3.042	2.838	5.880
40–44	2.519	2.215	4.734	2.496	2.191	4.687
45–49	1.958	1.669	3.626	2.040	1.733	3.773
50–54	1.687	1.537	3.224	1.634	1.418	3.053
55–59	1.117	0.898	2.015	1.277	1.094	2.371
60–64	1.251	1.128	2.379	1.034	0.881	1.916
65–69	0.653	0.515	1.167	0.763	0.625	1.388
70–74	0.691	0.549	1.241	0.632	0.523	1.155
75–79	0.273	0.190	0.463	0.273	0.190	0.463
80+	0.430	0.365	0.795	0.430	0.365	0.795
Total	57.314	54.141	111.455	57.314	54.141	111.455

Note: Totals may vary slightly because of rounding.

According to the 1981 and 1991 censuses, the total population of Bangladesh grew by 2.15 percent during 1981–91. If this growth rate remains constant, the population will double in just 32.3 years.

Sex ratios from the 1991 census, also presented in Table 1, suggest that there may have been some underreporting of girls aged 10–14 and of women aged 35–39 and above the age of 55. There are also noticeably fewer men than women in the 20–24 and 25–29 age groups. This might be due to male out-migration, but a comparison of age cohorts in the 1981 and 1991 censuses, discussed later, suggests that other factors may also be responsible. It is noteworthy that this male deficit is less pronounced in the 1974 and 1981 censuses and is not a feature of the 1961 census (see Kantner 1994, tables D, E, and F).

The United Nations has developed a summary "age-sex accuracy index" to measure the reliability of age and sex reporting in a census (see Shryock and Siegel 1976, 128). Age-sex accuracy index scores under 20 are considered to be "accurate," 20–40 "inaccurate," and above 40 "highly inaccurate." Given this criterion, the age-sex distributions in both the 1981 and 1991 censuses must be judged to be highly inaccurate. The 1981 census age-sex accuracy index was 64.8, and the 1991 census had a score of 68.0.

Given the apparent inaccuracy of the age-sex distribution in the adjusted 1991 census results (designated as BBS-1 and adjusted for an undercount of 4.6 percent), the BBS has employed smoothing procedures to derive final 1991 age-sex distributions. Two smoothed distributions have been released: one employs Sprague Multipliers to smooth the population within five-year age groups, and the other (designated as BBS-2) employs Sprague Multipliers and "moving averages" that smooth across five-year age groups. Table 2 compares the BBS-2 distribution with the adjusted age-sex distribution (BBS-1) shown in Table 1.

FORWARD-SURVIVAL PROJECTIONS

The forward-survival projections presented in this report were computed by multiplying each five-year age group in the 1981 population census by survivorship ratios obtained from estimates of life expectancy. These estimates were derived from United Nations South Asian model life tables (United Nations 1982). For example, the population aged 5–9 in 1981, when multiplied (survived) by five-year survivorship ratios, yields the population aged 10–14 in 1986. A forward projection can also make allowance for the effect of net migration on the size and distribution of a population.

Trends in fertility and mortality are used to generate estimates of the total number of surviving children for the projection period. In the forward-survival projections presented in this report, 1981–86 and 1986–91 TFRs re-create the 1991 census population aged 0–4 and 5–9.

Kantner and Noor (1991) computed the forward-survival projection of the 1991 Bangladesh population used in this report, based on the following data: the final 1981 census age distribution adjusted for a 3.2 percent undercount; fertility and mortality estimates geared to findings from the 1981 Census Sample Enumeration (CSE); results of Contraceptive Prevalence Surveys conducted between 1981 and 1991; and the 1989 Bangladesh Fertility Survey (Kantner 1994, Appendix). The survivorship ratios were derived from United Nations South Asian model life tables (United Nations 1982). The demographic inputs used to generate the Kantner-Noor forward-survival projection were as follows:

Year	Total fertility rate (TFR)	Crude birth rate (CBR)	Crude death rate (CDR)	Rate of natural increase (RNI)	Infant mortality rate (IMR)	Life expectancy (years)
1981	6.3	44.0	16.8	27.2	132	51
1986	5.3	39.4	14.6	24.8	128	52
1991	4.6	36.1	12.8	23.3	118	54

COMPARING THE 1991 CENSUS RESULTS WITH PROJECTIONS FROM THE 1981 CENSUS

An evaluation of the 1991 census can usefully include a comparison of final 1991 results with projections from the 1981 census. A population projection computed by Kantner and Noor (1991, 19–22) anticipated a total 1991 population of 115.2 million, or 3.8 million more than the final adjusted total of 111.4 million reported in the 1991 census. This forward-survival projection provided results similar to United Nations and World Bank estimates. It is probably fair to conclude that it represented the general consensus view of demographic change in Bangladesh before the release of the final 1991 census results. However, none of these projections made allowance for international migration.

Table 3 provides evidence of considerable inconsistency between the 1991 census and the Kantner-Noor projection. The 1991 census enumerated 4.163 million more children aged 0–9 and 4.358 million fewer men and 2.764 million fewer women aged 15–24 than Kantner and Noor projected from 1981 census figures. These results could imply that fertility is considerably above the levels incorporated in the Kantner-Noor projection. They could also imply that substantial international out-migration occurred between 1981 and 1991.

Although these conclusions are plausible given the evidence at hand, caution is in order for several reasons. For one thing, the total level of international out-migration implied by these calculations is between 7 and 8 million. Most of the implied migration (6 to 7 million) is concentrated among the 1991 census population of ages 10–24. This is a surprisingly high level of population loss over a 10-year period.

The implied age pattern of international out-migration from Bangladesh between 1981 and 1991 is unusual. In many developing countries, international out-migration tends to be concentrated among adolescents (ages 15–19) and young adults (ages 20–29). In Bangladesh, however, the population aged 15–29 in 1981 (which became the population aged 25–39 in 1991) shows no sign of having left the country in any great numbers. In fact, the population aged 25–29 in the 1991 census is slightly larger than Kantner and Noor projected from the population aged 15–19 in 1981.

By contrast, the 1991 census age groups 10–14, 15–19, and 20–24 have substantial deficits compared with projections from the 1981 census (when these groups were 0–14 years old). The 1991 population aged 10–14 is apparently missing 0.714 million people, the 15–19 age group is in deficit by 4.703 million, and the 20–24 group shows a shortfall of 2.420 million. In other words, children and young adolescents (the population aged 0–14 in 1981) appear to have left Bangladesh in large numbers, while adolescents and young adults (those aged 15–29 in 1981) did not depart to any appreciable degree.

Such an age pattern of international migration would be unusual. It suggests that factors other than migration may

Table 3. Comparison of the 1981 Bangladesh population census, the Kantner-Noor forward projection of the 1981 census to 1991, and the 1991 Bangladesh population census (BBS-1)

	1981 census (millions)			Kantner-Noor projection (millions)			1991 census (BBS-1) (millions)		
Age group	Males	Females	Total	Males	Females	Total	Males	Females	Total
0–4	7.718	7.615	15.333	8.910	8.402	17.312	9.482	9.213	18.695
5–9	7.363	7.181	14.544	8.068	7.543	15.611	9.505	8.886	18.391
10–14	6.442	5.595	12.037	7.170	6.987	14.157	7.175	6.267	13.443
15–19	4.290	4.223	8.513	7.207	6.996	14.203	4.819	4.681	9.500
20–24	3.359	3.635	6.994	6.326	5.458	11.784	4.356	5.009	9.364
25–29	3.369	3.261	6.630	4.197	4.096	8.293	4.537	4.934	9.472
30–34	2.551	2.520	5.071	3.271	3.510	6.781	3.495	3.302	6.797
35–39	2.426	2.128	4.554	3.255	3.131	6.386	3.367	2.782	6.149
40–44	1.982	1.81	3.793	2.435	2.400	4.835	2.519	2.215	4.734
45–49	1.613	1.304	2.917	2.270	2.003	4.273	1.958	1.669	3.626
50–54	1.440	1.321	2.761	1.794	1.667	3.461	1.687	1.537	3.224
55–59	0.932	0.721	1.653	1.388	1.150	2.538	1.117	.898	2.015
60–64	1.074	.956	2.030	1.148	1.084	2.232	1.251	1.128	2.379
65+	1.736	1.346	3.082	1.821	1.494	3.315	2.046	1.620	3.666
Total	46.295	43.617	89.912	59.260	55.921	115.181	57.314	54.141	111.455

account for the adolescent and young-adult age distribution in the 1991 census. The most likely factors are age misreporting and coverage errors (underenumeration) affecting both the 1981 and 1991 census counts.

One strong possibility is that the 5–9 age group was too large in the 1981 census, an error pattern clearly in evidence in the 1991 enumeration (see Table 1). If the size of the 5–9 age group was indeed inflated in 1981, then one would expect 1991 census figures for this cohort to fall short of projections based on the 1981 figures. That clearly appears to have happened: the 15–19 age group enumerated in the 1991 census is 4.7 million smaller than the number projected by Kantner and Noor.

Differences are considerably smaller between the projected and actual size in 1991 of the 10–14 and 20–24 age cohorts. A projection of the 1961 census forward to 1981 reveals a similar pattern (see Kantner 1994, figure 20)—namely, a large deficit for the 25–29 age group in the 1981 census, which could imply that the population aged 5–9 may have been too large 20 years earlier.

Traditionally, more males than females tend to migrate abroad. Thus if out-migration is the principal cause of shortfalls in specific population age groups, one might expect to find a greater deficit of males than of females. However, this is the case only for the 20–24 age group. Large deficits in the 15–19 age group are divided equally between males and females, suggesting that age misstatement and underenumeration may be more important explanatory factors than out-migration. It may be particularly difficult to obtain an accurate count of adolescents, especially adolescent girls. This is certainly suggested by results from the 1991 postenumeration survey, which reports a net error rate of 6.5 percent for females aged 15–19, compared with 4.9 percent for males in the same age group.

Thus a strong possibility exists that the 1991 census may have seriously

REVERSE-SURVIVAL PROJECTIONS

A reverse-survival projection regenerates the population of an earlier time by adding back the number of people who died or moved away during the intervening period. For example, the population aged 5–9 in 1991, when divided by the five-year survivorship ratio for the 5–9 age group, regenerates the under-5 population in 1986. Similarly, the population aged 0–4 in 1991, when reverse-survived using survivorship ratios for the 0–4 age group, produces the number of births over the projection period. These births, when distributed according to the age pattern of fertility, allow the generation of fertility estimates for different periods of time.

Reverse-survival estimates can be subject to considerable error, especially if mortality data are unreliable and age-sex distributions are subject to age misreporting and omission. For more details on methods of population projection, see Shryock and Siegel (1976) and United Nations (1983).

Table 4. Fertility estimates for Bangladesh: number of births, crude birth rate (CBR), and total fertility rate (TFR) derived from reverse survival of the 1991 population census (TFR-1) and forward survival of the 1981 population census (TFR-2)

Mortality assumption, census age-sex distribution, and period	Births (millions)		CBR	TFR-1[a]	TFR-2[b]
	Males	Females			
A. Assuming moderate mortality decline[c]					
Adjusted (BBS-1)					
1989–91	6.298	6.204	38.6	5.4	4.8
1986–91	10.904	10.730	41.0	5.8	5.3
1981–86	11.692	11.137	48.1	7.1	6.7
Smoothed (BBS-2)					
1989–91	6.233	6.251	43.2	5.6	4.8
1986–91	10.909	10.725	41.0	6.1	5.3
1981–86	11.692	11.137	48.1	7.3	6.7
Smoothed (United Nations)					
1989–91	6.298	6.204	38.4	5.5	4.9
1986–91	10.904	10.730	40.8	5.9	5.3
1981–86	11.692	11.137	47.9	7.1	6.7
B. Assuming slow mortality decline[d]					
Adjusted (BBS-1)					
1989–91	6.442	6.335	39.5	5.6	4.9
1986–91	11.154	10.956	41.9	6.0	5.4
1981–86	11.904	11.339	49.1	7.3	6.8
Smoothed (BBS-2)					
1989–91	6.376	6.382	44.3	5.7	4.9
1986–91	11.160	10.951	41.9	6.2	5.4
1981–86	11.904	11.339	49.0	7.4	6.8
Smoothed (United Nations)					
1989–91	6.442	6.335	39.3	5.6	5.0
1986–91	11.154	10.956	41.7	6.0	5.4
1981–86	11.904	11.339	48.8	7.3	6.8
C. Assuming fast mortality decline[e]					
Adjusted (BBS-1)					
1989–91	6.171	6.088	37.9	5.4	4.7
1986–91	10.684	10.529	40.2	5.7	5.3
1981–86	11.506	11.956	47.4	7.0	6.7
Smoothed (BBS-2)					
1989–91	6.107	6.134	42.3	4.7	4.7
1986–91	10.689	10.525	40.0	5.5	5.3
1981–86	11.606	10.956	47.4	7.2	6.7
Smoothed (United Nations)					
1989–91	6.104	6.136	37.6	5.4	4.8
1986–91	10.684	10.529	40.0	5.8	5.2
1981–86	11.506	10.956	47.2	7.1	6.7

a. Women of reproductive age derived from blending reverse survival of the 1991 census and forward survival of the 1981 census populations.

b. Calibrated to re-create the adjusted and smoothed 1991 census populations in the 0–4 and 5–9 age groups.

c. Calculations assume a moderate mortality decline based on an infant mortality rate of 132 per 1,000 and a life expectancy of 51 years in 1981 and an infant mortality rate of 100 per 1,000 and a life expectancy of 58 years in 1991.

d. Calculations assume a slow mortality decline based on an infant mortality rate of 132 per 1,000 and a life expectancy of 51 years in 1981 and an infant mortality rate of 118 per 1,000 and a life expectancy of 54 years in 1991.

e. Calculations assume a fast mortality decline based on an infant mortality rate of 132 per 1,000 and a life expectancy of 51 years in 1981 and an infant mortality rate of 82 per 1,000 and a life expectancy of 62 years in 1991.

underreported the number of females aged 10–24, especially in the age group 15–19. Unfortunately, there is no obvious way to distinguish between deficits caused by age misreporting, coverage error, and out-migration. It is important to consider all these factors carefully before drawing conclusions about the dynamics of recent population change in Bangladesh.

CALCULATING FERTILITY LEVELS AND TRENDS FROM THE 1981 AND 1991 CENSUSES

To estimate levels and trends in fertility between 1981 and 1991, it is critical to decide which of the factors just discussed are responsible for the size and age-sex distribution of the 1991 census population. If census deficits in the female age groups 15–19 and 20–24 are real (i.e., if they are largely the result of out-migration rather than age misreporting and coverage error), then fewer women have given birth to the number of children implied by the population under age 10. In other words, fertility could be expected to be higher if migration were largely responsible for the shortfalls in the 15–19 and 20–24 female age groups. If deficits in the female population aged 15–24 are not due primarily to migration, however, then different demographic realities emerge.

Table 4 presents reverse-survived birth-rate and fertility estimates based on adjusted and smoothed 1991 census age-sex distributions. The first calculations use the final adjusted 1991 census age-sex distribution (BBS-1) to derive fertility rates. Two smoothed age-sex distributions that may partially correct for age misreporting are also employed

Table 5. Infant mortality rates (deaths per 1,000) computed from the 1989 and 1991 Contraceptive Prevalence Survey (CPS), the 1989 Bangladesh Fertility Survey (BFS), the 1993/94 Bangladesh Demographic and Health Survey (BDHS), and sample vital registration statistics (VRS)

Source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1989 BFS	128	129	136	134	111	113	84 (120)[a]	—	—	—	—	—	
1989 CPS	—	—	—	—	107	99	90	102	—	—	—	—	—
1991 CPS	—	—	—	—	—	—	73	88	88	75	—	—	—
1993/94 BDHS[b]	116					112					87		
VRS	112	122	118	122	112	116	113	116	98	94	91	88	84

a. Adjusted estimate for 1987, allowing for underenumeration of recent deaths because of misstated dates of birth and the omission of dead children.
b. BDHS estimates of the infant mortality rate are five-year averages. The figure for 1981 actually covers the period 1979/80–1983/84, 1986 covers 1983/84–1988/89, and 1991 covers 1988/89–1993/94.

in deriving final fertility estimates—the adjusted/smoothed age-sex distribution derived by the BBS (BBS-2) and an age-sex distribution smoothed through a procedure developed by the United Nations (and described in United States, BOC 1993).

For each age-sex distribution, the number of male and female births was estimated for various periods by reverse-surviving the 1991 population aged 0–4, 5–9, and 10–14. Survivorship ratios were calculated for three 1981–91 mortality scenarios (i.e., slow, moderate, and fast declines in mortality) derived from United Nations South Asian model life tables (United Nations 1982). These different mortality patterns were employed because there is still considerable uncertainty about the actual level of mortality in Bangladesh. Direct estimates of the infant mortality rate from various surveys and BBS sample vital-registration statistics (VRS), given in Table 5, suggest levels of around 90 infant deaths per 1,000 live births as of 1991. However, indirect estimates that make some allowance for the underreporting of infant and child deaths imply that infant mortality in 1991 could still be as high as 120. (A discussion of indirect child-mortality estimation procedures can be found in United Nations 1983.) Recent analysis (e.g., by Kabir and Chowdhury 1993) suggests that the infant mortality rate has likely declined to around 100 as of 1989, a level roughly consistent with the pattern of moderate mortality decline presented in the first part of Table 4.[1]

Births estimated from reverse-survival of the 1991 population census are used to obtain estimates of the crude birth rate (CBR). Table 4 provides two total fertility rate estimates, one computed by simple reverse-survival of 1991 age-sex distributions (TFR-1) and the other by forward survival of 1981 age-sex distributions (TFR-2). (Reverse-survival estimates were computed using Population Analysis System (PAS) software developed by the United States Bureau of the Census.)

These findings generally imply that fertility declined rapidly during the 1980s. Nevertheless, there is considerable inconsistency in estimates of actual fertility levels. Total fertility rates obtained by reverse-surviving the 1991 census (TFR-1) tend to be higher than forward-survival estimates based on the age-sex distribution of the 1981 census (TFR-2). For example, using adjusted, nonsmoothed census results (BBS-1) and assuming the moderate mortality decline pattern, the reverse-survived fertility rate (TFR-1) for the period 1989–91 is 5.4, whereas the forward-survived fertility rate (TFR-2) for the same period is 4.8.[2] This difference stems partly from the fact that the 1991 census has a substantially lower percentage of women aged 15–24 than the 1981 census.

If one believes that the 1991 census age-sex structure is essentially correct, then the fertility rate of 5.4 children per woman is the preferred estimate. This position entails assuming that the apparent shortfalls in the female age groups 15–19 and 20–24 are real (i.e., the deficits reported in Table 3 are largely due to out-migration). However, if one is more inclined to argue that age misreporting and underenumeration account for much of the deficit in the 15–19 and 20–24 age groups, then a 1989–91 TFR closer to 4.8 is more likely to be correct.

Taking into account all three mortality scenarios, calculations based on the BBS-1, BBS-2, and United Nations

1. See Kantner (1994, tables 6–9 and Q–T) for birth rate and fertility estimates derived from the 1991 census results using all three mortality assumptions and four age-group distributions.

2. Since the 1991 census population aged 0–1 may be somewhat underenumerated even after the application of adjustment factors, the average annual TFR for the period 1989–91 is probably a more accurate reflection of fertility levels prevailing in 1991 than a TFR estimate for 1991.

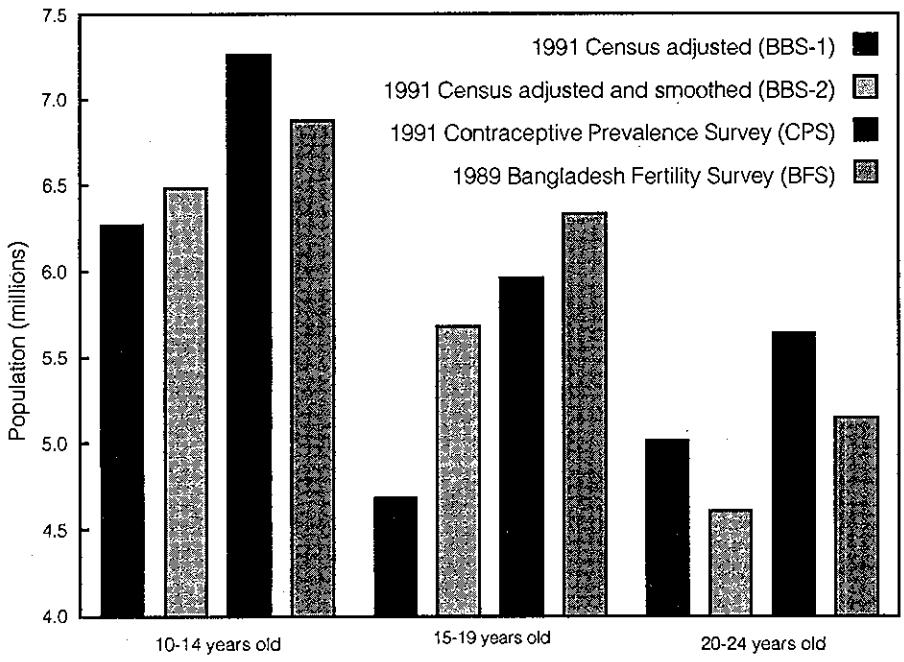

Figure 2. Estimates of the Bangladesh female population in the 10–14, 15–19, and 20–24 age groups from the 1991 census adjusted for underenumeration (BBS-1), the 1991 census adjusted and smoothed (BBS-2), the 1991 Contraceptive Prevalence Survey (CPS), and the 1989 Bangladesh Fertility Survey (BFS)

age-sex distributions for the 1991 census give average 1989–91 reverse-survived TFRs of 5.4–5.8. Forward-survived estimates from the 1981 census range from 4.7 to 5.0. Restricting the comparison to the moderate mortality pattern narrows the range considerably—to 5.4–5.6 for reverse-survival and 4.8–4.9 for forward-survival estimates.

An additional anomaly is clearly evident from Table 4. The very large 5–9 age group reported in the 1991 census implies an excessive number of births during 1981–86. The census count results in an unreasonably high reverse-survived TFR for this period, namely 7.1–7.3, if one assumes a moderate decline in mortality. Fertility then appears to fall extremely rapidly between 1981–86 and 1989–91. This implausible pattern almost certainly results from overcounting the 5–9 age group.

Such an overcount may result partly from systematically overstating the age of children who are actually less than 5 years old, plus some downward transfer from the 10–14 and 15–19 age groups. In earlier Bangladesh censuses, it was thought that enumerators frequently transferred adolescents to below 10 years of age to avoid having to ask questions on occupational status (for example, see Bean, Farooq, and Khan 1966). This form of error may still hold true for later censuses.

Since there is evidence that adolescent girls and young women may not have migrated to the extent implied by the 1991 census, one may conclude that 1991 fertility levels can be more closely approximated by forward- rather than reverse-survived census estimates. However, forward-survived TFRs assume that there has been no out-migration, which is not a viable assumption. Thus the forward-survived TFRs are probably too low.

Reality likely rests somewhere between the two extremes: although some young women have certainly emigrated from Bangladesh over the past 10 years, age misreporting and coverage errors affecting both the 1981 and 1991 census counts have almost certainly exaggerated the actual level of out-migration. This analysis does suggest that there may have been substantial emigration from Bangladesh during the 1980s, but it is not possible to specify the actual magnitude of this movement with any confidence.

Using the moderate mortality decline pattern, forward-survival results suggest that the average annual TFR for 1989–91 falls within a range from 4.8 to 4.9, depending upon one's choice of age-sex distribution (i.e., BBS-1, BBS-2, or United Nations). Allowing for some out-migration of reproductive-age women in the intercensal period, a

Table 6. Age-specific number of children ever born, computed from the 1976 and 1989 Bangladesh Fertility Survey (BFS), the Contraceptive Prevalence Survey (CPS) for various years, and the 1993/94 Bangladesh Demographic and Health Survey (BDHS)

Woman's age at time of survey	BFS 1976	CPS 1979	CPS 1981	CPS 1983	CPS 1986	CPS 1989	BFS 1989	CPS 1991	BDHS 1993/94
15–19	0.8	0.6	0.8	0.9	0.7	0.7	0.7	0.4	0.3
20–24	2.4	2.1	2.1	2.3	2.1	1.9	1.9	1.7	1.6
25–29	4.2	3.6	3.7	3.8	3.6	3.3	3.2	3.2	2.9
30–34	5.7	5.0	5.4	5.5	5.1	4.7	4.7	4.5	4.1
35–39	6.7	6.0	6.4	6.5	6.5	5.9	5.8	5.7	5.2
40–44	7.1	6.5	7.3	7.4	7.4	7.0	6.7	6.7	6.4
45–49	6.7	6.6	7.6	7.5	7.2	7.5	7.3	7.4	6.9

1989–91 TFR range between 4.8 and 5.2 is probably more realistic. An average TFR of 5.0 may be the most plausible single point estimate for the 1989–91 period.

COMPARING THE 1991 CENSUS RESULTS WITH OTHER DEMOGRAPHIC SOURCES

In judging the actual level of fertility implied by the 1991 census, it may be instructive to examine age-sex distributions from household listings collected by the 1989 Bangladesh Fertility Survey (BFS) (Huq and Cleland 1990) and the 1991 Contraceptive Prevalence Survey (CPS) (Mitra, Lerman, and Islam 1993). Although there is some evidence that the 1991 CPS may have undercounted males in urban areas, the BFS and CPS age-sex distributions for females provide useful evidence validating the 1991 census age-sex structure.

Figure 2 compares the number of females reported in the 10–14, 15–19, and 20–24 age groups by the 1991 census, the 1991 CPS, and the 1989 BFS. It is immediately apparent that both surveys recorded substantially more females in these three age groups than the 1991 census. The most dramatic evidence of possible census omission is the case of girls aged 15–19: results from the 1991 CPS imply a possible census (BBS-1) undercount of 1.274 million, and the 1989 BFS results suggest an undercount of 1.653 million. This evidence cannot be considered definitive, but it does support the view that the 1991 census may have significantly undercounted adolescent girls and young women. It also raises doubts about the wisdom of placing much confidence in reverse-survived TFR estimates computed from 1991 census data.

Table 7. Age-specific number of children born in the 12-month period before the survey, computed from the 1976 and 1989 Bangladesh Fertility Survey (BFS), the 1983, 1985, 1989, and 1991 Contraceptive Prevalence Survey (CPS), and the 1993/94 Bangladesh Demographic and Health Survey (BDHS)

Woman's age at time of survey	BFS 1976	CPS 1983	CPS 1985	CPS 1989	BFS 1989	CPS 1991	BDHS 1993/94[a]
15–19	0.109	0.157	0.130	0.174	0.172	0.179	0.140
20–24	0.289	0.256	0.248	0.250	0.241	0.230	0.196
25–29	0.291	0.227	0.201	0.216	0.210	0.188	0.158
30–34	0.250	0.186	0.160	0.156	0.142	0.129	0.105
35–39	0.185	0.108	0.117	0.110	0.095	0.078	0.056
40–44	0.107	0.049	0.048	0.060	0.049	0.036	0.019
45–49	0.035	0.006	0.018	0.011	0.007	0.013	0.014
TFR	6.3	4.9	4.6	4.9	4.6 (4.9)[b]	4.2	3.4

Note: The 1979 CPS did not collect data on births during the 12-month period before the survey. The 1981 CPS did collect this information, but the results were considered unreliable and were never published.
a. Average for the period 1991–1993/94.
b. Final point estimate based on a correction factor designed to adjust for the overreporting of infants' ages in BFS birth histories.

The 1991 census also counted far more children under the age of 10 than would be anticipated from the 1989 BFS or 1991 CPS age-sex structures. The surplus in the 5–9 age group can be partly explained by age misreporting. However, the large size of the 0–4 age group, compared with 1989 BFS and 1991 CPS results, does not yield to ready explanation. It is not likely that this age group was overcounted. Indeed, the opposite is more likely to be the case, since most censuses encounter difficulty in obtaining complete counts of infants and young children.

Regression procedures developed by Palmore, Rele, and Gunasekaran (Gunasekaran and Palmore 1984; Palmore 1978; Rele 1967, 1987) to estimate fertility from incomplete or defective data can also be used to produce estimates based on survey or census-based age-sex distributions. Regression estimates obtained from census data suggest that fertility may have fallen from around 8.0 births per woman in 1961 to 6.4 in 1981 and 5.7 in 1991. These levels, however, are at odds with the results of the 1989 BFS and 1991 CPS age-sex distributions: namely, average TFRs of 5.1 in 1989 and 4.7 in 1991.

Clearly, fertility estimates are highly sensitive to the accuracy of age reporting and the reliability of reported child-women ratios. If there is considerable doubt about the underlying quality of age-sex structure data in censuses and surveys, and especially if there is evidence of a substantial transfer of population from ages 10–19 to the under-10 group, then regression-based fertility estimates may give misleading results and should be interpreted with caution.

In addition to providing comparative figures on the population age-sex distribution, the 1991 CPS produces direct estimates of fertility from birth-history information collected in the survey. These estimates, along with those of the VRS, are generally lower than fertility estimates derived from the 1991 census. Tables 6, 7, and 8 present summaries of the number of children ever born and current fertility estimates from CPS,

Table 8. Total fertility rates (TFR), computed from the 1989 Bangladesh Fertility Survey (BFS), the 1989 and 1991 Contraceptive Prevalence Survey (CPS), the 1993/94 Bangladesh Demographic and Health Survey (BDHS), and birth-history data from sample vital registration statistics (VRS)

Source	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
1989 BFS[a]	7.0	6.1	6.1	5.9	5.6	5.0	4.9	4.6 (4.9)[b]	—	—	—	—	—
1989 BFS[c]	6.7	6.4	6.1	5.8	5.5	5.1	4.8	—	—	—	—	—	—
1989 CPS	—	—	—	5.6	5.5	5.0	4.6	4.9	—	—	—	—	—
1991 CPS	—	—	—	—	—	5.2	4.9	5.0	4.5	4.2	4.2	—	—
1993/94 BDHS[d]	—	—	—	—	—	—	—	5.1	4.8	4.5	3.7	3.2	3.3
VRS	5.0	5.2	5.1	4.8	4.7	4.7	4.4	4.4	4.4	4.3	4.2	4.2	4.0

a. Fieldwork for the 1989 BFS began in December 1988 and ended in April 1989. Most births that occurred 12 months before the enumeration took place in 1988.

b. Final-point estimate for 1988 representing the mid-point of the range 4.6–5.4. This estimate results from a correction factor designed to adjust for the overreporting of infants' ages in the BFS birth history.

c. Three-year moving average.

d. Based on preliminary data file.

BFS, and BDHS surveys as well as from the VRS data.

Both the 1991 CPS and the VRS system report a TFR for 1991 of 4.2, a figure that is considerably lower than the census-based TFR of 5.0 for 1989–91. It is of course quite possible that both the CPS and the VRS underestimated fertility. For example, omission of infants (especially those born alive who are no longer living) and some overstatement of children's ages may have produced a downward bias in CPS estimates. The 1989–91 TFR produced by reverse-surviving the hypothetical population generated from the 1991 CPS age-sex structure falls within a range of 4.8 to 5.0.

Despite the uncertainty regarding the actual level of fertility in Bangladesh, there is clear evidence that fertility fell substantially during the 1980s. Birth-rate trends derived from reverse-surviving 1961, 1981, and 1991 census age-sex distributions suggest that fertility may have begun to decline during the 1976–81 period, with the rate of decline accelerating between 1981 and 1991.

Much of the evidence of the decline is based on national survey reports of rapid gains in contraceptive use. As Table 9 shows, the contraceptive prevalence rate (the percentage of currently married women using any form of contraception) rose from 12.7 percent in 1979 to 45.1 percent in 1993/94.

Additional evidence of fertility levels and trends can be deduced from regression equations that estimate crude birth rates (Mauldin and Segal 1986) and total fertility rates (Blanc 1990) from international comparisons of family planning program performance—that is, the level of contraceptive prevalence—and fertility change. Results from these equations (shown in Table 10) suggest that between 1979 and 1993/94 the crude birth rate may have declined from 43.6 to 29.6 births per 1,000 population and the total fertility rate may have fallen from 6.3 to 4.2 births per woman. These figures are roughly consistent with direct estimates from national surveys, the only major exception being the low fertility rates reported by the 1993/94 BDHS (NIPORT, Mitra and Associates, and Macro International 1994).

Table 9. Contraceptive prevalence rates reported in the eligible-women samples of the Contraceptive Prevalence Survey (CPS) for various years, the 1989 Bangladesh Fertility Survey (BFS), and the 1993/94 Bangladesh Demographic and Health Survey (BDHS)

Method	CPS 1979	CPS 1981	CPS 1983	CPS 1986	CPS 1989	BFS 1989	CPS 1991	BDHS 1993/94
Modern methods	8.9	10.9	13.8	18.4	24.4	23.1	31.2	36.2
Oral pill	3.6	3.5	3.3	5.1	9.1	9.6	13.9	17.4
Condom	1.5	1.6	1.5	1.8	1.9	1.8	2.5	3.6
Vaginal methods	0.1	0.3	0.3	0.2	0.2	0.1	na	na
Injection	0.2	0.4	0.2	0.5	1.1	0.6	2.6	4.5
IUD	0.2	0.4	1.0	1.4	1.7	1.4	1.8	2.2
Tubectomy	2.4	4.0	6.2	7.9	9.0	8.5	9.1	8.1
Vasectomy	0.9	0.8	1.2	1.5	1.5	1.2	1.2	1.1
Traditional methods	3.8	7.7	5.4	6.9	7.0	7.6	8.7	8.4
Safe period	2.2	3.9	2.4	3.8	3.8	4.0	4.7	4.8
Withdrawal	0.2	1.8	1.3	0.9	1.2	1.8	2.0	2.5
Abstinence	0.8	1.2	0.4	0.5	0.5	1.0	0.5	na
Other	0.6	0.7	1.4	1.7	1.5	0.8	1.5	1.1
Any method	12.7	18.6	19.1	25.3	31.4	30.8	39.9	44.6

na—not applicable.

ERRATUM

What can we say about fertility trends in Bangladesh? An evaluation of the 1991 population census (Asia-Pacific Population Research Reports, number 5) by Andrew Kantner, Charles Lerman, and Mohammed Yusuf.

Page 12, second column, third line from the top: The contraceptive prevalence rate for any method from the 1993/94 BDHS is 44.6, not 45.1. The figure in Table 9, on the same page, is correct.

Table 10. Implied crude birth rates (CBR) and total fertility rates (TFR) based on regression analysis of contraceptive prevalence rates (CPR) reported in the eligible-women samples of the 1979–91 Contraceptive Prevalence Survey (CPS), the 1989 Bangladesh Fertility Survey (BFS), and the 1993/94 Bangladesh Demographic and Health Survey (BDHS)

Fertility indicator	CPS 1979	CPS 1981	CPS 1983	CPS 1986	CPS 1989	BFS 1989	CPS 1991	BDHS 1993/94
CPR	12.7	18.6	19.1	25.3	31.4	30.8	39.9	44.6
CBR[a]	43.6	41.1	40.9	38.2	35.6	35.8	31.9	29.6
TFR[b]	6.5	6.1	6.1	5.7	5.3	5.3	4.7	4.4
TFR[c]	6.0	5.7	5.6	5.3	4.9	4.9	4.4	4.0
TFR[d]	6.5	6.0	6.0	5.6	5.1	5.2	4.5	4.1
TFR[e]	6.3	5.9	5.9	5.5	5.2	5.3	4.7	4.3
TFR[f]	6.3	6.0	5.9	5.5	5.1	5.1	4.5	4.2
Mean TFR	6.3	6.0	5.9	5.5	5.1	5.2	4.6	4.2

Estimation formulas:
a. CBR = 49.07 – (.43 * CPR) b. TFR = 7.30 – (6.42 * CPR) c. TFR = 6.83 – (6.20 * CPR)
d. TFR = 7.38 – (7.20 * CPR) e. TFR = 7.28 – (6.55 * CPR) f. TFR = 7.15 – (6.56 * CPR)
Source for formulas: Blanc 1990.

While the regression formulas used in Table 10 provide additional clues as to the actual level of fertility in Bangladesh, these figures may nevertheless be seriously misleading. Fertility estimates obtained from such analyses assume that contraceptive use in Bangladesh resembles average international experience with regard to effectiveness, continuation, and method choice. Such estimates also assume that other proximate determinants of fertility (e.g., age at marriage, postpartum infecundability, level of induced abortion, and secondary sterility) are similar to international norms. Unfortunately, not enough is known about some of the proximate determinants of fertility in Bangladesh (e.g., rates of induced abortion) for us to be very confident about the reliability of fertility estimates based on contraceptive use.

The ICDDR,B (International Centre for Diarrhoeal Disease Research, Bangladesh) has provided corroborating evidence of declining fertility (Table 11) through the Demographic Surveillance System in the Matlab area and the

The actual level of fertility in Bangladesh is uncertain, but there is clear evidence for a substantial fall in fertility during the 1980s.

Table 11. Total fertility rates (TFR) in project areas of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B)

Area	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Matlab													
Treatment	4.8	5.0	4.5	4.0	4.5	4.3	4.1	3.8	3.4	3.4	3.0	2.9	2.9
Comparison	6.3	6.3	6.1	5.1	6.0	5.5	5.2	5.4	4.9	5.0	4.3	3.8	3.9
Teknaf	7.7	7.9	7.5	7.8	8.1	8.1	8.6	—	—	—	—	—	—
Aboynagar	—	—	4.4	3.6	4.1	3.2	3.4	3.3	2.6	2.7	2.7	2.7	—
Fultala[a]	—	—	4.6	4.4	3.8	3.1	3.9	3.5	2.8	—	—	—	—
Jessore	—	—	—	—	—	—	3.9	4.2	3.5	3.5	3.2	3.1	—
Sirajgonj[b]	—	—	6.4	6.7	6.3	5.8	5.7	5.9	4.4	4.0	3.6	4.0	—
Gopalpur[a]	—	—	6.0	6.2	6.1	5.0	5.2	5.0	3.8	—	—	—	—

Source for Aboynagar, Fultala, Sirajgonj, and Gopalpur: Hossain et al. 1994.
a. Fultala and Gopalpur were dropped in 1990.
b. Sirajgonj was dropped in 1993.

Table 12. Infant mortality rates (IMR) in project areas of the International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B)

Area	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Matlab													
Treatment	102	106	98	115	86	82	78	81	74	75	80	80	62
Comparison	114	118	112	127	118	93	94	97	91	91	115	90	99
Teknaf	139	119	154	152	123	127	141	—	—	—	—	—	—
Aboynagar	—	—	119	156	119	139	130	105	111	85	120	65	—
Fultala[a]	—	—	127	108	113	125	47	98	133	—	—	—	—
Jessore	—	—	—	—	—	—	92	79	72	99	81	87	—
Sirajgonj[b]	—	—	154	156	161	130	136	161	148	136	111	158	—
Gopalpur[a]	—	—	169	232	154	221	185	184	160	—	—	—	—

Source for Matlab: Strong 1994; for Aboynagar, Fultala, Sirajgonj, and Gopalpur: Hossain et al. 1994.

a. Fultala and Gopalpur were dropped in 1990.

b. Sirajgonj was dropped in 1993.

Sample Registration System in the extension project and comparison areas of Aboynagar, Fultala, Jessore, Sirajgonj, and Gopalpur. All of these project areas report substantial falls in fertility over the past decade. By 1993, TFRs in all project sites had fallen to 4.0 or less.

One discouraging feature of the current demographic situation in Bangladesh is that infant mortality is still high despite evidence of rapidly falling fertility. Infant mortality in the ICDDR,B project and comparison areas appears to fluctuate considerably from year to year (Table 12), making the identification of long-term trends difficult.

For example, between 1990 and 1991, the annual infant-mortality rate actually rose in some places—from 85 to 120 per 1,000 infants in Aboynagar and from 91 to 115 per 1,000 in the Matlab comparison area. Between 1991 and 1992, both Aboynagar and the Matlab comparison area experienced major drops in infant mortality, declining to 65 and 90 respectively, while the rate in Sirajgonj rose from 111 to 158. Given the high levels of infant mortality in some ICDDR,B project areas (and the volatility in annual estimates), it seems doubtful that the national infant-mortality rate could have fallen much below 90 by 1991.

SUMMARY AND CONCLUSIONS

The 1991 population census of Bangladesh tends to confirm information from national surveys and local-area registration data that indicate substantial declines in fertility over the past decade. The census analysis has settled on a total fertility rate of around 5.0 children per woman for 1991. The magnitude of discrepancy between census and survey-based fertility estimates cannot be known with any degree of certainty, but census data suggest that fertility in 1991 could have been anywhere from 0.6 to 1.0 births higher than the level reported by the 1991 Contraceptive Prevalence Survey, or between 4.8 and 5.2 rather than 4.2.

Unusual patterns of age reporting and the possibility of underreporting of certain age groups (mainly the undercounting of adolescent girls) call for considerable caution in interpreting any TFR estimate derived from the 1991 census. The conclusion reached by the National Academy of Sciences Panel on Bangladesh with regard to the 1974 census may well hold true for the 1991 enumeration: namely, "Serious problems with age reporting or completeness of coverage have distorted the age distribution under 15 so severely that it is extremely unlikely that applying reverse-survival or own-children techniques to the enumerated populations could yield satisfactory fertility estimates" (NAS 1981, 18).

The survey-based fertility estimates reported here were obtained from birth histories, which may also be subject to considerable error. Births (most notably of infants who were born alive but subsequently died) may be underreported, and misreporting may distort both children's and mothers' ages. A common form of error in birth histories is the overstatement of children's ages (e.g., the recording of infants under one year of age as one year or more). This can produce current fertility estimates that are too low and the appearance of a rapid fall in fertility in years immediately preceding the survey. Surveys (such as the 1993/94 BDHS) that include an extensive array of questions on the morbidity and mortality of children below a certain age may also be subject to the omission and temporal displacement of births by interviewers (i.e., intentional overstatement of children's ages), thereby producing current fertility estimates that are artificially low. One cannot be totally confident that such

error patterns are not partly responsible for the low fertility estimates derived from recent survey data in Bangladesh.

Evidence of declining fertility is particularly strong in the project areas of the ICDDR,B. By 1993, fertility in these sites had fallen to 4.0 or below. Since many ICDDR,B project sites may no longer typify conditions throughout the country, however, it may be reasonable to conclude that ICDDR,B figures provide, at best, lower-bound approximations of national-level trends.

In conclusion, age reporting and coverage errors in the 1991 population census (beyond what were captured by the postenumeration survey) do not allow for reliable estimation of fertility or international migration. An uncritical and overly mechanical analysis of the 1991 census can generate questionable results, such as average TFRs greater than 7.0 for the period 1981–86 and high adolescent out-migration. Misleading policy implications may also await the unwary.

Nevertheless, the 1991 census, while not capable of providing reliable estimates of fertility, does imply that fertility could be somewhat higher than reported by national surveys and the VRS. For now, this must remain a cause for concern among demographers measuring the course of the demographic transition in Bangladesh.

ACKNOWLEDGMENTS

The authors wish to thank Sidney B. Westley, a senior editor at the East-West Center, for the extensive editorial support provided in the preparation of this report. In addition, Marie Jose Chabot, an East-West Center project assistant, helped to collect and analyze much of the data incorporated in this study. The opinions expressed here are those of the authors and not necessarily those of the United States Agency for International Development (USAID). USAID funded this research under Cooperative Agreement CCP-3046-A-00-3015-00.

REFERENCES

BBS (Bangladesh Bureau of Statistics). 1977. *1974 Bangladesh population census report.* National volume. Dhaka: Ministry of Planning.

———. 1984. *1981 Bangladesh population census report.* National volume. Dhaka: Ministry of Planning.

———. 1992. *Statistical yearbook of Bangladesh 1991.* Dhaka: Statistics Division, Ministry of Planning.

———. 1993. 1991 *Bangladesh population census report.* National series. Vol. 2. Dhaka: Ministry of Planning.

Bangladesh, Population Control and Family Planning Division. 1978. *Bangladesh fertility survey, 1975: First report.* Dhaka: Ministry of Health and Population Control.

Bean, L. L., D. M. Farooq, and M. R. Khan. 1966. The labour force of Pakistan: A note on the 1961 census. *Pakistan Development Review* 6(4).

Blanc, Ann. 1990. *The relationship between contraceptive prevalence and total fertility in DHS countries.* Columbia, Maryland: Demographic and Health Surveys Project.

Gunasekaran, Subbiah, and James A. Palmore. 1984. Regression estimates of the gross reproduction rate using moments of the female age distribution. *Asian and Pacific Census Forum* 10(4): 5–10.

Hossain, M. B., K. A. Mozumder, S. C. Das, M. S. Alam, and B. Khuda. 1994. *Sample Registration System: Demographic events and rates from the MCH-FP extension project areas (rural): 1983–1992.* Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

Huq, Najmul Md., and John Cleland. 1990. *Bangladesh fertility survey 1989: Main report.* Dhaka: National Institute of Population Research and Training (NIPORT).

ICDDR,B (International Centre for Diarrhoeal Disease, Bangladesh). 1994. *Annual report 1993.* Dhaka.

Kabir, M., and Rafiquel Islam Chowdhury. 1993. Infant and child mortality levels and trends in Bangladesh. In John Cleland, G. Edward Edanks, Lokky Way, Nawab Ali, and M. Rashid, eds. *Bangladesh fertility survey, 1989: Secondary analysis.* Dhaka: NIPORT.

Kantner, Andrew. 1994. *Evaluation of final results from the 1991 population census: Implications for demographic change in Bangladesh.* Working Paper 75. East-West Center, Honolulu.

Kantner, Andrew, and Ali Noor. 1991. *Population dynamics in Bangladesh: Current demographic estimates and future prospects.* Unpublished manuscript. East-West Population Institute, Honolulu.

Mauldin, W. Parker, and Sheldon Segal. 1986. *Contraceptive prevalence: A factbook.* New York: Rockefeller Foundation.

Mitra, S. N., Charles Lerman, and Shahidul Islam. 1993. *Bangladesh Contraceptive Prevalence Survey, 1991.* Dhaka: Mitra and Associates.

NAS (National Academy of Sciences). 1981. *Estimation of recent trends in fertility and mortality in Bangladesh.* Washington, D.C.: National Academy Press.

NIPORT (National Institute of Population Research and Training), Mitra and Associates, and Macro International.

1994. *Bangladesh Demographic and Health Survey, 1993–94: Preliminary report.* Dhaka.

Palmore, James A. 1978. *Regression estimates of changes in fertility 1955–60 and 1965–75, for most major nations and territories.* Papers of the East-West Population Institute 58. East-West Center, Honolulu.

Rele, J. R. 1967. *Fertility analysis through extension of stable population concepts.* Ph.D. dissertation. Institute of International Studies, University of California, Berkeley.

———. 1987. Fertility levels and trends in India, 1951–1981. *Population and Development Review* 13(3): 513–30.

Shryock, Henry, and Jacob Siegel. 1976. *The methods and materials of demography.* New York: Academic Press.

Strong, M. A. 1994. *Demographic surveillance system early indicators: Matlab 1993.* Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

United Nations. 1982. *Model life tables for developing countries.* New York: Department of International Economic and Social Affairs.

———. 1983. *Manual X: Indirect techniques for demographic estimation.* New York: Department of International Economic and Social Affairs.

United States, BOC (Bureau of the Census). 1993. *Population Analysis System (PAS).* Washington, D.C.: Department of Commerce.

Asia-Pacific Population Research Reports provide an informative discussion of research on important population issues facing the Asia-Pacific region. Published several times a year with support from the Office of Population, U.S. Agency for International Development, this series and its companion series, **Asia-Pacific Population Research Abstracts,** are intended for social and health scientists, policymakers, program managers, and the interested public. All submissions are peer-reviewed. The opinions expressed in the series are those of the authors and not necessarily those of the East-West Center. Copies of the Research Reports and Abstracts may be reproduced for educational purposes.

ISSN 1079-0284

Correspondence to the authors should be addressed to Dr. Andrew Kantner, Program on Population, East-West Center, 1777 East-West Road, Honolulu, HI 96848.
E-mail: KANTNERA@EWC.BITNET

Copies of this and other Research Reports and Abstracts may be requested from:
East-West Center
Publication Sales Office
1777 East-West Road
Honolulu, HI 96848, U.S.A.
E-mail: EWCBOOKS@EWC.BITNET
Telephone: (808) 944-7145
Fax: (808) 944-7376

Also available in this series:

Asia's recent fertility decline and prospects for future demographic change, by Ronald Freedman. No. 1, January 1995.

Scenarios for the AIDS epidemic in Asia, by James Chin. No. 2, February 1995.

How Japan and the newly industrialized economies of Asia are responding to labor scarcity, by John G. Bauer. No. 3, March 1995.

Aging in Asia: Setting the research foundation, by Albert I. Hermalin. No. 4, April 1995