MANAGEMENT SCIENCES for HEALTH

Community-Based Health Care

Lessons from Bangladesh to Boston

4 The Impact of Development Interventions on Health in Bangladesh

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The story of BRAC (formerly the Bangladesh Rural Advancement Committee) is provided in several books and studies documenting the success of national programs in oral rehydration, immunization, treatment of tuberculosis, and dealing with the threat of arsenic in ground water. This chapter evaluates the comprehensive development package aimed at improving the livelihoods of the poor and shows that the provision of rural credit, schools, and empowerment of women have direct and measurable effects on health and fertility. While BRAC is a highly directive and standardized program, it is designed in a culturally sensitive fashion to reach the poorest of the poor and guided by ongoing research and modification of its components.

—*Jon Rohde*

This chapter has two parts: the first presents data from a carefully conducted study of the impact of (nonhealth) development interventions, including literacy, education, credit, and livelihood skills on health. The interventions were part of the standard Rural Development Program of BRAC, carried out in some 65,000 villages and focused on the poorest families.

The second part explores trends in development indicators in Bangladesh since its independence in 1971. There is abundant evidence of a substantial improvement in human development over the past 30 years, a result of synergies between government, nongovernmental organizations (NGOs), and international assistance that have strengthened community action and self-reliance. But much remains to be done to bring the population of Bangladesh to acceptable levels of human development, the "freedoms" described by Amartya Sen.

PART I: DEVELOPMENT FROM THE VILLAGE UPWARDS

Since Bangladesh's independence in 1971, numerous government and nongovernmental organizations have been implementing development programs in various sectors. Many of these programs have earned a reputation within and outside Bangladesh for their innovation, effectiveness, and scale. These programs include the Association for Social Advancement, Bangladesh Academy for Rural Development (BARD), BRAC, Grameen Bank, Proshika, and many others. Evaluations of such programs have traditionally looked at their success in increasing the income levels of participants but less often on the broader

goals of human well-being, particularly health. This section looks at the poverty alleviation program of BRAC, a large NGO in Bangladesh, and examines its impact on selected outcome indicators of health.

The BRAC Programs

BRAC started work in isolated rural areas when millions of refugees who had fled to India during the 1971 war of liberation returned. Housing, food, and employment, as well as health, were obvious needs. BRAC workers set out to help villagers reconstruct their lives. While initial efforts were directed at entire villages—providing materials to rebuild homes, supporting fishing infrastructure and agriculture, using locally trained male paramedical workers to provide rudimentary health services—BRAC soon learned that efforts must be directed to the most deprived. In spite of the best egalitarian efforts of BRAC workers, the social structure of rural Bengal society led to exploitation of the poor by those who were better off and to dependency on outside help. Thus, landless women and their families became the focus of BRAC, which established a broad range of development initiatives aimed to empower them as individuals and as an important part of the larger community.

The central effort was called the Rural Development Program. It emphasized group formation, functional literacy using a Freire-type of conscientization (Freire 2000), training in rural income projects, and credit offered without collateral. Today, these efforts have grown to embrace a major rural banking scheme, huge cooperatives in silk production and marketing, milk and other agricultural produce, printing, over 35,000 village schools, and management training on a vast scale. BRAC is now the world's largest NGO in terms of the scale and diversity of its interventions (see Table 1).

The poverty alleviation program functions in over 50,000 of Bangladesh's 84,000 villages and involves over 3.5 million poor women representing as many families. BRAC takes a holistic view of poverty: poverty is not only insufficient income or an absence of employment opportunities but a complex syndrome that manifests itself in many different ways. In the words of Amartya Sen (1995), "The point is not the irrelevance of economic variables such as personal incomes, but

TABLE 1
A Brief on BRAC
(August 2000, US$)

Full-time staff	25,378
Part-time staff	29,000
Participants in poverty alleviation program	4.1 million households
Amount of loans disbursed to the poor	$1.3 billion
Percentage of loans repaid	98%
Amount saved by village organization members	$74.0 million
Total primary schools run by BRAC	33,527
Total students enrolled	1.1 million (67% girls)
Mothers taught oral rehydration for diarrhea	13.0 million
Cases of tuberculosis treated in villages	45,377
Total budget (annual)	$152.0 million
Villages with BRAC poverty alleviation program	60,000 of 86,000
Number of field offices	1,070
Number of districts with BRAC program	64 (of 64)

their severe inadequacy in capturing many of the causal influences on the quality of life and the survival chances of people."

In addition to establishing programs to foster income and employment generation, BRAC aids the poor in forming self-help organizations, encourages conscientization, awareness raising, and gender equity, and provides human resource development training. The logic of these programs is the creation of an "enabling environment" in which the poor can participate in their own development and in improving the quality of their lives.

BRAC works through a process of social mobilization, delivery of inputs such as adult education, microfinance, and skills training, and creation of an environment of choice for the poor. Like most other poverty alleviation programs in Bangladesh (Hashemi et al. 1996, Pitt and Khandker 1996), BRAC defines the poor as those having half an acre of land or less. The process of social mobilization in a village begins with the identification of those who fit this definition. As soon as an adequate number of eligible individuals show definite interest, an institution of the poor, called a village organization (VO), is formed. In Bangladesh, about half of the households meet the BRAC eligibility criteria, and about 30 to 40% of the eligible villagers in the areas where

BRAC has a presence have so far joined the VOs. The gender ratio has changed dramatically over time in BRAC: in the 1990s, most VOs were composed of men only, whereas now 98% of the members are women. A VO has 40 to 50 members. Within a month of formation, VO members are allowed to apply for loans. The impressively high proportion of loans that are repaid (98%) is the result of a combination of members' consciousness, peer-group pressure, and BRAC staff supervision. BRAC bank staff are trained as extension agents to ensure the viability of village-based income production projects ranging from fish culture to silk production, from weaving to cattle and milk production, from power-pump rental for small irrigation to the sale of approved medicines by village health workers.

BRAC's education program runs nearly 34,000 primary schools, which enroll a total of 1.1 million pupils. Teachers are recruited from among women in the village, who are provided with a standard curriculum to follow for a three-year course. Two-thirds of BRAC school attendees are girls from the poorest sections of the community, to whom the formal public-sector schools are the least accessible. The effectiveness of the BRAC schools in terms of dropout rates (less than 5% over three years of study), attendance (nearly 100%), achievement (high pass rates on standard exams), and costs (some $18 per child per year) is truly remarkable (Ahmed et al. 1993, Chowdhury, Chowdhury, and Nath 1999).

While improved health of communities has been an objective of BRAC efforts from the start, health care, though important, has been seen as only one element. Although BRAC initially trained paramedics to deliver simple curative care, referring more difficult cases to doctors in fixed clinics, the use of paramedics soon became more prevalent. People neglected prevention. Nonetheless, BRAC areas had the highest use of and continuation rate for family planning, even in the early years. Turning its attention to the largest killer of children, diarrhea, BRAC undertook to teach every household in the country how to make and use oral rehydration therapy (ORT), a technology developed in Bangladesh but not widely known. Over a decade, BRAC workers visited some 13 million households in almost all of the country's 86,000 villages to instruct and demonstrate to each mother how to prepare ORT with home ingredients. This is the largest effort of its kind in the world and has contributed to the fall in infant and young child mortal-

ity. ORT has now become a part of Bangladeshi culture (Chowdhury and Cash 1993).

BRAC has applied similar mass approaches to improving immunization levels, in partnership with government health services; improved nutrition through village-based growth promotion; and strengthened the availability in communities of family planning and maternity services for women. Most recently, in response to the arsenic contamination of groundwater in a large proportion of the eight million shallow wells providing drinking water in the country, BRAC has developed field-testing procedures enabling identification of unsafe pumps, which are then painted red to warn villagers not to drink the water. Simple filters have been designed and tested for home use, and patients with symptoms of arsenic poisoning are being treated. The current health program also provides essential health services to villagers through trained women who charge a low fee and emphasize women's health and combating specific diseases such as tuberculosis (Chowdhury et al. 1997, Chowdhury 1999).

Since its early days, BRAC has maintained a research and evaluation division, whose role has been to investigate both the design and impact of BRAC programs. With more than 100 employees at present, it produces 30–40 reports each year, providing a continuous flow of information to modify and strengthen programs. Both qualitative approaches to sociocultural issues as well as quantitative studies of programs' impact are published and used to refine BRAC activities. While most studies are descriptive and not controlled, the collaboration with ICDDR,B has made possible a more rigorous evaluation of the impact of BRAC development efforts on health outcomes.

Studying the Impact of BRAC Programs on Health

Although BRAC works throughout Bangladesh, the data for the present analysis come from one subdistrict called Matlab, the field station of the ICDDR,B. Located 50 kilometers south of Dhaka in a riverine area of Chandpur district, the ICDDR,B has maintained this surveillance area since 1963. The many demographic studies and action research conducted there are testimony to its worldwide reputation (Van Ginneken et al. 1998, D'Souza 1984). Given the high quality of community

data collected routinely throughout the Matlab study area, BRAC and ICDDR,B initiated a research project to examine the impact of development activities on the health and well-being of the population. This effort became known as the BRAC-ICDDR,B Joint Research Project.

In 1992, BRAC moved to Matlab, where the population of 250,000 was divided into four study cells. Two cells, one inside and one outside a protective embankment to prevent flooding, received BRAC programs, and two similar cells did not. The BRAC inputs introduced in the villages included VO formation and organization of the poor, microcredit, training of VO members in human and legal rights and vocational skills, and nonformal primary education for children. In the 75 villages where BRAC initially started, a total of 164 VOs were formed with 6,736 members (all women), covering over half of the villages' poor households (all poor households were offered the chance to join). Since 1993, BRAC VO members have saved over $300,000. In addition, a total of $3 million in loans has been disbursed to them, with a 99.7% recovery rate. BRAC opened 81 nonformal schools, which enrolled 2,658 students.

Data Sources

The data used in the present analysis came from the following sources:

Baseline survey. Prior to BRAC's interventions in 1992, a survey of more than 12,000 households (over 60,000 people total) in villages belonging to the four cells referred to above collected quantitative information on assets, expenditures, education, nutritional status, health-seeking behavior, women's empowerment, family planning, and involvement with development activities.

Seasonal surveys. Three rounds of seasonal surveys were carried out in a subsample of the baseline population in 1995–96. These surveys collected the same information as did the baseline surveys.

Ethnographic surveys. Several ethnographic and other qualitative investigations were carried out using in-depth interviews, focus group discussions, and observations focusing on women's status and intrahousehold food distribution.

Demographic surveillance. The Demographic Surveillance System (DSS) of ICDDR,B provided mortality information on all households

in the villages under study. ICDDR,B collects data on births, deaths, in- and out-migration, and marriage through monthly household visits.

Management information. BRAC maintains a management information system for its projects. Information from households joining the BRAC program about the inputs received from BRAC, such as date of joining, amount of loans received, repayments, participation in education or vocational training, is linked with the DSS information.

Figure 1 illustrates the conceptual framework linking expected health impacts to inputs and processes in the BRAC program in Matlab, Bangladesh.

Impact of BRAC Programs on Family Planning

The Matlab area is noted for a highly successful family planning program, based on house-to-house delivery of services and coupled with good health care at the ICDDR,B rural hospital and its outlying clinics. Table 2 shows that the current use of family planning methods is greater among married BRAC members than among poor nonmembers ($p < .05$). BRAC members actually had higher rates of use of family planning than the nonpoor nonmembers did.

Impact of BRAC on Nutritional Status of Children

The BRAC-ICDDR,B project collected data on mid-upper-arm circumference (MUAC) in 1992, when the BRAC intervention was about to start, and in 1995, when the intervention was about three years old. Table 3 looks at severe protein-energy malnutrition (PEM, represented as MUAC < 12.5 cm) in children 6–72 months of age, according to their mothers' participation in BRAC. The prevalence of severe PEM has significantly declined among children of BRAC-member households, but there has been no such change among the children of nonmembers.

The pattern in intrafamily food distribution was explored through observations of 25 households having both girls and boys. It showed that among BRAC-member households, girls more often received equal treatment. Still, boys were more favored in terms of being given culturally preferred/superior parts of the fish, chicken, meat, etc. (Roy et al. 1998). When analyzed by gender, the MUAC data showed a signif-

FIGURE 1

Conceptual Framework Linking Expected Health Impacts to BRAC Inputs and Processes

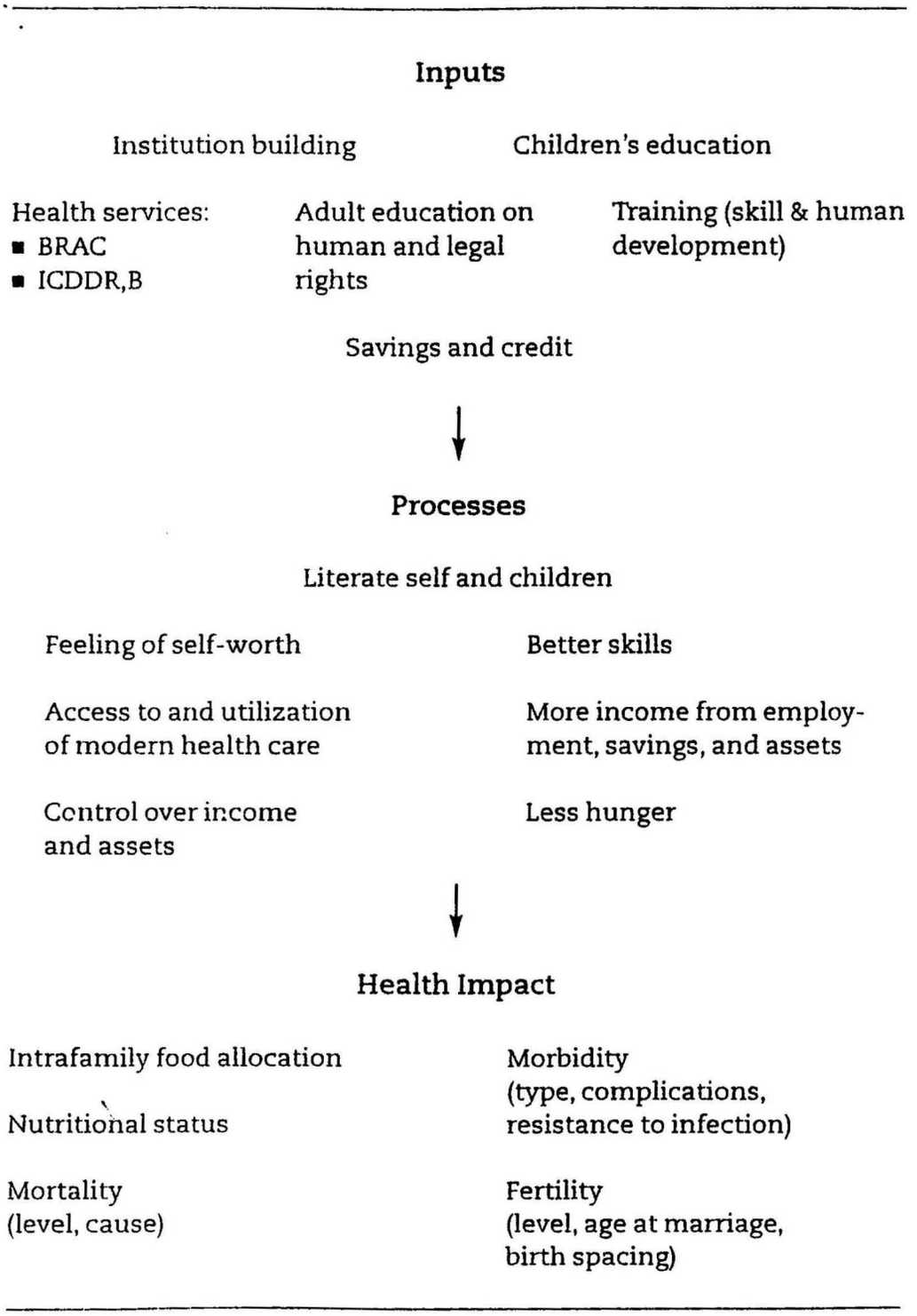


TABLE 2
Current Use of Family Planning by BRAC Members

BRAC Membership	No. of Respondents	Current FP Use (%)
Member	500	57.9
Poor nonmember	1,194	49.6
Nonpoor nonmember	1,088	51.3

TABLE 3
Prevalence of Severe Protein-Energy Malnutrition in Children by BRAC Membership Status before and after Intervention

	Year of Survey				Significance	
Malnutrition	1992 Baseline Poor Individuals ($n = 827$)	1995 BRAC Member ($n = 273$)	1995 Poor Nonmember ($n = 707$)	1995 Nonpoor Nonmember ($n = 538$)	1 vs. 2	1 vs. 3
% Severe PEM (MUAC < 12.5 cm)	23.2	12.1	21.2	11.5	$p < .01$	NS

Source: Khatun et al. 1998

icantly higher prevalence of severe PEM in females among both BRAC members and poor nonmembers, but not among nonpoor nonmembers. Gender bias is hard to overcome!

Impact of BRAC on Child Survival

Survival rates of children belonging to BRAC-member households in comparison to poor nonmember and nonpoor nonmember households are shown in Figure 2. It shows that survival of children in BRAC-member households is better than that of children from poor nonmember households and is in fact similar to survival of children from nonpoor nonmember households.

The pronounced survival advantage of children of poor members compared to poor nonmembers is seen for girls as well as for boys. It is striking that the survival advantage associated with BRAC member-

TABLE 4

Incidence of Violence against Women in Last Four Months by Characteristics of BRAC Membership, Matlab 1995

	Physical Violence (%)
BRAC Membership	
BRAC member (n = 438)	8.9
Poor nonmember (n = 1,550)	5.8
X^2 *significance*	$p < .05$
Length of BRAC Membership	
≤ 2 year (n = 185)	10.8
2+ year (n = 260)	7.3
X^2 *significance*	*NS*
Depth of BRAC Membership	
Poor nonmember (n = 1,595)	5.6
Only savings (n = 56)	5.4
Savings + credit (n = 268)	11.2
Savings + credit + training (n = 119)	3.4
X^2 *significance*	$p < .01$

Source: Khan et al. 1998

offered. It appears that the initial "threat" to male hegemony within the family, brought about by women's preferential access to credit, diminishes over time, presumably as the obvious benefits to the overall welfare of the family become apparent.

Conclusions

While BRAC health interventions have been shown to improve survival and nutrition and contribute to reduced fertility in BRAC participants, this study was designed to investigate the health and fertility impact of nonhealth efforts of the overall BRAC Rural Development Program: group formation, credit, schooling, and employment skills. Participants were limited to the poorest households in the communities chosen and were compared to the nonparticipating poor as well as the nonpoor living in the same communities. Survival benefits to children accrued particularly to girls and tended to decrease the typical

gender bias that reduces the nutrition and life expectancy of girls. The use of family planning by BRAC beneficiaries was higher, even in comparison to the nonpoor. While women's empowerment, and especially access to credit, seemed to be associated with more acts of domestic violence, this effect diminished over time, as the benefits of the program to the entire family became evident.

The BRAC development efforts clearly contribute to a better life for the poor, even measured by independent survival and quality of life measures.

PART II: NATIONAL TRENDS IN DEVELOPMENT INDICATORS

Having reviewed the evidence of improved health and well-being associated with participation of poor families in the BRAC Rural Development Program, we turn to the broader cumulative impact of development efforts in Bangladesh in the past 30 years.

Poverty Levels

Bangladesh is one of the poorest countries in the world. The GDP per capita (purchasing power parity, or ppp) of US$1,361 is one of the lowest in the world, lower than that of most other South Asian countries. Table 5 compares Bangladesh's per capita income with that of several other countries in the region and with that of the United States.

Whatever pessimistic picture one may draw from Table 5 does not negate the possibility of a better future for this country. In fact, a look at the trends points to a better future. Figure 3 shows the proportion of people in urban and rural Bangladesh who were below the poverty line (the so-called head-count ratio) in various years since independence. This line is based on the "fixed-bundle method"—the expenditure necessary to obtain 2,112 calories per person per day. The figure shows a nearly constant decline in urban and rural poverty, with the improvement in urban areas being faster than in rural areas. This translates into a long-term poverty reduction of 1.55% per year, which is slower than that experienced in East Asian economies but is nevertheless encouraging for Bangladesh (Sen 2000).

TABLE 5

GDP per Capita in Bangladesh and Selected Other Countries

Country	*GDP per Capita (ppp US$) in 1998*
Bangladesh	1,361
Bhutan	1,536
India	2,077
Nepal	1,157
Pakistan	1,715
US	29,605

Source: UNDP 2000

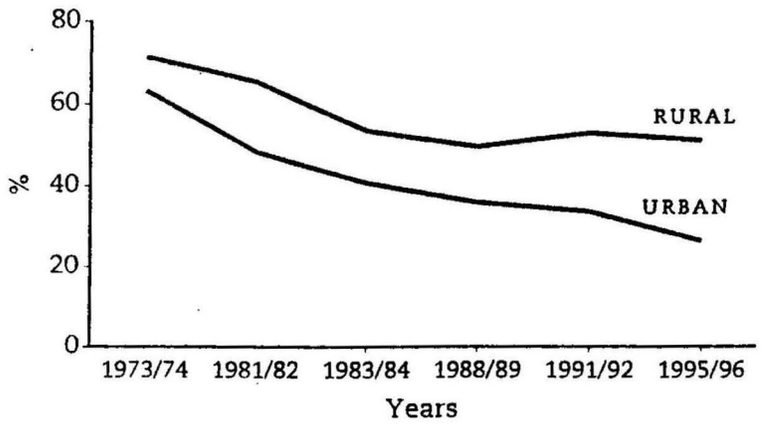
Economists have also looked at the trends in the depth and severity of poverty over the years. As Table 6 indicates, the depth of poverty, as represented by the "poverty-gap index,"[1] and its severity, as represented by the "squared poverty-gap index,"[2] also decreased, implying improved distribution of wealth as well as a reduction in overall poverty.

Food Production and Consumption

Bangladesh has made commendable progress in food production over the years. In spite of the runaway population growth in the 1970s and 1980s, the average availability and consumption of food grains has remained more or less unchanged (Table 7). This has been made possible by an increase in agricultural production through increased use of technology. For example, between 1984 and 1995, the use of fertilizers in the country more than doubled (from 1.25 million to 2.9 million

1. The poverty-gap index is the mean distance below the poverty line as a proportion of that line. This measure counts the nonpoor as the zero poverty gap.
2. The squared poverty-gap index is the mean of the squared proportionate poverty gaps. The squaring of the poverty-gap index reflects changes in the severity of poverty in the sense that it is sensitive to inequality among the poor.

FIGURE 3
Trends in Rural and Urban Poverty (1973/74–1995/96)



Source: Ravallion and Sen 1996, Sen 2000

metric tons), and the size of irrigated areas also almost doubled. The cropping intensity (the number of times a piece of land is cultivated in one year) also increased over these years, from 168 to 175%. However, the gross cropped area decreased during the same period, from 34.7 million acres to 33.3 million acres, mainly because of population increase and an already low land-to-population ratio[3] (Abdullah and Shahabuddin 1997).

Nutritional Status

Bangladesh also has one of the largest proportions of malnourished citizens in the world. It is estimated that around 80% of Bangladeshi children are malnourished to some degree. Table 8 shows the proportion of children under six years of age who are severely malnourished, as measured by a mid-upper-arm circumference of 12.5 centimeters or less. Nationally, 12.7% of children are severely malnourished, with the situation being worse in rural than in urban areas. The slight improve-

3. Bangladesh is the most densely populated country in the world, with more than 900 people per square kilometer.

TABLE 6

Depth and Severity of Poverty

	—Poverty-Gap Index—		—Squared Poverty-Gap Index—	
Years	*Urban*	*Rural*	*Urban*	*Rural*
1983/84	11.4	15.0	4.4	5.9
1988/89	8.7	13.1	2.8	4.8
1991/92	8.4	14.6	2.8	5.4
1995/96	6.0	14.1	1.9	5.5

Source: Ravallion and Sen 1996, Sen 2000

TABLE 7

Per Capita Daily Availability and Intake of Food Grains (1990–95)

Year	*Availability (gm)*	*Intake (gm)*
1990–91	458	461
1991–92	453	451
1992–93	439	449
1993–94	433	440
1994–95	404	434
1995–96	421	432

Source: Abdullah and Shahabuddin 1997

TABLE 8

Nutritional Status of Children
(Measured by Mid-Upper-Arm Circumference) (1985–95)

	———% Children with MUAC < 12.5 cm———		
Year	*Urban*	*Rural*	*All*
1985–86	9.90	14.90	14.40
1989–90	8.50	11.00	10.70
1992	8.40	13.20	12.60
1995–96	8.50	13.90	12.70

Source: Bangladesh Bureau of Statistics (1985–86, 1989–90, and 1992), Institute of Nutrition & Food Science (1995–96)

ment from 1986 to 1996 is of little significance and indicates a persisting problem. The country has the highest estimated level of low birthweight in the world: about 50% of newborns weigh less than 2.5 kilograms. These distressing figures are reflected in a secular trend of decreasing adult height in the entire population. This has profound implications for physical work capacity as well as an adverse impact on childbearing.

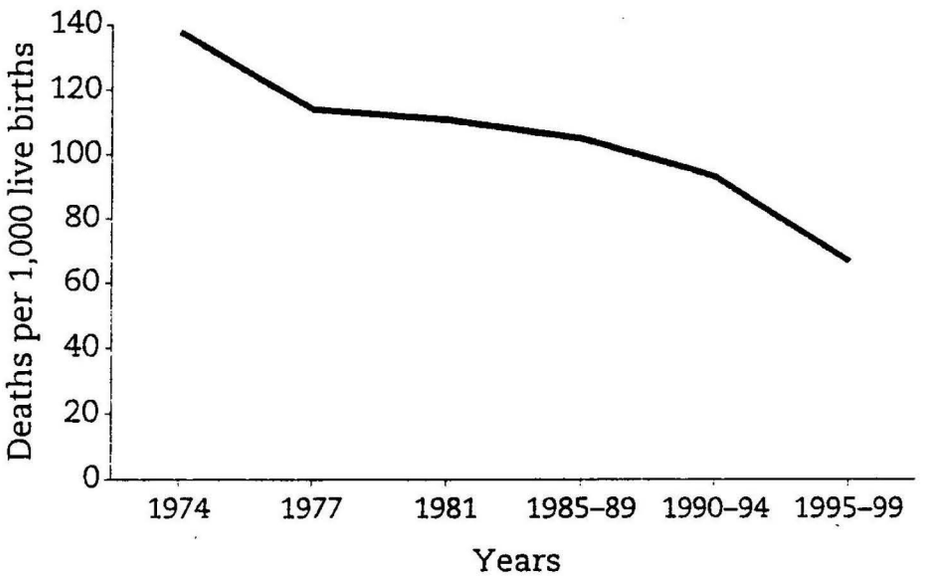
Health and Fertility

At independence in 1971, Bangladesh was one of the poorest and most unhealthy countries in the world. Nearly 140 of every 1,000 newborns died in their first year, and many more died before age five. Smallpox epidemics ravaged the country, and cholera was endemic. Malaria and kala-azar (an often-fatal tropical fever caused by a blood parasite and spread by a sandfly bite) plagued many areas. The health infrastructure provided care largely in district hospitals. All this fueled one of the highest fertility rates in the world, with over six births per woman.

Extensive external assistance contributed to building *thana* (subdistrict) health centers and, later, smaller clinics in unions (lowest-level administrative units). The global smallpox eradication program concluded its success in Asia with the last case of variola major in Bangladesh in 1975. Efforts to provide safe water through hand pumps were spearheaded by UNICEF and many other donors, as well as by the government. As a result, every hamlet had access to safe water by the early 1980s. In recognition of the role of childhood diarrhea as the major cause of child mortality, BRAC supported a national oral rehydration therapy (ORT) program. Program staff taught a woman in each of 13 million households to make and use homemade ORT—a *labon-gur* (salt-sugar) solution. A coalition of NGOs helped government vaccinators achieve high coverage of routine immunization in infants. A twice-annual dose of vitamin A was added to this regimen. Meanwhile, a major government effort focused on providing modern family planning services, delivered conveniently and reliably in or near women's homes. The combined effect of these health measures is dramatically shown in the decreases in the infant mortality rate and total fertility rate in Figures 4 and 5.

FIGURE 4

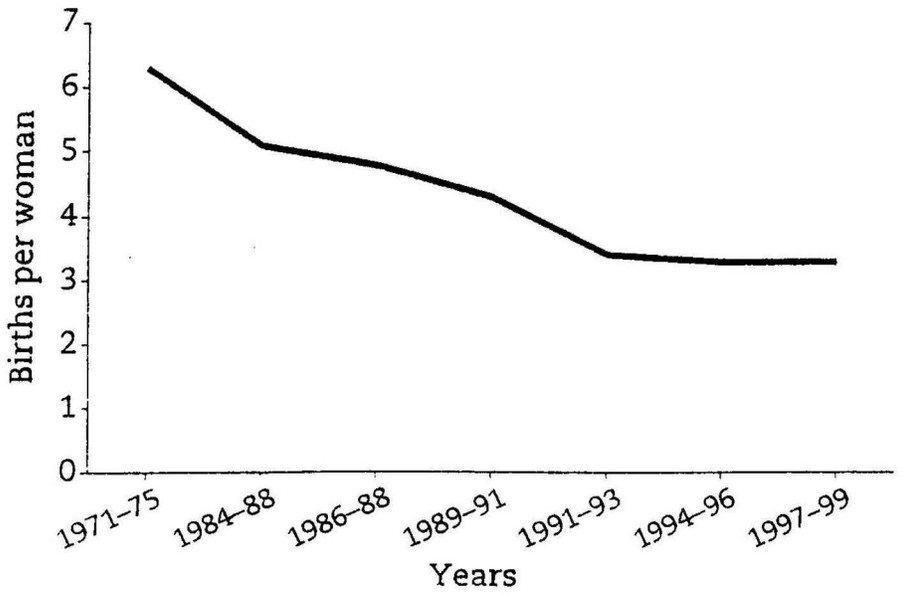
Trends in the Infant Mortality Rate



Source: Bangladesh Demographic and Health Survey, Dhaka 2001

FIGURE 5

Trends in the Total Fertility Rate



Source: Bangladesh Demographic and Health Survey, Dhaka 2001

While mortality appears to be dropping continually, the cessation of the decline in fertility over the last decade is a cause of concern. Bangladesh's demographic transition cannot be considered complete until there is further substantial decline in both these parameters.

Education

Bangladesh is also seriously disadvantaged in terms of the literacy and education status of its population. The country has made progress over the years but at fairly slow pace. As Table 9 shows, the literacy rate rose barely 10 percentage points between 1974 and 1994. The recent claim by the government that it has reached 62% is not borne out by any independent source. On the other hand, the country did make important headway in increasing the access of its children to primary schooling. Recent independent studies show that the gross enrollment ratio (number of children of any age enrolled at the primary level per 100 children) has now reached 107%. The net rate (number of children of primary school age who attend primary classes) has also increased but is still 77%. More significant is the elimination of gender disparity in primary enrollment; in fact, girls now outnumber boys in primary schools. However, the issue Bangladesh still faces concerns the quality of the education. When a very elementary test[4] was administered to children finishing the five-year primary cycle, only 57% qualified, indicating a serious waste of resources and missed opportunities (Chowdhury, Chowdhury, and Nath 1999).

The improvements in both literacy and access to education have been rather slow, and the quality of education is not encouraging. However, when one analyzes such improvements in more depth, important trends surface. Figures 6 and 7 show the share of different socioeconomic groups in the increase in access to primary education. The data show clearly that it is the hitherto-excluded groups that are gaining disproportionately more. The gain has been confined to girls, children from rural areas, and those belonging to socioeconomically disadvantaged groups. This has been possible because the government and NGOs have instituted several policies that favor these groups.

4. Assessment of Basic Competencies (ABC): This measure tests children on basic literacy, numeracy, and life skills (Chowdhury et al. 1994).

TABLE 9
Trends in Adult Literacy Rates and Primary Enrollment

Year	*Literacy Rate (%)*	*Primary Enrollment (Gross) (%)*
1971	NA	45
1974	25.8	58
1981	29.2	63
1990	24.8	78
1994	35.3	95
1998	NA	107
2000	62.0	NA

Sources: UNDP (various reports); "Literacy Rates Now 56%," *Daily Star* 1999; Chowdhury, Chowdhury, and Nath 1999

Environment: Arsenic, Iodine, and Other Issues

Unfortunately, few data are available to evaluate the trend in the environmental situation in Bangladesh. The country has few forests; only 8% of the land is wooded. However, a recent UNDP report (2000) suggests that the annual rate of deforestation in the country declined from 1.8 to 0.9% during the 1980s.

Three decades ago, a national nutrition survey found goiter only in the hilly border areas near India, confirming the classical location of iodine deficiency in high-rain and runoff areas. By the end of the 1980s, goiter was increasingly found on the plains, affecting women and children with predictable effects, including mental retardation, deaf-mutism, and probably lowered IQs. Fortunately, effective measures were taken to iodize all salt at the source from which some 200 distributors supplied most of the country. However, the reasons for this emerging public health epidemic of iodine deficiency have not been fully studied. It appears likely that the intensified agricultural practices of the recent decades have disrupted the replenishment of iodine in the soils through seasonal flooding and silt deposit originating from the high Himalayas. Floods are now controlled by riverine embankments, and most water for irrigation is pumped from the ground. Puddling of

rice paddy fields with tractors effectively washes the soil and may remove other micronutrients as well. The ultimate effects of this intensified agriculture could be far reaching.

Experts foresee other kinds of environmental disasters. Bangladesh was a success story in the provision of safe drinking water to its population. Over 90% of the population had access to tube wells that pumped pathogen-free water out of shallow aquifers. Suddenly, it was found that many of these wells had impermissible levels of arsenic. Arsenic has been detected in areas that constitute about a quarter of the country. This means that about 30 million people are exposed to drinking arsenic-contaminated water. Many experts believe it to be one of the worst environmental disasters in history. Unfortunately, the country is not ready to face this situation. Bangladesh has neither the expertise nor the resources to deal with it. In addition, policymakers are procrastinating. There is a $42-million project supported by the World Bank for arsenic mitigation, but with less than a year to go before its end, only about 10% of the funds have been spent. There are already reports of hundreds of arsenic-related deaths in the country; this problem may increase to epidemic proportions over the next few years. The five main challenges in the arsenic crisis are:

- Find out the reason(s) for the contamination of the ground water; it is unclear whether it is leached from the soils or is related to falling water tables and oxidation of rock layers.
- Test all tube wells for arsenic; there are over eight million such wells in the country. BRAC has conducted a large demonstration of the feasibility of testing and denoting wells that have dangerous levels of arsenic by painting them bright red—thus warning against use for consumption (bathing is permissible).
- Provide alternative safe water options to people; no option has been discovered that is safe, culturally acceptable, technically feasible, environmentally benign, and affordable for most people.
- Identify and treat patients affected by arsenicosis (the disease caused by arsenic poisoning); there is no proven treatment regimen for this condition, nor is the health system prepared to face this disaster.

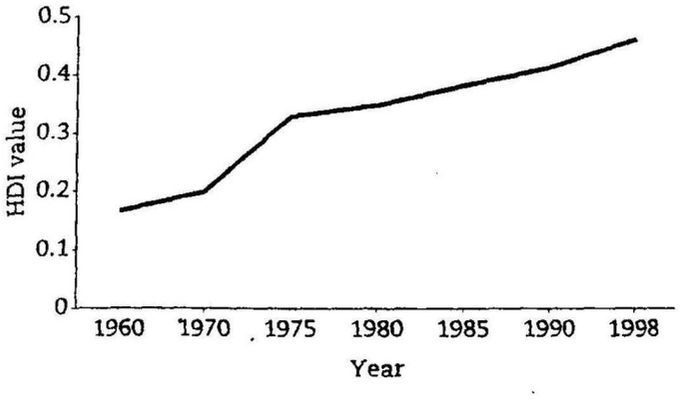
- Research the level of environmental contamination of the surface that is caused by arsenic; there are unconfirmed reports that the food chain has already been affected.

Fortunately, there are a few projects that are trying to address these issues, at least on a small scale. Initial results suggest that the arsenic crisis may be tackled successfully if concerted and coordinated efforts are mounted rapidly (BRAC 2000). For now, avoiding use of these wells for consumption is urgent.

Trends in the Human Development Index

The human development index (HDI) is a composite index that measures a society's human development record. Input factors include the expectation of life at birth, adult literacy rate, combined gross school enrollment ratio, and GDP per capita. Of the 174 countries for which the HDI is available, Bangladesh's place is a poor 146th (UNDP 2000). As shown in Figure 8, Bangladesh is making progress in terms of human development, but the country's HDI rank has hovered between 145th and 150th for almost 40 years. This means that other countries have also made comparable progress.

FIGURE 8
Trends in the Human Development Index
(1960–98)



Source: Sen 2000 (for 1960 and 1970), UNDP 2000 (for other years)

Thus, while Bangladesh has made some notable progress in health and education, and held the line against deteriorating nutritional status, there is far more to be done. Many would suggest that persisting poverty is an absolute barrier to further improvement in human development parameters. The experience of BRAC demonstrates, however, that greatly improved human well-being is possible, even in the face of persisting economic poverty. Holistic, community-based strategies that are centered on women and emphasize self-reliance have shown that not only good health but also humane and acceptable living standards can be achieved through decentralized, affordable development.

REFERENCES AND RESOURCES

Abdullah, A., and Q. Shahabuddin. 1997. "Recent Developments in Bangladesh Agriculture." In R. Sobhan, ed., *Growth or Stagnation!: A Review of Bangladesh's Development.* Dhaka: University Press.

Abed, F. H., and A. M. R. Chowdhury. 1997. "How BRAC Learned to Meet Rural People's Needs through Local Action." In Anirudh Krishna, Norman Uphoff, and Milton J. Esman, eds., *Reasons for Hope: Instructive Experiences in Rural Development.* West Hartford, CT: Kumarian Press, pp. 41–56.

Ahmed, M., et al. 1993. "Primary Education for All: Learning from the BRAC Experience." Washington, DC: Academy for Educational Development.

Bhuiya, A., et al. 2001. "An Interventions Study of Factors Underlying Increasing Equity in Child Survival." In Timothy Evans et al., eds., *Challenging Inequities in Health: From Ethics to Action.* New York: Oxford University Press.

BRAC. 2000. *Combating a Menace: Early Experiences with a Community-Based Arsenic Mitigation Project in Bangladesh.* Dhaka: BRAC.

Chabot, C., et al. 1993. *Primary Education for All: Learning from the BRAC Experiences.* Washington, DC: Academy for Educational Development.

Chen, M. A. 1993. *A Quiet Revolution: Women in Transition in Rural Bangladesh.* Rochester, NY: Shenkman Books.

Chen, M. A., and S. Mahmud. 1995. "Assessing Change in Women's Lives: A Conceptual Framework." Working Paper No. 2. Dhaka: BRAC and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B) Joint Research Project.

Chowdhury, A. M. R. 1999. "Success with the DOTS Strategy." *The Lancet* 353: 1003–4.

Chowdhury, A. M. R., and A. Alam. 1998. "BRAC's Poverty Alleviation Efforts: A Quarter Century of Experiences." In G. Wood and I. Sharif, eds., *Who Needs Credit?: Poverty and Finance in Bangladesh.* London: Zed Books, pp. 171–94.

Chowdhury, A. M. R., and A. Bhuiya. 2001. "Do Poverty Alleviation Programmes Reduce Health Inequity: Evidence from Bangladesh." In David A. Leon and Gill Walt, eds., *Poverty, Inequality and Health: An International Perspective.* Oxford: Oxford University Press, pp. 312–32.

Chowdhury, A. M. R., and R. A. Cash. 1993. "Cultural Incorporation of the ORT Message." *The Lancet* 34: 1591.

———. 1996. *A Simple Solution: Teaching Millions to Treat Diarrhoea at Home.* Dhaka: University Press.

Chowdhury, A. M. R., R. K. Chowdhury, and S. R. Nath. 1999. *Hope Not Complacency: State of Primary Education in Bangladesh.* Dhaka: Campaign for Population Education and University Press.

Chowdhury, A. M. R., M. Mahmud, and F. H. Abed. 1991. "Credit for the Rural Poor: The Case of BRAC in Bangladesh." *Small Enterprise Development* 2: 4–13.

Chowdhury, A. M. R., et al. 1994. "Assessing Basic Competences: A Practical Methodology." *International Review of Education* 40: 437–54.

———. 1995. "Effects of Socio-Economic Development on Health Status and Human Well-Being: Determining Impact and Exploring Pathways of Change." Proposals for Phase II of the BRAC-ICDDR,B Matlab Joint Project 1996–2000 AD. BRAC-ICDDR,B Working Paper No. 6. Dhaka: BRAC and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

———. 1997. "Control of Tuberculosis by Community Health Workers in Bangladesh." *The Lancet* 350: 169–72.

Chowdhury, F. I., and Chowdhury, A. M. R. 1978. "Use Pattern of Oral Contraceptives in Rural Bangladesh." *Bangladesh Development Studies.*

D'Souza, S. 1984. "Small Area-Intensive Studies for Understanding Morbidity Process: Two Models from Bangladesh—The Matlab Project and the Companion Health Project." In *United Nations Databases for Mortality Measurement.* Papers of the Meeting of the United Nations/World Health Organization Working Group on Databases for Measurement of Levels, Trend, and Differentials in Mortality. Bangkok, October 20–23, 1981. New York: United Nations Dept. of International Economic and Social Affairs, pp. 146–58.

Freire, Paulo. 2000. *Pedagogy of the Oppressed.* 30th anniversary ed. New York: Continuum.

Hashemi, S. M., S. Schuler, and P. Riley. 1996. "Rural Credit Programs and Women's Empowerment." *World Development* 24: 635–53.

Husain, A. M. M., ed. 1998. *Poverty Alleviation and Empowerment.* Dhaka: BRAC.

Khan, M. R., et al. 1998. *Domestic Violence against Women: Does Development Intervention Matter?* Joint Project Working Paper No. 28. Dhaka: BRAC and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

Khatun, M., et al. 1998. *Women's Involvement in BRAC Development Activities and Child Nutrition.* Joint Project Working Paper No. 30. Dhaka: BRAC and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

"Literacy Rates Now 56%." 1999, *Daily Star.* Dhaka, June 26, 1999, p. 11.

Lovell, C. H. 1992. *Breaking the Cycle of Poverty: The BRAC Strategy.* West Hartford, CT: Kumarian Press.

Pitt, M. M., and S. R. Khandker. 1996. *Household and Intra-Household Impact of the Grameen Bank and Similar Targeted Credit Programs in Bangladesh.* Discussion Paper No. 320. Washington DC: The World Bank.

Ravallion, M., and B. Sen. 1996. "When Method Matters: Monitoring Poverty in Bangladesh." *Economic Development and Cultural Change* 44: 761–92.

Roy, R. D., et al. 1998. *Does Involvement of Women in BRAC Influence Sex Bias in Intra-Household Food Distribution?* Joint Project Working Paper No. 25. Dhaka: BRAC and International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).

Sen, Amartya. 1995. *Mortality as an Indicator of Economic Success and Failure.* London: London School of Economics, The Development Economics Research Programme.

Sen, B. 2000. *Bangladesh Poverty Analysis: Trends, Policies and Institutions.* Dhaka: Bangladesh Institute of Development Studies.

United Nations Development Programme. 2000. *Human Development Report.* Oxford: Oxford University Press.

Van Ginneken, J., et al. 1998. *Health and Demographic Surveillance in Matlab: Past, Present and Future.* Special Publication No. 27. Dhaka: International Centre for Diarrhoeal Disease Research, Bangladesh (ICDDR,B).