

# Control of tuberculosis by community health workers in Bangladesh

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## Summary

**Background** Tuberculosis remains a major public-health problem in Bangladesh, despite national efforts to improve case identification and treatment compliance. In 1984, BRAC (formerly the Bangladesh Rural Advancement Committee), a national, non-governmental organisation, began an experimental tuberculosis-control programme in one *thana* (subdistrict). Community health workers screened villagers for chronic cough and collected sputum samples for acid-fast bacillus (AFB) microscopy (phase one). Positive patients received 12 months of directly observed therapy. Phase two (1992-94) included another nine *thanas* and, in phase three (1995), eight more *thanas* were included. From 1995, the treatment was an 8-month oral regimen.

**Methods** In 1995-96, we analysed all programme data from 1992 to 1995. First we analysed phases two (12-month therapy) and three (8-month therapy) separately for proportion cured, died, treatment failed, defaulted, migrated, and referred. Second, we did a cross-sectional survey of tuberculosis cases in more than 9000 randomly selected households in two phase-two *thanas* and one non-programme *thana*, and analysed the follow-up of all patients treated in the programme *thanas*.

**Findings** In the phase-two analysis, 3497 (90%) of 3886 cases identified had accepted 12-month treatment. In phase three, all of 1741 identified cases accepted the 8-month regimen. 2833 (81.0%) and 1496 (85.9%) in phases two and three, respectively, were cured; 336 (9.6%) and 133 (7.6%) died. The relapse rate 2 or more years after treatment was discontinued was higher than the early relapse rate. The drop-out rate was 3.1%. In the cross-sectional survey, the prevalence of tuberculosis in the two programme *thanas* was half of that in the comparison *thana*, where only government services were available (0.07 vs 0.15 per 100).

**Interpretation** The BRAC tuberculosis-control programme has successfully achieved high rates of case detection and treatment compliance, with a cure rate of at least 85% and a drop-out rate of 3.1%. The prevalence survey suggested that at least half of all existing cases had been detected by the programme.

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## Introduction

Tuberculosis remains a global public-health problem but is still a low priority in many developing countries. In these countries, an estimated 7 million new cases occur each year, resulting in 2-3 million deaths, despite the widespread availability of highly effective treatment regimens.<sup>1,2</sup> Improvements in case identification and in compliance with appropriate treatment remain major challenges. WHO recommends use of directly observed therapy, short course.<sup>3,4</sup> In theory, if control programmes used this therapy for a high proportion of new cases, the incidence of sputum-positive tuberculosis would be lowered and mortality would be reduced.

In 1984, BRAC, a large, national, non-governmental organisation in Bangladesh, began an experimental tuberculosis-control programme that relied mainly on community health workers to detect and treat tuberculosis in their own villages. Villagers were screened for chronic cough, and people with confirmed tuberculosis were given a short course of directly observed therapy. This approach was complementary and supplementary to the National Tuberculosis Control Programme. Initial results were encouraging and BRAC extended the programme in 1992 (phase two)<sup>5,6</sup> and again in 1995, when the treatment regimen was changed to an 8-month course (phase three).<sup>7</sup>

A national survey done during 1987-88 by the National Tuberculosis Control Programme showed that 0.87% of the population aged 15 years and older were sputum positive for acid-fast bacillus (AFB), and that tuberculosis was twice as common in men than in women, and more common in urban than rural areas.<sup>8</sup> In another survey done in 1984 in 50 villages in one *thana* (subdistrict), the percentage of patients who were positive for AFB was estimated to be between 0.33% and 0.55% among those aged 15 years or older. In addition, 70% of strains were sensitive to all 12 antituberculosis drugs, and the remainder were resistant to one or two combinations of streptomycin, isoniazid, thioacetazone, and ethionamide.<sup>9</sup>

The Bangladesh National Tuberculosis Control Programme, which is representative of such programmes in developing countries, is clinic-based with more than 1000 beds in 57 hospitals and clinics, all of which are located in urban areas. Although integration of tuberculosis control into primary health care has been government policy since 1976, little substantial progress has been made. Health staff require more training, supervision of patients needs improving, treatment compliance is poor, and the programme needs to be intensified at the community level. BCG immunisation of children younger than 1 year has increased, however, from 2% in 1986 to more than 80% in 1990. In addition, several non-governmental organisations now have tuberculosis-control programmes and care is available from many private physicians. Most antituberculosis drugs are produced in Bangladesh and are widely available from private pharmacies; in tests commissioned

by the Leprosy Mission, these drugs were found to be within acceptable standards (Danak, Denmark, unpublished). Although no reliable information is available on the performance of the National Tuberculosis Control Programme, a review for the World Bank in 1990 estimated that case detection was less than 20% and the cure rate was below 50%.<sup>10</sup> In 1993, the national programme adopted short-course observed therapy regimens and has since received substantial financial assistance from the World Bank and the government of the Netherlands. The overall cure rate for tuberculosis in Bangladesh is now reported to be 70%, including results from the national programme and non-governmental organisations.<sup>11</sup>

To assess the effectiveness of phase two of the programme, which relied on the 12-month regimen, and phase three, which used the 8-month course, we analysed the data to estimate the programme's impact on the prevalence of tuberculosis, as defined by the presence of AFB, and by the acceptance and outcome of treatment. We used two main approaches. The first was a cohort analysis of the outcome data for phase-two tuberculosis patients in nine *thanas* for 1992-94 and phase-three patients (the phase-two *thanas* plus an additional eight *thanas*) in 1995. The second approach was a cross-sectional household survey, done in the middle of 1995, that compared the detection of AFB-positive sputum samples in two BRAC programme *thanas* with those in a non-programme *thana*.

## Methods

### BRAC's tuberculosis-control programme

The BRAC programme was piloted and implemented between 1984 and 1991 in one *thana* and included 220 000 people. Results from the pilot programme (phase one), which used a standard 12-month treatment regimen, suggested that about two-thirds of patients completed the full course; the relapse rate was estimated to be 10% for patients who had completed treatment 4 or more years previously.<sup>5</sup> Drugs are provided free to BRAC by the National Tuberculosis Control Programme and at no cost to the patients. The second phase (1992-94) involved an additional nine *thanas*. Between 1984 and 1994, the treatment regimen was 30 streptomycin injections, given on alternate days for 2 months, and isoniazid (300 mg) and thioacetazone (150 mg) daily for 12 months. Sputum was tested 1, 3, 6, 9, 12, and 13 months after treatment was started. Patients with complications or sputum positive for AFB at the end of their treatment were referred to specialist clinics or hospitals. From 1995 (phase three) an 8-month regimen was used of isoniazid, pyrazinamide, ethambutol, and rifampicin daily for 2 months, then isoniazid and thioacetazone daily for 6 months. A further eight *thanas* (making a total of 17) were included.

BRAC's tuberculosis programme relies mainly on village women trained as community health workers who work as a part of the organisation's rural development programme. In addition to tuberculosis control, community health workers are also involved in immunisations, improvement of water and sanitation, family planning, deworming, and the treatment of diarrhoea, acute respiratory infections, and common fevers. The community health workers are members of the BRAC village organisations, which consist of women from the poorest communities and which are aimed at improving their socioeconomic conditions.<sup>12</sup> Community health workers are selected from village organisations and trained for 15-30 days, followed by 1 day per month of in-service training. Most of these women are aged 25-35 years, illiterate, and from the poorest households. They are not paid a salary but they do retain a small profit from the sale of drugs prescribed for common illnesses (tuberculosis drugs are supplied free to patients). The programme has so far trained

| Outcome                       | Number of cases (n=3497) |
|-------------------------------|--------------------------|
| Cured/completed*              | 2833 (81.0%)             |
| Died                          | 336 (9.6%)               |
| Failed treatment              | 51 (1.5%)                |
| Defaulted                     | 109 (3.1%)               |
| Migrated/referred/transferred | 168 (4.8%)               |

\*Cured=negative sputum at month 13; samples not available at month 13 for 402 patients who were, therefore, classified as completed.

Table 1: Treatment outcomes for AFB-positive patients treated with 12-month regimen (phase two)

more than 4500 community health workers to detect and treat tuberculosis. Each worker covers about 200 households, including members of her village organisation, and is supervised by BRAC physicians and field staff, who also maintain information on the programme.<sup>13</sup>

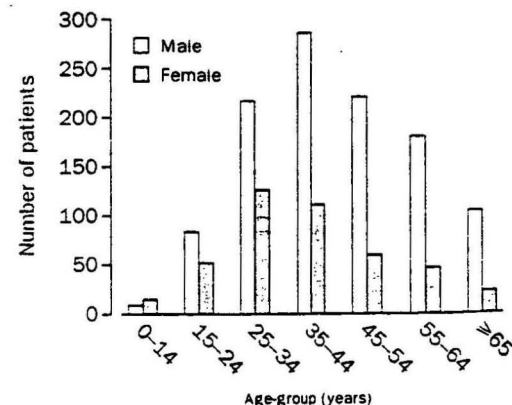
The community health workers distribute information about tuberculosis to the community, especially through village organisation meetings and posters. To detect cases of pulmonary tuberculosis, they follow up individuals with chronic cough of 4 weeks' duration or longer and collect two early-morning sputum samples. These samples are examined microscopically for AFB in a local BRAC laboratory, in which technicians have been trained by the National Tuberculosis Control Programme. The national programme also assists in quality control of diagnostic procedures. Positive patients are contacted by their community health worker and asked to register for treatment.

Patients willing to participate are asked to pay a deposit of 200 Taka (about US\$5), equivalent to about 5 days' wages, and sign a written agreement as an incentive to complete their course of treatment. At the end of treatment, 100 Taka is returned to the patient and the rest is given to the community health worker for her work. If the patient is too poor to pay the deposit, the village organisation will usually pay. The community health worker also receives 25 Taka for each new or relapsed positive patient whom she identifies. If the patient does not complete the treatment course, the community health worker gets her share of the deposit, but the remainder is retained by BRAC.

### Data collection

Programme data for phases two and three were analysed according to WHO/International Union Against Tuberculosis and Lung Disease categories, to calculate the number of people with a chronic cough who were identified as sputum positive for AFB, the proportion who accepted treatment, and the subsequent outcomes, including proportion cured, died, failed treatment, defaulted, and migrated.

For the cross-sectional survey, two *thanas* involved in phase two were chosen, one with low and one with high tuberculosis detection. A third, non-programme *thana* was chosen for comparison. The three *thanas* were socioeconomically similar. Heads of households or their spouses in more than 30 randomly selected households in each *thana* were interviewed to identify individuals with chronic cough of 4 weeks' duration.



Age and sex distribution of new patients positive for tuberculosis, 1995

longer. Each patient with a chronic cough was asked to give a sputum sample, which was examined for AFB by trained technicians by the Ziehl-Neelson method in a local BRAC laboratory. 95% of patients with chronic cough gave at least one sputum sample. For quality control, a random selection of the slides were re-examined by National Tuberculosis Control Programme technicians, who found the quality of staining, smearing, and microscopy to be well within acceptable standards. Before completion of the household survey, an initial analysis of the laboratory results showed that the proportion of patients who were AFB positive was lower than expected. Since this might have been due to poor case detection and under-reporting of chronic cough, all survey households in the three *thanas* were revisited and new information was gathered by the same methods. However, the survey methods seemed to be sound, since in the second round only one additional case was detected.

The household survey also included the follow-up of all tuberculosis patients previously diagnosed and treated in the two BRAC-programme *thanas* for their outcome. Treated patients were traced and three sputum specimens collected and examined as above. Routine data from the BRAC tuberculosis programme were also analysed for all nine phase-two *thanas* and 17 phase-three *thanas* for the patient outcomes.

## Results

Of the 3886 patients identified by community health workers between 1992 and 1994, 90% accepted the treatment offered. Of these, 81% completed the full 12-month course, and in 85% of these patients the sputum became AFB negative by the start of the 3rd month. We did cohort analysis of 3497 patients in phase two who started treatment between April, 1992, and December, 1994 (table 1). Although 81.0% were cured or completed the 12-month course, 9.6% died, the drop-out rate was 3.1%, and the failure rate was 1.5%. Therefore, there was a successful cure rate of at least 80% for patients who started treatment and of 73% (81% of 90%) for sputum-positive patients originally diagnosed.

Phase-three programme data for all patients diagnosed and started on the 8-month regimen during 1995 were analysed in the same way as the phase-two data. 1741 patients (1525 new cases and 216 patients previously treated) were confirmed to be AFB positive; all accepted treatment. The figure shows the distribution of new positive patients for 1995 by age and sex. On average, 72% were male; the greatest male-female difference was in the 35-44 years age-group. More than 85% of new cases and 90% of relapsed patients were AFB negative and were deemed to be cured at the end of the 8-month regimen. However, 8% of patients died and about 2% defaulted (table 2).

The cross-sectional survey included 9597 households, with a combined population of 44 505 people (table 3). 795 people with chronic cough were identified, half were from the comparison *thana* and half from the two programme *thanas*. Two-thirds of all the symptomatic patients were men. For those with a symptomatic cough

| Thana          | Total population >15 years | Number with chronic cough | Number AFB positive | Prevalence rate per (10 <sup>3</sup> ) |
|----------------|----------------------------|---------------------------|---------------------|----------------------------------------|
| A (programme)  | 7146                       | 181 (2.5%)                | 5 (2.7%)            | 0.07                                   |
| B (programme)  | 8639                       | 236 (2.7%)                | 6 (2.5%)            | 0.07                                   |
| C (comparison) | 8720                       | 378 (4.3%)                | 13 (3.4%)           | 0.15                                   |

Table 3: Characteristics of patients in cross-sectional survey

in the programme *thanas*, 2.7% and 2.5% of sputum samples, respectively, were AFB positive, compared with 3.4% in the non-programme *thana*. The prevalence of AFB-positive tuberculosis among patients aged 15 years and older in the programme *thanas* was about half that in the comparison *thana*. However, the total number of patients identified was smaller than expected. For instance, in the sample of 8720 people in the comparison *thana* the total number of AFB-positive patients should have been between 29 and 48 if the prevalence rates of 0.33% and 0.55% were still applicable in 1995. 75% of the patients confirmed to be AFB positive were men and all patients except one were 35 or older.

For the household-survey follow-up study, 90% of 483 patients who completed their treatment between 1992 and 1994 were successfully contacted. 18 patients were still sputum positive at the time of survey, nine each in the two programme *thanas*, and of these, 17 were found to have more than one bacillus per high-power field. The overall relapse rate was 4.1%, but when this was disaggregated by time since treatment had been completed, the rate was 7.8% for 2 years or more, 3.3% for 12-23 months, and 4.3% for less than 1 year.

## Discussion

Directly observed therapy, short course, is now accepted as the treatment regimen of choice for tuberculosis in many developing and developed countries.<sup>11</sup> However, although WHO describe this approach as a "breakthrough strategy" for combating the global tuberculosis epidemic, only about 10% of the world's patients have access to it. Of the 13 countries in which 75% of the world's tuberculosis patients live, only five, including Bangladesh, have adopted short-course directly observed therapy as their national strategy.<sup>11</sup> However, strategies to detect a high proportion of untreated patients in the general population are of equal importance. Although reliable information is lacking, Bangladesh seems still to have a low incidence of HIV/AIDS and to be in the early stages of that epidemic. Therefore, the epidemiology and transmission of tuberculosis has not yet been complicated, as in other countries in Asia.<sup>14</sup>

In countries such as Bangladesh, where the government health infrastructure is poorly developed, particularly in rural areas, non-governmental organisations have a major potential role. In this BRAC tuberculosis programme, the community health workers were successful in identifying tuberculosis and encouraging treatment compliance in their own villages. The community health workers receive some monetary incentives and the patients deposit a financial bond and sign an agreement to complete their treatment. Such approaches have also been successfully used in other countries, such as South Africa and China.<sup>11,15,16</sup> Qualified physicians and auxiliary staff are essential for supervision but have only a minor direct role in the programme. The National Tuberculosis Control Programme supports BRAC with technical advice, supplies, and monitoring of programme quality.

| Outcome                       | Number of cases (n=1741) |                     |                |
|-------------------------------|--------------------------|---------------------|----------------|
|                               | New (n=1525)             | Retreatment (n=216) | Total (n=1741) |
| Cured                         | 1301 (85.3%)             | 195 (90.3%)         | 1496 (85.9%)   |
| Completed                     | 1 (0.1%)                 | 2 (0.9%)            | 3 (0.2%)       |
| Died                          | 126 (8.2%)               | 7 (3.2%)            | 133 (7.6%)     |
| Failure                       | 43 (2.8%)                | 8 (3.7%)            | 51 (2.9%)      |
| Defaulted                     | 36 (2.4%)                | 4 (1.9%)            | 40 (2.3%)      |
| Migrated/referred/transferred | 18 (1.2%)                | —                   | 18 (1.0%)      |

Table 2: Treatment outcomes for AFB-positive patients treated with 8-month regimen (phase three)

Treatment compliance and cure rates progressively improved from the pilot phase to phase two, and again in phase three when the 8-month regimen was introduced. Our study strongly suggests that the BRAC programme has improved case detection and cure rates in a rural population in Bangladesh.

Our analysis of the impact of the BRAC programme produced similar and consistent results. At least 90% of diagnosed patients accepted the 12-month regimen and almost 100% accepted the 8-month course. The cure rate was at least 80% and 85% for the 12-month and 8-month courses, respectively. Even with an acceptance rate of 95% and a cure rate of 85%, the overall success is 80% for all diagnosed cases. The mortality rate was 8–10% and the relapse rate was 3–4% of all patients given treatment. The relapse rate 2 years or more after completion of treatment had risen to 7.8%, which suggests that a special follow-up of this group is required. Mortality and relapses may be further reduced by the shorter regimen. Such programme indicators appear to be much higher than those achieved by the national programme, but are consistent with those achieved in other similar programmes.<sup>11,14,17</sup>

The cross-sectional household survey showed that the prevalence of AFB-positive tuberculosis in the programme *thanas* was half of that in the comparison *thana*, where only the normal government tuberculosis services were available. These rates, although lower than previous population estimates, were based on sound epidemiological methods and the adequacy of the survey methods were checked. Therefore, the figures are comparable, even if the survey underestimated the true prevalence. An alternative interpretation is that the true prevalence may have decreased during the past two decades or so, possibly because of the wide availability of cheap antituberculosis drugs in Bangladesh through a progressive drug policy from 1982.<sup>18,19</sup> However, our survey results also suggest that at least 50% of all the existing tuberculosis patients started treatment because of the BRAC programme. With greater social mobilisation and the introduction of the shorter regimen, this situation is likely to improve. In addition, the National Tuberculosis Control Programme and private providers also have an important role in tuberculosis treatment and close working with them in the BRAC *thanas* may also improve the credibility of community health workers and performance of the programme. With support from the Bangladesh government and the donor community, BRAC plans to extend its community-based tuberculosis programme to a total of 120 *thanas* and about 25 million people. The challenge for BRAC is how to retain the high cure rates achieved by the present programme, while raising the rate of case identification and treating a higher

proportion of patients. The risk is that large-scale expansion may damage the quality of the programme, but BRAC has had much experience of scaling up development programmes.<sup>13</sup> Continued support from the Bangladesh government and the donor agencies will be crucial.

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