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Patient costs during tuberculosis treatment in Bangladesh and Tanzania: the potential of shorter regimens

E. Gospodarevskaya,* O. Tulloch,* C. Bunga,† S. Ferdous,‡ A. Jonas,† S. Islam,‡ M. Rahman,§ M. A. Hussain,§ M. N. Haque,§ S. Egwaga,¶ E. Gardiner,# G. PrayGod,† M. A. Islam,‡ G. H. Mann,* W. A. Wells,# S. B. Squire*

***Liverpool School of Tropical Medicine, Liverpool, UK; †National Institute for Medical Research, Mwanza, Tanzania; ‡BRAC Health Nutrition and Population Programme, BRAC Centre, Dhaka, §National Tuberculosis Control Programme, Dhaka, Bangladesh; ¶National Tuberculosis and Leprosy Programme, Ministry of Health and Social Welfare, Dar es Salaam, Tanzania; #TB Alliance, New York, New York, USA**

SUMMARY

OBJECTIVE: To estimate the costs incurred by patients during the intensive and continuation phases of the current 6-month tuberculosis (TB) regimen in Bangladesh and Tanzania, and thus identify potential benefits to patients of a shorter, 4-month treatment regimen.

DESIGN: The validated Stop TB patient cost questionnaire was adapted and used in interviews with 190 patients in the continuation phase of treatment with current regimens.

RESULTS: In both countries, overall patient costs were lower during 2 months of the continuation phase (US$74 in Tanzania and US$56 in Bangladesh) than during the 2 months of the intensive phase of treatment (US$150 and US$111, respectively). However, continuation phase patient costs still represented 89% and 77% of the 2-month average national income in the respective countries. Direct travel costs in some settings were kept low by local delivery system features such as community treatment observation. Lost productivity and costs for supplementary foods remained significant.

CONCLUSIONS: Although it is not a straightforward exercise to determine the exact magnitude of likely savings, a shorter regimen would reduce out-of-pocket expenses incurred by patients in the most recent 2 months of the continuation phase and allow an earlier return to productive activities.

KEY WORDS: patient preferences; treatment costs; poverty; access

THE ECONOMIC, physical and emotional burden of tuberculosis (TB) has received increased attention in recent years.[1-3] Some authors have commented that patients from low socio-economic subgroups bear a disproportionate economic burden of disease,[4-7] and that this is likely to affect treatment outcomes.

World Health Organization (WHO) recommended first-line treatment for new (presumed drug-susceptible) TB uses a 6-month regimen consisting of 2 months of daily isoniazid (H, INH), rifampicin (R, RMP), pyrazinamide (Z) and ethambutol (E), followed by 4 months of daily INH and RMP (2HRZE/4HR). Two shortened (4-month) regimens for TB, both containing moxifloxacin, are currently being tested in a Phase 3 clinical trial.[8] Decisions on regimen changes are often made on the basis of costs to the health system. Costs incurred by patients are also often high, yet patient perspectives are rarely incorporated into decision making.[9] The roll-out of shorter treatment regimens is one strategy that may help to reduce the economic burden associated with TB care and also help with adherence to treatment.[10]

Potential benefits include shortening the period associated with interruptions to everyday life, savings on travel costs, a shorter period of side effects, better treatment outcomes through improved adherence and a shorter period of lost productivity. Benefits from the shorter regimen may be greater for patients with lower socio-economic status. This study employed mixed quantitative and qualitative methods to investigate these preliminary suggestions and to quantify the potential savings within existing TB treatment delivery modalities in Bangladesh and Tanzania. The qualitative data will be presented in a separate paper.

The literature on TB patient costs in Africa[3,11-15] and Asia is extensive;[15-20] however, to date the studies have not distinguished between costs incurred during the intensive phase (the first 2 months of treatment) and those incurred during the continuation phase (the last 4 months). The main objective of the present

Correspondence to: S B Squire, Liverpool School of Tropical Medicine, Pembroke Place, Liverpool L3 5QA, UK. Fax: (+44) 151 707 9193. e-mail: s.b.squire@liverpool.ac.uk

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study was to make this distinction for the current 6-month TB treatment regimen in Bangladesh and Tanzania—two countries in different continents and with contrasting solutions to TB treatment delivery—so that we could identify and quantify the potential benefits to patients of a shorter, 4-month treatment regimen.

METHODS

This cross-sectional study was conducted in cooperation with the National Institute for Medical Research (NIMR; Mwanza, Tanzania) and BRAC, Dhaka, Bangladesh. Ethical approval was obtained from the Liverpool School of Tropical Medicine (LSTM), Liverpool, UK; the National Institute for Medical Research, Dar es Salaam, Tanzania; and the National Research Ethics Committee in Bangladesh, Dhaka, Bangladesh. The quantitative data were collected in Bangladesh and Tanzania between January and July 2012.

Instruments

Information on patients' demographic characteristics, socio-economic status, household assets and TB-related costs was collected by administering an adaptation of a validated[4,21] questionnaire recommended by the Stop TB Partnership. Patient costs included out-of-pocket medical costs (e.g., charges for tests, administration fees, expenses associated with hospitalisation); cost of travel to health centres and directly observed treatment (DOT) sites incurred by patients and their guardians, which included food, if necessary during a long trip, and other treatment-related costs (e.g., supplementary food and drinks, often recommended by health providers). To obtain estimates of productivity lost by patients and their care givers who gave up paid employment, information on their pre-TB earnings was collected. Patients were also asked about 'coping costs'—money they borrowed or received from selling assets to cover the cost of treatment—and any reimbursements received through insurance. New questions were added to the instrument for this study to differentiate between costs according to the stage of treatment (intensive vs. continuation phase). The adapted questionnaire was piloted and amended before final implementation in both countries.

Settings

In Tanzania, the study was conducted at 5 urban and 12 rural health facilities in all but one district of the Mwanza region. Mwanza is representative of Tanzania in terms of its poverty profile: in the Demographic Health Survey 2010,[22] ~20% of Mwanza's residents were in each of the five national income quintiles. In Tanzania, TB services are based out of government facilities: most patients receive community-based DOT by a family member but periodically collect their medications from a public health centre.

In Bangladesh, the study was conducted in two *upazilas* (subdistricts) of each of the six districts, which were representative of the national situation in terms of population density, poverty and rural/urban profiles. Public delivery of TB services in Bangladesh is organised by the National Tuberculosis Programme (NTP), with specific areas allocated to several non-government organisations (NGOs), who then implement TB control activities using different service delivery models. In 2010-2011, BRAC, the Damien Foundation and the Population Services and Training Centres (PSTC) started, respectively, 92 471, 24 600 and 1117 new patients on treatment. BRAC uses *shastya shebikas* (henceforth *shebikas*) as the cornerstone of its TB diagnosis and treatment. *Shebikas* are female community health volunteers who have received basic health training for common illnesses, including TB. As they provide DOT, patients travel to the health facility only once to register and collect their initial supply of medicine. The Damien Foundation, the second biggest provider, provides TB services through district- and subdistrict-level hospitals and a network of DOT providers at community level. The other provider sampled in this study was PSTC, which requires patients to travel to receive treatment under observation at their offices in Dhaka, usually on a daily basis. Both countries use the WHO-recommended first-line TB treatment regimen (2HRZE/4HR).

Sampling

Remote and less remote areas that were representative of the national poverty and rural/urban profiles were selected from TB registers. Proportions of male and female patients aged $\geqslant$18 years from the pre-selected villages and urban areas were then set to ensure that the sample was representative of the population of adult TB patients in terms of a gender profile. In each area, male and female patients were randomly selected from the respective TB registers. Patients who could not be located on the day of the interview were substituted with patients of the same sex and similar age. This study was planned as an exploration of the difference in patient costs between the intensive and continuation phases of anti-tuberculosis treatment. It was not formally powered to detect differences in costs, as there was no previous study on which to base estimates for sample size calculation. The intended sample size was 200 new patients on the 6-month treatment regimen (100 from each country), which is similar to other studies assessing patient costs associated with anti-tuberculosis treatment.[4,13] However, as it proved a challenge to recruit the required number of new patients within the time constraints, some patients on the 8-month retreatment regimen were also interviewed (Table 1).

Table 1 Study population characteristics

Characteristic	Bangladesh *n* (% of total)	Tanzania *n* (% of total)	Total *n* (%)
Total	96 (100)	94 (100)	190 (100)
Male	63 (66)*	57 (61)†	120 (63)
Female	33 (34)	37 (39)	70 (37)
Mean age, years	41.1	39.0	40.0
Pulmonary smear-positive TB	70 (73)	74 (79)	144 (76)
Pulmonary smear-negative TB	7 (7)	20 (21)	27 (14)
Extra-pulmonary TB	19 (20)	0	19 (10)
Retreatment patients	7 (7)	17 (18)	24 (13)
Patients returning after default	1 (1)	3 (3)	4 (2)
Rural	73 (76)‡	66 (70)§	139 (73)
Urban	23 (24)	28 (30)	51 (27)
Non-government organisations managing treatment			
BRAC	67 (70)	NA	
Damien Foundation	22 (23)	NA	
Population Services and Training Centres	7 (7)	NA	
Patients with treatment interruption	1	1	2 (1)
Mean days of interruption	17	60	
HIV-positive	—	52 (55.3)	—
HIV-negative	4 (4)	42 (44.7)	—
HIV status unknown	92 (96)	—	92 (48)

* Males comprise 64% of the TB population in Bangladesh (2009 NTP report).
† Males comprise 63% of the TB population in Tanzania (2006 NTP report).
‡ 72% of the general population in Bangladesh lives in rural areas (https://www.cia.gov/library/publications/the-world-factbook/geos/bg.html).
§ 73% of the general population in Tanzania lives in rural areas (https://www.cia.gov/library/publications/the-world-factbook/geos/tz.html).
TB = tuberculosis; NA = not applicable; HIV = human immunodeficiency virus.

The final sample was 94 patients in Tanzania and 96 in Bangladesh. Patients were interviewed at 16 weeks or later in their treatment, but no later than 2 months after treatment completion. Most patients were interviewed between months 4 and 6 after treatment initiation. At each interview, patients were asked to recall costs incurred during the first 2 months of treatment (intensive phase) separately from costs incurred during the 2 months leading up to the date of interview (continuation phase).

Measuring patient costs

The cost analysis was conducted from the patient's perspective; however, the patient was viewed as a member of the household where other members also share the economic burden of the disease. This includes 'guardians' who accompany patients to health centres or DOT sites, and 'care givers' who stay at home specifically to provide patient care. Patients' costs were collected in Tanzanian shillings or Bangladesh takas, then converted to US$ using the March 2012 conversion rates of 1570 Tanzanian shillings and 80 Bangladesh takas to 1 US$. Costs were estimated separately for the first 2 months of treatment (intensive phase) and for the most recent 2 months of continuation phase treatment. It was assumed that costs incurred during any 2 months of continuation phase treatment would provide a reasonable estimate of costs that would be incurred during the final 2 months of a 6-month regimen. The total cost incurred during the 6-month treatment regimen was estimated by combining the cost incurred during the intensive phase with twice the cost incurred during the 2 months of the continuation phase. *t*-tests for paired samples using log-transformed cost distributions were conducted to establish statistical significance of the differences in mean cost values in the first and the most recent 2 months of the continuation phase of treatment in Tanzania and Bangladesh.

To obtain travel costs for each patient, the cost of a single visit to the health care facility where medicine was collected or to the DOT site (if different from the place of medicine collection) was multiplied by the number of visits during the two treatment periods of interest. Other patient costs, such as charges for tests, administrative charges, costs associated with hospital admissions and costs of other medicines and supplements, were taken directly from patients' responses to the corresponding questions and allocated to the time intervals to which these costs applied.

Lost productivity was calculated as income lost due to TB for the patients and their guardians who would otherwise be in paid employment (i.e., excluding students, pensioners and those who were unemployed before the episode of TB). For those patients whose main occupation was housework, the cost of the time

lost to household production was based on the average wage the household would have paid for domestic help if they could afford it (although none of the patients in our sample used a hired domestic help, the level of awareness of the daily earnings of paid house workers was high). Any reimbursements received by patients through insurance would have been deducted, but none were recorded.

Data analysis

Data were collected using pre-programmed personal digital assistants (in Tanzania) or paper forms (in Bangladesh), analysed for invalid responses and logic errors, converted or entered into Excel (Microsoft, Redmond, WA, USA), and checked for data entry errors. Data analysis was conducted in Excel and SPSS v20 (Statistical Product and Service Solutions, Chicago, IL, USA).

Mean and median costs were first calculated with respect to the patients who incurred any particular type of cost (cases with expenditures) (Appendix Tables A.1 and A.2)*; mean values were then recalculated for the entire sample in each country, with zero values inserted for those patients who did not incur any particular type of cost (Tables 2 and 3). The mean values for the entire sample were aggregated and compared with the average national income for a 2-month period.

*The Appendix is available in the online version of this article, at http://www.ingentaconnect.com/content/iuatld/ijtld/2014/00000018/00000007/art00013.

RESULTS

Study population

Table 1 summarises the characteristics of the study population. Due to the strategic choice of geographic regions, the sample was representative of the socio-demographic profile of each country as well as the population of TB patients according to the respective NTP data.[23,24]

In both countries, the sample included a large proportion of patients from low socio-economic backgrounds. For example, 17% of patients in Tanzania had no education and 72% had only attended primary school, while in Bangladesh 46% of patients identified themselves as illiterate and an additional 32% had only attended primary school. In Tanzania and Bangladesh, respectively 77% and 43% of patients' homes had no electricity supply.

Costs in the first and most recent 2 months of treatment

Appendix Tables A.1 and A.2 illustrate the magnitude of the economic burden borne by those who incurred each type of cost. The results reported in Tables 2 and 3 show the mean costs for all patients. They permit comparisons of the contribution of each cost component to the cost per patient in the first 2 months, the most recent 2 months of the continuation phase, and overall.

Collecting medicines: travel

Most (77%) of the Tanzanian patients travelled every

Table 2 Mean costs in the first and the most recent 2 months of treatment in 94 patients in Tanzania (2012 US$)

Cost categories	Mean cost in first 2 months (n = 94) US$	Proportion of total cost per patient %	Mean cost in the most recent 2 months (n = 94) US$	Proportion of total cost per patient %	Mean cost total regimen (n = 94) US$	Proportion of total cost per patient %
Collecting medicines, total (transport and related costs)	22.5	15	13.0	18	48.4	16
Tests, total	—	—	2.0	2	4.0	1
Other, total (guardian, hospitalisation, food supplements)	66.7	45	23.2	31	113.1	38
Guardian* (travel cost and loss of income due to travel)	10.8	7	11.8	16	34.4	12
Hospitalisation	36.2	25	0.0	0	36.2	12
Food supplements	19.8	13	11.3	15	42.4	14
Coping, total (borrowing and selling assets below market value)	12.2	8	1.2	2	14.6	5
Productivity loss by patients	43.7	29	31.6	43	106.9	36
Productivity loss by care givers†	4.5	3	3.1	4	10.7	4
Total cost per patient	149.6	100	74.1	100	297.8	100
Total cost as a percentage of the national income per capita, %	155*		77‡		103§	

* Patient supporters who accompany patients to health centres or DOT sites.
† Supporters who stay at home specifically to provide patient care.
‡ With respect to the 2-month per capita national income (TZS151 937 or US$96.8).
§ With respect to the 6-month per capita national income.
DOT = directly observed treatment; TZS = Tanzania shillings.

Table 3 Mean costs in the first and the most recent 2 months of treatment in 96 patients in Bangladesh (2012 US$)

Cost categories	Mean cost in first 2 months ($n = 96$) US$	Proportion of total cost per patient %	Mean cost in the most recent 2 months ($n = 96$) US$	Proportion of total cost per patient %	Mean cost total regimen ($n = 96$) US$	Proportion of total cost per patient %
Collecting medicines, total (transport and related costs)	5.1	5	3.6	6	12.3	5
Tests, total	—	—	4.0	7	8	4
Other, total (guardian, hospitalisation, food supplements)	69.8	62	25.4	45	120.6	54
Guardian* (travel cost and loss of income due to travel)	3.6	3	1.9	3	7.4	3
Hospitalisation	31.5	28	0	0	31.5	14
Food supplements	34.7	31	23.5	42	81.7	37
Coping, total (borrowing and selling assets below market value)	14.7	13	7	13	28.7	13
Productivity loss by patients	20.7	19	16.1	28	52.9	24
Productivity loss by care givers†	0.6	1	0.3	1	1.2	1
Total cost per patient	110.9	100	56.4	100	223.7	100
Total cost as a percentage of the national income per capita, %	175‡		89‡		117§	

* Patient supporters who accompany patients to health centres or DOT sites.
† Supporters who stay at home specifically to provide patient care.
‡ With respect to the 2-month per capita national income (BDT5106 or US$63.5).
§ With respect to the 6-month per capita national income.
DOT = directly observed treatment; BDT = Bangladesh taka.

week to collect their medicines in the intensive phase, but many (49%) travelled only every 2 weeks during the continuation phase. This change in travel frequency largely explains the reduction in the mean cost of collecting medicines for 2 months from US$22.50 in the intensive phase to US$13.00 in the continuation phase. In Bangladesh, about two thirds of patients (most of the BRAC patients) travelled to pick up their medicine only once, when they registered for treatment. About 25% of patients were treated by the Damien Foundation and travelled to a health facility every 2 or 4 weeks. Most of these patients ($n = 17$, 70%) used transport for travel. The remaining nine patients, all identified as very poor, were treated through the PSTC, and all but one used transport to travel to the facility on a daily basis to take their medicines. Although these nine patients picked up their drugs daily, 90% of all the other patients received community DOTS with no further associated travel costs after their initial visit to pick up their drugs. For all patients in Bangladesh, the pattern of regular travel did not change between treatment phases; the reduction of travel costs from US$5.10 in the first 2 months to US$3.60 in the most recent 2 months was therefore almost entirely explained by the cost of a single trip at the start of treatment for BRAC patients.

Other costs: guardian, hospitalisation and food supplements

Guardian costs (out-of-pocket expenses for travel and food while travelling and assumed loss of earnings for those in income-generating employment) were around US$11 in both the first 2 months and the most recent 2 months in Tanzania. In Bangladesh, these costs were only US$3.60 during the first 2 months and fell to US$1.90 during the most recent 2 months, as most of the guardians accompanied patients on a single trip at the start of treatment. Mean out-of-pocket hospitalisation costs were high (>US$30 on average) in both countries during the first 2 months, and were concentrated among only a few patients (17 in Tanzania and 7 in Bangladesh), but fell to zero during the continuation phase. Caution should be exercised in interpreting the high mean cost of hospitalisation because of the small number of hospitalised patients and the all-inclusive method of costing. Hospitalisation costs included those borne by patients (administrative costs, fees charged for linen, tests and drugs), those borne by guardians staying in the hospital, as well as costs of travel and food borne by visitors.

Almost all patients (95% and 88% in Bangladesh and Tanzania, respectively) bought food supplements in the intensive phase; however, these numbers roughly halved in the continuation phase. The mean cost of food supplements was lower in Tanzania (US$20 in the first 2 months, and US$11 in the most recent 2 months) than in Bangladesh (US$35 in the first 2 months, falling to US$23.5 in the most recent 2 months).

Coping costs

About half of the Tanzanian patients had to sell assets (mostly livestock or land) and/or borrow money to cover the expenses associated with their TB illness;

71% of these sales were at a loss, i.e., below the estimated market value. Only three patients borrowed money and/or sold assets during the continuation phase of treatment. Only 5 (15%) of the 34 Tanzanian patients who borrowed had to pay interest, and 27 (79%) were not expected to reimburse the money. About half of the patients in Bangladesh ($n = 50$) borrowed money to cover the expenses associated with their TB, and although 38% of these borrowed with interest, 54% were not expected to pay back the money. A small proportion of patients in Bangladesh (13%) sold assets to cover the cost of their illness, and most of them sold below the estimated market value. All but two of the patients who borrowed money and sold assets did so before the continuation phase of treatment.

Lost productivity

Of the 85% of Tanzanian patients who stopped productive activity due to TB, 50% stopped working for $\geqslant$6 months. Those patients who did not stop working still reduced their number of work hours, and all but one attributed this reduction to TB. In the total sample, working hours were reduced by more than three-fold, from a mean of 9.8 h/day before TB to 3.0 h/day at the time of the interview. The income lost was valued at US$43.70 in the first 2 months and US$31 in the most recent 2 months. The number of hours worked by patients in Bangladesh decreased from 9h/day before TB to 6 h/day at the time of the interview. All but one patient stated that this reduction had occurred due to TB. A large proportion (71%) of patients in Bangladesh terminated their productive activities due to TB, but only 22% of these stopped working for $\geqslant$6 months. The income lost was valued at $20.70 in the first 2 months and US$16 in the most recent 2 months.

In Tanzania, only 5/55 (9%) guardians were in paid employment; in comparison, in Bangladesh 21/39 (54%) guardians were in paid employment, but most of them (62%) accompanied patients only on a single trip at the start of treatment. The loss of income to the guardians is reported together with their other travel-related expenses, as it made only a small contribution to the total cost of travel and due to uncertainty about whether the income-generating activities were not in fact forgone but postponed. Loss of productivity was more certain for care givers who gave up income-generating jobs to stay at home specifically to provide care for patients. In Tanzania, 33% of the patients stated that they needed a care giver for some time during the 6-month regimen, and a large proportion of care givers (71%) gave up an income-generating job. In Bangladesh, the proportion of patients with care givers was much smaller (7%), but a large proportion of these (57%) gave up an income-generating job.

Overall costs

The total costs per patient in the most recent 2 months of the continuation phase was about half of the total cost per patient in the first 2 months, dropping from US$150 to US$74 (respectively 155% and 77% of the 2-month national income per capita) in Tanzania and from US$111 to US$56 (respectively 175% and 89% of the 2-month national income per capita) in Bangladesh. The distributions of unadjusted cost values were right-skewed in both countries and both stages of treatment. *t*-tests for paired samples using log-transformed cost distributions were conducted to establish the statistical significance of the differences in mean cost values. In both countries, there was a statistically significant difference between the mean costs in the first 2 months and the most recent 2 months of treatment ($t = 8.6$, $P < 0.001$, and $t = 5.8$, $P < 0.001$ in Tanzania and Bangladesh, respectively).

In both countries, the two major drivers of cost were other costs (a combination of guardian, hospitalisation and food costs) and lost productivity. For the first 2 months, other combined costs accounted for 45% of patient costs in Tanzania and 62% of costs in Bangladesh. This percentage fell to 31% in Tanzania and 45% in Bangladesh for the most recent 2 months of treatment, in part due to the lack of hospitalisation costs in the continuation phase. Lost productivity accounted for 29% of costs in Tanzania and 19% of costs in Bangladesh during the first 2 months, increasing to 43% and 28%, respectively, in the most recent 2 months.

The total patient cost of 6 months of treatment was greater in Tanzania (US$300) than in Bangladesh ($224), but as a percentage of per capita income over the 6-month period, Bangladeshi patient costs were higher (117% vs. 103% in Tanzania). The higher absolute total in Tanzania was due in part to the costs of travel, which were four times higher in Tanzania than in Bangladesh during the first 2 months. In addition, guardian costs and lost productivity were almost five- and two-fold higher, respectively, in Tanzania than in Bangladesh, but food supplements and coping costs were half as high in Tanzania as in Bangladesh. Seeking money from others to meet the cost of treatment occurred more often in Bangladesh (52% of patients vs. 36% in Tanzania), and fewer Tanzanian patients had to reimburse their loans.

DISCUSSION

Some previous studies of TB patient costs have focused on catastrophic costs before and during TB diagnosis,[4] but here we demonstrate that significant patient costs continue throughout treatment, even up to the most recent 2 months of the continuation phase. In other studies that have reported post-

diagnostic costs,[15-19] patient expenditures ranged from $3.50 in India[18] to $220 in China.[1] Lost productivity ranged from $9.20 in Ethiopia[11] to $516 in Tajikistan,[16] and the total cost per patient ranged from $32.20 in Ethiopia[11] to $760 in Tajikistan.[16] In three studies that reported the total cost of TB treatment as a percentage of the annual household income, the costs per patient were equal to 18.4% of income in India,[25] 49% in Ethiopia[13] and 93% in China.[1] One study reported expenditures on health care as a percentage of monthly household income of TB patients. The estimates varied from 12% in Viet Nam to 360% for the lowest income group in the Dominican Republic.[15]

Comparing the results of patient cost studies is problematic due to the different definitions and methods used to measure and quantify costs. Patient costs usually differ with respect to the range of included cost components (e.g., hospitalisation costs or some of its components, guardian costs or transport costs for some care-provider types may be omitted).[1,18,26] Lost productivity can be assessed in different ways; the greatest variation arises from the different methods used to place a value on productive time lost.[2] As our study included the broadest range of costs believed to be associated with TB illness, a high total cost per patient was expected. The size of the cost estimates are nevertheless comparable with previously reported estimates in low-income countries such as Ethiopia and Cambodia.[13,20] Our study was not designed to assess the poverty level of TB patients or their occupational status and compare it with the national statistics; however, TB patients tend to belong to less educated lower-income groups. The comparison made with the national average income may therefore underestimate the real burden of illness for TB patients.

This study focused on the out-of-pocket expenses and loss of income incurred by patients in the intensive and continuation phases of anti-tuberculosis treatment. The objective was to quantify potential savings of a 4-month regimen for the patients. For those taking new, shorter regimens expected to be available in the future, savings on the cost of travel will be in proportion to the number of trips required by the service model in the continuation phase. Considerable savings will be realised by the minority of patients who travel far on a daily basis in Bangladesh, while moderate savings will be realised for the majority of patients in Tanzania, as these patients take fewer trips to collect their drugs in the continuation phase than in the intensive phase. However, these costs are guaranteed to be eliminated by a shorter regimen. This reduction in travel costs, including the costs incurred by guardians, is therefore the minimum saving per patient that could be expected of a shorter regimen; this comes to US$24.80 (25.6% of the 2-month national income) in Tanzania and US$5.40 (8.5% of the 2-month national income) in Bangladesh (Tables 2 and 3).

A shorter regimen also offers the opportunity of returning to productive activities sooner, but whether this becomes a reality will depend on whether physical and nutritional recovery occur at the same speed as TB cure. Delayed resumption of work was especially notable in Tanzania, where a substantial proportion of patients delay returning to work due to ill health or advice from health care professionals. Patients who undertake heavy manual work (such as agriculture) or need the flexibility to move around for their work would likely benefit the most. Food supplements constitute a substantial percentage of patient costs. It is possible that a shorter regimen would allow patients to attain their normal weight sooner, and thus shorten the time during which supplements are necessary, but this remains unproven.

Only three patients borrowed money during the final 2 months of treatment; as loans made earlier would still need to be paid off, this part of the total cost is unlikely to be saved in a shorter regimen. However, it is not clear if the prospect of shorter treatment would influence patients' decisions to borrow money and the amount they would need to borrow.

This study of two countries highlights interesting variations in both the costs incurred and possible costs saved by a shorter regimen. Any study of patient costs is really a study of whether health systems are aligned to patient needs. Well-designed service delivery can reduce patient costs, although only up to a point. In both countries, substantial efforts have been made to design health systems so that travel costs are minimised, such as via home DOT in Tanzania, and the use of community *shebikas* in Bangladesh. This left productivity loss (especially in Tanzania) and supplementary food costs (especially in Bangladesh) as the dominant costs for patients. A reduction in these costs may be less likely to come from health system redesign and more likely to rely on shorter regimens that increase the speed of recovery. It will be important to monitor the ability of shorter regimens to reduce these costs.

Neither country currently provides supplementary schemes such as food support, cash transfers, insurance or travel vouchers to mitigate treatment costs. It is possible that such schemes will be needed in addition to health system redesign and shorter regimens to have maximal effect in reducing patient costs.

CONCLUSION

Studies describing the costs of anti-tuberculosis treatment and care show considerable variation in estimates of the economic impact of treatment on patients; however, a consistent finding is that the cost of anti-tuberculosis treatment to patients is high and

can often be bench-marked as catastrophic, i.e., constituting more than 10% of annual household income.[2] Based on the findings of our study, costs decrease from the intensive to the continuation phase, but remain significant. Expenses incurred in the most recent 2 months of the continuation phase may be viewed as potential savings for patients if a shorter regimen is introduced. Although determining the exact magnitude of likely savings is not straightforward, a shorter regimen would, at the very least, reduce the out-of-pocket travel expenses incurred by patients in the last 2 months of treatment, representing a minimum saving of between 8.5% of the 2-month national income in Bangladesh and 25.6% in Tanzania, and allow an earlier return to productive activities.

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Appendix Table A.1 Mean and median costs for cases with expenditure in the first and the most recent 2 months of treatment in Tanzania (2012 US$)

Cost categories	Cases with expenditure: first 2 months *n*	Mean cost in first 2 months US$	Median cost in first 2 months US$	Cases with expenditure: the most recent 2 months *n*	Mean cost in the most recent 2 months US$	Median cost in the most recent 2 months US$	Mean cost of 6-month regimen US$
Collecting medicines, total	93*	22.5	14.5	94	13.0	7.6	48.4
Transport	93*	15.4	6.1	94	8.2	4.6	31.8
Food	93*	7.1	5.1	94	4.8	2.5	16.7
Tests, total	—	—	—	34	5.4	2.0	10.8
Other, total (guardian, hospitalisation, food supplements)	83	74.2	19.1	85	25.1	9.9	124.3
Guardian* (travel cost and loss of income due to travel)	52	18.9	13.1	52	20.7	12.1	60.4
Hospitalisation	17†	197.9	142.7	NA	NA	NA	197.9
Food supplements	76	24.4	12.7	30	35.1	15.9	94.6
Coping, total (borrowing and selling assets below market value)	45	25.3	12.7	7	15.6	5.7	56.4
Productivity loss by patients	94	43.7	38.2	94	31.6	25.6	106.9
Productivity loss by care givers‡	30	14.0	19.1	30	9.7	9.6	33.4

* Patient supporters who accompany patients to health centres or DOT sites.
† One answer was missing; applied only to those family members who were in income-generating activities.
‡ Supporters who stay at home specifically to provide patient care.
NA = not applicable; DOT = directly observed treatment.

Appendix Table A.2 Mean and median costs for cases with expenditure in the first and the most recent 2 months of treatment in Bangladesh (2012 US$)

Cost categories	Cases with expenditure: first 2 months *n*	Mean cost in first 2 months US$	Median cost in first 2 months US$	Cases with expenditure: the most recent 2 months *n*	Mean cost in the most recent 2 months US$	Median cost in the most recent 2 months US$	Mean cost of 6-month regimen US$
Collecting medicines, total	96	5.1	1.0	96	3.6	0	12.3
Transport	96	4.2	0.7	96	3.2	0	10.6
Food	96	0.9	0.0	96	0.4	0	1.8
Tests	-	-	-	86	4.3	1.0	8.7
Other, total (guardian, hospitalisation, food supplements)	91	71.3	37.3	61	38.7	34.8	148.7
Guardian* (travel cost and loss of income due to travel)	37	8.7	1.9	16	10.3	4.7	29.4
Hospitalisation	5	587.3	85.8	—	—	—	587.3
Food supplements	90	36.6	37.3	55	40.7	37.3	118.0
Coping, total (borrowing and selling assets below market value)	29	46.8	19.0	23	28.2	19.9	103.3
Productivity loss by patients	96	20.7	13.7	96	16.0	6.3	52.8
Productivity loss by care givers†	1	61.3	NA	1	30.7	NA	122.6

* Patient supporters who accompany patients to health centres or DOT sites.
† Supporters who stay at home specifically to provide patient care.
NA = not applicable; DOT = directly observed treatment.

RESUME

OBJECTIF : Estimer les coûts induits par le traitement et à la charge des patients pendant les phases de traitement intensif et de continuation du protocole actuel de 6 mois du traitement de la tuberculose au Bangladesh et en Tanzanie, et ainsi identifier les bénéfices potentiels pour les patients d'un protocole plus court de 4 mois de traitement.

SCHÉMA : Le questionnaire validé Stop TB du coût supporté par les patients a été adapté et utilisé lors d'entretiens avec 190 patients en cours de traitement de continuation selon les protocoles actuels.

RÉSULTATS : Dans les deux pays, les coûts imputés aux patients étaient plus faibles pendant 2 mois de la phase du traitement de continuation (74$US en Tanzanie et 56$US au Bangladesh) que pendant les 2 mois de la phase intensive du traitement (150 et 111$US, respectivement). Les coûts pour les patients de la phase de continuation représentaient 89% et 77% respectivement du salaire national moyen de 2 mois dans les deux pays. Les coûts directs de transport dans certains endroits ont été limités grâce à un système de prestations locales comme une observation communautaire du traitement. Par contre, les coûts liés aux pertes de productivité et aux suppléments alimentaires sont restés significatifs.

CONCLUSIONS : Bien qu'il ne soit pas simple de calculer l'ampleur exacte des économies possibles, un protocole plus court réduirait les dépenses à la charge des patients pendant les 2 derniers mois de la phase de continuation et permettrait un retour plus précoce aux activités productives.

RESUMEN

OBJETIVO: Calcular los costos sufragados por los pacientes durante la fase intensiva y de continuación del régimen de tratamiento antituberculoso corriente de 6 meses en Bangladesh y Tanzanía y examinar así la posible utilidad para los pacientes de un tratamiento más corto de 4 meses.

MÉTODO: Se adaptó y validó el cuestionario de la estrategia Alto a la Tuberculosis sobre los costos incurridos por los pacientes y luego se administró a 190 personas que recibían el tratamiento antituberculoso en la fase de continuación según los regímenes vigentes.

RESULTADOS: En ambos países, los gastos globales costeados por los pacientes fueron inferiores durante 2 meses de la fase de continuación (US$74 en Tanzanía y US$56 en Bangladesh) que durante los 2 meses de la fase intensiva (US$150 y US$111, respectivamente). Estos costos para el paciente durante la fase de continuación correspondían sin embargo a 89% y 77% del ingreso promedio de 2 meses en los respectivos países. Los costos directos de desplazamiento en algunos entornos fueron bajos, gracias a los mecanismos locales de entrega de medicamentos, como la observación comunitaria del tratamiento. No obstante, la pérdida de productividad y los costos relacionados con la alimentación complementaria permanecieron altos.

CONCLUSIÓN: Aunque no es sencillo determinar la magnitud exacta de los posibles ahorros, un régimen terapéutico más corto habría reducido los gastos directos de los pacientes durante los 2 meses más recientes de la fase de continuación (analizados) y podrían haber facilitado un regreso más rápido a las actividades productivas.