Tuberculosis in Salvador, Brazil: costs to health system and families

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Abstract

Objective
Tuberculosis is one the greatest causes of mortality worldwide, but its economic effects are not well known. This study had the objective of estimating the costs to the public and private healthcare systems and to families of tuberculosis treatment and prevention.

Methods
This study was made in the municipality of Salvador, State of Bahia, Brazil, in 1999. Data for estimating the costs to the healthcare system were collected from the Department of Health, healthcare facilities and a philanthropic institution. The public and private costs were analyzed using cost accounting methodology. Cost data relating to families were collected by means of questionnaires, and included data on transportation, food and other expenses, and also income losses associated with this disease.

Results
The average cost of treating one new case of tuberculosis was approximately US$ 103. The cost of treating one multiresistant patient was 27 higher than this. The cost to the public services consisted of 65% on hospitalization, 32% on treatment, and only 3% on prevention. The families committed around 33% of their income on expenses related to tuberculosis.

Conclusion
Despite the fact that the families did not have to pay for medications and treatment, given that this service is offered by the State, the costs to families related to loss of income due to the disease were very high. The proportion of public service funds utilized for prevention is small. Greater investment in prevention campaigns not only might diminish the numbers of cases but also might lead to earlier diagnosis, thus reducing the costs associated with hospitalization. The lack of an integrated cost accounting system makes it impossible to visualize costs across the various sectors.

INTRODUCTION

The report of the Commission on Macroeconomics and Health of the World Health Organization[7] has emphasized that tuberculosis is the most common of the infectious diseases. Approximately one-third of the world's population is infected with *Mycobacterium tuberculosis* and around 5% to 10% of infected individuals will become ill and infective at some time during their lives. The same report has estimated that, if not controlled, tuberculosis will be responsible for the death of 35 million people over the next 20 years. Brazil ranks tenth in the world in numbers of cases, with around 83,000 cases notified every year, in all age groups but especially among those aged over twenty years old. In the State of Bahia, around 7,800 cases occur every year, which corresponded to an incidence of 60.3/100,000 in-

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habitants in 1999. Of these, approximately 3,000 cases of tuberculosis occur in the city of Salvador every year, with an incidence of 131.2/100,000 inhabitants in 1999.[11]

In addition to the direct suffering caused by the disease, tuberculosis has been taking up significant proportions of public budgets in developing countries. It is estimated that, by 2015, investments of the order of US$12 billion will be needed for controlling diseases like Aids, tuberculosis and malaria.[7] The increased costs involved in attending to and controlling tuberculosis are also due to the ever-growing numbers of cases that are resistant to different types of chemotherapy. As well as the high cost to the healthcare system, tuberculosis puts a burden on family budgets, thus worsening poverty conditions. This results not only from the direct costs related to the treatments, but especially from the income losses caused by the disease.[1,2,6,7,9,10,12,13]

In Brazil, the economic effects of tuberculosis are not well known. The present study had the objective of estimating the economic costs of tuberculosis for the healthcare system and for the families of patients undergoing treatment for tuberculosis. It also aimed to contribute towards the development of similar studies in other contexts, through laying out in detail the methodology utilized.

METHODS

To study the cost of tuberculosis for patients and their families, the sample size was defined by convenience, to include 146 patients who had received a diagnosis of tuberculosis for the first time, 33 hospitalized patients and 39 patients with multiresistant tuberculosis. The new cases were recruited from among the recently diagnosed cases of tuberculosis at ten healthcare centers in Salvador, State of Bahia. These ten centers attend to around 90% of the tuberculosis cases in the city. The hospitalized patients were recruited from among the patients in the reference hospital for tuberculosis treatment in the city, and the multiresistant patients were recruited from the outpatient service of this same hospital.

The information was collected using a standardized questionnaire that was administered by nurses, nursing auxiliaries (or technicians) and social workers who had been trained for this purpose. For the new patients beginning outpatient treatment, the ob-

jective of the questionnaire was to obtain information on the costs that they had had prior to and subsequent to the start of tuberculosis treatment. The new patients were recruited during the months of February and March 2000. For the hospitalized patients, the objective was to verify the costs during the six months preceding the date of hospitalization and the costs during their hospitalization. The hospitalized and multiresistant patients were recruited during the months of July and August 2000. For the multiresistant patients, the objective was to estimate the costs over a one-year period prior to the date of the interview.

For the new outpatients, the questionnaires were applied on three occasions: at the start of their treatment (to register their costs prior to the diagnosis) and three and six months later. This last application coincided with the end of the treatment. For the multiresistant and the hospitalized patients, the questionnaire was applied on a single occasion (the information collected from the patients is shown in Table 1 published on ISC's website.*

The data utilized for estimating the costs of the public and private healthcare sectors was collected for the year 1999, from the central administrations of the *Secretaria de Saúde do Estado da Bahia* (Health Department of the State of Bahia - SESAB) and the *Secretaria Municipal de Saúde de Salvador* (Municipal Health Department of Salvador - SMS), and from healthcare centers and one private philanthropic entity that were treating tuberculosis in Salvador. For this collection, six healthcare centers from among the twelve centers where tuberculosis control activities were being performed in the municipality of Salvador were selected. This selection was based on the availability of the information needed for calculating the costs. Thus, the centers that had all the information needed for the cost calculations were selected.

The files of the new outpatients and multiresistant patients were also reviewed in order to determine the average number of consultations and tests that these patients did. The files of the hospitalized patients were not reviewed. The costs of the epidemiological surveillance of tuberculosis were not estimated.

For analysis, the procedures of cost accounting were utilized, in which the proportion of the resources that is utilized for each activity is considered in order to

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Table 1 - Cost to families according to patient category. Salvador. In US$ (at 1999 rate).

Cost item	Outpatient (new case)	%	Multiresistant patient	%	Hospitalized patient	%
Transportation	4,010	10.6	1,732	13.3	181	5.7
Other expenditure on return visits to the service	717	1.9	273	2.1	31	1.0
Additional expenditure on food	2,125	5.6	580	4.5	0.00	0.0
Expenditure on medications (other than those within the tuberculosis control program)	1,745	4.6	1,960	15.1	0.00	0.0
Expenditure on tests	980	2.6	112	0.9	58	1.8
Other expenditure (repairs to house, utensils, etc.)	1,367	3.6	2,669	20.5	401	12.7
Loss of income due to incapacitation (temporary)	20,208	53.6	3,646	28.0	2,134	67.6
Loss of income by accompanying person	3,299	8.8	30	0.2	260	8.2
Losses because of the time expended	3,287	8.7	1,995	15.4	93	3.0
Total cost in the sample (a)	**37,738**	**100.0**	**12,998**	**100.0**	**3,158**	**100.0**
Sample size (b)	142	-	39	-	33	-
Average cost (a divided by b) = c	266	-	333	-	96	-
Total number of patients treated in Salvador (d)	**3814**	**-**	**120**	**-**	**962**	**-**
Total cost according to patient category (c multiplied by d)	1,013,617 (e)	-	39,993 (f)	-	92,076 (g)	-
Total cost for all the families (e + f + g)					**US$ 1,145,686**	

determine the unit cost of this activity.[4] For each segment studied, specific indicators were utilized.*

RESULTS

Cost to the families

Of the 146 new cases that were initially included in the sample, four were lost. Table 1 presents the total costs to the families (US$1,145,686), for each cost item and patient group. The average cost to the family varied according to the type of treatment needed. For the family of a patient who was diagnosed with tuberculosis for the first time and was treated as a new outpatient (six months of treatment) the cost was US$266. For the family of a patient with multiresistant tuberculosis (one year of treatment), the estimated cost was US$333 and, for the family of a hospitalized patient (average of 18 days), the cost was US$96.

The average cost to a family for a hospitalized patient was calculated only for the number of days of hospitalization. When this patient left hospital and proceeded with outpatient treatment, it was assumed that the family would have an increase in its costs, which could be considered to be close to the estimate for outpatient treatment (US$266).

Cost to public services

The outlays on attending to and controlling tuberculosis within the public sector, for each health facility, are presented in Table 2. This shows the cost estimates for new cases according to the healthcare center. The two most relevant cost items for healthcare units were the costs of the professionals exclusively within the program and the cost of medications. The variations in the cost of the treatment that were observed in the six centers studied result from the fact that some centers have professionals who are not available in others (for example, nutritionists), and from the variation in the productivity of the centers. Some centers function as referral centers for large areas, thus attracting greater numbers of patients. Consequently, these centers present lower average costs than other centers at which smaller numbers of patients are treated. In this respect, as can be seen in Table 2, the second healthcare center attended to a

Table 2 - Average cost of treating a new case of tuberculosis, according to healthcare unit. In US$ (at 1999 rate).

Cost items	2nd center	%	3rd center	%	5th center	%	6th center	%	14th center	%	CSP	%
Full-time professionals	14.12	16.5	47.54	41.6	47	31.9	27.60	22.5	31.61	29.9	27.60	27.9
Professionals partially within tuberculosis program	6.93	8.1	9.63	8.4	43.40	29.5	41.29	33.6	13.44	12.7	10.67	10.8
Administrative professionals	4.22	4.9	3.50	3.1	2.60	1.8	3.35	2.7	5.00	4.7	4.81	4.9
Depreciation	7.78	9.1	1.21	1.1	2.04	1.4	0.76	0.6	0.59	0.6	1.87	1.9
Current expenses in the unit	4.26	5.0	4.29	3.8	4.24	2.9	1.72	1.4	7.04	6.7	5.91	6.0
X-ray and bacilloscopy	4.97	5.8	4.96	4.3	4.96	3.4	4.96	4.0	4.96	4.7	4.96	5.0
Medications (78.00)	43.09	50.5	43	37.7	43	29.3	43	35.1	43	40.8	43	43.6
Total	**85.375**	**100.0**	**114.13**	**100.0**	**147.24**	**100.0**	**122.68**	**100.0**	**105.64**	**100.0**	**98.82**	**100.0**
Numbers of patients attended during the year*	1006		563		158		204		284		269	
Total annual cost	**85,888**		**64,255**		**23,263**		**25,027**		**30,002**		**26,582**	
Average unit cost (average weighted according to numbers of patients)											**US$ 103**	

*Source: Health Department of the State of Bahia

Table 3 - Total cost of tuberculosis for the public sector. In US$ (at 1999 rate).

Items	Average cost (R$)	Quantity*	Total cost	%
Prevention				
Vaccination	1.398	35,847	50,114	
Search activities (contacts and missing patients)	11.92	819	9,762	
Prophylaxis for patients treated in the public sector	72.6	124	9,002	
Prophylaxis for patients treated in the private sector*	4.77	71	338	
Total cost of prevention	-	-	**US$ 69,216**	3
Treatment				
New cases	102.75	2,882	296,125	
Cost of medications for new patients in private sector	43	932	40,076	
Retreatment for patients in public sector	114.75	190	21,812	
Cost of medications for retreatment patients in the private sector	54.10	145	7,844	
Multiresistant tuberculosis (one year of treatment, without hospitalization)	2,744	120	329,280	
Total cost of treatment	-	-	**US$ 695,137**	32
Hospitalization				
Hospitalization	1,468.165	962	US$ 1,412,375	
Total cost of hospitalization	-	-	**US$ 1,412,375**	65
Total cost for the public sector	-	-	**US$ 2,176,728**	100

*Source: *Secretaria da Saúde do Estado da Bahia* (Health Department of the State of Bahia)

total of 1,006 patients, thus presenting the lowest average cost (US$85). The center with the smallest number of patients (158), the fifth healthcare center, presented the highest average cost (US$147). The average cost of treating one new case of tuberculosis in Salvador (US$103) was calculated as an average that was weighted according to the number of patients attended at each center. This same calculation procedure was utilized for estimating the costs of chemoprophylactic treatment and retreatment.

Table 3 shows that the average estimated cost for the treatment of one new case of tuberculosis in Salvador was US$103. For chemoprophylactic treatment, it was US$ 73, and for retreatment, it was US$115. Table 3 also presents the estimated costs of applying a dose of BCG vaccine (US$1.40) and searching for defaulters (US$12) and the average cost of hospitalization (US$1,468).

The average cost of hospitalization was estimated only for the public reference hospital for hospitalization of patients with tuberculosis. The patients with a diagnosis of multiresistant tuberculosis were also treated at this hospital. The estimated average cost for treating one of the multiresistant patients, for a one-year course of treatment, was US$2,744. Around 95% of this amount was due to the expenditure on medications alone, paid for by the public healthcare system.

Table 3 also shows that, out of the total public ex-

penditure in Salvador for tuberculosis control, approximately 65% was incurred on hospitalization, 32% on outpatient treatment (of new and multiresistant cases) and just 3% on prevention.

Cost to the private sector

The cost of tuberculosis to the private sector is shown in Table 4. The available costs are always greater in the private sector than in the public sector, for every activity. This is mainly due to the fact that the salaries paid to healthcare professionals are higher in the private sector than in the public sector.

Table 5 shows the consolidation of costs related to tuberculosis for the public and private sectors and for families. The greatest proportion of the costs is borne by the public sector (62%), followed by the families (33%) and the philanthropic entity (5%).

DISCUSSION

The results from the present study can be discussed in relation to three principal findings:

1 - The families bore 33% of the total costs of tuberculosis in the city of Salvador, in 1999

The main criticisms directed towards studies in which the sample is defined by convenience are re-

Table 4 - Total cost of tuberculosis for the private sector. In US$ (at 1999 rate).

Items	Average cost	Quantity	Total cost	%
Patients treated in the private sector				
New cases	163.624	932	152,497.57	**82**
Prophylaxis	157.16	145	22,788.20	**12**
Retreatment	290.92	37	10,764.04	**6**
Total cost for the private sector	-	-	**US$ 186,050**	**100**

lated to possible bias in the data and the consequent limitations on the inferences that can be drawn. Such bias may, for example, be connected with the fact that the patients in the sample might come from socioeconomic strata that differ from those that would characterize the population affected by tuberculosis. However, around 90% of the patients with tuberculosis who were registered in Salvador were being attended at the ten healthcare centers from which the sample of new outpatients was extracted. Also, the patients selected for the study were chosen randomly from the two shifts in which attendance was provided. These two facts are evidence against any possible influence of such bias.

Among the patients in the sample studied, around 21% originated from the health district of the railway suburb of Salvador, and around 80% of them had low income levels (up to two minimum salaries) and low educational level (up to four years of schooling): data not tabulated. In a study on the spatial distribution of mortality due to tuberculosis in Salvador, Mota et al[8] showed that the greatest risk of death due to tuberculosis was also observed in this health district, where the population is characterized by the lowest income and education levels in the city of Salvador.

The data from the national home sampling survey (*Pesquisa Nacional por Amostra de Domicílios - PNAD*) in 1999[5] showed that 40% of the urban population of northeastern Brazil was in the family income band of up to two minimum monthly salaries, corresponding to an average annual family income of the order of US$994. Considering that a large proportion of tuberculosis cases come from the population within this income band, and that the family expenditure on a new case of tuberculosis that is treated as an outpatient (estimated as US$266), it can be seen that one tuberculosis case committed around 27% of the average family income. This means that more than one-quarter of the income of poor families in the city of Salvador was committed in the event that one family member was affected by tuberculosis. The loss of income due to temporary incapacitation for work was what contributed most to the cost incurred by the families. Among the patients studied, around 80% depended on their health conditions in order to maintain their work and daily earnings, since their occupations were as masons, wall painters, and domestic employees, among others, relying on precarious contracts and without social security protection. For the multiresistant patients, the item of loss of income related to periods prior to the diagnosis. The majority of the multiresistant patients had not done any productive activity for a long time, nor did they have any prospects of performing any such activity.

Table 5 - Total consolidated costs for Salvador. In US$ (at 1999 rate).

Items	Total costs	%
Public sector	2,176,728	62.0
Private sector	186,050	5.3
Families	1,145,686	32.7
Total	US$ 3,508,464	100.0

The findings were similar to others found in the international literature. Similar percentages of loss of income due to temporary incapacitation for work (53.5% of the costs for the families of new cases and 67.5% for the families of hospitalized patients) were found in India.[10] In Thailand, it was found that 20% of family income was committed because of tuberculosis: 15% on the cost of medications and consultations and 5% on loss of income.[6]

Memory bias, which is inherent to all studies that seek recollection of information from the past through questionnaires or interviews, must also be considered as a limitation on the results found.

2 - The public sector bore 62% of the total costs of tuberculosis in Salvador and accomplished few activities for prevention of this disease

The difficulty in accessing information on the expenses of all of the twelve units that treated tuberculosis in Salvador, in 1999, meant that these costs were only estimated for six healthcare centers for which the information was available. In addition to this, the expenses relating to epidemiological surveillance and educational campaigns were not calculated in the cost analysis. For the hospital cost, the decision to base the estimate on a single hospital was due to the fact that, as well as being the reference hospital for the treatment of tuberculosis, around 92% of all hospitalizations due to tuberculosis in the municipality were taking place at this hospital.

Despite the restrictions on the estimates of the public costs described here, it is possible that they may be close to the real values. The methodology utilized very closely reflects the real average costs for the public sector relating to the treatment of tuberculosis.

The present findings indicate that, out of the total public expenditure on tuberculosis, around 65% was directed towards hospitalization. Data from the Department of Information and Information Technology of the Brazilian national health system (Datasus) have revealed that, in 1999, around 12% of the patients hospitalized with a diagnosis of tuberculosis first obtained this diagnosis in the hospital, thus beginning their treatment.

This may be an indication that the diagnosis is being made late, or that the patient is delaying in seeking out the healthcare services. However, no studies have been put forward to confirm these questions.

Nevertheless, these findings simply reinforce the theory that prevention activities – the seeking of missing patients and use of prophylaxis, in accordance with the National Program for Tuberculosis Control (*Programa Nacional de Controle da Tuberculose* - PNCT) – are being little utilized. Out of the total public expenditure, only 3% of the resources were directed towards prevention activities. This in itself cannot be an affirmation that prevention activities were not being undertaken, or that they were being performed ineffectively, since they may just represent the resources that are necessary and sufficient for this activity. Nonetheless, out of the twelve healthcare centers that were treating tuberculosis during that year, ten were asked about whether they were undertaking home searches (for missing patients and contacts) and prophylaxis. Of these ten healthcare centers, only three were regularly doing searches for missing patients and prophylaxis for contacts. However, even for these three centers, the search was performed on average around 55 days after the patient had failed to come to collect the medication. It must be noted that, for the PNCT to consider that a patient has abandoned the treatment, a period of sixty days must elapse.

Costa et al[3] showed that, in relation to the three healthcare centers that were performing search activities in Salvador, around 80% of the patients contacted returned to the treatment and around 70% of these same patients were discharged as cured, even though such cure was not always confirmed by bacilloscopy.

An increase in prevention activities could possibly assist in reducing the numbers of patients hospitalized and the severe morbidity and mortality due to tuberculosis, and could also reduce the possibility that patients might become multiresistant to drugs.

This would diminish the overall cost involved in the tuberculosis program in the city of Salvador.

3 - The overall costs of tuberculosis are not perceived by government entities, given the fragmentation of the involvement of the three spheres of government

The non-existence of a cost control unit for the activities of controlling tuberculosis, and the fragmentation of the involvement of the public entities that fund the operation of the PNCT, in practice generate a lack of overview of the resources involved. This suggests the high possibility of inefficiency in operating the program. For example, at the moment when a patient is hospitalized due to tuberculosis, the cost ceases to be borne by the municipality and starts to be borne by the State. This transfer of onus does not cause any incentive for reducing hospitalization rates among the municipal entities responsible for the outpatient treatment.

Because the costs are not under the control of a specific entity, the magnitude of the total losses caused by tuberculosis goes unnoticed. To the extent that the program could become more integrated, greater rationality and effectiveness might be achieved, thereby favoring a possible reduction in costs for the healthcare system and for families. To this end, advances in the municipalization of healthcare services and greater integration between the different levels of government are part of the solution for the problem.

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