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Original Article

COST OF THERAPY INCURRED FOR TUBERCULOSIS PATIENTS RECEIVING DIRECTLY OBSERVED THERAPY (DOT)

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ABSTRACT

Objective: To estimate the cost of therapy of tuberculosis patients registered under DOTS program in the treatment of tuberculosis.

Methods: A prospective observational study was conducted over a period of nine months in the Pulmonary Department of Bharati hospital and Research centre, Pune. 97 patients registered under RNTCP between August 2014 and April 2015, were interviewed at two time points: one at the time of first hospital visit and second on the completion of treatment. During the interview, information relating to various costs such as direct (out of pocket) and indirect cost was collected.

Results: The mean total cost for Pulmonary tuberculosis treatment was found to be/5474.7 ($85.4), Extra pulmonary was/10574.8 ($164.9) and Pulmonary and Extra pulmonary was/14638.5 ($228.3) respectively. Out of total cost the cost incurred by the patients for the hospital stay and diagnosis (i.e. tuberculosis detection) has the maximum expenditure cost which was 90.4 % for pulmonary tuberculosis, 77.2% extra pulmonary and 72.5% pulmonary and extra pulmonary. About 39.2 % of patients and their care takers lost work days. 52.0% pulmonary patients, 68.4% extra-pulmonary and 66.7 % pulmonary and extra-pulmonary patients had decreased earning ability due to illness.

Conclusion: The maximum cost is incurred for diagnosis and hospital stay in tuberculosis patients. Though DOTS strategy can help to reduce cost, achieve effective cure and save life of TB patients, still patients need to spend for other investigations and other drugs.

Keywords: Tuberculosis, DOTS, Patient cost.

INTRODUCTION

Tuberculosis (TB) is one of the leading causes of mortality among infectious disease worldwide and has an enormous economic impact on many countries [1]. India is the highest TB burden country accounting for one fifth of the global incidence of TB. In 2013, an estimated nine million people developed TB and 1.5 million died from the disease, 360,000 of whom were HIV-positive [2]. India accounts for fourth of the global burden of TB and 29% of global mortality due to TB [3]. The disease is more prevalent in the productive age group of 15-54 y which causes an economic burden on the individual's household when they fall sick.

The disease is also a major barrier to social and economic development. An estimated 100 million workdays or three to four months of work time are lost due to illness, affecting potential earning of 20-30% of annual household income. Society and the country incur a huge cost due to TB nearly $3 billion in indirect costs and $300 million in direct cost [4].

Tuberculosis is treatable and curable with timely diagnosis and adherence to the prescribed course of treatment. The launch of the Directly Observed Treatment Short-course (DOTS) strategy by the World Health Organization (WHO) was expected to control tuberculosis i.e. Substantially reduce the number of new TB cases by improving case detection and cure rates of patients. RNTCP provides DOTS treatment to registered patients free of cost throughout the country, a substantial portion of the costs still fall on the patients and their families. A thorough understanding of the costs associated with TB diagnosis and treatment is important to develop interventions to reduce that economic burden on patients. The present study was to estimate the direct, indirect and total (diagnosis and treatment) costs to patients on account of tuberculosis treated in DOTS programme.

MATERIALS AND METHODS

A prospective observational study was conducted over a period of nine months from August 2014 to April 2015 in Pulmonary Department of Bharati hospital and Research centre, Pune. 97 patients registered under RNTCP between August 2014 and April 2015, were interviewed. Pulmonary, extra-pulmonary and pulmonary and extra-pulmonary TB cases receiving DOTS therapy were included in the study. Patients who were not willing to participate in the study and HIV patients with tuberculosis were excluded from the study. Patients under inclusion criteria were selected and their informed consent was taken for the study. TB patients and their supporters (relatives) were interviewed at two time points: one at the time of hospital visit and second on the completion of treatment. During the interview, information relating to various costs such as direct (out of pocket) and indirect cost was collected. Direct costs are defined as Consultation fees and money spent on investigations and drugs were classified as medical expenditure.

Money spent on travel, lodging, special food and expenditure incurred for persons accompanying the patient was classified as nonmedical expenditure. Indirect costs were classified as loss of wages due to illness, decreased earning ability due to illness or long term disability that necessitated change in type of work. Total cost includes the expenditure incurred for tuberculosis detection and treatment under direct and indirect costs. The cost was calculated in terms of Indian rupees and US dollars (exchange rate during study period: ($1 US= Rs. 64.11). Total treatment cost was calculated for only those patients who completed treatment successfully. Patients with treatment outcomes such as defaulted, migrated, transferred out and died were not available and hence excluded. Patients who had failed and were on re-treatment were not considered for this analysis. The cost of therapy data was analyzed by using standard deviations.

RESULTS

Out of 97 patients studied, 43 (44.3%) were males and 54 (55.7%) were females; the majority of patients 60 (61.8%) were in the age group of 15-34 y. 68(70.1%) patients were from urban area. Annual family income of 8 (8.2 %) patients ranged between 50,000-1, 20000 rupees. 15 (15.5%) patients were illiterate and 36 patients (33.0%) were unemployed.

Table 1: Sociodemography of tuberculosis patients (n=97)

Characteristics	Number of patients			Total Number Of patients (%)
	Pulmonary	Extra-pulmonary	Pulmonary and Extra-pulmonary	
Gender				
Male	26	14	3	43 (44.3)
Female	22	29	3	54 (55.7)
Age group				
5-14	-	3	1	4 (4.1)
15-24	14	14	1	29 (29.9)
25-34	12	17	2	31 (31.9)
35-44	5	4	-	9 (9.3)
45-64	14	4	1	19 (19.6)
>64	3	1	1	5 (5.1)
Place of residence				
Rural	14	12	3	29 (29.9)
Urban	34	31	3	68 (70.1)
Education				
None	8	6	1	15 (15.5)
Primary	14	11	2	27 (27.8)
High school	19	17	1	37 (38.1)
University	7	9	2	18 (18.5)
Annual Income				
50,000-1,20,000	4	3	1	8 (8.2)
1,21,000-2,20,000	19	13	1	33 (34.0)
2,21,000-3,20,000	18	16	-	34 (35.1)
>3,20,000	7	11	4	22 (22.7)
Employment status				
Employed	21	16	3	40 (41.2)
Unemployed	14	16	2	32 (33.0)
Retired	4	1	-	5 (5.1)
Student	9	10	1	20 (20.6)
History of hospitalization				
Yes	13	19	6	38 (39.1)
No	35	24	0	59 (60.9)

49.4 % had pulmonary tuberculosis, 44.3 % had extra pulmonary tuberculosis and 6.2 % had pulmonary and extra-pulmonary tuberculosis.

Table 2: Direct, indirect, and total costs incurred by patients during tuberculosis treatment

Types of tuberculosis	Direct cost/($)				Indirect cost/($)		Total cost/($)	
	Medical Cost		Non Medical Cost		Mean/($)	SD	Mean/($)	SD
	Mean/($)	SD	Mean/($)	SD				
Pulmonary	4451.8($69.4)	4397.2	270.6 ($4.2)	1089.9	752.0($11.7)	1621.6	5474.4 ($85.4)	4239.6
Extrapulmonary	9116.1($ 142.2)	2864.8	614.8($9.6)	1552.3	843.9($13.2)	1937.6	10574.8($164.9)	3612.5
Pulmonary and extrapulmonary	12496.6($194.9)	2742.6	1306.6($20.4)	656.4	835.3($13.0)	2181.4	14638.5($228.3)	3313.6

The cost incurred by the patients for the hospital stay and diagnosis (i.e. tuberculosis detection) has the maximum expenditure compared to other medical cost which was 90.4 % for pulmonary tuberculosis, 77.2% extra pulmonary and 72.5% pulmonary and extra pulmonary. The expenditure for lab investigation was 747.8 ($11.7) for pulmonary, 1879.1 ($29.3**)** for extra pulmonary and for 3050.0($47.6) extra pulmonary and pulmonary patients. The X-ray examination expenses were 1047.9 ($16.3) for pulmonary, 1133.7 ($17.7) extra pulmonary and 1291.6($20.1) for extra pulmonary and pulmonary tuberculosis. The expense for other medication was 359.4 ($5.6) for pulmonary, 454.7 ($7.1) for extra pulmonary and 1050.0 ($16.4) for extra pulmonary and pulmonary patients. The cost for food and travel during diagnosis (i.e. direct non medical cost) is listed in table 3.

DISCUSSION

The study estimated the average total costs incurred by pulmonary, extra-pulmonary and pulmonary and extra pulmonary tuberculosis. The mean total cost for Pulmonary tuberculosis treatment was found to be/5474.4 ($85.4), Extra pulmonary was/10574.8($164.9) and Pulmonary and Extra pulmonary was/14638.5 ($228.3). However, the encouraging finding is that the estimated mean total cost in our study was less as compared to earlier study [5]. Our results suggest that DOTS program is cost saving for patients.

The cost incurred by the patients for the hospital stay and diagnosis (i.e. tuberculosis detection) has the maximum expenditure compared to other medical cost which was 90.4 % for pulmonary tuberculosis, 77.2% extra-pulmonary and 72.5% pulmonary and extra-pulmonary. Our results suggest that TB diagnosis and treatment posed a significant economic burden on patients in terms of cost. The expenditure for lab investigation was/747.8 ($11.7) for pulmonary,/1879.1 ($29.3) for extra-pulmonary and for/3050.0($47.6) extra-pulmonary and pulmonary patients. The X-ray examination expenses were/1047.9 ($16.3) for pulmonary,/ 1133.7 ($17.7) extra-pulmonary and/1291.6 ($20.1) for extra-pulmonary and pulmonary tuberculosis. The expense for other medication was/359.4 ($5.6) for pulmonary,/454.7 ($7.1) for extra-pulmonary and/1050.0($16.4) for extra pulmonary and pulmonary patients. Anti tubercular drugs and sputum test were free for patients who registered under RNTCP and so no expenses were incurred to the patients who were registered under DOTS strategy. One of the goals of RNTCP is that patient should not lose wages or incurs expenditure for travel. The travel expenses during diagnosis

were/67.5 ($16.3) for pulmonary,/84.6($1.3) extra pulmonary and/90($1.4) for extra-pulmonary and pulmonary tuberculosis. Our findings confirm that travel costs were lower as compared to study by Devra M Barter *et al.* [6].

Table 3: Direct cost incurred by tuberculosis patients

Direct costs (cost in rupees)	Pulmonary Mean/($)	Extra-pulmonary Mean/($)	Pulmonary and Extra-pulmonary Mean/($)
i) Medical cost			
Hospital stay and visit	2156.3(33.6)	5476.8 (85.4)	6666.7(104.0)
Administrative fees (consultation costs and patient registration fees)	140.4(2.2)	171.8 (2.6)	438.3(6.8)
Expenditure on	Investigation		
i) lab examination			
During diagnosis	465.8 (7.3)	670 ($10.5)	943.2(14.7)
During treatment	282.0 (4.4)	1209.1($18.8)	2106.8(32.9)
Total	747.8 (11.7)	1879.1 ($29.3)	3050.0(47.6)
ii)X-ray examination			
During diagnosis	240(3.7)	390 ($6.1)	430 (6.7)
During treatment	807.9(12.6)	743.7 ($11.6)	861.6 (13.4)
Total	1047.9 (16.3)	1133.7 ($17.7)	1291.6(20.1)
Cost of medication other than tuberculosis drugs (including nutritional supplements)	359.4 (5.6)	454.7 ($7.1)	1050.0(16.4)
ii) Non medical cost			
Cost for travel during diagnosis	67.5 (1.1)	84.6(1.3)	90(1.4)
Cost for food During diagnosis	203.1 (3.2)	530.2 (8.3)	1216.6(19.0)

It was found that mean loss of income for pulmonary was 284.4($4.4) and loss of income by accompanying person was 467.6($7.3) for Extra pulmonary the mean loss of income was/326.7 ($5.1) and loss of income by accompanying person was/517.2 ($8.1) and mean loss of income for Pulmonary and Extra pulmonary patients was/835.3($13.0)

Table 4: In direct cost incurred by tuberculosis patients

In direct costs (cost in rupees)	Pulmonary Mean/($)	Extra-pulmonary Mean/($)	Pulmonary and extra pulmonary Mean/($)
Loss of income during diagnosis	284.4($4.4)	326.7 ($5.1)	835.3($13.0)
Loss of income by accompanying person during diagnosis	467.6($7.3)	517.2 ($8.1)	-

39.2% of working patients lose working days on account of diagnosis and hospitalization

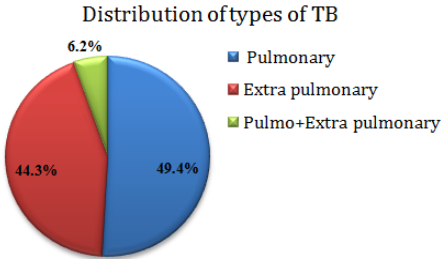

Fig. 1: Distribution of types of tuberculosis

The mean total cost for Pulmonary tuberculosis treatment was found to be/5474.4 ($85.4), Extra pulmonary was/10574.8($164.9) and Pulmonary and Extra-pulmonary was/14638.5 ($228.3).

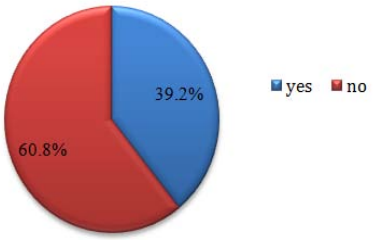

Fig. 2: Loss of working days during TB detection (student and employed patients)

The employed patients of pulmonary were 21 patients; 16 with extra-pulmonary and 3 with pulmonary and extra-pulmonary. The earning ability of pulmonary tuberculosis, extra-pulmonary tuberculosis and pulmonary and extra-pulmonary was 52.4 %, 68.7 % and 66.7 % respectively.

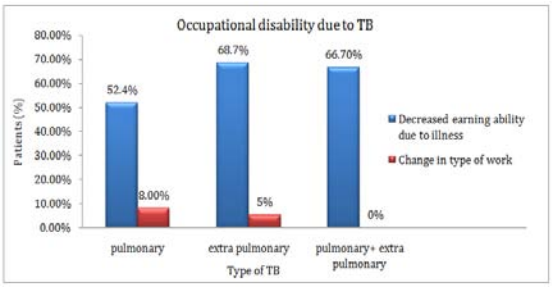

Fig. 3: Occupational disability due to TB

The proportion of total cost in relation to annual family income was computed for all patients. The patients with annual income of 50,000-1.20 lakhs spent 19.8% of their family annual income for tuberculosis detection and treatment.

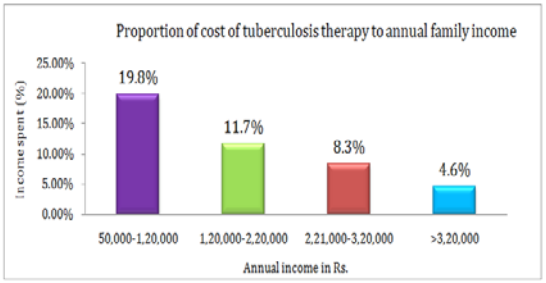

Fig. 4: Proportion of cost of tuberculosis therapy to annual family income

Indirect costs were classified as loss of wages due to illness, decreased earning ability due to illness or long term disability that necessitated change in type of work was calculated for 97 patients. In our study loss of income for pulmonary was 284.4 ($4.4) and loss of income by accompanying person was 467.6($7.3) for Extra-pulmonary the mean loss of income was/326.7($5.1) and loss of income by accompanying person was 517.2 ($8.1) and mean loss of income for Pulmonary and Extra-pulmonary patients was/835.3 ($13.0). Of all 60.8% of working patient did not lose work days on account of illness which is quite similar to result study conducted by M. Muniyandi *et al.* [7]. Several other studies indicated that having TB had consequences for work [8].

The proportion of total cost in relation to annual family income was computed for all patients. The patients with annual income of 50,000-1.20 lakhs spent 19.8% of their annual income for TB detection and treatment and our findings were similar to that of a study done by Ramya Ananthakrishnan *et al.* [9]. As reviewed by Russell S [10] the household financial burden would be catastrophic in developing countries if the total incurred cost of TB is more than 10% of annual household income.

CONCLUSION

RNTCP has proven to be cost effective health intervention. The most expenses for tuberculosis treatment were related to hospitalization which incurred in pulmonary and extra pulmonary tuberculosis patients. In cases where the disease was diagnosed on time, costs were relatively low. Whereas, delay in disease diagnosis led to the worsening of the disease. If government can approve new scheme free of cost for diagnosing tuberculosis, which can help in reducing patients total cost of therapy.

Our study concludes that DOTS strategy can help to reduce cost, achieve effective cure and save life of TB patients, especially among the poor, enabling them to return to work at the earliest, thus increasing their productivity.

ABBREVIATION

DOTS-Directly Observed Treatment Short-course, HIV-Human Immuno deficiency Virus, RNTCP-Revised National Tuberculosis Control Programme, TB-Tuberculosis, WHO-World Health Organization.

CONFLICTS OF INTERESTS

All authors have none to declare

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