ejpmr, 2017,4(9), 495-500

SJIF Impact Factor 4.161

EUROPEAN JOURNAL OF PHARMACEUTICAL AND MEDICAL RESEARCH

www.ejpmr.com

Research Article

ISSN 2394-3211

EJPMR

CROSS SECTIONAL STUDY ON DIRECT AND INDIRECT COSTS INCURRED TOWARDS DOTS TREATMENT BY TUBERCULOSIS PATIENTS IN BENGALURU CITY

Dr. Prasad K. N.*[1] and Puttaswamy M.[2]

[1]Professor, Department of Community Medicine, Dr. B. R. Ambedkar Medical College, Bengaluru.
[2]Assistant Professor in Biostatistics, Department of Community Medicine, Dr. B. R. Ambedkar Medical College, Bengaluru.

***Corresponding Author: Dr. Prasad K. N.**

Professor, Department of Community Medicine, Dr. B. R. Ambedkar Medical College, Bengaluru.

Article Received on 28/06/2017 **Article Revised on 18/07/2017** **Article Accepted on 08/08/2017**

ABSTRACT

Background: There are innumerable costs involved in treatment of Tuberculosis. There are costs which are contributed by patients or his relative towards treatment other than availing free TB Medicines. **Objective:** To estimate the direct and indirect cost incurred towards DOTS treatment of Tuberculosis in Bangalore city. **Methodology:** A cross sectional, community based, descriptive and explorative study was conducted among all TB cases registered for treatment in randomly selected 4 DOT centers during September and October 2016 in Bangalore city. The pilot tested, pre designed and semi open ended questionnaire was used to collect information from TB patients at their door steps by direct interview. The data contained information about patients' socio economic details, transport mode and costs, absent for work and loss of earnings, accompanying persons work, income and absent for work details. The data was analysed in SPSS version 20. **Results:** There were 64 male and 48 female TB patients on treatment during the study period. The mean age of TB patient was 35.8±16.1 years. There were more number of male patients in category I, pulmonary and Intensive phase period of treatment Majority used their own vehicle to reach DOT centers which is less than 2 km distance. The costs were not calculated for homemakers and travelling to DOT centers by walking. The total absent days for work among TB patients was 3178. The crude loss of pay per day per person for TB patients and accompanying person were Rs 633 and Rs 431 respectively. The adjusted loss of pay for TB patients was Rs 341 per day per person. **Conclusion:** The direct cost is resulting from TB patients visiting DOT centre as one way was approximately Rs 20 per day. The indirect costs were estimated to be Rs.46842 per day among working class of patients except for homemaker. This economic loss to the families of TB patients is enormous irrespective of free treatment and subsidized provisions.

KEYWORDS: Tuberculosis, Direct cost, indirect cost, loss of pay, earnings, crude, adjusted.

INTRODUCTION

Every year 8.4 million of Tuberculosis (TB) patients are initiated on treatment worldwide, 80 percent of them from Asia and African countries. Tuberculosis is one of the leading causes of deaths in adults in the world accounting to 1.5 to 2 million per year. The governments are providing free treatment to all TB patients under their national health programs. The maximum numbers of people affected with all forms of TB are in the age group of 15 to 50 years. Globally the estimated economic loss is 12 billion US$ per year.[1,2,3]

There are many issues faced by patients or relatives to reach DOT centre at the time of initiating treatment or to take medicine under direct observation either in intensive phase or continuation phase. The inevitable costs are the expenditure from patients or family members' income towards visiting, transport and sometimes this is on additional burden to the family. There are situations where TB patients are unable to work for few days due to serious or severity of TB disease. These costs are likely to determine the compliance to TB treatment.

Most of the TB patients had lost their earnings from absent of work due to delay in diagnosis of TB. Additional costs towards transport, food, investigations and medicines will burden the family members. There are studies done towards the cost for treating TB in both urban and rural areas after implementation of Revised National Tuberculosis Control Program (RNTCP) in India. The cost is not constant which is taken into account the earnings, nature of work, capacity to work and availability of leaves etc. The average cost was US$35 to 49 from rural area and US$ 102 to 328 in urban areas.[4.5,6,7] Few studies focuses on the loss incurred during treatment may or may not extrapolate for

the full duration of treatment.[4.5] This study highlights the cost incurred during the current treatment period and not the full course of treatment. This study is carried out with an objective to find the direct and indirect cost incurred by TB patients towards treatment under DOTS in Bangalore city.

METHODOLOGY

A cross sectional, descriptive, community based and explorative study was conducted during August to September 2016 in the Devarajevanahalli Tuberculosis unit of Bruhat Bengaluru Mahanagara Palike area among Tuberculosis patients receiving direct observation treatment (DOT) in four DOT centers namely Sultanpalya, Kavalbyrasandra and Kadugondanahalli and Ambedkar Medical College hospital. Inclusion criteria were any TB patient initiated on treatment in any category irrespective of age, sex doses and resident of the DOT areas. The exclusion criteria were TB patient who were gone out of the area or admitted to hospital during the study period. The TB patients were traced from the addresses mentioned in the TB treatment card to their residence with the help of DOT facilitators. The patients were explained about the importance of the study and consent was taken before collection of the required information in the proforma. All the TB patients who were on treatment at the DOT centers were available for data collection and at least three visits on different days were made to trace some of the patients. The data was collected by direct interviewing the patient and in few cases from their relatives. The data collection tool was pilot tested, semi open ended and structured questionnaire. The time required for collection of data from each TB patient or their relative was an average of 25 minutes.

The data included information on four parts. First part contained information on socio demographic factors of the TB patients, second part about the details on the type of TB, categorization of treatment, current dose of treatment, date of initiation of treatment, extra pulmonary sites. Third part about distance travelling time and mode of transport to DOT centre, cost incurred for travelling, persons accompanying the TB patient to the DOT centre, nature of work of the accompanying person. Fourth part contained information about the change of job, absent for work after initiation of treatment, earning per day by the TB patient and accompanying person.

The data was entered in to the Microsoft excel and analysed in SPSS version 21 The descriptive analysis included the counts, frequencies, percentages or proportions and categorizations of the information related to TB patients and accompanying people. The female TB patients who were homemakers were excluded for analysis on absence of work and earnings as indirect cost.

Definitions of the terms

1. Current dose of treatment: The current number of dose the patient is consuming on the day of interviews.
2. Absent for work: The number of days TB patient did not attend to his regular work after diagnosing and treatment initiation.
3. Travelling/transport mode: The modes of commuting to the DOT centre for consuming medicine by the TB patient. Travelling modes was considered as one way from home to the DOT centre. The travelling mode and time was not considered from DOT centre to home because many TB patients or accompanying person went to their regular work or studies after consuming medicines. The home makers also calculated for one way travel to the DOT centre. It was considered based on the maximum number of visits to them to the DOT centre.
4. Travelling/transport cost: The actual money spent on transport to the DOT centre on each treatment days as scheduled. If the mode of transport was own vehicle (two/three/four wheeler), the cost was estimated based on the approximate mileage of the vehicle would run for one liter of fuel.
5. Accompanying people: The person accompanied the TB patient to the DOT centre for treatment and using the same mode of travelling.
6. Change of job: The TB patient charged the nature of job of diagnosing or initiation of treatment due to any reasons except for home makers.
7. Home maker: Adult female who is not employed outside irrespective of the marital status and literacy level.
8. Direct cost of treatment: This includes other than the cost of TB medicines. The money or cost incurred by the patient for purchase of other supplementary drugs or medicine for TB or co morbid conditions.
9. Indirect cost of treatment: The loss of pay on number of days of work by the TB patients or accompanying person.
10. Crude loss of pay: This is calculated as average of the total earnings of TB patients or accompanying person when they were working.
11. Adjusted loss of pay: This is calculated as sum of the products of total duration of absent days and the earnings of TB patients expressed on daily basis.

RESULTS

The number of TB patients on treatment during the study period was 64 males and 48 females from the four DOT centers irrespective of age group of patients. The mean age of the TB patients was 35.8± 16.1 years (median 33.5 year, range 7 to 75 year). The median age for males and females were 40.5 and 23.5 years. None of the TB patients were taking medicines under supervision at local DOT providers.

These were more number of extra pulmonary TB cases among females compared to males as shown in Table 1.

The number of TB cases in category I were equal among males and females and more number of male patients were in category II than female patients. Majority of the patients were walking to DOT centre and 37.5% used their own vehicle as mode of transport. The travelling distance was less than 2 kms (52.6%) and travelling time was less than 15 minutes. The number of daily wagers and salaried among males were 27(42%) and 30(40.5%) respectively. Approximately 40 percent of the female patients were homemakers followed by 29% were working as salaried category. The proportion of family members accompanying with patient to DOT centre was 75% among female compared to 39% among males. The number of TB patients in category I (84) was more than category II (28). The median number of doses consumed by patients in category I and category II were 25 and 36. There were 66, 14 and 32 sputum smear positive, sputum smear negative and extra pulmonary TB cases respectively. The number of sputum smear positive cases were more in males than females and 60% were in category I treatment regimen.

Table 2 shows the mean cost for travelling to DOT centre by 55 TB patients after exclusion of walking was Rs. 19.2 per person per visit (95%. CI 14.5-24.3) and cost were similar among all categories, sites of TB and sex. The average cost incurred per day per person towards non-TB medicines among 24 TB patients was Rs. 24 (95%. CI, 9.4-62.7). (The costs, were higher for males, category II and extra pulmonary) TB patients. The cost included the treatment for their co-morbid conditions; protein supplements vitamins, minerals, and cough syrup and anti inflammatory medicines.

The mean loss of working days by 74 TB patients was 42.9 days as on the date of study is shown in Table 3. This excludes home makers and students. The mean number of absent days was 52.9 among TB patients receiving category II regimen compared to category I. There were differences in loss of pay after adjusting to the patients' occupation, daily earnings and number of days. When compared to crude loss of pay per person per day. The loss of pay was observed to be more among men, category I and pulmonary TB patients.

Table 4 shows the cumulative visits by earning 13 persons accompanying the TB patients. The total of 331 visits by the accompanying persons along with TB patients had lost the average pay as Rs. 431 per day per person. The visits by the accompanied family member or earning relative were high for the male, category I and extra pulmonary TB patients.

Table 1: General Characteristics of TB Patients.

Characteristics	Sex		Total N(%)
	Male N (%)	Female N (%)	
Number of Patients	64(57.1)	48(42.9)	112(100.0)
Type Of Work			
Daily Wage	27(93.1)	26.9)	29(25.9)
Housewife	0(0.0)	19(100.0)	19(17.0)
Salaried	30(68.2)	14(31.8)	44(39.3)
Student	3(23.1)	10(76.9)	13(11.6)
Unemployed	4(57.1)	3(42.9)	7(6.3)
Mode of travel			
Autorikshaw	4(50.0)	4(50.0)	8(7.1)
Own vehicle	0(0.0)	12(28.6)	42(37.5)
Public Bus	4(50.0)	4(50.0)	8(7.1)
Walking	26(48.1)	28(51.9)	54(48.2)
Distance to DOTS Centre(kms)			
<1	9(47.4)	10(52.6)	19(17.0)
1-2	19(47.5)	21(52.5)	40(35.7)
>=2	36(67.9)	17(32.1)	53(47.3)
Persons accompanied the TB patients			
Yes	25(41.0)	36(59.0)	61(54.5)
No	39(76.5)	12(23.5)	51(45.5)
Type of TB			
Pulmonary			
Sputum Positive	44(66.7)	22(33.3)	66(58.9)
Sputum Negative	8(57.1)	6(42.9)	14(12.5)
Extra Pulmonary	12(37.5)	20(62.5)	32(28.6)
Category –I			
Intensive Phase	22(52.4)	20(47.6)	42(37.5)
Continuation Phase	21(50.0)	21(50.0)	42(37.5)
Category-II			
Intensive Phase	13(76.5)	4(23.5)	17(15.2)
Continuation Phase	8(72.7)	3(27.3)	11(9.8)
Median number of visits			
Category-I	26	25	25
Category-II	36	34	36

Table 2: Distribution of Direct cost by the TB Patients towards treatment.

	Transport Cost (Rupees/day/person)			Other Medicines Cost (Rupees/day/person)		
	No.	Mean	95% CI	No.	Mean	95% CI
Sex						
Male	37	19.5	13.3- 26.2	10	37.1	10.8 - 70.2
Female	18	18.6	10.9 - 27.5	14	10.1	6.4 - 13.6
Categories of TB						
Category -I	39	18.5	13.1 - 25.0	17	17.6	10.5 - 26.8
Category -II	16	20.8	10.8 - 31.6	7	30.6	4.5 - 70.3
Type of TB						
Pulmonary	39	19	13.3 - 25.6	20	18.6	8.6 - 35.1
Extra Pulmonary	16	19.7	10.5 - 29.8	4	35.3	3.0 - 67.7
Total	55	19.2	14.5 - 24.3	24	21.4	9.4 - 62.7

Table 3: Distribution of absent days for work and loss of pay of TB patients.

	Number	Cumulative Absent days	Mean Absent days	Crude loss of pay (Rupees/day/person)	Adjusted loss of pay (Rupees/day/person)
Sex					
Male	58	2513	43.3	589	416
Female	16	665	41.6	40	57
Categories of TB					
Category -I	52	2013	38.7	478	391
Category -II	22	1165	52.9	165	256
Type of TB					
Pulmonary	53	2282	43.0	516	417
Extra Pulmonary	21	896	42.7	117	150
Total	74	3178	42.9	633	341
Cumulative loss per day in Rupees				46842	25234

Table 4: Distribution of absent days for work and loss of pay of accompanying people.

	Number	Cumulative Visit days	Mean Visit days	Loss of pay (Rupees/day/person)
Sex				
Male	8	217	27.1	419
Female	5	114	22.8	451
Categories of TB				
Category -I	13	331	25.5	431
Category -II	0	0	0.0	0
Type of TB				
Pulmonary	6	156	26.0	391
Extra Pulmonary	7	175	25.0	465
Total	13	331	25.5	431

DISCUSSION

The free medicines were made available to all TB patients under National health program (RNTCP) irrespective of age, sex, category, etc. There is enormous economic loss to the community in spite of correct treatment provided for the adequate period without interruption in drugs consumption.

The DOT centre is considered as a good move in order to reduce the default from taking medicine and interruption in treatment duration. The family and community had loss of economic productivity due to TB disease burden and have been estimated periodically.[1,3,7,8] The loss can be considered under two conditions, the first being the loss of wages or salary of the TB patients, guardians or caretakers for getting diagnosed Tuberculosis. Second condition accounts to the loss of pay or money for being absents for the work by TB patient or related family members after initiation of treatment. The reason for second condition could be resulting from severity of the disease, drug tolerance in the initial period, side effects of the medicines, visit to the DOT centre, additional cost on supplementary medicines, drugs, transport cost, etc… Hence the study focused on cost incurred towards treatment excluding the cost of treatments given by the government.[1,5,6,8,9]

The TB has been attributed to result in poverty to family and more number of cases is seen among poor or urban slums or semi urban areas. The majority of women in

this study are homemakers and dependent on earning from other family members irrespective of their age and educational status. Their contribution to the family income is enormous and difficult to relate in terms of money or earnings. Hence loss of wages or earnings was not calculated in this study and if other methods or projections are used, then the indirect cost towards the treatment could have been much higher than the calculated amount.

The basic characteristics of the study populations are similar to other studies conducted in various parts of India, especially rural area.[4,5,6,7,10] The age was not considered for detailed analysis in this study since the majority of the TB patients were in the age group of 7 to 75 years. In this study there were two pediatric TB cases.

The distance travelled by TB patients was less than one Km accounted 18 percent which show the DOT facility is not accessible for nearly 80% of the TB patients as convenient place. It may be assumed that the local DOT providers in the neighbors were not encouraged by the local administrator of the TB program and secondly there could be social stigma present in this urban area, which may be preventing them to take medicines from local DOT providers. Hence TB patients used transport facility of their own to reach DOT centre and they were accompanied by a person in most of the cases (54.5%) as shown in Table 1. The number of TB patients was new cases as reflected in category I and sputum smear positive cases were majority among them. This reflects the cost incurred towards the new cases of TB with the background of their nature of work and earnings. This is evident in this study that one fourth of the TB patients were daily wages and nearly 40 percent were salaried category. The studies conducted at Vellore and other parts of our country reflects the similar findings and the earnings were variable because of different wages and salaries for the similar nature of work by the TB patients.[4,5,6]

The travel or transport cost was estimated for using the public transport, hiring or using their own vehicle. The time taken for reaching DOT centre by walking was not considered in the analysis. The one way cost to reach DOT centre by 55 TB patients from their home was in range of Rs 14.5 to 24.3 per person as shown in Table 2, excludes the transport cost of the accompanying person. Most of the TB patients were taking medicines in the forenoon time of the centers. These DOT centre were urban family welfare centers of Bangalore city except for the medical college hospital.

The co-morbid conditions, such as Hypertension, malnutrition Diabetes, Anemia etc were present in 24 TB patients all these patients were purchasing medicines from their own income or earning. The cost mentioned in table 2 includes the prescriptions to buy vitamins, minerals etc.

The cost spent on medicine could be burden in terms of loss of absent for the work to carry out the work in the same capacity as before initiation of treatment. The medicines could be for the therapeutic purpose or as prophylaxis. The cost was higher for males (Rs. 37.1), category II (Rs 30.6) and extra pulmonary (Rs. 35.3) TB patients. The cost for their person habit satisfaction such as tobacco products or alcohol etc were not collected and analysed in this study. There were no HIV infected TB patient in the present study. The direct cost to the TB patients other than TB medicines accounts for approximately Rs 20 per day per person and the cost to some patients towards additional drugs was Rs 22 per day per person. This transport cost calculated applies only to the Bangalore city and it needs to be interpreted to other areas by estimating the fares or fuel cost and the mode of transports.[4,6,8]

The cumulative number of 74 TB patients was 3178 as on the day of interview of the subjects. This reflects most of the TB patients in category I and category II in both sexes had completed half of their duration of treatment course (category I 25doses, range 1 to 42 and category II 36 doses, range 3 to 62). Hence the indirect cost mentioned in this study by the TB patients may be interpreted as cost till half of the treatment course in the respective categories and site of TB disease.[2,7,8]

This study analysed the direct and indirect cost as defined is methodology incurred by TB patients towards free treatment under RNTCP at DOT centers. The first dose of the week in continuation phase of treatment is as direct observation and others are unsupervised. This takes into consideration while calculating the per day cost transports. The estimated cost is appearing a small amount but if the same is converted to the proportion of TB patients on treatment will run into millions of rupees, as a result the either offering free treatment or subsidized medicines are not answers to the loss economic loss to the family or Community especially when the earning members of the family are sick and unable to work. These small amounts may be debt to the in addition to the direct and indirect cost. The estimated cost as direct cost towards receiving direct treatment by 55 TB patients was in the range of Rs. 797.5 to 1336.5 per day. The additional cost towards medicine will be in the range of Rs. 225.6 to 1504.8 per day and the cumulative loss per month or duration of treatment course will be enormous if we consider the similar situation throughout the country.

The TB patients who are sick or unable to go on their own to the DOT centre require an adult individual to accompany them. In our study it was observed that 13 earning relatives or accompanying persons were made 331 visits along with the TB patient and remained absent for work on those days or visits. The home makers, students, old people etc were excluded as accompanying person in this study. The male patients, category I and extra pulmonary TB patients were accompanied more

number of times. The per day loss of pay per earning accompanying person either as male or female was found to be Rs. 431 and estimated total loss of Rs. 5603 per day by these people is considered as indirect cost incurred to TB treatment. The overall indirect cost towards TB treatment is estimated to be high compared to direct cost. The studies done on treatment cost by the TB patients includes many other costs and their estimation were found to be higher than the findings of the present study.[4,5,6]

CONCLUSION

The costs mainly accounting from visiting DOT centers and severity of the TB disease affecting their regular work. The direct incurred by TB patients towards travel and medicines were in the range of Rs 14.5 to 62.7. The indirect cost incurred by 74 TB patients was Rs 341 to 633 per day per person and loss of earning was Rs 5603 per day for 13 accompanying persons. The costs were not calculated for homemakers.

ACKNOWLEDGEMENT

The authors thank the junior faculty Dr Chidanand B, Dr Danial D, Dr Siddhartha D, Dr Suhas CMV, Dr Mohammad Faizan Hussain, Dr Zeba Basha, Dr Dhrubajyoti Biswas, Dr Pooja Sneha, Dr Pushpa Gopal and Dr Mohammed Sadiqulla Shariff for their help in collection of information from patients. We thank the valuable time and co operation given by the Medical Officers, DOT facilitators, TB patients and their family members.

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