

RESEARCH ARTICLE

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Effect of Delay in Tuberculosis Diagnosis on Pre-Diagnosis Cost

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Abstract

Background: Delay in TB diagnosis can increase the financial burden of patients, especially those who are suffering from poverty. The cost of Tuberculosis (TB) diagnosis, either pre- or post-diagnosis, is an important concern in TB control programs worldwide. The new Tuberculosis (TB) patients that diagnosed at Tuberculosis referral centre, Sana'a, Yemen were the subjects of this study. **Objective:** This study aimed to evaluate the pre-diagnosis costs for delayed TB patients (prior to the actual TB diagnosis) in a tuberculosis referral center in Sana'a, Yemen. **Materials and Methods:** A cross-sectional study on newly diagnosed TB patients was performed by the National Tuberculosis Control Program in a tuberculosis center in Sana'a, Yemen. A total of 505 new TB patients were interviewed using a questionnaire. The study period was from 2008 to 2010. Information on the pre-diagnosis costs (direct medical and non-medical costs) for the newly diagnosed TB patients was collected. **Results:** Differences in the pre-diagnosis costs between delayed (%) and non-delayed patients (%) were obtained. The medical (medication, laboratory investigation, and chest X-ray test) and non-medical (food, transportation, and accommodation) costs incurred by the TB patients were statistically different between the delayed and non-delayed TB groups ($p < 0.05$). **Conclusion:** The delayed group incurred extra costs prior to the actual TB diagnosis compared with the non-delayed group. Promoting information and awareness on TB and health care systems in both public and private sectors should be done for both groups to detect TB at an earlier stage and to reduce extra costs incurred during the pre-diagnosis period. **Key words:** Cost, TB, DOTS, Yemen, Prediagnosis, Delay.

INTRODUCTION

TB, a major public health problem in Yemen, is considered as the fourth largest cause of death in the country.^[1] Almost 85% of TB cases occur in the productive age; Hence, TB is not only a health problem but is also a socio-economic concern in Yemen.^[2] According to a Directly Observed Treatment Short Course (DOTS) report in 2005, the prevalence of infection in the total population is 136/100000/year, with an incidence rate of 82/100000/year.^[3] The detection rate of newly diagnosed TB cases was 44% according to the annual report on TB control published by the Yemeni Ministry of Public Health and Population and DOTS in 1995.^[4,5]



The diagnostic delay of TB in Yemen, similar to other countries with TB cases, increases morbidity and mortality, because patients serve as reservoirs of this disease. This phenomenon is a serious problem that could hamper the control of TB and success of the National TB Control Program in Yemen.^[6] The cost of TB diagnosis and treatment consider as one burden either for the people or for the country as poor and low developing country. Delay and extra- cost of diagnosis can increase this burden among TB cases in this country.

The easy access to tuberculosis (TB) diagnosis and treatment is indicator of good TB control program. Delay in TB diagnosis consider as series barrier associated the poor access in TB diagnosis as well as TB control program. This is in turns, could increase the economic burden, especially among those patients who are suffered of poverty. Analyses of TB diagnosis costs could inform policies to improve the easy access, reducing delay diagnosis period and reducing of pre-diagnosis cost.^[7] Cost of diagnosis; both of pre and post- diagnosis cost as well as treatment cost, is an important concern in all TB control programs around the world. TB control programs should concern providing free services as essential base in their strategies. These free services could help to achieve higher rate of TB notification levels, especially in low developing countries.^[7,8]

Insufficient knowledge and awareness of TB either from the patients or the health system provider will lead to spend a lot of money before the actual diagnosis of TB (pre-diagnosis cost). Few studies were concerned of delay diagnosis of TB and an increasing of pre-diagnosis costs that were incurred by TB patients.^[9] Moreover, getting treatment from alternative sources and insufficient knowledge of TB with public health providers were the key problems contributing to increase the cost of tuberculosis diagnosis. The cost payment of TB diagnosis may represent high portion of monthly income in addition to the delays in their diagnosis in most developing countries.^[10] This study aims to assess the pre-diagnosis cost and the effect of TB diagnosis delay on pre-diagnosis cost.

MATERIALS AND METHODS

This study was conducted at a TB referral center at Sana'a, the capital of the Republic of Yemen, located southwest of the Arab Peninsula. Sana'a has a population of 1.7 million.^[4] The TB referral center provides diagnosis, treatment, and follow-up services to TB patients in Sana'a. Patients from other Yemeni cities can also avail of these services from the center. Thus, the sample of patients interviewed in the present study represents TB patients in the entire country.

The TB referral center conducts activities related to the TB control program, such as training courses and control guidance. The referral center has branches in other Yemeni cities through which similar activities are also conducted. All these features make the center a good source of data on TB patients in line with the objectives of this study. The study period was from June 2008 to March 2010.

Study design and population: Across sectional study was conducted at a TB referral center at, Sana'a city. Only smear-positive PTB (Pulmonary TB) patients aged above 15 years old were interviewed and qualified as subjects. All data were obtained by interviewing the participating patients. A total of 234 people comprised the delayed and non-delayed diagnosis patient groups based on the sample size equation.^[11] Considering the probable drop outs, sampling was continued for up to 505 new smear-positive TB patients to cover the required sample size. Thus, 505 new TB patients were used as the sample population in this study.

Study instrument and outcome measures: The questionnaire was prepared to obtain the required data containing the pre-diagnosis costs for the delayed and non-delayed TB groups. The questionnaire was designed and formulated according to the literature.^[12-15] The patients were interviewed using this questionnaire, which includes information on the extra costs incurred by patients due to the delay in TB diagnosis. This cost will be referred to as pre-diagnosis cost henceforth. The direct medical costs include physician service, laboratory service, X-ray service, and medication costs, whereas the non-medical costs include transportation, accommodation, and food.^[16] The indirect cost was not included based on the objectives of the present study.

Delay was defined as the period between the onset of TB symptoms and the actual diagnosis of TB. Longer delay of diagnosis was defined as the number of days that exceeds the median of days that consumed to get actual diagnosis.^[14-16]

Visiting private and public healthcare facilities costs approximately 1500 Yemeni Riyal (United State Dollar; USD 7.0) and 300 Yemeni Riyal (USD 1.4), respectively. For data verification, each participating case was asked to mention the name of the healthcare facilities he or she visited and the date of visits. The physician cost incurred by the patient was calculated by multiplying the visit cost by the number of visits. Whether the institution was a private or a public facility was also considered. Each participating case was also asked about the number of chest X-rays taken before the actual TB diagnosis. The average cost in private and

non-private sectors was 600 Yemeni Riyal (USD 2.8) for each chest X-ray test at the time of investigation.

Due to the difficulty of patients in recalling the names of the prescribed medications and performed laboratory tests, the pre-diagnosis costs of these two items were determined by asking the patients about the amount of Yemeni Riyals they spent on each one of them.

Data analysis: Data were analyzed using the Statistical Package for Social Science version 16.0. Descriptive statistics, including frequency, percentage, median, and interquartiles range (IQR), was used. The Mann-Whitney U test was used to compare the pre-diagnosis cost between the delayed and non-delayed diagnosis groups.

This study aims to estimate the relationship between pre-diagnosis extra cost (direct medical and non-medical costs) and delay in TB diagnosis by comparing the pre-diagnosis cost between the delayed and non-delayed patients. The study protocol was approved by the Scientific and Ethical Board of the Ministry of Health and TB referral center. Written consent was obtained for every participated patients.

RESULTS

A total of 505 smear-positive PTB patients were interviewed during the study period. The distribution of male to female TB patients in this study was approximately similar. Of the 505 study subjects, 260 (51.5%) were male and 245 (48.5%) were female. Of the 505 TB patients, 241 (48%) were delayed TB patients and 264 (52%) were non-delayed TB patients. The pre-diagnosis (direct medical and non-medical) costs for the delayed and non-delayed TB groups had different median (IQR) and mean (\pm SD). As shown in Table 1, the pre-diagnosis costs (mean and median) were different between the two groups. Table 2 shows the details regarding the cost of each medical action performed prior to the actual diagnosis.

The difference in the costs incurred between the delayed and non-delayed TB groups was determined. The median of direct medical cost for the delayed patients was USD 118.1, whereas that for the non-delayed patients was USD 46.5. The median of non-medical cost for the delayed patients was USD 11.5, whereas that for the non-delayed patients was USD 9.3 (Table 1). The median of medication cost for the delayed group was USD 55.8, whereas that for the non-delayed group was USD 23.3 (Table 2). The

Table 1: Distribution delay diagnosis among TB patients

Variable	Delayed* cases (%)	Not delayed cases (%)	N (%)
Gender	Male: 123 (51.0) Female: 118 (49.0)	137 (51.9) 127 (48.1)	260 (51.5) 245 (48.5)
Total	241(100)	264 (100)	505 (100)

*Median of delayed cases was: 60 days, IQR was from 30 to 90.

Table 2: Cost difference (In USD*) Between Delayed and non Delayed Groups**

Cost	Mean (\pm SD)	Median (Interquartile)	P value*
Total Medical Cost:			
Delayed group	310.8 (\pm 987.6)	118.1 (38.0–262.0)	0.000
Non- delayed group	94.4 (\pm 16.5)	46.5 (0.0–113.0)	
Other Cost:			
Delayed group	55.2 (\pm 150.3)	11.5 (0.0– 46.5)	0.000
Non- delayed group	21.4 (\pm 44.2)	9.3 (0.0– 23.3)	
Medication Cost:			
Delayed group	165.8 (\pm 294.9)	55.8 (19.4– 161.6)	0.000
Non-delayed group	49.5 (\pm 98.6)	23.3 (0– 62.8)	
**Lab. Inv. Cost:			
Delayed group	87.5 (\pm 150.4)	46.5 (7.9– 88.1)	0.000
Non- delayed group	30.3 (\pm 56.7)	12.1 (0– 4.7)	
Chest X-ray Cost:			
Delayed group	5.3 (\pm 6.5)	2.8 (2.8– 5.6)	0.000
Non- delayed group	3.3 (\pm 5.6)	2.8 (0– 5.6)	

*Mann-Whitney U Test. ** Laboratory investigation. *** United Stat Dollar

median of laboratory cost for the delayed group was USD 46.5, whereas that for the non-delayed group was USD 12.1. The median of chest X-ray cost for the delayed and non-delayed TB groups was USD 2.8 (Table 2).

The Mann-Whitney U Test revealed statistically significant differences in the pre-diagnosis cost between the delayed and non-delayed TB groups (Table 2, $p < 0.05$). The results obtained in this part of study give emphasis to the extent of difference between the amount spent in seeking medical care for delayed and non-delayed TB patients. As shown in (Table 2), the significant differences were found through the medians of total direct medical, non-medical, medication, laboratory, and chest X-ray costs. The previous difference (Table 2) between the two medians of each cost shows the extra cost associated with TB diagnosis. That is, the delayed patients spent more money either for medical or non-medical purposes compared with the non-delayed patients. The significant differences in the medical and non-medical pre-diagnosis costs were found between the delayed and non-delayed patients, p value was < 0.05 for each parameter.

DISCUSSION

Seeking care is not easy for symptomatic TB patients, especially for patients suffering from poverty. Thus, the cost of seeking care for poor patients could be more than what they could afford. Accordingly, their quality of life could be worse.^[11,14] Furthermore, the risk of TB, as a prevalent disease in poor communities, is further aggravated by diagnostic delays.^[17]

The aim of estimating the pre-diagnosis cost could help TB control programs to be more concerned for poor patients.

This study investigated the relationship between the delay of TB diagnosis and the increase in pre-diagnosis medical costs. The medical cost includes direct medical and non-medical costs associated with delays in diagnosis. The cost incurred by TB patients during pre-diagnosis served as the impetus for us to conduct this investigation. Currently, the government does not provide financial support for TB patients during pre-diagnosis. Thus, in this study, the relationship between pre-diagnosis cost and delay was determined based on the perspective of patients, which was represented by costs incurred during pre-diagnosis.

This study excluded the indirect costs incurred by TB patients. Moreover, most employees sought care beyond office hours; only 2 out of the 42 employees sought care during office hours. The association between pre-

diagnosis costs and delay was determined in this study. The pre-diagnosis cost incurred by the delayed patients was different from that incurred by the non-delayed patients. The statistical test revealed significant differences in pre-diagnosis costs between the delayed and non-delayed patients (Mann-Whitney U Test; $p < 0.01$). The findings of this study were used to explore the effects of delay in diagnosis. Longer delays in diagnosis increased pre-diagnosis cost. This result (p -value of Mann-Whitney U Test; $p < 0.01$) could be attributed to the long period TB patients spent in seeking for an accurate diagnosis. A study conducted in Tanzania^[7] found that the pre-diagnosis costs of TB patients are associated with long delays in diagnosis ($p < 0.05$). This study revealed that despite the availability of community-based care for TB patients, the significant economic burden of TB patients remained a challenge in creating a successful TB control program and that the delay in diagnosis contributed to this challenge. In the present study, no community-based care was available especially for patients in rural and semi-rural areas. Thus, this challenge will worsen when delays in TB diagnosis are prolonged. Therefore, significant efforts should be done to reduce diagnostic delays and control TB in Yemen. This urgent need is further highlighted because of economic instability and increased poverty rate.

In the present study, most TB patients suffered from financial problems. The cost of seeking care severely limited the access of TB patients to health care units, which could increase the prevalence of TB in Yemen. Therefore, the official health care system should focus on creating effective TB control programs. A local study^[16] conducted in 2004 did not perform such investigations. However, the study mentioned that heavy expenditures associated with pre-diagnosis cost are incurred by TB patients. The median expenditure incurred by some of the delayed patients was USD 17.1, and even reached USD 296. These expenditures include the amount spent on self-medication, traditional treatments, drug stores, and health care provider prior to the actual TB diagnosis. As previously mentioned, the study did not investigate the relationship between delay and pre-diagnosis cost.

The cost estimation (pre-diagnosis cost) in Ethiopia^[10] was different that obtained in the present study. The medians of the direct total medical and non-medical costs in the study in Ethiopia (USD 14 and 2.3, respectively) were less than those in the present study (USD 118 and 11.5, respectively). This difference was due to the fact that the days of delay from the onset of illness to the first consultation were not considered in estimating the cost in the study in Ethiopia. In addition, the patients in the present study that sought

care in TB referral center came from the capital and other governorates. Moreover, the number of delay days in the Ethiopian study was fewer than that in the present study. Thus, the high cost associated with seeking care in the present study was a better estimate compared with that in the Ethiopian study.

Unfortunately, only a few studies investigated the association between pre-diagnosis cost and delay in TB diagnosis. The critical pre-diagnosis period of TB should be taken into consideration. TB control programs should focus more on shortening the pre-diagnosis period. Early identification and diagnoses of TB cases are the only ways to reduce this period. Moreover, early identification could be achieved when awareness and knowledge campaigns on TB are continuously implemented. These campaigns should involve both the community and health care providers. Moreover, collaboration among public, private, traditional healers, and other informal health care providers should be promoted. This campaign should be further improved to control TB better.

Recommendation and Limitations: Further studies that are financially supported on pre- and post-delay diagnosis cost estimation are recommended to obtain a comprehensive view of this problem among TB patients. Collaborative efforts to improve the ability of private and public health providers in making early diagnosis for symptomatic TB patients should be done to reduce further diagnostic delays. Efforts should also be done to reduce the extra cost incurred during the pre-diagnosis period. The source of cost information were only the TB patients that may limit some conclusions in this study. The study did not receive any financial support and has not been involved with any organizations with financial interest in the subject matter. Only one area of the country was studied because of limited resources. Therefore, making general conclusions on the findings in this study to other areas is difficult (states).

CONCLUSIONS

Delay in TB diagnosis increases the pre-diagnosis cost for TB patients, which increases the burden of the disease either for the patients or for the society. The delayed

patients incurred extra costs during pre-diagnosis compared with the non-delayed patients. This extra cost was incurred prior to the actual TB diagnosis. The difference in direct medical costs (medication and consultation, laboratory tests, and chest X-ray) and direct non-medical costs (food, transportation, and accommodation) was apparent between the delayed and non-delayed TB patients.

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