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Epidemiological Factors and Preventable Tuberculosis Transmission in a Hospital Setting in Malaysia

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Abstract: Tuberculosis (TB) is a public health challenge in Malaysia. Delay in diagnosing and treating TB patients are associated with TB transmission. These treatment delays can be reduced by identifying and managing the contributing epidemiological factors. This study measured the magnitude of the delays in TB treatment in terms of patient delay, medical visit delay and treatment initiation delay. In addition, it aims to identify epidemiological factors contributing to these delays, the disease severity and positive sputum smear outcome. This is a cross sectional study of TB patients in a district hospital and the outcomes were computed in terms of percentage, survival curve, odds ratio and confidence interval. The patient delay, medical visit delay and initiation of treatment delay are 73%, 53% and 14% respectively. Patient delay is reduced to 50% after 28 days and is eliminated after 1120 days. Malay patients and patients without family history of TB have higher risk of experiencing all three delays. Non-Malays, males, patients with family history of TB and patients with TB contact have been related to higher risk of severe form of TB and positive smear. TB transmission can be reduced by managing the epidemiological factors identified in TB control measures.

Keyword: TB Transmission, Treatment Delay, Epidemiological Factor

1. Introduction

Tuberculosis (TB) remains as one of the most prevalent infectious disease and a significant public health challenge in both developing and developed countries. In 2013, it has been estimated that there were 9 million active TB cases diagnosed globally with 1.5 million TB deaths [1]. Malaysia contributed about 22,710 active TB cases and 810 TB deaths, with incidence of 78.26 per 100,000 and death rate of 5.37 per 100,000 during the same year [2].

Prompt diagnosis and treatment of TB are essential to improve both the clinical outcomes and risk of disease transmission. World Health Organization reported that effective diagnosis and treatment between the year of 2000 and 2013 have saved about 37 million lives globally [1]. Without proper TB treatment, an active TB patient can infect 10 to 15 people a year [3]. Thus, delay in TB treatment has become the cornerstone in TB transmission.

In order to achieve effective diagnosis and treatment, National Tuberculosis Control Programme (NTBCP) was initiated in 1961 in Malaysia and state managerial team was implemented since 1973 with 303 treatment centers. Since 2005, this programme has achieved 70% of case detection and 85% treatment success [4]. It is noted that notification trend has also increased from 69.8% in 2010 to 77.4% in 2012 [5].

Several studies addressed the issue of delays but, there is no consensus on duration of these delays or its influencing factors that can be considered acceptable or generalized to the whole population [6-15]. The definition of acceptable

delays and its associated factors should probably be context-specific and changed according to TB local epidemiology and the healthcare system.

Although TB control programs are said to be effective in Malaysia, treatment delay has been observed in some hospital settings. The study by Liam and Tan et al has reported 12.5 weeks of diagnosis delay [6]. Meanwhile a study by Rundi et al reported that delay in seeking treatment was more common in a non-government health facility [7].

These studies emphasize the importance of reducing the delays in TB treatment. In public health, the diagnosis and treatment of TB stage begins with patients acquiring the symptoms. Usually TB patients may have cough for more than two weeks before seeking treatment at a health facility (patient delay), followed by the patients making an attempt to visit a TB Clinic (medical visit delay) and finally patients are commenced with TB treatment (treatment delay). Delay may occur at any point of this stage of treatment.

Other studies have also attributed the epidemiological factors of age, gender, ethnicity, TB family history and TB contact as determinants for these delays [8-12]. These factors are also associated with TB severity and positive smear [10, 13, 14]. Identifying these determinants for specific setting may help in planning effective local TB control measures and curb the transmission of TB [15].

The purpose of this research is to measure patient delay, medical visit delay and treatment initiation delay and to determine how epidemiological factors are associated with these delays within a typical hospital setting in Malaysia. This study also analyzes the relationship between these epidemiological factors and TB severity and positive smear outcome. TB severity was further analyzed with other explanatory variables such as patients with co-morbidity, patients with pulmonary TB and smear positive patients.

2. Materials & Methods

This was a cross sectional study. Newly diagnosed TB patients from January to December 2012 were selected for analysis from a district hospital. All patients who were seeking TB treatment were included at the time of diagnosis. The inclusion criteria were participants aged more than 15 and diagnosis of TB was made from either sputum examination or by applying the WHO clinical criteria [16]. Epidemiological data were routinely collected for each notified cases.

Patient delay was defined as a period of more than 14 days between the onset of symptoms to the first presentation to the healthcare facility and medical visit delay as the period of more than 14 days after the diagnosis to the first medical visit for treatments. Treatment Initiation delay was defined as a period of more than 24 hours between the time of diagnosis to the start of treatment.

The following variables were explored in this study: age, gender, ethnicity, family history of TB and TB contacts. To examine the association of the epidemiological variables using odds ratio, the variables were further classified into binary values: 1) Age: <55 or >55, 2) male or female 3) Malay or non-Malay, 4) with or without family history of TB, 5) with or without TB contacts. Explanatory variables such as morbidity, pulmonary tuberculosis (PTB) and positive sputum smear were also explored to determine its relation to severity of TB.

The Epi 7.04 program was used for data analysis. Univariate analysis was carried out by cross tabulation in Epi 7.04 program. Frequency, survival curve and percentage were used to describe the delays. Their association with epidemiological factors were examined by using odds ratio (OR) and confidence interval (CI). The OR and CI were also used to describe the relationship between the epidemiological factors and TB severity and positive smear.

3. Result

A total of 89 newly diagnosed TB patients were included in the analysis. The patient delay, medical visit delay and treatment initiation delay were 73% and 53% and 14% respectively. The study reveals that patient delay was reduced to 50% after 28 days and was eliminated only after 1120 days (Figure 1). In terms of epidemiological association, for the patient delay (Table 1), age of the patients more than 55-year-old, patients without family history of TB, males, Malays and patients with TB contact are associated with higher risk of delay. Meanwhile, for the medical visit delay (Table 2), age group of less than 55 years, male patients, Malays, patients without TB family history and patients without TB contacts are related to higher risk of delay in seeking medical treatment after diagnosis. For the treatment initiation delay (Table 3), age group more than 55, females, Malays, patients without TB family history, patients with TB contact are associated with higher risk of delay more than 24 hours in initiating treatment after diagnosis.

Severe form of TB contributed to 59% of the total TB cases. In terms of its epidemiological association, TB patients less than 55, males, non-Malays, patients with family history of TB, patients with TB contact were more likely to have severe form of TB (Table 4). Similar epidemiological factors except for age was also associated to have higher risk of smear positive TB (Table 5). Explanatory variables such as patients with co-morbidity, patients with pulmonary TB and smear positive were related to severe form of TB.

4. Discussion

The duration of delay in TB treatment remains as a public health concern. There is no consensus on the duration of these delays. The associated epidemiological factors cannot be generalized to the all population. Thus, the definition of delays and its associated factors should be tailored towards the local epidemiology of TB in a healthcare centre. This study confirms there is such delay in a local hospital setting indicating there is room for improvement in the local TB programme. Patient delay is the most prominent among the three types of delays in TB treatment.

It is crucial to note that our study shows that a TB patient can remain unattended to and put the community at risk of exposure for up to 3 years. As an unattended patient could infect 10-15 people per year. This may theoretically cause 45 people to get infected at the end of three years.

In terms of epidemiological associations with these delays, it has been observed that age group more than 55 is more likely to experience patient delay and treatment initiation delay. This could be due to coexisting medical conditions in the elderly patients such as heart diseases and chronic respiratory problems, which can contribute to masking of the newly developed TB symptoms [17]. Apart from that, most of the patients in this group consists of retirees and may not have the motivation to seek medical treatment due to financial reasons.

Males have been associated with patients delay and medical visit delay. Apart from TB being a male dominated disease, males, being the primary breadwinners in most families, may find it difficult to access healthcare during working hours. Apart from that, Johansson et al also reported that males were more likely to neglect the symptoms and seek treatment only when it gets to the advanced stage[18]. This has also been highlighted in HIV care, where men were found to present with advanced disease and were more likely lost to follow-up in TB treatment [19]. This finding differs from studies in Vietnam and Southern Ethiopia where females are associated with the delays [12, 20].

The Malay TB patients have been associated with all three delays. This could be due population bias as the majority of population in this setting are Malays. We speculate that lack of awareness, economic issues and local cultural beliefs may influence their health-seeking behaviour and these highlights potential area of research. This finding is similar to an Italian study where locals (non-migratory) contributed more to patient delay [21].

Patients with TB family history were less likely to delay in TB treatment compared to patients without TB family history. Having a TB family history may have enabled them to understand the disease and plan their health care better. Patients with TB contact were associated with patient delay and treatment initiation delay. Even though TB contact is an important source of infection, patients are still being missed from contact tracing in TB management. This may be due to healthcare provider not rigorously enquiring about TB contacts or respond appropriately. However, this also due the casual attitude of the patients following their low awareness of the disease.

Patient delay may also indicate casual attitude of patients due to low awareness of the disease. This highlights the importance of contact based investigations of TB to enhance the diagnosis and educating the public about the disease [22].

However, it is possible that some delays can be reduced through alteration of clinical practice by developing more aggressive approach for the mentioned epidemiological factors in this hospital setting. This study also suggests further research to be carried out to understand the reasons behind the delays in order to improve health service practices of TB control in Malaysia.

The severe pulmonary TB and patients with positive smear has been known to pose higher risk in TB transmission [10, 13, 14]. It is important to identify the specify epidemiological factors of TB population in the hospital setting associated with these delay in order to reduce overall transmission. Our study also revealed that explanatory variables such as patients with co-morbidity, patients with pulmonary TB and positive smear are associated with severe form of TB. These findings were similar with other studies [7]. In terms of its epidemiological relation, males, non-Malays, patients with family history of TB and patients with TB contact are at higher risk of severe TB and positive smear. Although we were unable to postulate the possible reasons to justify these results, it may as well serve as an extra platform to focus in enhancing TB management to reduce the overall transmission in this particular setting besides creating room for future research.

Although the research has reached its objectives, it is limited by its sample size. While the findings of the study are applicable for this setting, it may not be suitable to generalize for other settings. A study with a larger sample size can be conducted to overcome this limitation.

5. Conclusion

Delay in TB treatment comprises of patient delay, medical visit delay and treatment initiation delay and is associated epidemiological factors namely Malay ethnicity and without family history TB. These factors pose an important public health challenge in TB prevention. Managing these epidemiological factors may reduce the delays and the overall risk of TB transmission.

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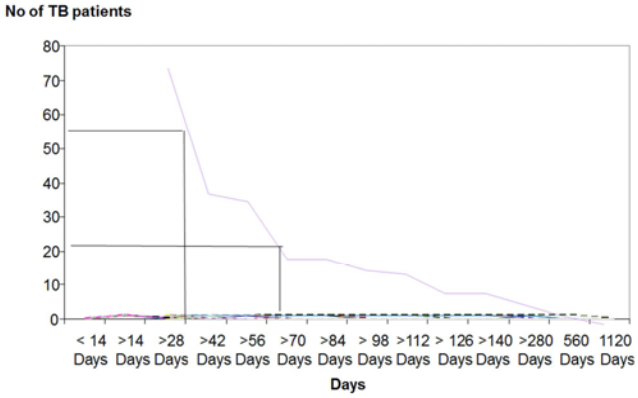

Figure 1. *Delay in Seeking Treatment after Sign and Symptom among TB Patients in Hospital Setting.*

Table 1. *Epidemiology Factors, Odd Ratio and CI for Patients Delay.*

Epidemiological Factors	OR	CI
Age (<55 years)	0.90	0.31-2.61
Gender (Males)	1.8	0.64-5.02
Ethnicity (Malays)	1.04	0.42-3.11
With Family History of TB	0.30	0.10-1.53
With TB Contact	1.7	0.31-10.44

Table 2. *Epidemiology Factors, Odd Ratio and CI for Medical Visit Delay.*

Epidemiological Factors	OR	CI
Age (<55 years)	1.48	0.57-3.85
Gender (Males)	1.50	0.53-4.26
Ethnicity (Malays)	1.13	0.43-2.98
With Family History of TB	0.60	0.13-2.55
With TB Contact	0.45	0.09-2.51

Table 3. *Epidemiology Factors, Odd Ratio and CI for Treatment Initiation Delay.*

Epidemiological Factors	OR	CI
Age (<55 years)	0.85	0.21-3.44
Gender (Males)	0.75	0.18-3.35
Ethnicity (Malays)	3.02	0.56-21.55
With Family History of TB	0.61	0.03-5.55
With TB Contact	2.52	0.44-13.23

Table 4. *Epidemiology Factors, Odd Ratio and CI for Severity.*

Epidemiological Factors	OR	CI
Age (<55 years)	1.28	0.49-3.33
Gender (Males)	1.30	0.45-3.76
Ethnicity (Malays)	0.74	0.28-1.97
With Family History of TB	4.51	0.97-23.5
With TB Contact	3.31	0.80-14.55
Co morbidity	1.42	0.54-3.77
Type TB	4.7	1.11-22.86
Smear	2.50	0.93-6.88

Table 5. *Epidemiology Factors, Odd Ratio and CI for Smear Positive.*

Epidemiological Factors	OR	CI
Age (<55 years)	0.86	0.33-2.26
Gender (Males)	1.23	0.43-3.45
Ethnicity (Malays)	0.73	0.27-1.96
With Family History of TB	1.22	0.29-5.47
With TB Contact	1.42	0.35-6.22

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