ORIGINAL ARTICLE

Analysis on Tuberculosis in Bintulu from 2013 to 2017

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Abstract:

In Malaysia, Tuberculosis (TB) cases has been identified as one of re-emerging communicable disease with high number of death rate. This study aims to analyze the TB incidence trend in Bintulu, Sarawak from 2013 to 2017 using spatial and temporal approach. TB cases were classified by risk factors of gender, age, nationality, occupation, level of education and health status. The XY-coordinates of all 1175 identified cases data were used to generate spatial-temporal maps using ArcMap 10.5 and later for the identification of the hotspots area. Results showed that Bintulu town is the hotspot of TB, with the greatest proportion was among male patients (70.3%), age of 15 to 65 and above, Malaysians (85%), those with no education (29.4%), unemployed patients (26.8%), non-diabetics (85.3%), non-smokers (60.7%) and HIV-negative patients (94.8%). For effective prevention and control, thorough TB screening should be implemented for all citizens and non-citizens in Bintulu. This study also suggest the application of spatial and temporal analysis on TB should be extend for other areas in Sarawak.

Keywords: Bintulu, risk factors, spatial-temporal distribution, Tuberculosis,

1. INTRODUCTION

Tuberculosis is an infectious disease caused by *Mycobacterium tuberculosis* and it remains being a prevalent communicable disease in underdeveloped countries such as Bangladesh, Ethiopia, Thailand and Philippines where it has earned its stop in the top 10 for being the dominant cause of death by single infectious disease globally [1,2]. , there are many factors contributing to the transmission and indication of tuberculosis which are overcrowding, poor sanitary conditions, lack of health care access, under nutrition and pre-existing diseases or co-morbidities such as diabetes, smoking, and HIV infection. Hence, the socioeconomically underprivileged populations are at greater risk at contracting the infectious disease [2]. Today, TB still remains as a global public health problem of enormous dimension and also responsible for more deaths than any other infectious disease. According to World Health Organization (2017), new TB cases worldwide were an estimated 10.4 million of which 6.2 million were men, 3.2 million were women and 1 million were children. 67% of the new cases are accounted from 7 countries which are India, Indonesia, China, Philippines, Pakistan, Nigeria, and South Africa [3].

The dynamics of infectious diseases depends on the spatial distribution of pathogens and hosts, and the likelihood of an encounter between the triads. When the distance between individuals increases, then the transmission of the disease from infecting any susceptible hosts decreases. Just like many infectious diseases, TB is disposed to spatial aggregation or clustering [4]. As TB is known to be a disease that is constantly present at a high incidence and/or prevalence rate which affects all groups equally, “hotspots” are often characterized by crowding, HIV infection, and other social determinants, new approaches, such as mapping and spatial analysis may be of value in contributing to basic elements of TB control [5].

According to World Health Organisation [6], 24,711 of new cases were reported in Malaysia and number of cases were diagnosed have become more worsen throughout the year. In 2015, notification rate for TB was 79.4 cases per 100,000 populations. Three states were reported with high TB cases are Sabah, Selangor and Sarawak, making up a total of nearly half which is 50% of the new cases in Malaysia.TB disease is still a major public health concern in Sarawak, particularly in division of Bintulu and Kuching. The number of TB cases reported has not shown any signs of declining and it has been steadily increase as of 2016. [7]. In Bintulu alone, 1175 TB cases were reported from 2013 to 2017. The objective of this study was to analyse to incidence of TB in Bintulu while simultaneously identify the risk factors that contributed to all TB cases and then generate temporal-spatial map for TB area in Bintulu during 2013 to 2017.

2. MATERIALS AND METHODS

This study used Bintulu, Sarawak as its research area located in the East of Malaysia, occupying 12,515 km^2. It is a coastal town in the central region of Sarawak with a population of 231,200 making it one of the most populated divisions in Sarawak.

2.2 Data Collection

2.2.1 Tuberculosis Case

Data. Collection of registered TB cases diagnosed from several hospitals and healthcare centres together with demographic characteristics reported to Bintulu Health Office from 2013 to 2017

2.2.2 Normalizing

TB Data. The data was pivoted into categories of risk factors of an age, gender, nationality, occupation, and health status which are diabetes mellitus, smoking and HIV status.

*2.2.3 Data Analysis.*ArcMap10.5 was used to analyse the data to identify the spatial and temporal distribution of TB in Bintulu. The data was then analysed by using IBM SPSS Statistics 21 for the correlations between risk factors.

3. RESULTS AND DISCUSSION

There were 1175 TB cases detected from 2013 to 2017 in Bintulu where in 2013 (219 cases), 2014 (237 cases), 2015 (201 cases), 2016 (274 cases), and 2017 (244 cases) respectively. The data analyses are divided into two parts; demographic data and spatial-temporal distribution data.

3.1. Demographic Analysis

Gender. The differences in social roles, risk behaviours and activities can affect the exposure of TB in gender [8]. Males may have been travelling frequently, socializing more, spending more time in social settings where the transmission may occur such as bars and engaging in professions associated with high risk of being exposed to TB such as mining [7]. At the same time, male might be exposed to other workers coming from different countries in their workplace hence; it is plausible that the infection must probably be transmitted in the workplace.

Age. According to World Health Organization [9], 1 million children under the age of 14 were infected with TB with with 140,000 case of mortalities (2014). A similar study in 2013 found that children under 2 years of age are at high risk of TB progression following the initial exposure whereas for 5-10 years of age are exposed through nursery and school [7]. Another study in 2011 found that between the age of 1 and 4, the risk declined to 1% only to rise 2% between the age of 15 and 25 years old [10]. However, in Bintulu, it is shown that the highest number of TB cases age range between 35–44 and 25-34 years of age with 219 and 212 cases respectively. All things considered, this might be due to the fact that most of the patients within that age range adults in their most productive years (working adults). However, some studies conducted in different target populations had showed inconsistent results regarding age difference. One study also conclude that those of younger age was a potential risk factor group for having TB meanwhile another study reported that there is no significant effect of age risk of TB[11][7].

Nationality. Migrant has been found to be the resilient factor of the high incidence of active TB rate on country of birth which stems to other variables such as the status of the migrants' socio-economic in their country of residence, gross national income of the migrants' country of origin and the unemployment level of the migrant in the country of residence [11]. The rationale behind this fact is that the individuals coming from country of origin with higher risk of developing TB are often known to be living in overcrowded spaces, highly vulnerable to HIV, lack of education, inaccessibility to healthcare, possess poor health-seeking behaviour and social and cultural barriers with the population of origin [12].

Level of Education. It was found that 29.4% of the TB patients were uneducated and coming close at 26.6% were only primary school level. It is evident that these patients were not aware of TB especially on the transmission and symptoms experienced during an onset period. A study conducted in Bangladesh showed that those infected with extra pulmonary TB were female from lower level of education qualification group and residing in rural area of the country, with poor awareness on TB transmission, preventions and basic precautions of TB [13]. This study underscores the simple fact that education is the first pre-requisite for improving health and living standards, as literacy and education can not only enlighten the masses but create and enhance awareness regarding diseases and ways and means of improving their quality of life.

Occupation. The highest number of TB cases observed in this study were among unemployed group with 26.8%, followed by others such as technicians, plant operator, safety officers and tourism coordinator at 20.6%. A significant association between occupation and nationality ($p<0.01$) were recorded as Malaysians comprises 85.3% of the TB cases in Bintulu. Number of unemployed TB patients were found to be higher as the patients are consisting of students, retiree, and also those with lower level of education

3.2 Health Status

Diabetes mellitus. Active TB disease has always been linked to diabetes [14]. A systematic review done in 2008 found that diabetic patients has higher risk of developing TB compared to non-diabetic patient, achieved by comparing 13 studies which examined the relationship between diabetes and TB s [15]. However, this study found that 85.3% of the TB patients are non-diabetic whereas the diabetic patients are only 14.7%. This result shows the opposite of what most study has done. It is found that diabetes has no significance with all of the other risk factors except for the significance associated with age ($p<0.01$).

Smoking. 40% to 50% of TB patients in Malaysia are smokers. It is widely known that 20% of TB cases are associated with smoking and many studies have proved and supported of this claim [16,17,9]. However, the result obtained from Bintulu showed that 60.7% of the patients coming from non-smokers group and the remaining 39.3% are smokers. Correlation between smoking and gender are at

(*r*-value = .47) for female. Smoking was found to be significantly associated with gender (p<0.01) for male group. Since the dominant age group is that of 25 years old and above, it is evident that the patients are those who are working and chances are, they are smokers which contribute to the progression of the disease.

HIV. HIV-positive patients are found to be only 2.1% whereas the HIV-negative patients made up 94.8% of the total percentage of cases. No test was done on the remaining 3.1% of patients as it probably due to the fact of inadequacy of treatment or diagnosis for HIV. As of 2014, 1.2 million (12%) out of 9.6 million TB cases globally are those cases of HIV-positive patients. Patients with HIV are discovered to have the most common presenting illness which is TB and that HIV-positive persons are highly likely to develop active TB [18,9]. The progression of the disease is increased due to both TB and HIV infection which will result in mortality [19]

Table 1 **:** Characteristics of Tuberculosis cases from 2013 to 2017 in Bintulu Division (Total cases = 1175)

Variable	2013 (Total case = 219)	2014 (Total case = 237)	2015 (Total case = 201)	2016 (Total case = 274)	2017 (Total case = 244)	Total
Gender						
Male	157	162	146	191	170	**826**
Female	62	75	55	83	74	**349**
Age (years)						
<1	3	12	6	8	3	**32**
1-4	5	11	10	5	7	**38**
5-14	6	4	3	8	6	**27**
15-24	34	32	14	30	22	**132**
25-34	48	49	40	43	32	**212**
35-44	47	46	37	45	44	**219**
45-54	27	39	36	45	48	**195**
55-64	24	21	27	39	41	**152**
>65	25	23	28	51	41	**168**
Nationality						
Malaysian	170	196	180	229	231	**1006**
Indonesian	41	36	18	41	11	**147**
Filipino	5	3	1	2	0	**11**
Indian	3	1	0	0	0	**4**
Myanmarese	0	0	0	2	0	**2**
Vietnamese	0	1	0	0	0	**1**
South African	0	0	1	0	0	**1**
Bruneian	0	0	0	0	1	**1**
Nepalese	0	0	0	0	1	**1**
Level of Education						
Primary school	72	53	55	68	65	**313**
Lower secondary school	44	51	31	48	43	**217**
Upper secondary school	41	39	45	44	46	**215**
Form 6/Diploma/Certificate	9	18	11	17	10	**65**
Bachelor's Degree	3	2	2	3	9	**19**
Uneducated	50	73	57	92	70	**342**
Health status						
Diabetes mellitus						
Diabetic	25	31	31	43	43	**173**
Non-diabetic	194	119	170	231	201	**915**
Smoking						
Smoker	101	83	82	105	91	**462**
Non-smoker	118	154	119	169	153	**713**
HIV						
HIV-positive	6	7	3	5	4	**25**
HIV-negative	207	219	195	262	231	**1114**
No test done	6	11	3	7	9	**36**
Occupation						
Health worker	1	0	1	0	2	**4**
Farmer	18	17	14	18	17	**84**
Labour	44	42	12	36	12	**146**
Teacher	4	1	1	1	5	**12**
Driver	11	12	13	12	14	**62**
General Worker	5	5	2	10	6	**28**
Clerk	3	4	2	4	6	**19**
Mechanic	5	6	3	4	3	**21**
Fisherman	3	2	0	1	0	**6**
Student	15	8	3	14	7	**47**

3.2 Spatial and Temporal Analysis

Figure 1 and figure 2 below showed the temporal and spatial distribution of TB cases in Bintulu from 2013 until 2017. The distribution of TB cases throughout 5 years was observed to be more concentrated in Bintulu tow area and Sebauh. Meanwhile, scattered distribution can be seen in the rural area. Overcrowding and high dense populated area is suggested as the most prominent hot spot for TB in Bintulu Division.

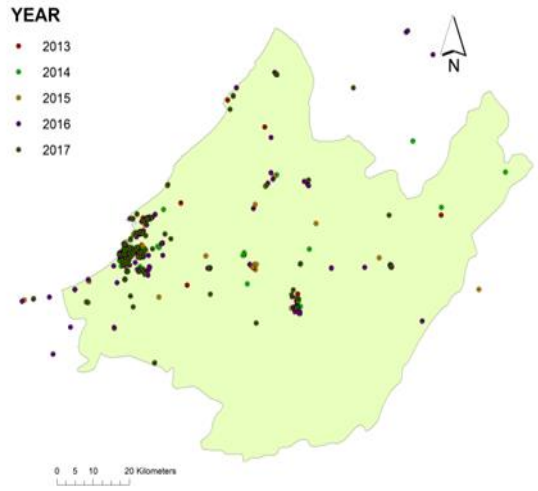

Figure 1: Temporal distribution of TB cases from 2013 until 2017 for Bintulu Division

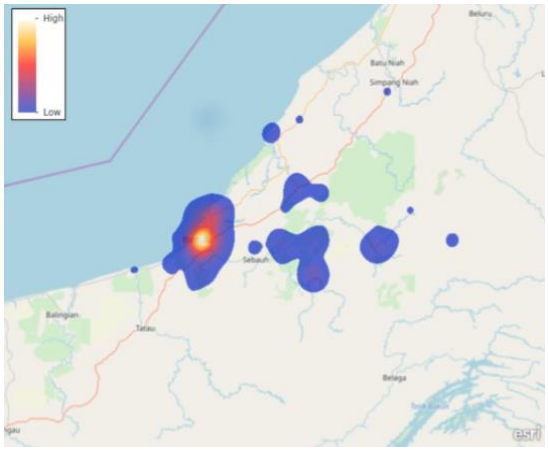

Figure 2: The spatial distribution pattern of Tuberculosis in Bintulu from 2013 until 2017. The darkest color to the lightest color demonstrate he highest number to the lowest of TB cases respectively (not up to scale)

4 CONCLUSION

This study has subsequently determined risk factors and TB hotspot area by extrapolating the pattern of TB cases between 2013 to 2017. With the data obtained, it was made possible to determine the risk area of TB based on the analysis of the data obtained. In conclusion, mitigation and control measures can be implemented in depth and thoroughly with the help of the successful mapping of TB cases in this district. It is also important to understand and have a wider sense of knowledge on the factors that may contribute to the transmission of TB disease. The contributing factors may vary, but the factors that remained stagnant are the ones that can be mitigated and can be meticulously focused to ensure that the number of cases can be decreased in accordance to the End TB Strategy. The result in this study described an exploration of environmental dynamics and associated geographic distribution for surveillance, monitoring and evaluation of TB cases in future. This study may also open a new door for a newly improved spatial and temporal analysis on TB to be done other areas in Sarawak

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