

Tuberculosis incidence in area with sulfur dioxide pollution: an observation

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Abstract

Tuberculosis is an important public health problem that needs good control. The interrelationship between air pollution and incidence of tuberculosis is interesting. In the present report, the authors report the observation on tuberculosis incidence in area with sulfur dioxide pollution. The retrospective analysis on public available on incidence of tuberculosis and ambient air sulfur dioxide level in Thailand is done. There is no significant relationship between air sulfur dioxide level and corresponding incidence of tuberculosis ($r = -0.224$, $P = 0.535$). In conclusion, there is a lack of association between air sulfur dioxide level and corresponding incidence of tuberculosis in our setting.

Key words: air; association; control; incidence; pollution; public health; sulfur dioxide; tuberculosis

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INTRODUCTION

Tuberculosis is an important public health problem that needs good control. The interrelationship between air pollution and incidence of tuberculosis is interesting. Jafta et al.¹ found that exposure to environmental smoke resulted in increased risk of tuberculosis. Lin et al.² found that there was an association between air pollution from solid fuel and tuberculosis.

Several pollutants are mentioned for possible relationship with tuberculosis.³⁻¹⁰ Recently, Popovic et al.³ found that “There was some evidence of significant associations between PM_{10} ($< 10 \mu m$), nitrogen dioxide (NO_2) and sulfur dioxide and tuberculosis outcomes.” Liu et al.¹⁰ studied in a Chinese setting and reported that “most of the air pollutants ($PM_{2.5}$, sulfur dioxide, O_3 , and CO) were significantly associated with increased risk of tuberculosis among the males, the females, the < 60 years, and the smear negative cases.” In the present report, the authors report the observation on tuberculosis incidence in area with sulfur dioxide pollution.

MATERIALS AND METHODS

This retrospective analysis on public available on incidence of tuberculosis and ambient air sulfur dioxide level in Thailand is done. The focused studied area is a rural province in Thailand namely Lampang province. The study setting is a rural province in northern region of Thailand, about 600 km from Bangkok, the capital of Thailand (Figure 1). The area is a mountainous area of Thailand. The coordinates of this province is at 19.239° latitude north and 99.628° longitude east with an average elevation of 234.92 m above sea level. The biggest charcoal power electricity plant in Thailand locates in this province. Sulfur dioxide pollution exists in this province due to the exhalation from the local big charcoal mine. In this area, tuberculosis is also an important local public

health problem. During 2014–2018, the rate of tuberculosis among local people in this area is between 90.1 and 106.9 per 100,000 population.

The primary data for analysis included a) the data on incidence of tuberculosis provided by provincial public health office (www.lpho.go.th) and b) the data on air sulfur dioxide



Figure 1: Map of Lampang province, Thailand (black area).



monitoring provided by Thai Pollution Control Department (www.pcd.go.th). The monitoring of tuberculosis incidence was performed by Lampang provincial public health office. The focused target population is the whole population of the province. The surveillance for tuberculosis is done according the national public health policies of Thai Ministry of Public Health which is based on WHO standards for tuberculosis control and management (www.who.int). Active case search by active tuberculosis screening (chest X-ray and sputum examination) is done to find the new tuberculosis case. The case with either positive chest X-ray or sputum examination is diagnosed for tuberculosis and recruited for further anti-tuberculosis drug treatment. The monitoring for sulfur dioxide is routinely performed for 24 hours per year, and sample collection is performed at different air pollution sampling stations in all 10 districts of the province. The air sulfur dioxide level is determined by standard ultraviolet technique. The monitoring was performed by Thai Pollution Control Department under standard protocols and quality control process. The data in 2018 (from January 2018 to December 2018) were analyzed in the present study.

The correlation analysis was used for assessment the relationship between incidence of tuberculosis and air sulfur dioxide level. Bivariate analysis and correlation coefficient determination were done. The SPSS 11.5 for Windows software (SPSS, Chicago, IL, USA) was used for statistical analysis in the present study. The present study is a retrospective analysis on the primary public available data and does not deal with any human or animal subject; therefore, no written informed consent or ethical approval is required.

RESULTS

According to the available data in 2018, the average air Sulphur dioxide in different monitoring stations in different district of Lampang province and corresponding incidence of tuberculosis are present in **Table 1**. There is no significant relationship between air sulfur dioxide level and corresponding incidence of tuberculosis ($r = -0.224$, $P = 0.535$). For further subgroup analysis, there is also no significant relationship between air sulfur dioxide level and corresponding incidence of tuberculosis in different sex and age groups (**Table 2**).

Table 1: Air sulfur dioxide level ($\mu\text{g}/\text{m}^3$) and corresponding incidence (%) of tuberculosis in different districts of Lampang province, Thailand

District No.	Air sulfur dioxide level	Incidence of tuberculosis
1	0	11
2	0	6
3	0	74
4	0	74
5	1	6
6	2	6
7	3	74
8	54	6
9	1	6
10	0	10

Table 2: Correlation analysis for relationship between air sulfur dioxide level and corresponding incidence of tuberculosis in different sex and age groups

	Correlation coefficient (r)	P -value
Sex		
Male	-0.202	0.632
Female	-0.172	0.714
Age (yr)		
0-15	-0.196	0.824
15-60	-0.072	0.552
> 60	-0.184	0.641

DISCUSSION

Tuberculosis is still an important infectious disease. As a disease that is mainly transmitted via air, the great concern is usually on the clean air. Clean air usually means there is no problematic contamination. The air pollution becomes an important consideration in respiratory medicine in the present day. Due to the rapid globalization in several areas around the world, the poor air quality can be detectable. The effect of air pollution on human health is reported.¹¹⁻¹⁶

The relationship between air pollution and tuberculosis is an interesting issue in respiratory medicine. In the present report, the authors assess the possible relationship between incidence of tuberculosis and ambient air sulfur dioxide level. Regarding sulfur dioxide, there is a recent interesting report regarding ambient air sulfur dioxide level and tuberculosis incidence. Ge et al.¹⁷ found that a short-term exposure to ambient sulfur dioxide was associated with reduced risk of tuberculosis. Ge et al.¹⁷ noted that acute protective effects of low-level ambient sulfur dioxide exposure might be due to antibacterial property of sulfur dioxide. On the other hand, a totally different observation was recently reported by Zhu et al.,¹⁸ in which exposure to sulfur dioxide could result in increased incidence of newly diagnosed tuberculosis.

The potential mechanism that sulfur dioxide pollution might relate to the incidence of tuberculosis is impaired lung physiological defense due chronic inflammation of lung from pollutant irritant.¹⁹ The mentioned pathophysiology is well described in the previous study on association between sulfur dioxide pollution and chronic lung disease.²⁰ Nevertheless, in our study, no significant association between air sulfur dioxide level and corresponding incidence of tuberculosis is observable. This finding is discordant with the proposed hypothesis in report by Ge et al.¹⁷

To conclude, due to the insignificant poor correlation from statistical analysis, a lack of association between air sulfur dioxide level and corresponding incidence of tuberculosis in the area with problem of sulfur dioxide pollution is concluded.

Author contributions

SY and VW contributed equally to this work.

Conflicts of interest

None declared.

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Institutional review board statement

The present study is a retrospective analysis on the primary public available data and does not deal with any human or animal subjects; therefore, no ethical approval is required.

Declaration of patient consent

The present study is a retrospective analysis on the primary public available data and does not deal with any human or animal subjects; therefore, no written informed consent is required.

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Data sharing statement

Datasets analyzed during the current study are available from the corresponding author on reasonable request.

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