Title: Tuberculosis among Nurses: Prevalence and Factors that Associated with Infection

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ABSTRACT

Background: The spread of tuberculosis (TB) is a major health problem that needs to be monitored. Health care workers (HCWs) who perform the services patients in hospital are high risk of *Mycobacterium tuberculosis* infection especially among nurses who spend a majority of time with patients.
Objective: To determine prevalence of TB infection among nurses and factors that associated with TB.
Methods: This study utilized data from the baseline survey of the Thai Nurse Cohort Study (TNCS) database. It was a mailed survey conducted in September 2009 involving a total of 18,756 respondents who were then become members of the Cohort. The primary outcomes of this study were tuberculosis (TB) infection in nurses during operation that reported by registered nurses (RNs). Effects of tuberculosis were quantified by prevalence rate, odds ratio (ORs) and its 95%CI using multiple logistic regression.
Results: Among a total of 18,756, there were 10,048 nurses included in the analysis, 96.4% were female, with a mean age of 40.8 ± 9.9 years old. The prevalence of TB infection during the operation that reported by service nurse and its 95% confidence interval (CI) was 3.6% (3.2% to 3.9%). Prevalence was highest in group whose relatives have been infected with TB 6.6% (95%CI: 4.9 to 8.4). Factors that associated with TB, presented as odds ratio (ORs) and 95%CI, included age more or equal 30 years old (OR = 2.5; 95%. CI: 1.5 to 4.3; p-value = 0.001), and relative have been TB infected (OR = 2; 95%CI: 1.4 to 2.8; p-value < 0.001.
Conclusions: Prevalence of TB infection was high in service nurses whose relatives have been TB infected, and found that high age and relatives have been TB infected groups were associated with TB infection among nurses. However, this study shows that prevalence of TB infection remain high and remains a health problem that needs to be burned. Especially, in medical personals who closes to patients.

Key words: tuberculosis, prevalence, risk, factors, relation, associated, nursing

INTRODUCTION

Tuberculosis (TB) is caused by *Mycobacterium tuberculosis* infection remains a major global health problem that needs to be monitored.[1] The World Health Organization (WHO) reported about 9 million people in 2011 fell ill with TB and more than 1 million died from TB. TB is highest in Asia and Africa. Almost 40% of the world's TB cases were in India and China. Thailand is one of the 22 countries in the world with the highest TB infection. Prevalence of TB in Thailand nearly 130,000 cases with populations 64 million.[2 3] There are many risk factors for TB infection. One of many factors is the factor of occupation, especially among health care workers who spend a majority of time with TB patients.[4]

Health care workers (HCWs) who perform the services patients in hospital are high risk of *M. tuberculosis* infection particular in many low and middle-income countries.[5 6] Several studies have reported on the TB infection among nurses, for example, the study of TB risk among nursing professionals from Central Brazil (2008) found that 69.5% of 128 nursing professionals infected TB.[7] The prevalence rate of TB infection in the 91 nursing home in Puerto Rico was 42.9%.[8] The Study of TB among HCWs at King Chulalongkorn memorial hospital (2005) from 3,959 HCWs found that TB incidence rate was 188 per 100,000 person-years. The occupation of highest risk was nurse, RR=2.4 (95%CI: 0.9 to 9.1).[9] The study was aware of the spread of TB among nurse's issue and health problems that affect their daily lives. Infection caused by several factors, and factors that may be related to TB included personal factors.

Factors that associated with TB have several aspects, including environmental, economic and social, behavioral, and personal factors. Previous studies have reported that various factors that associated with TB. The study increased risk of TB among HCWs in Samara Oblast, Russia (2005) found that HCWs working in TB services were found to be at highest risk, with an incidence rate ratio of 17.7 (95%CI 11.6 to 27.0) compared to HCWs at the general health services.[10] Study of prevalence and risk factors for latent TB infection among HCWs in China (2013) found that technician staff, working duration as a HCW for 11 to 20 years and 20 years above, and history of household TB contact were associated with increased risk of latent TB infection.[11] The study of TB among HCWs at King Chulalongkorn memorial hospital (2005) found the highest risk TB was emergency room.[9] The study risk of *Mycobacterium tuberculosis* infection and disease among HCW, Chiang Rai, Thailand found factors that associated with positive tuberculin skin test were age more or equal 30 years (OR = 2.38; p-value = 0.005) compare with age less than 30 years, and duration of employment more than 1 years (OR = 2.02; p-value = 0.030) compare with duration of employment less or equal 1 year.[12] Study of TB among HCWs in a short working period (2005) at a teaching hospital in southeast Turkey found that the mean age of nurses was 20.6 years, and the mean working experience was 2.8 years.[13] These problems affect the reliability of health personnel. Especially among nurses that is to find the first checkpoint on the use of health services. Even with measures to prevent this from happening, but it is not possible to eliminate the problem permanently. However, there are few studies on the factors associated with Tuberculosis infection among nurses.

The above situation can be seen that the spread of TB is a major health problem, which affects the performance of work and the living that needs monitoring and managed to prevent. This study aims to determine the prevalence of TB infection in service nurses in Thailand and factors that associated with TB infection. The study used data from Thai Nurse Cohort Study (TNCS). With the large sample size and spread across the country like this can make the population aware of the broad range of contexts, location or work area, and much more that are not in the earlier study. It can reflect a problem and solutions in a large sample survey of nursing across the country to be held in the future.

MATERIALS AND METHODS

Study design

This study is part of the Thai Nurse Cohort Study (TNCs). The TNCs was planned as a 20-year longitudinal cohort study. In 2009 the base-line survey was performed. A random sample of registered nurses (RNs) who held nursing licenses granted by Thailand Nursing and Midwifery Council (TNMC) as of 2008 were surveyed by mailed-questionnaires and the respondents were enrolled as cohort members. The first wave of the study was carried out as a cross-sectional survey. The sampling method was stratified random sampling with probability proportional to size of nurses in each 10-year age intervals. This paper involved a total of 18,756 members of the cohort then excluded those nurses who worked outside of service nurses.

Study outcome

Primary outcome was TB infection during the operation that reported by nurses. Values of the variable are 0 means no infection and 1 means infection.

Statistical analysis

Demographic characteristics of the respondent, nurses who worked in nursing career were included in the analysis. These characteristics were described using frequency and percentage for categorical data such as gender, age group, marital status, highest education attainment, receive a scholarship, current major work position, working status, working status, workplace, region of workplace, working experienced, average of monthly income, liabilities, sufficiency of monthly income, and TB infection in relative, and TB infection. To describe continuous data such as age and working experienced using mean, standard deviation, median, minimum, and maximum.

Prevalence rate of TB infection was calculated using the number of nurses who reported TB infection during operation as the numerator and total number of nurse who responded to the questionnaire and work in service nurse as the denominator. The 95% confidence interval (CI) of the prevalence rate was computed based on normal approximation to binomial distribution.

To investigate factors that associated with TB infection, adjusted odds ratios (ORs) and their 95% confidence intervals (95%CIs) were estimated using multiple logistic regression for survey sampling. This analysis was adjusted for baseline variables that were considered biologically and sociologically relevant or which showing a univariate relationship with outcomes such as gender, age, marital status, receive a scholarship, highest education, working experienced, and relatives have been infected with tuberculosis.

All analyses were performed by using STATA version 12.0 (StataCorp, College Station, TX). All test statistics were two-sided and a p-value of less than 0.05 was considered statistical significant. This project was approved by the Human Research and Ethics Committees of the Ministry of Public Health of Thailand.

RESULTS

A total of 142,699 RNs who held nursing licenses and were listed in TNMC database in 2008 were the population of this study. From the 18,756 RNs who randomly selected, responded to the survey, and agreed to participated as members of the TNCS 8,708 RNs were excluded for this paper due to worked outside of services nurses, hence 10,048 nurses were included in the analysis (Fig 1).

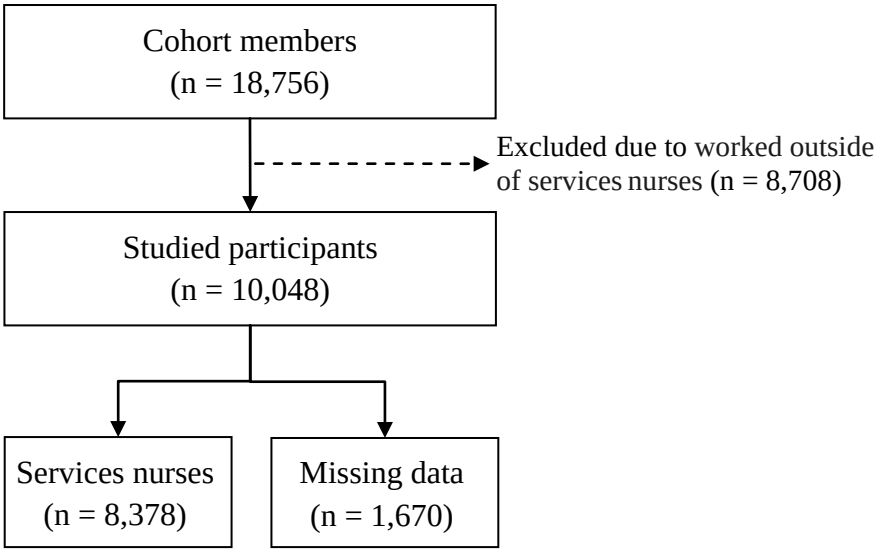

Figure 1 Consort diagram of samples

Demographic Characteristics

From the 10,048 nurses, almost all of them 96.4% were female with a mean age of 40.8 ± 9.9 years old (ranged: 20.5 to 64.9) (Table 1). They were mainly married (65.2%), relatives have been infected with TB (7.5%) and mean of working experience 15.5 ± 10.2 years (ranged: 0.5 to 53).

Table 1. Demographic characteristic of the serviced nurses presented as number and percentage (n = 10,048)

Characteristics	Number (n)	Percent (%)
Gender (n = 9,990)		
Male	363	3.6
Female	9,627	96.4
Age (years) (n = 10,048)		
Less than 30 years	1,850	18.4
More or equal 30 years	8,198	81.6
Mean ± standard deviation	40.8 ± 9.9	
Median (Min : Max)	41.2 (20.5 : 64.9)	
Marital status (n = 10,002)		
Single	3,477	34.8
Married	6,525	65.2
Highest education attainment (n = 9,739)		
Bachelor's degree	8,799	90.4
Master's degree or higher	940	9.6
Receive a scholarship (n= 9,705)		
No	2,240	23.1
Yes	7,465	76.9
Working experienced (years) (n = 8,348)		
Lower or equal 3 years	1,232	14.8
More than 3 years	7,116	85.2
Mean ± standard deviation	15.5 ± 10.2	
Median (Min : Max)	15 (0.5 : 53)	

Characteristics	Number (n)	Percent (%)
Relatives have been infected (n = 10,048)		
No	9,294	92.5
Yes	754	7.5
Tuberculosis infection among nurses (n = 10,048)		
No	9,691	96.5
Yes	357	3.5

Prevalence of Tuberculosis infection

From the 10,048 nurses, prevalence of TB infection was 3.6% (95%CI: 3.2 to 3.9) (Table 2). Found that TB infection in group whose relatives have been infected with tuberculosis were highest 6.6% (95%CI: 4.9 to 8.4). Followed by whose finish master's degree or higher and age more or equal 30 years old 4.8% (95%CI: 3.4 to 6.2) and 4.1% (95%CI: 3.6 to 4.5), respectively.

Table 2. Prevalence of Tuberculosis infection among service nurses and their 95% confidence intervals (CI)

Variables	Number	Tuberculosis (TB) infection		
		% TB	95% CI	p-value*
Tuberculosis infection	10,048	3.6	3.2 to 3.9	NA
Gender				0.088
Male	363	1.9	0.5 to 3.3	
Female	9,627	3.6	3.2 to 4.0	
Age (years)				< 0.001
Less than 30 years	1,850	1.3	0.8 to 1.8	
More or equal 30 years	8,198	4.1	3.6 to 4.5	
Mean ± standard deviation	42.4 ± 8.2			
Median (Min : Max)	43 (22.9 : 60.7)			
Marital status				0.048
Single	3,477	3.1	2.5 to 3.6	
Married	6,525	3.8	3.4 to 4.3	
Highest education attainment				0.041
Bachelor's degree	8,799	3.5	3.1 to 3.9	
Master's degree or higher	940	4.8	3.4 to 6.2	
Receive a scholarship				0.042
No	2,240	2.9	2.2 to 3.5	
Yes	7,465	3.8	3.3 to 4.2	
Working experienced (years)				< 0.001
Lower or equal 3 years	1,232	1.2	0.6 to 1.8	
More than 3 years	7,116	3.9	3.4 to 4.3	
Mean ± standard deviation	17.5 ± 8.9			
Median (Min : Max)	17 (0.5 : 42)			
Relatives have been infected				< 0.001
No	9,294	3.3	2.9 to 3.7	
Yes	754	6.6	4.9 to 8.4	

*The p-value of comparison difference rate of TB infection between groups in each variable.

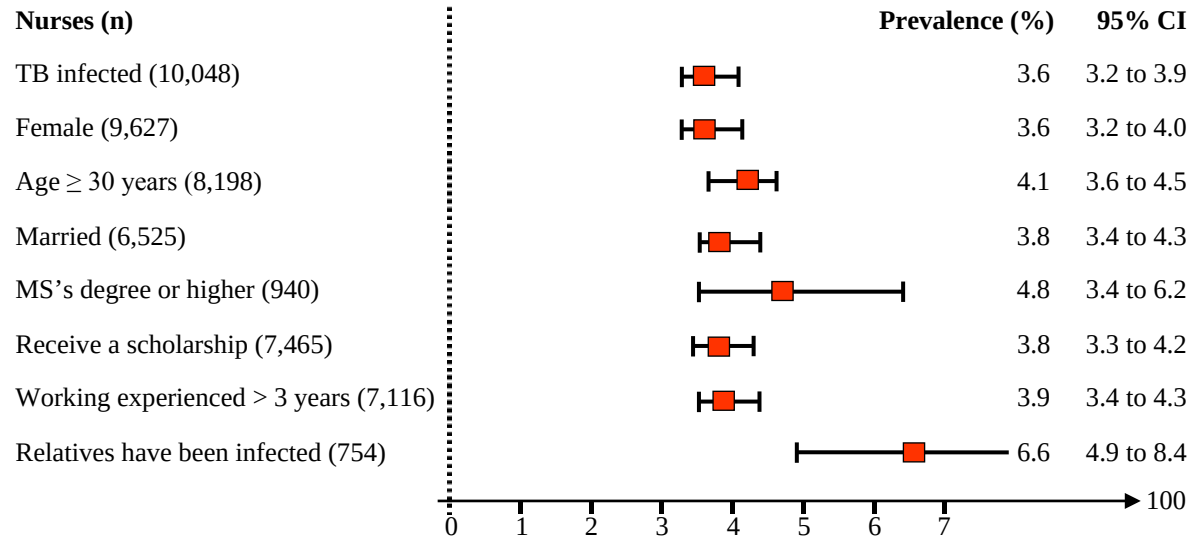

Figure 2 Prevalence of TB infection among nurses

Factors that associated with TB

Among a total of 10,048 nurses, the factors that associated with TB, presented as adjusted odds ratio (ORs) and 95%CI (Table 3) showed that age more or equal 30 years old (OR = 2.5; 95%. CI: 1.5 to 4.3; p-value = 0.001), and relative have been TB infected (OR = 2; 95%CI: 1.4 to 2.8; p-value < 0.001.

Table 3. Odds ratio (ORs) of factors that associated with TB infection and their 95% confidence intervals (CI) for each factor adjusted for all other factors using logistic regression

Factors	Number	% TB	Crude OR	Adjusted OR	95%CI	p-value
Age (years)						0.001
Less than 30 years	1,850	1.3	1	1		
More or equal 30 years	8,198	4.1	3.2	2.5	1.5 to 4.3	
Marital status						0.501
Single	3,477	3.1	1	1		
Married	6,525	3.8	1.3	0.9	0.7 to 1.2	
Highest education						0.484
Bachelor's degree	8,799	3.5	1	1		
MS degree or higher	940	4.8	1.4	1.1	0.8 to 1.7	
Receive a scholarship						0.210
No	2,240	2.9	1	1		
Yes	7,465	3.8	1.3	1.2	0.9 to 1.7	
Working experienced						0.046
Lower or equal 3 years	1,232	1.2	1	1		
More than 3 years	7,116	3.9	3.3	1.9	1.0 to 3.4	
Relatives have been infected						< 0.001
No	9,294	3.3	1	1		
Yes	754	6.6	2.1	2.0	1.4 to 2.8	

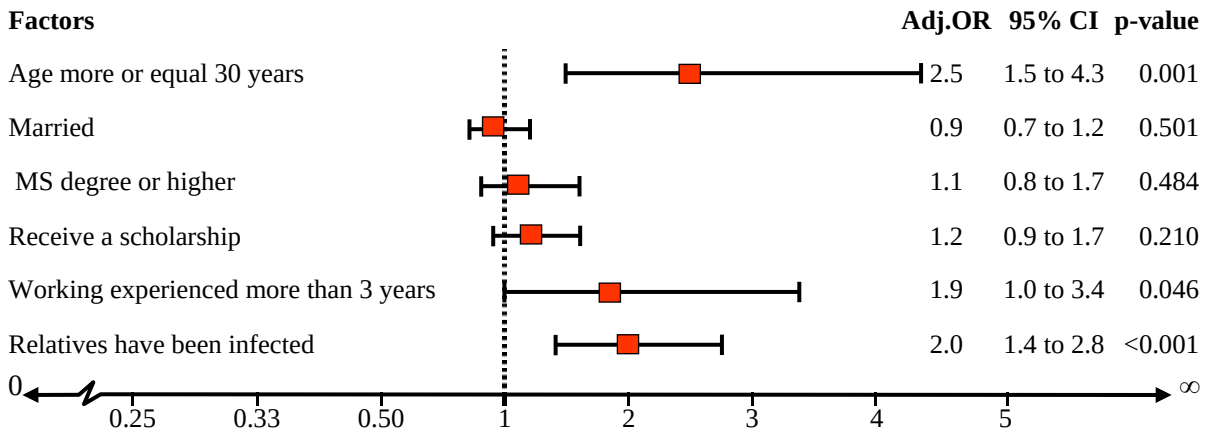

Figure 3 Factors that associate with TB, presented as odds ratio adjusted for age, marital status, education, scholarship, working experienced and relative have been TB infected

DISCUSSIONS

Prevalence of TB infection among nurses was 3.6% (357/10,048). Which is not consistent with the study of TB risk among nurses from Central Brazil (2008) found that 69.5% of 128 nurses infected TB and the study of prevalence rate of TB infection in the 91 nursing home in Puerto Rico was 42.9%, etc.[7-8] This is because the difference in the size of the sample and other studies conducted in only some areas of the country which do not cover as this study. However when considering the population of the other side, such as age, the prevalence of TB infection increases in the age group more or equal 30 years, the age of working experience more than 3 years, those who are married including who get divorced or widowed or separated as well as the groups who had higher education. For the average age of those infected with TB are 42 years and work experience is about 18 years, which is different from the study of TB among HCWs in a short working period (2005) at a teaching hospital in southeast Turkey found that the mean age of nurses was 20.6 years, and the mean working experience was 2.8 years.[13]

For the factors that associated with TB infection among nurses, the study found two first factors that were most associated include age more or equal 30 years old, and relatives have been infected (OR = 2.5; 95%CI: 1.5 to 4.3; p-value = 0.001), and (OR = 2; 95%CI: 1.4 to 2.8; p-value < 0.001), respectively. This were consistent with the study risk of *Mycobacterium tuberculosis* infection and disease among HCW, Chiang Rai, Thailand found factors that associated with positive tuberculin skin test were age more or equal 30 years old.[12] From the result of analysis were not controlled by other factors showed that marital status, highest education, receive a scholarship, and working experienced were associated with TB, but when adjusted for all other factors, the result found that these factors were not associated with TB.

However, the prevalence of TB infection among nurses in this study made it possible to image health problems that cannot be ignored. Infection in nursing career affect the image and belief that the person using the service a lot. The service nurse is a profession that is highly dependent on patient needs. Most of the time was spent in the nursing care of patients including consulting health and how to prevent diseases. Therefore, surveillance and prevent such incidents as important measures to be implemented to achieve a substantial reduction in the prevalence of infection among nurses until the end to be eradicated.

Strength of the study

This study was conducted in a large population across the country with a variety of cultural, well-being and environmental which can be a good representation of the population will be able to study and reference.

Limitation of the study

This study has several limitations. Firstly, study result from a large number of samples may be varying in terms of statistics. Second, the study sample, only one group is a group of professional nurses, which are not covered in other professional groups. Third, the data from the study were derived from self-administered questionnaire, which if interpreted the wrong question to answer certain questions that will lead to results that are inaccurate. Fourth, TB infection was reported by nurses who respondents without medical diagnosis confirmed, which could cause under estimate due to the fact some people do not dare to report or not to disclose such results. Finally, because the study was cross-sectional, which cannot identify the causal factors and cannot order that either before or after the data can only be described by the relationship.

Conclusions

Prevalence of TB infection is high in service nurses whose relatives have been TB infected, highest education, and age more or equal 30 years old found that high age and relatives have been TB infected groups were associated with TB infection among nurses. However, this study shows that TB infection rates remain high and remains a health problem that needs to be burned. Especially, in medical personals who closes to patients.

Recommendations

This study was conducted in only one nursing group, which may not be referred to other populations across the country with a wide diversity of professional education, income, etc. For the forward education should focus on specific disease in a population with diverse demographic characteristics to be compared with this study. However, the results from this study can be used as a guideline in conducting the upcoming events in the future.

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