FACTORS ASSOCIATED WITH DRUG-RESISTANT TUBERCULOSIS OF TUBERCULOSIS PATIENTS IN PRISONS IN THAILAND

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FACTORS ASSOCIATED WITH DRUG - RESISTANT TUBERCULOSIS OF TUBERCULOSIS PATIENTS IN PRISONS IN THAILAND

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ABSTRACT

This retrospective cohort study aimed to determine prevalence of drug-resistant tuberculosis in prisons and to examine risk factors associated with drug-resistant tuberculosis in prisoners.

The subjects were pulmonary tuberculosis (TB) patients who were registered from 1 Jan 2008 to 31 Dec 2010 in 10 prisons of Thailand. A total of 1332 TB patients were registered, of which 493(37%) had sputum culture testing. Of 347 new TB cases, 461(93.5%) had culture and DST performed. Prevalence of resistance to one or more drugs among new and previously treated was 21.6% (75/347) and 33.3% (38/114), respectively. It was found that prevalence of MDR-TB among new and previously treated were 4.32% (15/347) and 24.56% (28/114), respectively. The history of previous treatment was the only factor that was associated with drug resistant tuberculosis and MDR-TB.

The researcher recommended that the National Health Security Office Thailand (NHSO) should support the program of culture and DST for all TB patients in prison. Early detection and management of MDR-TB can prevent the transmission in prisons. The National Tuberculosis Program Thailand (NTP) and Department of Correction must seriously implement interventions to prevent MDR-TB outbreak. The interventions include capacity building of prison nurses to handle any MDR-TB cases, and provide effective care, as well as provision of access to culture & DST for all prisoners with TB.

KEY WORDS: DRUG-RESISTANT TUBERCULOSIS / MDR-TB / PRISON / PRISONER

54 pages

ปัจจัยที่มีความสัมพันธ์กับการดื้อต่อยารักษาวัณโรคของผู้ป่วยวัณโรคในเรือนจำในประเทศไทย
FACTORS ASSOCIATED WITH DRUG-RESISTANT TUBERCULOSIS OF TUBERCULOSIS PATIENTS IN PRISONS IN THAILAND

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บทคัดย่อ

การศึกษานี้เป็นการศึกษาแบบ Retrospective cohort มีวัตถุประสงค์เพื่อศึกษาความชุกของวัณโรคดื้อยาและปัจจัยเสี่ยงต่อการดื้อยาวัณโรคของผู้ป่วยวัณโรคในเรือนจำ 10 แห่งใน 4 ภาคของประเทศไทย

ผลการศึกษาพบว่ามีผู้ป่วยวัณโรคที่ขึ้นทะเบียนตั้งแต่วันที่ 1 มกราคม 2551 ถึง วันที่ 31 ธันวาคม 2553 มีทั้งหมด 1332คน ผู้ป่วยที่ได้รับการทดสอบเพาะเลี้ยงเชื้อวัณโรคจำนวน 493คน ผู้ป่วยที่มีผลการทดสอบติดเชื้อวัณโรคและได้รับการทดสอบความไวต่อยารักษาวัณโรคจำนวน 461 คน โดยเป็นผู้ป่วยวัณโรครายใหม่จำนวน 347 คน ผู้ป่วยที่เคยรักษาวัณโรคมาก่อนจำนวน 114 คน ความชุกของการดื้อต่อยารักษาวัณโรคที่ดื้อต่อยาอย่างน้อย 1 ขนานในกลุ่มผู้ป่วยวัณโรครายใหม่คิดเป็นร้อยละ 21.6(75/347) ของผู้ป่วยวัณโรครายใหม่ทั้งหมด และร้อยละ 33.3 (38/114)ของผู้ป่วยทั้งหมดที่เคยรักษาวัณโรคมาก่อน สำหรับความชุกของวัณโรคดื้อยาหลายขนานในกลุ่มผู้ป่วยวัณโรครายใหม่คิดเป็นร้อยละ 4.32(15/347) ของผู้ป่วยวัณโรครายใหม่ทั้งหมด และร้อยละ 24.56 (28/114) ของผู้ป่วยทั้งหมดที่เคยรักษาวัณโรคมาก่อน ปัจจัยเสี่ยงต่อการดื้อต่อยารักษาวัณโรคอย่างน้อย 1 ขนาน และ วัณโรคดื้อยามีเพียงปัจจัยเดียวคือ ประวัติเคยรับการรักษาวัณโรคมาก่อน

ผลการศึกษานี้พบอัตราการตรวจเพาะเชื้อและการทดสอบความไวต่อยาต่ำ ส่วนความชุกของวัณโรคดื้อยาหลายขนานมีอัตราสูง ดังนั้นจึงแนวทางนโยบายและการปฏิบัติงานดังนี้

1. สำนักงานหลักประกันสุขภาพแห่งชาติควรให้ผู้ป่วยวัณโรคในเรือนจำทุกคนได้รับสิทธิ์การตรวจเพาะเลี้ยงเชื้อและทดสอบความไวต่อยา เพราะอาจจะมีผู้ต้องขังที่แพร่กระจายเชื้อวัณโรคดื้อยาหลายขนานในเรือนจำ

2. สภาพความเป็นอยู่ที่แออัดของผู้ต้องอาจจะทำให้มีการระบาดของเชื้อวัณโรคดื้อยาหลายขนานได้ ดังนั้นการป้องกันไม่ให้ผู้ต้องขังวัณโรคดื้อยาหลายขนานอยู่รวมกับผู้ต้องอื่นจะสามารถป้องกันการแพร่กระจายเชื้อได้

สำนักวัณโรคและกรมราชทัณฑ์ควรดำเนินงานอย่างจริงจังเพื่อป้องกันการแพร่ระบาดของเชื้อวัณโรคและวัณโรคดื้อยาหลายขนาน โดย การเสริมสร้างศักยภาพของพยาบาลเรือนจำในการจัดการดูแลผู้ป่วยวัณโรคดื้อยา และการสนับสนุนให้ผู้ป่วยวัณโรคในเรือนจำทุกคนให้เข้าถึงการวินิจฉัยวัณโรคโดยการเพาะเลี้ยงเชื้อและทดสอบความไวต่อยา

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CHAPTER I
INTRODUCTION

1.1 Rational and background

TB (TB) is a serious and contagious disease which once had been a leading cause of death in many countries all over the world. The World Health Organization (WHO) estimates the global burden of disease caused by TB in 2009 as 9.4 million incident cases, 14 million prevalent cases, and 1.3 million deaths among HIV-negative people and 0.38 million deaths among HIV-positive people[1]. The number of TB patients has become increasing again after the arrival of Acquire Immune Deficiency Syndrome (AIDS).

TB is epidemic in prisons, because of specific characteristics of prisoner and environment including drug addictions, unhealthy habits and unhealthy conditions. These factors promote the transmission of the agent from affected person to others. Trends of TB in prison had increased especially among those with disseminated of AIDS who were smear positive[2]. The incidence of TB in prison is higher than in general populations approximately 8 to 20 times[3]. A study in Spain reported an incidence of 45/100,000 in general population and 639/100,000 in prisoner [4]. In Russia, the incidence of TB in general population was 71.6 /100,000 and 1,649.9/100,000 in prisoner[5]. The main risk factors of TB in prisons include exposure to TB patients, previous imprisonment, longer duration of stay in prison and low body mass index (less than 18.5 kg/m^2) [6]. A study of drug- resistant TB in Bangladesh reported that the prevalence of sputum smear-positive pulmonary TB in a prison in Bangladesh was 2,227 per 100,000 population. The patients were resistant to isoniazid 11.4%, rifampicin 0.8%, streptomycin 22.4%, and ethambutol 6.5% [6]. In Russia, the prevalence of multidrug-resistant TB (MDR-TB) was 37.3% in all new prison cases and factors associated with the resistance included previous TB treatment for more than 4 weeks, and smoking(for isoniazid resistance)[7].

In Thailand, the incidence of TB was 94 per 100,000person in 2005[8]. Previous studies in Thailand reported that the prevalence of TB in prisons were 568/100,000 population and 354.8/100,000 population in 1997 and 2005, respectivel[9, 10]. Factors of the frequency of prior prison admissions, previous TB treatment, the duration of incarceration and density of the prison population have been identified as independent risk factors for *M.TB* infection among inmates. Isoniazid (INH) was the most common resistant drug, Another study showed resistance to at least one drug was 50.6% while multidrug-resistant TB (MDR-TB) was 19.5% [11].

In Thailand, the TB patients who needed to be investigated for drug resistance include:

i RE Retreatment patients:
- Patients who previously treated for TB.
-Patients who have returned to treatment TB after default with smear positive.
- Patients with chronic pulmonary TB

ii ON On treatment patients: Patients who are treated with medication of CAT 1 or CAT 2 at the end of intensive phase (end of the second or third month) or end of the fifth month but smear positive.

iii PRE Pre-treatment are new TB patients with any condition.
- TB patients with HIV positive.
- TB patients with a history of drug resistance.
- TB patients in the prison.
- TB patients in the migrants.
- Diabetic patients with larger ulcer cavity.

From Re-On-Pre criteria, it shows that all TB patients in prison are eligible for sputum culture & Drug Susceptibility Test (DST)[12].

It is evident that identifying risk factors of drug resistant TB in prison is crucial. There is inconclusive information on the relationship between HIV infection and drug resistant TB as well as limited current evidence on drug resistant TB in prisons in Thailand. Understanding the situation of drug-resistant TB in prison will be

useful to both policy makers and practitioners to improve the TB management and control for prisoners and related population.

1.2 Objectives

1. To determine prevalence of drug-resistant TB in prisons in Thailand from 1 Jan 2008 to 31 Dec 2010.

2. To examine risk factors associated with drug-resistant TB in prisoners.

1.3 Research hypotheses

1. HIV status is associated with drug-resistant TB.
2. Age is associated with drug-resistant TB.
3. Gender is associated with drug-resistant TB.
4. Thai nationality is associated with drug-resistant TB.
5. History of previous treatment is associated with drug resistant TB.
6. Smear grading is associated with drug-resistance TB.
7. Level of CD4 among HIV infected patients is associated with drug-resistant TB.
8. ARV treatment is associated with drug-resistant TB.

1.4 Variable of the research

1. Independent variables
    - 1.1 Age
    - 1.2 Gender
    - 1.3 Thai nationality
    - 1.4 History of previous treatment
    - 1.5 Smear grading
    - 1.6 HIV status
    - 1.7 Level of CD4

1.8 ARV treatment

2. Dependent variable

2.1 Drug-resistant TB

1.5 Operational definitions

1. Prison: Correctional institution, a large building where people are kept as a punishment after being found guilty of a crime or while waiting to be trialed[13].

2. Prisoner: A person kept in a prison for a crime or while waiting to be trialed[14].

3. Case definitions of TB: The TB case definitions below are based on the level of certainty of the diagnosis and on whether or not laboratory confirmation is available[15].

3.1 TB suspect: Any person who presents with symptoms or signs suggestive of TB. The most common symptom of pulmonary TB is a productive cough for more than 2 weeks, which may be accompanied by other respiratory symptoms (shortness of breath, chest pains, haemoptysis) and/or constitutional symptoms (loss of appetite, weight loss, fever, night sweats and fatigue).

3.2 Case of TB: A definite case of TB (define TB suspect) or one in which a health worker (clinician or other medical practitioner) has diagnosed TB and has decided to treat the patients with a full course of TB treatment.

4. Anatomical site of TB disease: Defining the site is important for recording and reporting purpose identify the more infectious patients[15].

4.1 Pulmonary TB (PTB): A case of TB involving the lung parenchyma. Miliary TB is classified as pulmonary TB because there are lesions in the lungs. TB intrathoracic lymphadenopathy (mediastinal and/or hilar) or tuberculous pleural effusion, without radiographic abnormalities in the lungs, constitutes a case of extrapulmonary TB. A patient with both pulmonary and extrapulmonary TB should be classified as a case of pulmonary TB.

4.2 Extrapulmonary TB (EPTB): A case of TB involving organs other than the lungs, e.g. pleura, lymphnodes, abdomen, genitourinary tract, skin, joints and bones. Diagnosis should be based on at least one specimen with

confirmed *M. TB* or histological or strong clinical evidence consistent with active EPTB, followed by decision from a clinician to treat with a full course of TB chemotherapy. The case definition of an EPTB case with several sites affected depends on the site representing the most severe form of disease.

5. History of previous treatment: The patients were classified as follows[16]:

5.1 Relapse: A patient previously treated for TB has been declared cured or treatment completed, and is diagnosed with bacteriologically positive (smear or culture).

5.2 Treatment after failure: A patient who is started on a re-treatment regimen after having failed previous treatment.

5.3 Treatment after default: A patient who has returned to treatment, positive bacteriological, following interruption of treatment for 2 months or more.

6. Smear grading: Grading of the sputum smear is categorized according to the following criteria. [17]

Number of AFB	**Result**	**Grading**	**No. of fields examined**
More than 10 AFB per oil immersion field	Positive	3+	20
1-10 AFB per oil immersion field	Positive	2+	50
10-99 AFB in 100 oil immersion fields	Positive	1+	100
1-9 AFB in 100 oil immersion fields	Scanty	Record actual number	100
No AFB in 100 oil immersion fields	Negative	0	100

(**Reference:** The public Health Service Nation TB Reference Laboratory and the National Laboratory Network. IUATLD 1998, ISBN 2-9504238-7-6)

7. Type of patients: The patients were classified as follows[15]

7.1 New: A patient who has never had treatment for TB or who has taken antiTB drugs for less than 1 month.

7.2 Relapse: A patient previously treated for TB has been declared cured or treatment completed, and has been diagnosed with bacteriologically positive (smear or culture).

7.3 Treatment after failure: A patient who has started on a re-treatment regimen after having failed previous treatment.

7.4 Treatment after default: A patient who has returned to treatment, positive bacteriologically, following interruption of treatment for 2 months or more.

7.5 Transfer in: A patient who has been transferred from another TB register to continue treatment.

7.6 Other: All cases who do not fit the above definitions including chronic case, a patient who has sputum-positive at the end of re-treatment regimen.

8. HIV infection: detection of HIV infection can be carried out by any of the following test[18]

8.1 Antibodies to HIV

8.2 P24 HIV antigen

8.3 HIV nucleic acid (RNA/DNA)

8.4 Human Immunodeficiency Virus in clinical samples

The most commonly used test for the diagnosis of HIV infection is by serological tests detecting anti-HIV antibodies (13).

9. CD 4 Testing: A measure of the number of "helper" T cells that carry the CD4 glycoprotein on their cell surface and that help B cells produce certain antibodies. The human immunodeficiency virus (HIV) binds to CD4 and kills T cells bearing this glycoprotein. Thus, the CD4 cell count is an indicator of the progress of an HIV infection and helps measure the effectiveness of anti-HIV drugs. CD4 T cells mainly produce interleukin 2, an autocrine and paracrine T cell growth factor preactivated or memory CD4 T cells secrete a much larger array of lymphokines on restimulation[18].

10. ARV treatment: ARV is a primary medication for the treatment of HIV infection. When several such drugs, typically three or four, are taken in combination, the approach is known as Highly Active Antiretroviral Therapy. Bureau of AIDS TB and STIs (sexual transmitted infections), Ministry of Public Health recommend offering antiretroviral treatment to all patients with AIDS. Because of the complexity of selecting and following a regimen, the severity of the side effects and the importance of compliance to prevent viral resistance, however, such organizations emphasize the importance of involving patients in therapy choices, and recommend analyzing the risks and the potential benefits to patients with low viral loads[18].

11. Culture Test: A microbiological culture of sputum to diagnose TB. The spread of disease is a possible result of conventional culture techniques, which take 4 to 6 weeks. Newer or more rapid techniques include the BACTEC method, which uses a substrate labeled with radioactive carbon polymerase chain reaction culture methods, which use genetic DNA probes to detect *Mycobacterium TB* and a sputum smear for acid-fast bacillus[17].

12. Drug Susceptibility Test (DST): Testing of M. TB isolates to determine the susceptibility of the bacteria of first-line anti-TB drugs is an established practice for the surveillance of drug resistance. It should also be considered for investigation of patients failing standard first-line drug regimens[17].

13. Regimen of Treatment: TB treatment category has associated standard treatment regimens, giving in treatment is based on 5 essential first-line drugs, isoniazid (H), rifampicin(R), pyrazinamide(Z), streptomycin(S) and ethambutal(E)[13].

TB treatment category	Patient case classification	Alternative TB treatment regimes	
		Initial phase (daily or 3 times per week)	Continuation phase
I	-Smear positive New case Or:Severely ill New smear negative or Extra pulmonary case	2EHRZ(SHRZ)	6HE or HR or 4 HR3
II	-Smear positive Retreatment case -Relapse -Failure -Return after default Or:Severely ill smear negative or extra pulmonary retreatment case	2SHRZE/1HRZE	5H3R3E3 or 5HRE
III	-Smear negative pulmonary TB -Extra pulmonary TB	2HRZ	6HE or 4HR or 4H3R3
IV	-Chronic cases	Refer to specialist treatment centre (or DOTS-Plus project) if available. If not, provide counseling, palliative treatment and place in respiratory isolation.	

14. Drug resistance: Drug-resistant TB is confirmed through laboratory test showing that the infecting isolates of *Mycobacterium TB* grow in vitro in the presence of one or more anti-TB drugs [16].

15. Multidrug-resistant TB (MDR-TB): MDR-TB case is defined as a patient infected with a strain that is resistant to at least isoniazid and rifampicin [16].

16. Extensively drug-resistant TB (XDR-TB): XDR-TB is one that is resistant to isoniazid, rifampicin, plus any fluoroquinolone, and at least one of three injectable second line medicines (amikacin, kanamycin, or capreomycin) [16].

17. Treatment Outcome: The evaluation and reporting of treatment outcomes were define[15].

17.1 Cure: A patient who was smear-positive at the start of treatment and is smear-negative in the last month of complete treatment and on at least one previous occasion.

17.2 Complete: A patient who has completed treatment but who does not meet the criteria to be classified as cured or failed.

17.3 Failure: A patient who smear positive at 5 months or later, during treatment.

17.4 Died: A patient who dies for any reason during the course of treatment.

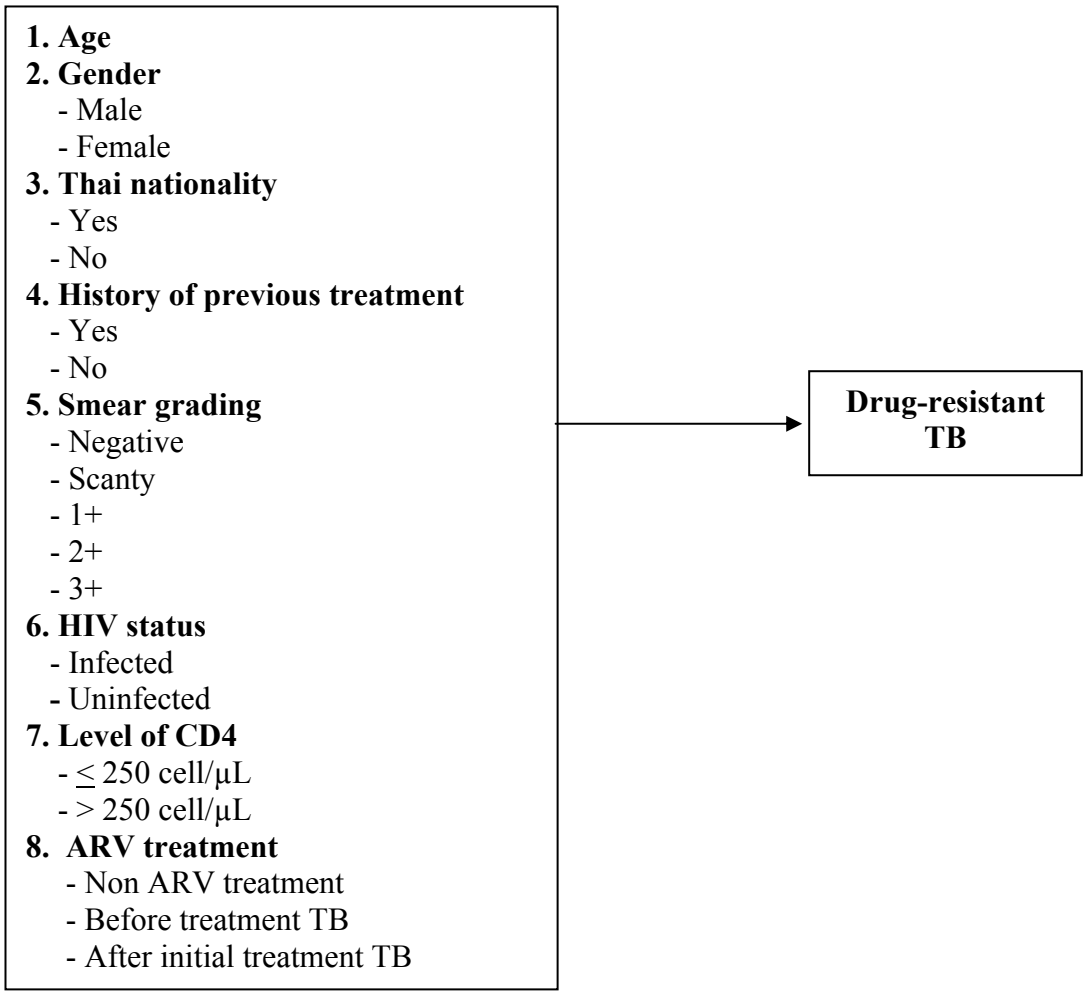
17.5 Default: A patient whose treatment was interrupted for 2 consecutive months or more.

17.6 Transfer out: A patient who is transferred to another reporting unit and for whom the treatment outcome is not known.

18. Success rates: Rate of new smear-positive TB cases registered in a given year that successfully completed treatment, whether with or without bacteriological evidence of success (“cured” or “treatment completed” respectively) [15].

19. Failure rates: Rates of patients of treatment will be considered to have failed if two or more of the five smears recorded in the final 12 months of therapy are positive, or if any one of the final three cultures is positive. (Treatment will also be considered to have failed if a clinical decision has been made to terminate treatment early because of poor clinical or radiological response or adverse events[19].

1.6 Conceptual framwork



CHAPTER II
LITERATURE REVIEW

Reviewing of the literature consists of 4 parts as follows:

2.1 The Prison Population

2.2 TB in prison

2.3 TB control program in prison of Thailand

2.4 The relevant research studies

2.1 The Prison Population

2.1.1 The Global Prison Population

The world's prison population is increasing by varying rates among countries based on socioeconomic and political (including war) factors. The estimated number of people detained on any given day, worldwide, is over 9 million [20]. These data include primarily prisoners who are serving their sentences but also include people detained in police station, remand center (under investigation or on trial), centers of war camps. The turnover of prisoners (anyone under custody of the state) is high. On any given day, four to six times the estimated 9 million incarcerated persons pass through prisons.In Thailand, a total of 224,864 prisoners were in 141 prisons in 2011.

2.1.2 Prisoners Demographics

Prisoners do not represent a homogenous segment of society. Many have lived on the margins of society, are poorly educated, and come from socioeconomically disadvantage groups. Most of them are young (15-44 years) and are male. In Thailand 86% of total prisoners were male.

Offenders commonly live in unhealthy setting and do not have the means to, or the habit of, keeping themselves healthy. They may have unhealthy habits or addictions, such as alcoholism, smoking, and drug use, which contribute to their poor health and are risk factors for developing TB as well. For these reasons, they may

enter prison with some illnesses or with a higher risk of becoming ill compared to general population.

2.1.3 Health Care Delivery in Prison

The ministry responsible for the prison system varies from country to country. It may be responsible by the Ministry of Justice (MOJ), the Ministry of Interior (MOI), and The Ministry of Security. In general, health services in prisons are organized vertically and independently by the Ministry of Health (MOH). In some settings, prison health staffs are hired by the penitentiary services. The tendency to shift the responsibility of prisons from MOI to the MOJ has been implemented in several countries in the past 20 years; however, prison health care services usually are organized by the MOH[21].

2.2 TB (TB) in prisons

2.2.1 The Burden of TB in prison

Prisons are not mere static venues holding large populations. They represent dynamic communities where at-risk groups congregate in a setting that exacerbates disease and its transmission, including TB. Prevalence rates of TB in prisons usually exceed prevalence rates in the specific country substantially. TB rates of over 3,000 per 100,000, as compared to general population, are not unusual. TB case fatality in prisoners has been reported high in many settings. For example, published data from Azerbaijan indicates of 24% case fatality rate[20]. Any prison sentence served in a prison that has such a high TB incidence, prevalence, and mortality rate may, in fact, become a death sentence.

2.2.2 Drug Resistant TB in prisons

Resistance to isoniazid and rifampicin, the two strongest bactericidal anti-TB agent, precludes use of the most potent standard TB regimens and disallows the use of short course therapy contained in the DOTS strategy. MDR-TB, which is defined by resistance to at least isoniazid and rifampicin at the same time, is difficult to treat and can occur with or without resistance to other medicines. According to the WHO, approximately 500,000 cases of MDR-TB emerge every year. The number of MDR-TB case in prison is often proportionally higher than that found in the general

population of a given country. Drug resistant TB reflects problems with either patient management or program management.

Multidrug-resistant TB is much less likely to respond to the “first line” drugs used in DOTS. Successful treatment for such case has been reported with “second line”drugs, but this treatment is very expensive, complicated and prolong. Therefore, it is extremely important to prevent the further development of MDR-TB by the widespread application of DOTS and other measure such as health education, strengthened case-finding and respiratory isolation of infectious drug-resistant case.

Where MDR-TB has become established, factors that led to its creation must be addressed as matter of urgency. It must be noted that merely providing new drugs will not tackle the underlying causes. If these factors persist, acquired resistance to second-line drugs will be generated, creating a genuinely untreatable global threat.

Unfortunately, some prisons’ programmes have reported very high level of drug resistant TB.

MDR-TB may be more common in prison setting as factors that encourage transmission of regular TB will enhance the spread of MDR-TB. In addition, various prison aspects may particularly enhance the development of MDR-TB. These include:

* Failure to complete supervised treatment courses through repeated inter-prison transfer where treatment when completion is not assured

* Release during treatment when TB services are not accessible, associated with recidivism, so bringing drug-resistant TB back into the prison environment

These factors must be addressed as a priority to prevent the development of drug-resistant TB. This is even more the case in prisons where MDR-TB has become established and specific treatment programmes are considered with “second-line” anti-TB drugs.

2.3 TB control program in prison of Thailand

TB control in prisons has been operating continuously. In 2011, Thailand has implemented TB control program in prisons with collaboration among Department of Communicable Disease Control (DDC), Ministry of Public Health (MOPH) and Department of Correction (DOC), and Ministry of Justice (MOJ). According to the national TB program data, there were 1,632 prisoners who were new smear positive TB patients in 2008[21].

Principles of TB control in prisons

The activities of TB control in prison are as follows:

1. Finding case of TB in prison.
2. Treating TB patients in prison.
3. Preventing and controlling of the spread of TB in prison.
4. Record and report of TB patient to TB program in the unit.
5. Supervision and monitoring operating TB in prison.

TB control in prison is an important policy to prevent prisoners and prison staff from TB infection. .

Policy goals

In 2001, the MOPH and MOJ collaboration established a policy on TB control that the treatment success rate for TB must equal or greater than 85 %.

Approach implementation in accordance with policy

Ministry of public Health and Ministry of Justice have cooperated in controlling TB in prisons, with the following approaches.

1. Supporting services for TB control

1.1 Case finding for TB patient in prison. This approach includes TB symptom screening for all new comers is entry and for all existing prisoner. Annual prisoners with TB symptoms would be investigated.

1.2 Providing care for TB treating patients according to the standard of the country which is consistent with international according to the guidelines, international standard for TB care.

The diagnosis TB Patients in prisons have been diagnosed according to the standard of the country, especially, the diagnosis of pulmonary TB by sputum microscope.

The treatment TB Patients in prisons have been treated according to the standard and along with the evaluation of drug-resistant TB.

1.3 Providing system to monitoring prisoners have been treated continuously until the end of treatment.Coordination The Provincial Health Office and prison staff is in place in providing care patients and support to prisoners before the treatment of TB until completion.

1.4 Performance activities TB/HIV in prison. The Provincial Health Office encouraged to the diagnosis HIV treatment for TB patient. TB patient with HIV receive antiretroviral treatment in accordance with standard of the country which Regulation to prevent the death of a patient during treatment.

1.5 Providing treatment patients with TB without health care coverage (ID number 13 digits) to be treatment according to human rights. Hospital Coordinates social work unit to help and advise in the diagnosis and treatment To TB patients in prisons that do not have national health insurance or without ID number 13 digits which regard to human rights.

1.6 Empowerment of the prison healthcare team in providing care for TB patients according to the standard of the country.

Provincial Health Office supervise performance TB in prisons which providing training of prison health care staff and Prison health teams to join the activities of the Provincial Public Health Office TB.

2. Management for TB control

2.1 Strategy for control the TB in prisons.

Prison officers had knowledge of TB and could transfer the inmates in the prison for creating awareness of TB control.

2.2 Empowerment prison officers to participate in TB control.

Prison officers and the prison nurses cooperate in the following activities.

1) Finding the case of TB in the new prisoner.
2) Treating TB patients by directly observed treatment (DOT).
3) Isolating the TB patients.
4) Supporting health promotion in patients with TB ; such as providing high protein foods and suspending vocational training to reduce the spread of infection.

2.3 Arrangements essential to control the spread TB infection include

1) The separate room accounted for control infections TB patients.

2) Ventilation control in prisons according to standard of country which have adequate ventilation window, ventilators and have sunlight shining through in the room.

2.4 The transfer of TB among prisoners in the treatment only if necessary.

2.4 The relevant research studies

2.4.1 The prevalence of drug-resistant TB

V. Panyanandana et al[22] reported that TB among prison inmate population, Thailand: A survey of TB burden, factors associated with development of disease, and effectiveness of supervised intermittent regimens, the prevalence of drug resistance to one or more drugs and MDR-TB was 31.5% and 6% respectively but the study of **W. Pleumpanupat et al[11]** examined resistance to anti-TB drugs among smear-positive cases in Thai prisons 2 year after the implementation of the DOTS strategy, was increased from previous study. The prevalence of drug resistance to one or more drugs was 50.6% and MDR-TB was 19.5 %.

2.4.2 Age

Michelle E Kruijshaar et al[23] reported in anti-TB drug resistance in the United Kingdom, the younger age was association with anti-TB drug resistance that the same as **Jeffery P Taylor et al[24]** reported in identified prevalence and risk factors of drug resistant TB along the Mexico-Texas Border, the being of age 20 to 39 years were risk factors of drug resistance among new patients.

I Suarez-Garcia et al[25] found that TB patients in age groups 45-64 years were at high risk of MDR-TB in TB unit in Madrid, Spain. Similary, the study of **A Faustini et al**[26], systematic review risk factors for multidrug resistant TB in Europe, showed that age younger than 45 years were not related to MDR-TB. But the study of **Somsak Akksilp et al** [27], MDR-TB and HIV in Thailand is overlapping

showed the age 18-29 years associated with MDR-TB the same as study of **Jeffery P Taylor et al[24],** found that the age of 19 years or younger among patients with history of previous treatment was associated with MDR-TB.

2.4.3 Gender

Jeffery P Taylor et al[24] reported the prevalence and risk factors of drug- resistant TB along the Mexico-Texas Border, female sex among new patient was risk factors for drug resistant TB.

Somsak Akksilp et al[27] reported in Multidrug Resistant TB and HIV in Thailand is Overlapping, but not independently associated risk factors. Male sex was risk factor for MDR-TB.

2.4.4 Nationality

Jeffery P Taylor et al[24] reported the prevalence and risk factors of drug resistant TB along the Mexico-Texas Border, foreign birth among new patient was risk factors for drug resistant TB.

2.4.5 History of previous treatment

Michelle E Kruijshaar et al[23] reported in increasing antiTB drug resistance in the United Kingdom, the patient with previously TB treatment was resistance to all drugs. The same as study of **M Ruddy et al**[7], rates of drug resistance and risk factor analysis in civilian and prison patients with TB in Samara Region and **W. Pleumpanupat et al[11]** examined resistance to anti-TB drugs among smear-positive cases in Thai prisons 2 year after the implementation of the DOTS strategy, the previously TB treatment associated with drug resistance TB.

I Suarez-Garcia et al[25] factors for multidrug-resistant TB in a TB unit in Madrid, Spain and **A Faustini et al**[26] study Risk factors for multidrug resistant TB in Europe, found that the previously TB treatment was a risk factor for MDR-TB.

Kai Kliiman and Alan Altraja[28] Predictors of extensively drug-resistant pulmonary TB found that the previously TB treatment is a common risk factor for extensively drug resistant and multi drug resistant.

2.4.6 Smear grading

Sanjay Raipal et al[29] reported on sputum grading as predictor of treatment outcome in pulmonary TB a retrospective analysis of newly diagnosed sputum positive patients registered to assess the importance of initial sputum grading

as a predictor of treatment outcome. The analysis revealed that a longer proportion of previous untreated sputum positive patients with 3+ grading required extension of the intensive phase and had a more unfavorable treatment outcome in the form of treatment failures and deaths than among those with a lower grading.

2.4.7 HIV status

Catharina Hendrika Haar et al[30] explored TB drug resistance and HIV infection, the Netherlands found that among new TB patients in the Netherlands found that multidrug resistance are associated with HIV infection.

Kai Kliiman and Alan Altraja[28] reported on predictors of extensively drug-resistant pulmonary TB, HIV infection was risk factor for extensively drug resistance.

CHAPTER III
MATERIAL AND METHOD

3.1 Research design

The study design is a retrospective cohort study.

3.2 Population and study sample

The selection criteria of study site;

1. Houses prisoners incarcerated for 15 – 30 years; the prison central hospital, which has 80 beds for admitting severe TB patients, is located in the same area.

2. Maximum security prison designed for prisoners with sentence of over 30 years, life sentence, or who are awaiting execution.

3. Contains only those prisoners who are drug addicts or who have broken narcotics laws.

Study site: Prisoners in 10 prisons coverage 4 regions in Thailand.

1. Medical of correctional institutions.
2. Bangkwang central prison
3. Klongphai central prison
4. Chiangmai central prison
5. Suratthani central prison
6. Nakhonsi thammarat central prison
7. Chacherngsao central prison
8. Minburi especial prison
9. Songkla prison treatment
10. Udornthani central prison

The reasons of researcher was selected 10 prisons in the study were

1. The high density of prisoners and poor ventilation which has resulted to infection of TB and drug resistant TB.

2. The patients are consent for HIV testing to high over 90 percents of all TB patient.

Inclusion criteria

1. Prisoner with pulmonary TB who was diagnosed by sputum microscopy or sputum culture.

2. Prisoners with TB and DST results.

Exclusion criteria

1. Prisoner with extra pulmonary.

2. Prisoner with negative culture.

3. Prisoner without availability of results.

3.3 Laboratory

Laboratory personnel at each prison identified study subjects whose sputum specimens were sent to the prison laboratory for diagnosis by direct microscopy and for whom at least one sputum smear was found to be positive for acid-fact bacilli (AFB). All sputum smear positive specimens were examined for culture and for drug susceptibility testing at laboratory as follows

Prison	Hospital treating TB patients	Laboratory of Culture Testing	Laboratory of DST Testing
1. Medical of correctional institutions	Medical of correctional institutions	TB Chest Disease and Critical care	TB Chest Disease and Critical care
2.Bangkwang central prison	Pranangklao Hopital	Bamrasnaradura Infectious Disease Institute	Bamrasnaradura Infectious Disease Institute
3.Klongphai central prison	Sikhiu Hospital	Office of Disease Prevention and Control Region 5, Nakhonratchasima	Office of Disease Prevention and Control Region 5, Nakhonratchasima
4.Chiangmai central	Nakornping Hospital	Office of Disease	Office of Disease

Prison	Hospital treating TB patients	Laboratory of Culture Testing	Laboratory of DST Testing
prison		Prevention and Control Region 10, Chiangmai	Prevention and Control Region 10, Chiangmai
5.Suratthani central prison	Suratthani Hospital	TB Chest Disease and Critical care	TB Chest Disease and Critical care
6.Nakhonsi thammarat central prison	Nakhonsi thammarat Hospital	TB Chest Disease and Critical care	TB Chest Disease and Critical care
7.Chacherngsao central prison	Chacherngsao Hospital	Office of Disease Prevention and Control Region 3, Chonburi	Office of Disease Prevention and Control Region 3, Chonburi
8. Minburi especial prison	Medical of correctional institutions	TB Chest Disease and Critical care	TB Chest Disease and Critical care
9.Songkla prison treatment	Songkla Hospital	Bureau of TB	Bureau of TB
10.Udornthani central prison	Udornthani Hospital	Office of Disease Prevention and Control Region 6, Khonkaen	Office of Disease Prevention and Control Region 6, Khonkaen

3.4 Sample size estimation

$$n_1 = \frac{[Z_{\alpha/2}\sqrt{(1+1/k)\,\pi(1-\pi)} + Z_{\beta}\sqrt{\pi_1(1-\pi_1) + \{\pi_2(1-\pi_2)/k\}}]^2}{(\pi_1 - \pi_2)^2}$$

Where n = estimated sample size

α =0.05

β = 0.10

$Z_{\alpha/2}$= 1.96

Z_{β} = 1.28

$\pi = \frac{\pi_1 + k\pi_2}{1+k}$

π_1 = 0.60 (rate of drug resistant TB in HIV patient)

π_2 = 0.35 (rate of drug resistant TB in non HIV patient)

$$\pi = 0.433$$

$$= \frac{[1.96\sqrt{(1 + 1/2)0.433(1 - 0.433)} + 1.28\sqrt{0.60(1 - 0.60)} + \{0.35(1 - 0.35)/2\}]^2}{(0.60 - 0.35)^2}$$

$$\approx 52.37 = 53 \text{ person}$$

The appropriate sample size for the study is 53 persons with pulmonary TB and resistance to anti-TB drug, 106 persons with pulmonary TB and non resistance to anti-TB drug.

3.5 Data collection

The researcher coordinated with the Department of Correction for approval of the data collection process. The researcher made a contact with nurses of the prisons to set a period of data collection.

Researcher collected data by using case record form certified by Siriraj Institutional Review Board. The information included TB number, date of registered, age, gender, nationality, date of start treatment, drug of treatment, drug susceptibility test, result of drug susceptibility test, classification of patient, previous treatment, smear grading, cavitary disease, history of intravenous drug use, counseling blood test, red star, CD4 testing, number of CD 4 testing and ARV treatment. TB Registration (TB03) and treatment card (TB01) was mainly used as a source of data.

The study included data from a total of 1332 prisoners with pulmonary TB in 10 prisons who were registered since 1 January 2008 to 31 December 2010. There were 493(37%) patients who had culture test and those with culture and DST were 461(93.5%) patients of whom 347 cases were new patients and 114 were retreatment patients. There were 75 cases of new patients and 38 cases of retreatment patients who were resistant to antiTB drug. The numbers of MDR-TB cases who were new patients and retreatment patients were 15 and 38, respectively. (Figure3.1)

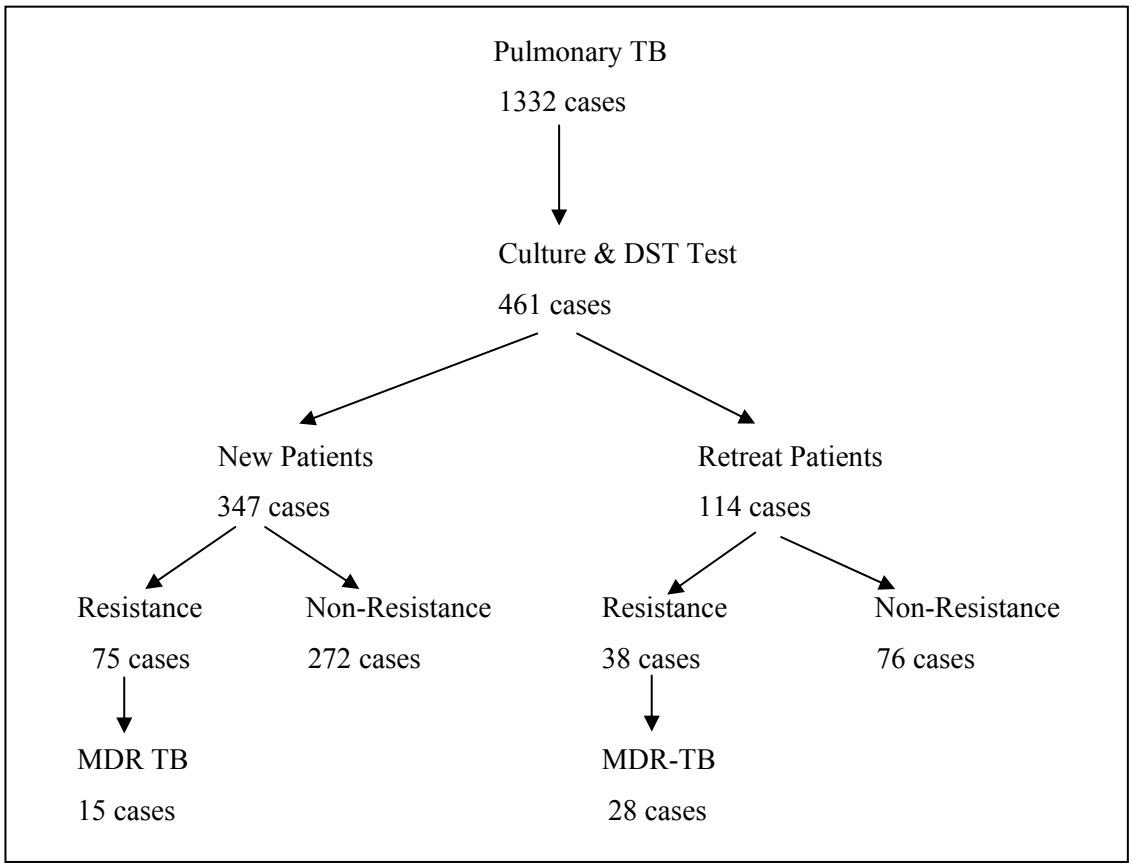


Figure 3.1 Enrollment of study samples

3.6 Protection of human subjects

This research was approved by the Research Review Committee of The Faculty of medicine, Siriraj Hospital. Confidentiality of information has been guaranteed to protect individual human subject.

3.7 Data analysis

3.7.1 Descriptive statistics

Independent variables included general characteristics such as age, gender, nationality, type of patients, smear grading, regimen of treatment, HIV status, culture test, DST test, history of previous treatment, treatment outcome, level of CD4 testing

and ARV treatment of the study subject. The data were summarized and presented as frequency distribution, percentages, means and standard deviations.

3.7.2 Inferential statistics

1. Univariate analysis

Chi-square test, odds ratio and 95 percent confidence interval of odds ratio were calculated in order to test the association of independent variables with outcome variables such as drug resistant TB and multi drug resistance TB.

2. Multivariate analysis

Multiple logistic regressions were used to examine the association between the independent variables and drug-resistant TB. Backward strategy modeling was used. The independent variable included age, gender (female as reference), nationality (non-Thai as reference), history of previous treatment (no history as reference), smear grading (negative as reference), HIV status (negative as reference), CD4 level (≥ 250 cell/µl level as reference), and ARV treatment(no as reference).

CHAPTER IV
RESULTS

The study design was a retrospective cohort study. The results of the study were presented in 5 parts as follows:

4.1 Epidemiology of pulmonary TB in prisons.

4.2 Characteristics of pulmonary TB patients in prisons.

4.3 Characteristics of subjects after excluding patients without drug susceptibility testing.

4.4 Description of pulmonary TB patients in prisons who resisted to anti-TB drugs.

4.5 Factors associated with drug-resistant TB of TB patients in prisons.

4.1 Epidemiology of pulmonary TB in prisons.

Epidemiology of pulmonary TB in prisons; The prevalence of pulmonary TB patients in prison who registered since 1 January 2008 to 31 December 2010 were 1.14% (431/29795) in 2008, 1.61% (530/32799) in 2009 and 1.10% (371/33539) in 2010. New smear positive cases were 180 in 2008(604/100,000), 228 in 2009 (695/100,000) and 166 in 2010(495/100,000). Prevalence of TB patients with HIV positive were 33.6% in 2008, 30.8% in 2009 and 34.8% in 2010. Proportion of pulmonary TB patients in prisons having sputum culture were 38.5% in 2008, 37.5% in 2009 and 34.8% in 2010; with DST 36% in 2008, 35.1% in 2009 and 34.6% in 2010. Success rates of treatment outcome were 75.56% in 2008, 73.69% in 2009 and 75.13% in 2010.

4.2 Characteristics of pulmonary TB patients in prisons who registered between 1 Jan 2008 – 31 Dec 2010.

The sample consisted of 1332 pulmonary TB patients (table 4.1):431(32.4%) in 2008, 530(39.8%) in 2009 and 371(27.8%) in 2010 (Table1), with a mean age 36.79 years (SD = 9.75, range 18-85 years). The majority of cases were male (95.8%) and Thai nationality (94.7%). Out of 1332 patients, 43.1% were new smear positive. For smear grading, smear positive were found to be 54.5%. Most patients were CAT 1 89.7%. Proportion of HIV positive was 32.8%. The proportion of patients who were tested for drug susceptibility were 34.6% and for culture were 37%. About 15% were retreated TB. The proportion of cases with complete treatment was 40.2%.

Table 4.1 Characteristics of pulmonary TB patients in prisons who registered between 1 Jan 2008 and 31 Dec 2010.

Characteristic and clinical features	All patients n= 1332 n (%)	2008 n= 431 n (%)	2009 n=530 n (%)	2010 n=371 n (%)
Age (years) mean ± SD	36.80±10.13	37.25±10.11	36.44±10.42	36.79±9.75
Gender				
Male	1276(95.8)	422(97.9)	507(95.7)	347(93.5)
Female	56(4.2)	9(2.1)	23(4.3)	24(6.5)
Thai nationality				
Yes	1261(94.7)	407(94.4)	500(94.3)	354(95.4)
No	71(5.3)	24(5.6)	30(5.7)	17(4.6)
Type of TB patients				
New M+	574(43.1)	180(41.8)	228(43)	166(44.7)
New M-	557(41.8)	183(42.5)	236(44.5)	138(37.2)
Relapse	116(8.7)	35(8.1)	37(7)	44(11.9)
TAF	21(1.6)	6(1.4)	7(1.3)	8(2.2)
TAD	27(2)	12(2.8)	7(1.3)	8(2.2)
Other	37(2.8)	15(3.5)	15(2.8)	7(1.9)

Table 4.1 Characteristics of pulmonary TB patients in prisons who registered between 1 Jan 2008 and 31 Dec 2010 (continued).

Characteristic and clinical features	All patients n= 1332 n (%)	2008 n= 431 n (%)	2009 n=530 n (%)	2010 n=371 n (%)
Smear grading				
Negative	606(45.5)	201(46.6)	254(47.9)	151(40.7)
Scanty	51(3.8)	14(3.2)	13(2.5)	24(6.5)
1+	257(19.53)	75(17.4)	99(18.7)	83(22.4)
2+	200(15)	50(11.6)	92(17.4)	58(15.6)
3+	218(16.4)	91(21.1)	72(13.6)	55(14.8)
Regimen of treatment				
CAT1	1195(89.7)	376(87.2)	489(92.3)	330(88.9)
CAT2	113(8.5)	45(10.4)	34(6.2)	34(9.2)
CAT3	7(0.5)	7(1.6)	0(0)	0(0)
CAT4	17(1.3)	3(0.7)	7(1.3)	7(1.9)
HIV Status				
HIV Positive	437(32.8)	145(33.6)	163(30.8)	129(34.8)
HIV Negative	886(66.5)	282(65.4)	362(68.3)	242(65.2)
Unknown	9(0.7)	4(0.9)	5(0.9)	0(0)
Culture Test				
Yes	493(37)	166(38.5)	199(37.5)	128(34.5)
No	839(63)	265(61.5)	331(62.5)	243(65.5)
DST Test				
Yes	461(34.6)	155(36)	186(35.1)	120(32.3)
No	871(65.4)	276(64)	344(64.9)	251(67.7)
History of previous treatment				
Yes	200(15)	67(15.5)	66(12.5)	67(18.1)
No	1132(85)	364(84.5)	464(87.5)	304(81.9)

Table 4.1 Characteristics of pulmonary TB patients in prisons who registered between 1 Jan 2008 and 31 Dec 2010 (continued).

Characteristic and clinical features	All patients n= 1332 n (%)	2008 n= 431 n (%)	2009 n=530 n (%)	2010 n=371 n (%)
Treatment Outcome				
Cure	504(37.8)	157(36.4)	198(37.4)	149(40.2)
Complete	535(40.2)	177(41.1)	225(42.5)	133(35.8)
Failure	12(0.9)	2(0.5)	6(1.1)	4(1.1)
Default	1(0.1)	1(0.2)	0(0)	0(0)
Die	153(11.5)	48(11.1)	52(9.8)	53(14.3)
Transfer Out	121(9.1)	44(10.2)	46(8.7)	31(8.4)
Other	6(0.5)	2(0.5)	3(0.6)	1(0.3)

TB patients were mostly housed at prison A where 439 pulmonary TB patients were included in this study (Table 4.2). The mean age of patients in prison A was 34.95 years (SD = 9, range 20-60 years). Most of the cases were male 93.2% and Thai nationality 96.8%. The proportion of patients with new smear positive was 44.2%. The proportion of patients with positive smear was 61%. Most of the treated patients were CAT 1 89.1%. The proportion of HIV positive was 60.4%. The proportion of patients who tested for drug susceptibility and culture were 100%. 21.9% of patients were retreated TB. 40.2% of patients had completed treatment.

Table 4.2 Characteristics of pulmonary TB patients in 10 prisons.

Characteristic and clinical features	All patients n= 1332 n(%)	A n= 439 n(%)	B n=222 n(%)	C n=69 n(%)	D n=140 n(%)	E n=33 n(%)	F n=73 n(%)	G n= 57 n(%)	H n=115 n(%)	I n=41 n(%)	J n=143 n(%)
Age (years) mean ± SD	36.80±10.1	34.95±9	41.06±10.1	39.07±8.9	37.74±11.5	36.30±10.2	36.30±9.9	36.77±12.5	32.98±8.6	34.20±9.4	37.88±10.5
Gender											
Male	1276(95.8)	409(93.2)	222(100)	69(100)	140(100)	32(97)	72(98.6)	54(94.7)	108(93.9)	41(100)	129(90.2)
Female	56(4.2)	30(6.8)	0(0)	0(0)	0(0)	1(3)	1(1.4)	3(5.3)	7(6.1)	0(0)	14(9.8)
Thai nationality											
Yes	1261(94.7)	425(96.8)	193(86.9)	65(94.2)	133(95)	33(100)	72(98.6)	55(96.5)	114(99.1)	39(95.1)	132(92.3)
No	71(5.3)	14(3.2)	29(13.1)	4(5.8)	7(5)	0(0)	1(1.4)	2(3.5)	1(0.9)	2(4.9)	11(7.7)
Type of TB patients											
New M+	574(43.1)	194(44.2)	32(14.4)	53(76.8)	62(44.3)	13(39.4)	56(76.7)	32(56.1)	1(0.9)	22(53.7)	109(76.2)
New M-	557(41.8)	149(33.9)	162(73)	9(13)	57(70.7)	18(54.5)	14(19.2)	11(19.3)	108(93.9)	10(24.4)	19(13.3)
Relapse	116(8.7)	58(13.2)	4(1.8)	7(10)	15(10.7)	1(3)	2(2.7)	5(8.8)	5(4.3)	4(9.8)	15(10.5)
TAF	21(1.6)	7(1.6)	0(0)	0(0)	4(2.9)	1(3)	1(1.4)	7(12.3)	0(0)	1(2.4)	0(0)
TAD	27(2)	15(3.4)	4(1.8)	0(0)	1(0.7)	0(0)	0(0)	2(3.5)	1(0.9)	4(9.8)	0(0)
Other	37(2.8)	16(3.6)	20(9)	0(0)	1(0.7)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Smear grading											
Negative	606(45.5)	171(39)	185(83.3)	9(13)	59(42.1)	18(54.5)	14(19.2)	11(19.3)	108(93.9)	12(29.3)	19(13.3)
Scanty	51(3.8)	33(7.5)	5(2.3)	0(0)	6(4.3)	0(0)	0(0)	0(0)	0(0)	6(14.6)	1(0.7)
1+	257(19.53)	128(29.2)	14(6.3)	20(29)	28(20)	5(15.2)	22(30.1)	11(19.3)	6(5.2)	8(19.5)	15(10.5)
2+	200(15)	51(11.6)	6(2.7)	16(23.2)	13(9.3)	6(18.2)	17(23.3)	12(21.1)	0(0)	8(19.5)	71(49.7)
3+	218(16.4)	56(12.8)	12(5.4)	24(34.8)	34(24.3)	4(12.1)	20(27.4)	23(40.4)	1(0.9)	7(17.1)	37(25.9)

Table 4.2 Characteristics of pulmonary TB patients in 10 prisons.

Characteristic and clinical features	All patients n= 1332 n(%)	A n= 439 n(%)	B n=222 n(%)	C n=69 n(%)	D n=140 n(%)	E n=33 n(%)	F n=73 n(%)	G n= 57 n(%)	H n=115 n(%)	I n=41 n(%)	J n=143 n(%)
Regimen of treatment											
CAT1	1195(89.7)	391(89.1)	195(87.8)	62(87.8)	122(87.1)	32(97)	69(94.5)	43(75.4)	110(95.7)	34(82.9)	137(95.8)
CAT2	113(8.5)	41(9.3)	27(12.2)	27(12.2)	13(9.3)	0(0)	3(4.1)	4(7)	5(4.3)	7(17.1)	6(4.2)
CAT3	7(0.5)	7(1.6)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
CAT4	17(1.3)	0(0)	0(0)	0(0)	5(3.6)	1(3)	1(1.4)	10(17.5)	0(0)	0(0)	0(0)
HIV Status											
HIV Positive	437(32.8)	265(60.4)	22(9.9)	14(20.3)	42(30)	7(21.2)	17(23.3)	23(40.4)	16(13.9)	10(24.4)	21(14.7)
HIV Negative	886(66.5)	174(39.6)	200(90.1)	55(79.7)	91(65)	26(78.8)	54(74)	34(59.6)	99(86.1)	31(75.6)	122(85.3)
Unknown	9(0.7)	0(0)	0(0)	0(0)	7(5)	0(0)	2(2.7)	0(0)	0(0)	0(0)	0(0)
Culture Test											
Yes	493(37)	439(100)	34(15.3)	0(0)	5(3.6)	1(3)	2(2.7)	10(17.5)	1(0.9)	1(0.9)	1(2.4)
No	839(63)	0(0)	188(84.7)	69(100)	135(96.4)	32(97)	47(82.5)	47(82.5)	47(82.5)	114(99.1)	40(97.6)
DST Test											
Yes	461(34.6)	439(100)	3(1.4)	0(0)	5(3.6)	1(3)	1(1.4)	10(17.5)	1(0.9)	1(2.4)	0(0)
No	871(65.4)	0(0)	219(98.6)	69(100)	135(96.4)	32(97)	72(98.6)	47(82.5)	114(99.1)	40(97.6)	143(100)
History of previous treatment											
Yes	200(15)	96(21.9)	28(12.6)	7(10.1)	21(15)	2(6.1)	3(4.1)	14(24.6)	6(5.2)	9(22)	14(9.8)
No	1132(85)	343(78.1)	194(87.4)	62(89.9)	119(85)	31(93.9)	70(95.9)	43(75.4)	109(94.8)	32(78)	129(90.2)
Treatment Outcome											
Cure	504(37.8)	132(30.1)	29(13.1)	52(75.4)	60(42.9)	7(21.2)	56(76.7)	36(63.2)	3(2.6)	23(56.1)	106(74.1)
Complete	535(40.2)	112(25.5)	187(84.2)	9(13)	44(31.4)	24(72.7)	12(16.4)	7(12.3)	107(93)	10(24.4)	23(16.1)

Table 4.2 Characteristics of pulmonary TB patients in 10 prisons.

Characteristic and clinical features	All patients n= 1332	A n= 439	B n=222	C n=69	D n=140	E n=33	F n=73	G n= 57	H n=115	I n=41	J n=143
	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)	n(%)
Failure	12(0.9)	8(1.8)	0(0)	0(0)	4(2.9)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Default	1(0.1)	1(0.2)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Die	153(11.5)	101(23)	2(0.9)	5(7.2)	17(12.2)	1(3)	5(6.8)	7(12.3)	2(1.7)	2(4.9)	11(7.7)
Transfer Out	121(9.1)	85(19.4)	4(1.8)	1(1.4)	13(9.3)	0(0)	0(0)	6(10.5)	3(2.6)	6(14.6)	3(2.1)
Other	6(0.5)	0(0)	0(0)	2(2.9)	3(1.4)	1(3)	0(0)	1(1.8)	0(0)	0(0)	0(0)

4.3 Characteristics of subjects after excluding patients without DST.

After excluding patients non DST testing, we analyzed data from 461 patients in this study(Table4.3); 155(33.6%) in 2008, 186(40.3%) in 2009 and 120(26.1%)in 2010 .Most sample were Thai men with a mean age 36.67 years (SD 8.69, range 18-74 years). Most of the patients were new smear positive (42.5%). The proportion of cases with positive smear was 62.5%. Most of the patients were treated TB with drug CAT 1 (85.5%). 59.2%of cases were HIV positive. 93% of the HIV positive patients had known CD4 level and 88.6% had a CD4 count ≤ 250 cell/µl. Most HIV positive patients received ARV treatment (65.4%). The proportion of patients who had TB retreated was 24.7%. The proportion of drug resistance to one or more drug was 24.5% and multi drug resistant was 9.3%. The cure rate was 31.9%.

Table 4.3 Characteristics of subjects after excluding patients without drug susceptibility testing.

Characteristic and clinical features	All patients n= 461 n (%)	2008 n= 155 n (%)	2009 n=186 n (%)	2010 n=120 n (%)
Age (years) mean ± SD	35.17±9.06	35.08±8.99	34.27±9.27	36.67±8.69
Gender				
Male	431(93.5)	150(96.8)	170(91.4)	111(92.5)
Female	30(6.5)	5(3.2)	16(8.6)	9(7.5)
Thai nationality				
Yes	446(96.7)	150(96.8)	181(97.3)	115(95.8)
No	15(3.3)	5(3.2)	5(2.7)	5(4.2)
Type of TB patients				
New M+	196(42.5)	72(46.5)	81(43.5)	43(35.8)
New M-	151(32.8)	48(31)	60(32.3)	43(35.8)
Relapse	61(13.2)	17(11)	23(12.4)	21(17.5)
TAF	19(4.1)	4(2.6)	7(3.8)	8(6.7)
TAD	18(3.9)	8(5.2)	5(2.7)	5(4.2)
Other	16(3.5)	6(3.9)	10(5.4)	0(0)

Table 4.3 Characteristics of subjects after excluding patients without drug susceptibility testing (continued).

Characteristic and clinical features	All patients n= 461 n (%)	2008 n= 155 n (%)	2009 n=186 n (%)	2010 n=120 n (%)
Smear grading				
Negative	173(37.5)	55(35.5)	71(38.2)	41(39.2)
Scanty	34(7.4)	11(7.1)	5(2.7)	18(15)
1+	136(29.5)	46(29.7)	56(30.1)	34(28.3)
2+	56(12.1)	17(11)	29(15.6)	10(8.3)
3+	62(13.4)	26(16.8)	25(13.4)	11(9.2)
Regimen of treatment				
CAT1	394(85.5)	130(83.9)	163(87.6)	101(84.2)
CAT2	43(9.3)	15(9.7)	16(8.6)	12(10)
CAT3	7(1.5)	7(4.5)	0(0)	0(0)
CAT4	17(3.7)	3(1.9)	7(3.8)	7(5.8)
HIV Status				
HIV Positive	273(59.2)	87(56.1)	113(60.8)	73(60.8)
HIV Negative	188(40.8)	68(43.9)	73(39.2)	47(39.2)
CD4 Level				
≤ 250 cells/µl	255(88.6)	63(85.1)	96(87.3)	66(94.3)
>250 cells/µl	29(11.4)	11(14.9)	14(12.7)	4(5.7)
Unknown and HIV Negative	207(100)	81(39.1)	76(36.7)	50(24.2)
ARV Treatment				
Not receive	126(46.2)	46(52.9)	49(43.4)	31(42.5)
Received before treatment TB	49(17.9)	10(11.5)	21(18.6)	18(24.7)
Received after treatment TB	98(35.9)	31(35.6)	43(38.1)	24(32.9)
HIV Negative	188(100)	68(36.2)	73(38.8)	47(25)

Table 4.3 Characteristics of subjects after excluding patients without drug susceptibility testing (continued).

Characteristic and clinical features	All patients n= 461 n (%)	2008 n= 155 n (%)	2009 n=186 n (%)	2010 n=120 n (%)
Any drug-resistant				
Yes	113(24.5)	40(25.8)	36(19.4)	37(30.8)
No	348(75.5)	115(74.2)	150(80.6)	83(69.2)
MDR-TB				
Yes	43(9.3)	12(7.7)	13(7)	18(15)
No	418(90.7)	143(92.3)	173(93)	102(85)
History of previous treatment				
Yes	114(24.7)	35(22.6)	45(24.2)	34(28.3)
No	347(75.3)	120(77.4)	141(75.8)	86(71.7)
Treatment Outcome				
Cure	147(31.9)	53(34.2)	65(34.9)	29(24.2)
Complete	114(24.7)	33(21.3)	49(26.3)	32(26.7)
Failure	8(1.7)	0(0)	4(2.2)	4(3.3)
Default	1(0.2)	1(0.6)	0(0)	0(0)
Die	103(22.3)	33(21.3)	36(19.4)	34(28.3)
Transfer Out	87(18.9)	34(21.9)	32(17.2)	21(17.5)
Other	1(0.2)	1(0.6)	0(0)	0(0)

4.4 Description of pulmonary TB patients in prisons who resisted to anti-TB drugs.

The prevalence of resistance to one or more drugs among new and previously treated was 21.6% and 33.3%, respectively. It was found that prevalence of MDR-TB among new and previously treated was 4.32% and 24.56%, respectively.

Of 113 patients who were resistant to any drug, 43 patients were MDR-TB, defined as resistance to at least isoniazid and rifampicin) (Table 4.4). The proportions of patients who were resistant to any drug was 25.8% in 2008, 19.4% in 2009 and 30.8% in 2010. The proportions of patients who had multi drug resistance

were 7.7% in 2008, 7% in 2009 and 15% in 2010. Most of the case were resistant to streptomysin 5.6%.The proportion of patients resisted to two drugs (Isoniazid and Rifampicin) was 5.4% and to three drugs (Isoniazid, Rifampicin and Streptomtcin) was 1.5%.

Table 4.4 The pattern of drug resistance to anti-TB drugs of patient who has drug susceptibility testing.

Pattern of drug resistance	All patients n= 461 n (%)	2008 n= 155 n (%)	2009 n=186 n (%)	2010 n=120 n (%)
Any resistance	113(24.5)	40(25.8)	36(19.4)	37(30.8)
One drug	47(10.2)	18(11.6)	17(9.1)	12(10)
Isoniazid(INH)	16(4.2)	6(3.9)	6(3.2)	4(10.8)
Rifampicin(R)	5(4.4)	1(0.6)	3(1.6)	1(0.8)
Ethambutol(EMB)	0(0)	0(0)	0(0)	0(0)
Streptomtcin(SM)	26(5.6)	11(7.1)	8(4.3)	7(5.8)
Two drugs	45(9.8)	12(7.7)	16(8.6)	17(14.2)
INH+R	25(5.4)	4(2.6)	10(5.4)	11(9.2)
INH+EMB	2(0.4)	1(0.6)	0(0)	1(0.8)
INH+SM	13(2.8)	5(3.2)	4(2.2)	4(3.4)
R+EMB	2(0.4)	1(0.6)	0(0)	1(0.8)
SM+EMB	3(0.7)	1(0.6)	2(5.6)	0(0)
Three drugs	14(3)	8(5.2)	1(0.5)	5(4.2)
INH+R+EMB	4(0.9)	2(1.3)	0(0)	1(0.8)
INH+R+SM	7(1.5)	4(2.6)	0(0)	3(1.8)
INH+SM+EMB	3(0.7)	2(1.3)	0(0)	1(0.8)
Four drugs INH+R+EMB+SM	7(1.5)	2(1.3)	2(1.1)	3(2.5)
MDR-TB	43(9.3)	12(7.7)	13 (7)	18(15)

Table 4.5 shows the pattern of anti-TB drugs resistance among new cases and retreatment cases. The proportion of any drug resistance TB in the new cases was 17.3% and of MDR-TB was 8.8%. Most of the new cases (6.6%) were resistant to streptomycin and 29.4% of retreatment cases were MDR-TB.

Table 4.5 The pattern of drug resistance to anti-TB drugs of patient who has drug susceptibility testing define by history of TB treatment.

Pattern of drug resistance	Years							
	All patients		2008		2009		2010	
	New n= 347	Retreat n= 114	New n= 120	Retreat n= 35	New n= 141	Retreat n= 45	New n= 86	Retreat n= 34
Any resistance	**60(17.3)**	**10(8.8)**	**21(17.5)**	**7(20)**	**21(14.9)**	**2(4.5)**	**18(20.9)**	**1(2.9)**
One drug	**40(11.5)**	**7(6.1)**	**12(10)**	**6(17)**	**16(11.3)**	**1(2.3)**	**12(14)**	**0(0)**
Isoniazid(INH)	13(3.7)	3(2.6)	4(3.4)	2(5.7)	5(3.5)	1(2.3)	4(4.7)	0(0)
Rifampicin(R)	4(1.2)	1(0.8)	0(0)	1(2.9)	3(2.1)	0(0)	1(1.2)	0(0)
Ethambutol(EMB)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)
Streptomtcin(SM)	23(6.6)	3(2.6)	8(6.7)	3(8.6)	8(5.7)	0(0))	7(8.1)	0(0)
Two drugs	**22(6.3)**	**23(20.2)**	**7(5.8)**	**5(14.3)**	**7(5)**	**9(20)**	**8(9.3)**	**9(26.5)**
INH+R	5(1.4)	20(17.5)	0(0)	4(11.4)	2(1.4)	8(17.8)	3(3.5)	8(23.5)
INH+EMB	1(0.3)	1(0.9)	1(0.8)	0(0)	0(0)	0(0)	0(0)	1(2.9)
INH+SM	13(3.7)	0(0)	5(4.2)	0(0)	4(2.8)	0(0)	4(4.7)	0(0)
R+EMB	1(0.3)	1(0.9)	0(0)	1(2.9)	0(0)	0(0)	1(1.2)	0(0)
SM+EMB	2(0.6)	1(0.9)	1(0.8)	0(0)	1(0.7)	1(2.2)	0(0)	0(0)
Three drugs	**11(3.2)**	**3(2.6)**	**6(5)**	**2(5.7)**	**1(0.7)**	**0(0)**	**4(4.7)**	**1(2.9)**
INH+R+EMB	4(1.2)	0(0)	2(1.7)	0(0)	1(0.7)	0(0)	1(1.2)	0(0)
INH+R+SM	4(1.2)	3(2.6)	2(1.7)	2(5.7)	0(0)	0(0)	2(2.3)	1(2.9)
INH+SM+EMB	3(0.9)	0(0)	2(1.7)	0(0)	0(0)	0(0)	1(1.2)	0(0)
Four drugs INH+R+EMB+SM	**2(0.6)**	**5(4.4)**	**0(0)**	**2(5.7)**	**0(0)**	**2(4.5)**	**2(2.3)**	**1(2.9)**
MDR-TB	**15(4.3)**	**28(24.6)**	**4(3.3)**	**8(22.9)**	**3(2.1)**	**47(10.2)**	**8(9.3)**	**10(29.4)**

4.5 Factors associated with drug-resistant TB.

The patients were divided in two groups according to the results of drug susceptibility testing. 113 (24.5%) patients had drug resistant TB (Table4.6). The variables that were significantly associated with drug resistant TB in a univariate analysis (χ^2 test) were history of previous treatment ($p=0.012$) and smear grading ($p<0.001$).

Table 4.6 Factors associated with drug resistance to one or more drugs by univariate analysis.

	All Patients	Resistance to one or more drug		
		Yes	No	
Characteristics	n (%)	n (%)	n (%)	*P* value
Total	461(100)	113(24.5)	348(75.5)	
Age (years) mean ± SD	35.17 ± 9.06	36.12 ± 9.06	34.86 ± 9.05	0.642
Gender				0.302
Male	431(93.5)	108(25)	323(75)	
Female	30(6.5)	5(16.7)	25(83.3)	
Thai nationality				0.419
Yes	446(96.75)	108(24.2)	338(75.8)	
No	15(3.25)	5(33.3)	10(66.7)	
History of previous treatment				0.012
Yes	114(24.73)	38(33.3)	76(66.7)	
No	347(75.27)	75(21.61)	272(78.39)	
Smear grading				<0.001
Negative	208(45.12)	19(9.13)	189(90.87)	
1+	134(29.07)	47(35.07)	87(64.93)	
2+	57(12.36)	20(35.09)	37(64.91)	
3+	62(13.45)	27(43.55)	35(56.45)	
HIV Status				0.388
HIV Positive	273(59.22)	63(23.08)	210(76.92)	
HIV Negative	188(40.78)	50(26.6)	138(73.4)	
CD4 Level				0.054
≤ 250 cell/μL	225(88.58)	50(22.22)	175(77.78)	
>250 cell/μL	29(11.42)	2(6.9)	27(93.1)	
Unknown and HIV Negative	207(100)	61(29.47)	146(70.53)	
ARV Treatment				0.097
Yes	147(53.85)	27(18.37)	120(81.63)	
No	126(46.15)	36(28.57)	90(71.43)	
HIV Negative	188(100)	50(26.6)	138(73.4)	

In addition, the patients were also divided in two groups according to multi drug resistance 43 (9.3%) patients had multi drug-resistant TB and 418(90.7%) patients did not have multi drug resistant TB. Again, the variables significantly associated with multi drug resistance TB were history of previous treatment ($p<0.001$)and smear grading ($p<0.001$) (Table4.7).

Table 4.7 Factors associated with multi drugs resistant by univariate analysis.

	All Patients	Multi drug resistance		
		Yes	No	
Characteristics	n (%)	n (%)	n (%)	*P* value
Total	461(100)	43(9.33)	418(90.67)	
Age (years) mean ± SD	35.17 ± 9.06	36.60 ± 9	35.02 ± 9.06	0.847
Gender				0.243
Male	431(93.5)	42(9.7)	389(90.3)	
Female	30(6.5)	1(3.3)	29(96.7)	
Thai nationality				0.588
Yes	446(96.75)	41(9.2)	405(90.8)	
No	15(3.25)	2(13.3)	13(86.7)	
History of previous treatment				<0.001
Yes	114(24.73)	28(24.6)	86(75.4)	
No	347(75.27)	15(21.61)	332(95.7)	
Smear grading				<0.001
Negative	208(45.12)	2(5.9)	206(94.1)	
1+	134(29.07)	18(5.9)	116(86.6)	
2+	57(12.36)	9(15.8)	48(84.2)	
3+	62(13.45)	14(22.6)	48(77.4)	
HIV Status				0.880
HIV Positive	273(59.22)	25(9.2)	248(90.8)	
HIV Negative	188(40.78)	18(9.6)	170(90.4)	
CD4 Level				0.114
≤ 250 cell/μL	225(88.58)	18(8)	207(92)	
>250 cell/μL	29(11.42)	0(0)	29(100)	
Unknown and HIV Negative	207(100)	25(12.08)	182(87.92)	

Table 4.7 Factor associated with multi drugs resistant univariate analysis (continued).

	All Patients	Multi drug resistance		
		Yes	No	
Characteristics	n (%)	n (%)	n (%)	*P* value
ARV Treatment				0.319
Yes	147(53.85)	10(6.8)	137(93.2)	
No	126(46.15)	15(11.9)	111(88.1)	
HIV Negative	188(100)	18(9.6)	170(90.4)	

Multiple logistic regression analysis showed that factors associated with drug resistant TB in the univariate analysis remained independently associated with drug resistant TB: history of previous treatment [*P*-value 0.009, AOR 1.81, 95%CI (1.14-2.89)] and smear positive [*P*-value <0.001, AOR 7.763,95%CI (3.999-15.070)](Table 4.8).

Table 4.8 Multiple logistic regression analysis for factors associated with drug-resistant TB of TB patients in prison.

Characteristics	AOR	95% CI	*P* value
Age (years)			0.558
> 36	0.807	(0.393-1.656)	
≤ 36	referent		
Gender			0.956
Male	1.035	(0.301-3.558)	
Female	referent		
Thai nationality			0.416
Yes	0.469	(0.076-2.901)	
No	referent		
History of previous treatment			0.012
Yes	1.813	(1.138-2.889)	
No	referent		

Table 4.8 Multiple logistic regression analysis for factors associated with drug-resistant TB of TB patients in prison (continued).

Characteristics	AOR	95% CI	*P* value
Smear grading			<0.001
Positive	7.763	(3.999-15.070)	
Negative	referent		
HIV Status			0.388
HIV Positive	1.120	(0.704-1.783)	
HIV Negative	referent		
CD4 Level			0.072
≤ 250 cell/μL	3.857	(0.887-16.781)	
>250 cell/μL	referent		
ARV Treatment			0.051
No	1.762	(0.997-3.116)	
Yes	referent		

Multiple logistic regression analysis showed that factors associated with multi drug-resistant TB were history of previous treatment [*P*-value <0.001, AOR 7.206, 95%CI (3.686-14.089)] and smear positive [*P*-value <0.001, AOR 19.467, 95%CI (9.421-38.751)] (Table 4.9).

Table 4.9 Multiple logistic regression analysis for factors associated with multi drug resistant TB of TB patients in prisons.

Characteristics	AOR	95% CI	*P* value
Age (years)			0.192
> 36	0.482	(0.161-1.445)	
≤ 36	referent		
Gender			0.943
Male	1.084	(0.120-9.799)	
Female	referent		
Thai nationality			0.590
Yes	0.658	(0.143-3.018)	
No	referent		
History of previous treatment			<0.001
Yes	7.206	(3.686-14.089)	
No	referent		
Smear grading			<0.001
Positive	19.467	(9.421-38.721)	
Negative	referent		
HIV Status			0.880
HIV Positive	0.952	(0.504-1.799)	
HIV Negative	referent		
ARV Treatment			0.070
No	1.851	(0.801-4.281)	
Yes	referent		

CHAPTER V
DISCUSSION

This study included a total of 1332 prisoners with pulmonary tuberculosis registered in 10 prisons between 1 January 2008 and 31 December 2010. 493(37%) patients had culture test performed. 461(93.5%) patients had DST performed. There were 347 new cases and 114 retreatment patients.

5.1 The prevalence of drug resistant TB in prison

The results of this study showed that the prevalence of drug resistance to one or more drugs was 15.2% and to MDR-TB was 9%. The prevalence was lower than that of previous study in Thailand. In 2000, the prevalence of drug resistance to one or more drugs was 50% and MDR-TB was 19.5% [11]. The results of study in 1998 showed that the prevalence of drug resistance to one or more drugs was 35.1% and MDR-TB was 6% [22]. The decreasing in drug resistant TB might be due to systematically implements of TB center of prisons TB control activities as follows:

1. Finding of TB in prison that search all new prisoner. The prison staffs search TB case every year in old prisoners and every 6 months in prisoners with HIV infection.
2. Treating TB patients in prison that treated approach DOTS strategy.
3. Preventing and controlling of the spread of TB in prison that set a separate room for TB patients in initial phase for prevention the transmission of TB.
4. Record and report of TB patient to TB program in the unit that analyze the trends of TB in prison which leads to the action plan of TB in the future.
5. Supervision and monitoring operating TB in prison that acknowledges the operation problems of TB and find solutions in the future.

5.2 Factors associated with drug resistant TB in prisoners

5.2.1 Age

A study in the United Kingdom[23] found that the younger age was significantly associated with anti TB drug resistance**.** Similarly, a study in Spain showed that MDR-TB was associated with age group 45-64years [25]**.** The patients with previous history of TB who were 19 years old or younger was the only factor associated with multi drug resistance and age between 20 to 39 years in new patients was associated with multi drug resistance in the study of Mexico-Texas Border[24]. In Thailand, an observational research study reported an association between MDR and patients with age 18-29 years old [27].

This study showed that age was not associated with drug resistant TB and MDR-TB, because most of cases in this study were aged over 25 year and prisoners in Thailand will be aged 18 years old.

5.2.2 Gender

In Thailand, the study by Somsak akkasilk, et al.[27] that male was positively associated with MDR-TB. A study in Mexico-Texas Border found that female was associated with multidrug resistance among patients with no previous history of TB [24].

This study showed that gender was not associated with drug resistant TB and MDR-TB because most of cases in this study were male (93.5%) and health care in female better than male.

5.2.3 Nationality

Nationality was a risk factor of multi resistance among patients with no history of previous TB in the study in Mexico-Texas Border[24].

This study showed that nationality was not associated with drug resistant TB and MDR-TB because most of cases were Thai nationality (96.7%) and prisoners who are foreign national’s inaccessibility of health services.

5.2.4 History of previous treatment

The result of the association between previous treatment and drug resistant was consistent with other studies [7, 11, 23, 24, 26].

This study showed that history of previous treatment was associated with drug resistant TB and MDR-TB because the patient has been treated with same medicine might be caused the resistance.

5.2.5 Smear grading

Smear positive was associated with drug resistant TB. This result is same from that of **Sanjay Raipal et al[29]** which reported that patients with 3+ grading required extension of the intensive phase and had a more unfavorable treatment outcome in the form of treatment failures and deaths than among those with a lower grading.

5.2.6 HIV status

Researcher did not found any association between HIV infection and drug resistance TB. Although some studies have found a higher risk of drug resistant TB in patient with HIV infection. This result is consistent with a study in the Netherlands by **Catharina Hendrika Haar et al[30]** determining the association between TB drug resistance and HIV infection, and found that among new TB patients, multidrug resistance was associated with HIV infection.

5.3 Limitations of the study

This study used routine records (TB03) as a primary source of information. The missing data or incomplete record was a major limitation. The missing of culture & DST result might be due to either testing not done or incomplete data recording. Good practice was observed at the Medical of correctional institutions and Bangkwang central prison in term of total coverage of DST for all patients with completed record. Other prisons need a lot of improvement to ensure that all TB patients could access to DST service. The provincial health office should supervise to prisons in area of responsibility in improvement of recording. The provincial or regional TB coordinator should visit the prison TB coordinator at least quarterly to assess the quality of program performance, identify problems and appropriate solutions, and take the necessary action to overcome these problems.

The study has another of from using a retrospective design. Some potential factors such as cavitations and intravenous drug use were not documented in the patient record.

5.4 Utilization of study findings

The results of this study can be used to guide the policy & practice in management of TB in prison as follows:

The National Health Security Office of Thailand (NHSO) should support the sputum and DST for all TB patients in prisons.

The NationalTuberculosis Program of Thailand (NTP) and The Department of Correction must seriously implement such interventions to prevent MDR-TB outbreak. The interventions practice include capacity building of prison nurses to handle any MDR-TB cases, guide to help prison nurse provide care effectively, provide budget for a total coverage of culture & DST for all TB patients.

CHAPTER VI
CONCLUSION

This study was a retrospective cohort study on "Factors associated with drug-resistant TB of TB patients in prisons of Thailand" The objectives of this study were

1. To determine prevalence of drug-resistant TB in prisons in Thailand between 1 Jan 2008 and 31 Dec 2010.
2. To examine risk factors associated with drug-resistant TB in prisoners.

Data were collected during 1 January 2008 to 31 December 2010 by medical record review on treatment history and TB register in 10 prisons, coveraging 4 regions of Thailand. Researcher collected data by using case record form. The data included the following variables; TB number, date of registered, age, gender, nationality, date of start treatment, drug of treatment, drug susceptibility test, result of drug susceptibility test, classification of patient, previous treatment, smear grading, cavitary disease, history of intravenous drug use, counseling blood test, agree with blood test, HIV infection, CD4 test and ARV treatment. TB Registration (TB03) was mainly used as a source of data.

The results showed that the prevalence of resistance to one or more drugs among new and previously treated was 21.6% (75/347) and 33.3% (38/114), respectively. It was found that prevalence of MDR-TB among new and previously treated was 4.32% (15/347) and 24.56% (28/114), respectively. The history of previous treatment was the only factor associated with drug-resistant TB and MDR-TB.

In conclusion, early diagnosis of drug resistance is important. The results of susceptibility testing can take as long as several weeks, when the patients with drug-resistant TB and MDR-TB have already been treated with the equivalent of biotherapy or mono therapy. The findings can be used as an evidence for both policy and practice in strengthen MDR-TB prevention and TB care in prison settings.

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APPENDIX

Case record form

1. Prison
   - ☐ 1. Hospital of department of correction
   - ☐ 2. Bangkwang central prison
   - ☐ 3. Ayutthaya central prison
   - ☐ 4. Pathumthani prison treatment
   - ☐ 5. Klongphai central prison
   - ☐ 6. Khonkean central prison
   - ☐ 7. Ubonratchathani central prison
   - ☐ 8. Chiangrai central prison
   - ☐ 9. Chianmai central prison
   - ☐ 10. Lampang central prison
   - ☐ 11. Suratthani central prison
   - ☐ 12. Nakhon si thammarat central prison
2. TB Number ……
3. Date of registered ☐☐ - ☐☐ - ☐☐☐☐
4. Date of birth ☐☐ - ☐☐ - ☐☐☐☐
5. Age ☐☐ Years ☐☐ Months ☐☐ Days
6. Gender ☐ 1. Male ☐ 2. Female
7. Nationality
   - ☐ 1. Thai
   - ☐ 2. Non Thai
8. Date of start treatment ☐☐ - ☐☐ - ☐☐☐☐
9. Drug of treatment
   - ☐ 1. CAT 1 (2 HRZE (S)/4HR)
   - ☐ 2. CAT 2 (2HRZES/1HRZE/5HRE)
   - ☐ 3. CAT 3 (2HRZE/4HR)
   - ☐ 4. CAT4 (Second line drug)
10. Drug susceptibility test
    - ☐ 1. Yes
    - ☐ 2. No

11. Result of drug susceptibility test
    - ☐ 1. Not resistant of tuberculosis drug
    - ☐ 2. Resistant to Isoniazid (H)
    - ☐ 3. Resistant to Rifampicin (R)
    - ☐ 4. Resistant to Pyrazinamide (Z)
    - ☐ 5. Resistant to Streptomycin (S)
    - ☐ 6. Resistant to Ethambutol (E)
12. Classification of patient
    - ☐ 1. New
    - ☐ 2. Relapse
    - ☐ 3. Treatment after failure
    - ☐ 4. Treatment after default
    - ☐ 5. Other
13. Previous treatment
    - ☐ 1. Yes
    - ☐ 2. No
14. Smear grading
    - ☐ 1. Negative
    - ☐ 2. Scanty
    - ☐ 3. 1+
    - ☐ 4. 2+
    - ☐ 5. 3+
15. Cavitary disease (the presence of cavitations on the cheat radiograph)
    - ☐ 1. Yes
    - ☐ 2. No
16. History of intravenous drug use
    - ☐ 1. Yes
    - ☐ 2. No
17. Counseling blood test
    - ☐ 1. Yes
    - ☐ 2. No

18. Agree with blood test

☐ 1. Yes

☐ 2. No

19. Red star

☐ 1. Yes

☐ 2. No

20. CD 4 testing

☐ 1. Yes

☐ 2. No

21. Number of CD 4 testing = ……. cell/µL

☐ 1. Less than or equal to 250 cell/µL

☐ 2. More than 250 cell/µL

22. On ARV treatment

☐ 1. Not received ARV

☐ 2. Received before treatment of tuberculosis

☐ 3. Received after initial treatment of tuberculosis

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