Drug-Resistant Tuberculosis among Prisoners of Three Prisons in Bangkok and the Vicinity

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Abstract

The purpose of this study was to determine the prevalence of drug-resistant tuberculosis and some factors associated with drug resistance among prisoners of three prisons in Bangkok and the vicinity. Susceptibility testing to four first-line antituberculous drugs was performed on 165 *M. tuberculosis* strains isolated from prisoners of three prisons including Klongprem Central (KC) prison, Bangkwang Central (BC) prison and the Correctional Institution (CI) for Male Drug Addicts. Of 165 smear positive tuberculosis (TB) cases with drugs susceptibility results, resistance to one or more drugs was 49.7 per cent. Resistance to one, two, three, and four drugs was 20.0, 13.3, 4.2 and 12.1 per cent, respectively. Multidrug resistant tuberculosis (MDR-TB) was 18.8 per cent. Patients classified as primary and acquired drug resistant were 6.7 and 50.0 per cent. The primary drug resistance to one or more drugs among prisoners at KC, BC and CI were 42.5, 36.4 and 53.9 per cent, respectively and MDR-TB were 8.2, 3.0, and 7.7 per cent, respectively. Of several factors analyzed in the present study, only a history of previous TB treatment was significantly associated with drug resistance ($p < 0.05$). In conclusion, the results indicate the high prevalence of drug-resistant tuberculosis and the seriousness of the TB problem in prisons. The public health sector and prison authorities should work in close collaboration and co-ordination to continue improving TB case detection. Directly Observed Treatment Short course (DOTS) is highly recommended. Moreover, discharged prisoners with tuberculosis should be appropriately referred to hospitals or TB control centers.

Key word : Tuberculosis, Drug-Resistant TB, Prisoners, Prisons Multidrug-Resistance

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The reemergence of tuberculosis (TB) and the increasing number of drug resistance among *Mycobacterium tuberculosis* (MTB) strains pose a public health threat of global concern. In Thailand, TB is a leading cause of mortality, and the spread of the HIV epidemic contributes significantly to the worsening of the situation. Furthermore, the rapid emergence of multidrug resistant-tuberculosis (MDR-TB) has become a major problem to TB control. The national surveillance for drug resistance was conducted in 1997-1998, and MDR-TB was 2.02 per cent[1]. However, MDR-TB figures in high HIV burden areas has shown the alarming sign of being 3 times higher than the country figure.

Prisons have long been recognized as a high-risk environment for the transmission of MTB. The factors associated with the transmission include the prevalence of infection in the source population, HIV infection, overcrowding and systematic rotation of prisons[2]. In addition, close quarters, insufficient ventilation, poor hygiene and poor general health of inmates may lead to a substantial TB epidemic in the prison systems. Therefore, the incidence of TB among inmates is much higher than the rate for the general population[3-7].

TB is also an increasing problem in Thai prisons. The problem is compounded by overcrowding, poor general health, high prevalence of risk groups, delay in case finding and improper treatments. Additionally, the prison population comes mainly from the most depressed socioeconomic strata, where TB and intravenous drug use are more frequent. Thailand has a population of over 180,000 prisoners in 130 prisons. The prevalence of new smear positive pulmonary tuberculosis among prisoners in Bangkok was 1,226 cases/100,000 prisoners, almost 20 times higher than the national average[8].

Since drug-resistant TB data in large prisons located in Bangkok and the vicinity have rarely been presented. Thereby, this study was performed to determine the prevalence of drug-resistant TB among prisoners who had positive acid-fast bacilli in their sputum stained smear and also to identify possible associated factors in these prisoners.

MATERIAL AND METHOD

Patient population and data collection

The study population comprised prisoners in three prisons located in Bangkok and the vicinity including Klongprem Central (KC) prison, Bangkwang Central prison (BC) and the Correctional Institution (CI) for Male Drug Addicts. These prisoners had positive sputum by direct smear microscopy and registered between May to October, 2000. All patients were men and over 15 years old. Face to face, interview questionnaires were conducted by using a constructed questionnaire to collect data from the study group.

Specimen collection and culture

Either spot or collection sputum was taken from the prisoners. All specimens were examined first in stained smears by Ziehl-Neelsen staining and scored according to the IUATLD scale[9]. Sputa were decontaminated with an equal volume of NALC-NaOH, and centrifuged before inoculating the sediment onto two slopes of Lowenstein-Jensen (L-J) media and incubated for 8 weeks. Positive cultures were examined for growth rate, colony morphology, and identified by conventional biochemical tests[10].

Susceptibility testing

Drug susceptibility testing was performed by the proportion method[11]. *M. tuberculosis* strains isolated from the prisoners were tested in comparison with a reference H37Rv standard strain on the same batch medium. Drug-containing L-J slopes with the critical concentrations for streptomycin, isoniazid, rifampicin and ethambutol were 4, 0.2, 40 and 2 μg/ml, respectively. Standard criteria was used for classifying resistant strain.

Statistical analyses

Demographics and other characteristics of the study subjects were computed and interpreted by using frequency, percentage, mean, median and standard deviation. The percentage was used for drug susceptibility patterns. Statistical association was performed by using the chi square test, p-value < 0.05 was considered significant.

RESULTS

During the 6-month period from May 1, 2000 to October 31, 2000, a total of 186 sputum specimens were collected from smear positive pulmonary TB cases who had been registered in three prisons. Isolation of *Mycobacteria* was failed in 15 cases (8.1%) due to contamination, and 4 cases (2.1%) due to no growth. *M. tuberculosis* was isolated from 165 cases (88.7%) and nontuberculous mycobacteria from 2 cases (1.1%). Drug susceptibility testing was done for

all 165 MTB strains isolated from prisoners in the KC prison for 101 (61.2%), the BC prison for 37 (22.4%) and the CI for 27 (16.4%).

However, completed questionnaires were obtained from 154 of 165 prisoners (93.3%) surveyed. Whereas, 11 of 165 (6.7%) were incomplete for several reasons, i.e., death before interview (n = 7), dispersal prisoner (n = 1), severe patients who did not communicate (n = 2), or released before interview (n = 1). Table 1 describes the prevalence rate of drug resistance among these 154 prisoners classified by sociodemographic characteristics.

According to previous history of PTB and close contact with household PTB (Table 2), the highest prevalence rate of one or more drugs resistance was found in those who had a history of previous PTB (66.7%), number of previous treatment was > 1 time (71.4%), duration of treatment was ≥ 6 months (75.0%), treatment with cure (73.1%), had previous close contact with household PTB cases (53.3%) and treatment of close contact was cure (60.0%). MDR was found in those who had a history of previous PTB (46.7%), number of previous treatment was > 1 time (57.1%), duration of treatment was ≥ 6 months (56.3%), cure treatment (53.8%), had previous close contact with household PTB cases (26.7%) and result of TB treatment of close contact was cure (40.0%).

According to registration of patients, the prevalence rate of drug resistance to one or more drugs was found in 43.8 per cent of new patients, 73.9 per cent of relapsed patients, 85.7 per cent of failure patients, 30.0 per cent of transfer in patients, 50.0 per cent of default patients and 100 per cent of other patients. MDR was found in 8.0 per cent of new patients, 43.5 per cent of relapsed patients, 85.7 per cent of failure patients, 10.0 per cent of transfer in patients, 33.3 per cent of default patients and 100 per cent of other patients.

The association between factors and drug resistance among infectious TB patients is shown in Table 3. The factors for analysis included age, years in the prison, previous detention, moved from another prison, intravenous drug use, HIV infected, previous TB treatment and previous close contact with an infected household. Of all factors analyzed, only previous TB treatment was significantly associated with drug resistance (one or more drugs, p-value = 0.011; and MDR, p-value < 0.001). Statistical association using chi square test revealed that there was no statistically significant association with drug resistance (p-value > 0.05).

Table 4 shows the drug resistance patterns among 165 *M. tuberculosis* strains isolated from prisoners in these prisons. In general, 49.7 per cent of the isolates were resistant to one or more drugs. Resistance to one, two, three, and four drugs was observed in 20.0, 13.3, 4.2, and 12.1 per cent of the isolates, respectively. MDR was found in 18.8 per cent of the isolates. Resistance to isoniazid alone was 8.5 per cent, any resistance 35.8 per cent; for streptomycin-single 11.5 per cent, any 36.4 per cent; for rifampicin-single 0 per cent, any 19.4 per cent; for ethambutol-single 0 per cent, any 16.4 per cent.

Table 5 shows the drug resistance patterns as classified by type of drug resistance. Of the total bacteriologically confirmed 165 TB cases, 119 cases (72.1%) had primary drug resistance strains while 46 cases (24.2%) had acquired drug resistance strains. The prevalence of primary drug resistance to one or more drugs was 42 per cent. Resistance to one, two, three and four drugs was 23.5, 12.6, 1.7 and 4.2 per cent, respectively; and MDR was 6.7 per cent. The prevalence of acquired drug resistance to one or more drugs was 69.6 per cent. Resistance to one, two, three, and four drugs was 10.9, 15.2, 10.9, and 32.6 per cent, respectively; and MDR was 50 per cent.

Of the total 119 cases who had primary drug resistance strains, 73 cases were from the KC, 33 cases from the BC, and 13 cases from the CI (Table 6). The strains from prisoners of the CI showed the highest resistance to one or more drugs (53.9%), followed by the KC prison (42.5%) and the BC prison (36.4%). However, MDR was found mostly from strains isolated from the prisoners of the KC prison (8.2%), followed by the CI (7.7%), and the BC (3.0%), respectively.

DISCUSSION

Pulmonary TB in prisoners often went undetected and was frequently misdiagnosed, resulting in delay in treatment from medical services that are usually inferior to those for the general population. Worse still, poorly treated patients in prison may spread MDR bacilli to fellow prisoners, guards, and medical personnel. When released, they may infect their own families and general population[7]. This effect may be enhanced by HIV infection and inade-

Table 1. Number and prevalence rate of anti-tuberculosis drug resistance to one or more drugs and multi-drug resistance among prisoners in three prisons classified by socio-demographic characteristics.

Characteristics	No. tested	Resistance to one or more drug		Multidrug resistance	
	N	N	%	N	%
Total	154	78	50.6	30	19.5
Age (years)					
< 35	100	48	48.0	13	13.0
≥ 35	54	30	55.6	17	31.5
Region					
Bangkok	77	41	53.2	18	23.4
Central	29	12	41.4	3	10.3
Northern	11	6	54.5	3	27.3
Southern	11	8	72.7	3	27.3
Northeastern	21	9	42.9	2	9.5
Foreign	5	2	40.0	1	20.0
Education level					
No education	6	2	33.3	1	16.7
Primary level	85	42	49.4	13	15.3
Secondary level	55	30	54.5	15	27.3
Vocational level	8	4	50.0	1	12.5
Occupation					
Unemployed and student	17	11	64.7	4	23.5
Employee	105	52	49.5	22	21.0
Agriculturist	16	7	43.8	2	12.5
Merchant and own private business	16	8	50.0	2	12.5
Type of offense					
Offense against narcotic law	90	51	56.7	19	21.1
Offense against property	20	11	55.0	6	30.0
Offense against life and body	36	13	36.1	4	11.1
Sex offense	4	2	50.0	1	25.0
Others (firearm, fault document, offense about weapon)	4	1	25.0	0	0.0
Type of prisoners					
Remand prisoners	18	12	66.7	5	27.8
Sentenced prisoners	136	66	48.5	25	18.4
The length of time spent in this prison (months)					
< 12	85	37	43.5	12	14.1
≥ 12	69	41	59.4	18	26.1
Cell occupancy (persons/cell)					
< 30	106	56	52.8	24	22.6
≥ 30	48	22	45.8	6	12.5
Previous detention					
Never	69	33	47.8	13	18.8
Yes	85	45	52.9	17	20.0
Moved from other prisons					
Never	28	17	60.7	10	35.7
Yes	126	61	48.4	20	15.9
Intravenous drug users					
Yes	82	43	52.4	19	23.2
No	72	35	48.6	11	15.3
HIV infection					
Positive	88	47	53.4	21	23.9
Negative	59	27	45.8	8	13.6
Unknown	7	4	57.1	1	14.3

Table 2. Number and prevalence rate of anti-tuberculosis drug resistance to one or more drugs and multidrug resistance among prisoners in three prisons classified by previous history of pulmonary tuberculosis and close contact with a household with pulmonary tuberculosis.

Characteristics	No. tested	Resistance to one or more drug		Multidrug resistance	
	N	N	%	N	%
Total	154	78	50.6	30	19.5
Previous pulmonary tuberculosis					
Yes	45	30	66.7	21	46.7
No	109	48	44.0	9	8.3
Number of previous tuberculosis treatment (times)					
1	38	25	65.8	17	44.7
> 1	7	5	71.4	4	57.1
Place of previous treatment					
Health center	2	1	50.0	1	50.0
Government hospital	13	10	76.9	6	46.2
Prison	30	19	63.3	14	46.7
Duration of treatment (months)					
< 6	13	6	46.2	3	23.1
≥ 6	32	24	75.0	18	56.3
Treatment outcome					
Cure	26	19	73.1	14	53.8
Not cure	19	11	57.9	7	36.8
Previous close contact with household pulmonary tuberculosis					
Yes	15	8	53.3	4	26.7
No	139	70	50.4	26	18.7
Result of previous family treatment					
Cure	5	3	60.0	2	40.0
During treatment	2	1	50.0	0	0.0
Death	8	4	50.0	2	25.0

quate infection control. Unfortunately, the emergence of MDR-TB is a serious concern and an obstacle to successful treatment because commonly used medicines are no longer effective. Medicines used for the treatment of patients with MDR-TB may have severe adverse reactions and these medicines cost at least 100 times as much as a normal course of routine treatment(12).

Several studies have evaluated the prevalence rate of drug resistance and factors associated with prisoners but there are no published data on levels of MDR-TB in comparable civilian populations, although high levels have been documented in many regions and countries. Of several prisons in Bangkok and the vicinity, three large prisons with over 6,000 prisoners including the KC prison, BC prison, and the CI had high rates of MTB infection and disease. These prisons have been conducted directly observe treatment with short course (DOTS) since 1998 and all TB suspected cases are diagnosed by sputum examination. Each prison has different characteristics; for example the prisoners at the KC prison are both Thai and foreign prisoners who have sentences of less than 30 years, the prisoners at the BC prison have the death penalty and life sentences or have sentences of more than 30 years, and the prisoners at the CI are only for offenses against the narcotic law, and some prisoners have already been sentenced (sentences < 10 years), or are still on remand.

During the 6-month period of the present study, most of the MTB isolates were taken from prisoners at the KC prison as this prison has a central hospital which takes care prisoners who are severe patients and transferred from other prisons. The hospital also has a laboratory section for the early detection of suspected TB cases. The prevalence rate of drug resistant TB in the three prisons showed that primary drug resistance to one or more drugs was 42.0 per cent and MDR-TB was 6.7 per cent, while acquired drug resistance to one or more drugs was 69.6 per cent and MDR-TB was 50.0 per cent. Primary drug resistance to one or more drugs in the KC prison, BC prison and

Table 3. Factors associated with resistance to one or more drugs and multidrug resistance among 154 smear-positive tuberculosis prisoners.

Characteristics	Resistance to one or more drugs					Multidrug resistance				
	Yes[a]		No[b]		P-value	Yes[c]		No[d]		P-value
	N	%	N	%		N	%	N	%	
Total	78		76			30		124		
Age (years)					0.371					0.060
< 35	48	48.0	52	52.0		13	13.0	87	87.0	
≥ 35	30	55.6	24	44.4		17	31.5	37	68.5	
Years in this prison					0.506					0.555
< 1	37	53.6	32	46.4		12	17.4	57	82.6	
≥ 1	41	48.2	44	51.8		18	21.2	67	78.8	
Previous detention					0.528					0.857
Yes	45	52.9	40	47.1		17	20.0	68	80.0	
No	33	47.8	36	52.2		13	18.8	56	81.2	
Move from other prison					0.239					0.162
Yes	61	48.4	65	51.6		20	15.9	106	84.1	
No	17	60.7	11	39.3		10	35.7	18	64.3	
Intravenous drug user					0.635					0.217
Yes	43	52.4	39	47.6		19	23.2	63	76.8	
No	35	48.6	37	51.4		11	15.3	61	84.7	
HIV status					0.363[e]					0.284
Yes	47	53.4	41	46.6		21	23.9	67	76.1	
No	27	45.8	32	54.2		8	13.6	51	86.4	
Unknown	4	57.1	3	42.9		1	14.3	6	85.7	
Previous TB treatment					0.011					< 0.001
Yes	30	66.7	15	33.3		21	46.7	24	53.3	
No	48	44.0	61	56.0		9	8.3	100	91.7	
Previous close contact with an infected household					0.827					0.459
Yes	8	53.3	7	46.7		4	26.7	11	73.3	
No	70	50.6	69	49.4		26	18.7	113	81.3	

a = resistance to one or more drugs, b = susceptible to all four drugs tested,
c = resistance to both isoniazid and rifampicin with or without resistance to other drugs (MDR-TB),
d = the remaining tested without MDR-TB, e = not include unknown group.

CI were 42.5, 36.4 and 53.9 per cent, respectively; and MDR-TB were 8.2, 3.0 and 7.7 per cent, respectively.

Of several factors analyzed in the present study, only previous TB treatment was associated with drug resistance ($p < 0.05$). While other factors, i.e. age, length of time in prison, previous detention, moved from another prison, IV drug use, HIV infected and previous close contact with an infected household were non significant ($p > 0.05$). High numbers of MDR-TB cases in prisons have also been reported from many countries[13]. From the prevalence survey among sentenced inmates with PTB in prisons in Georgia[14], the initial resistance to at least one drug was 75.0 per cent and MDR-TB was 5.6 per cent. Risk markers associated with MDR were a prison stay of less than 2 years and being over 25 years of age. While the authors found the length of time spent in the present prison and age were not risk factors for resistance. This may explain the difference characteristics of these prisons in the present study.

However, a previous history of TB treatment was by far the most important predictor of drug resistance in the present study which was consistent with several studies[15-17]. This highlights the critical importance of obtaining a thorough history of previous treatment of all prisoners suspected of having TB[16]. The authors did not find that HIV infection was associated with drug resistance, in contrast to several reports[16,18]. However, many studies for MDR-TB in prisons did not find an association between HIV infection and becoming infected with MDR-TB, but HIV infection was strongly associated with rapid progression to active disease once a person was infected, and most MDR-TB cases had a very high mortality rate[19].

Table 4. Drug resistance among *M. tuberculosis* strains isolated from prisoners in three prisons; Klongprem Central prison (KC), Bangkwang Central prison (BC), and the Correctional Institutional (CI) for Male Drug Addicts-Bangkok.

Drug resistance	Prisons						Total	
	KC		BC		CI			
	N	%	N	%	N	%	N	%
Total number of strain tested	101	100	37	100	27	100	165	100
Susceptible to all 4 drugs	49	48.5	23	62.2	11	40.7	83	50.3
Any resistance	52	51.5	14	37.8	16	59.3	82	49.7
1 drug	19	18.8	11	29.7	3	11.1	33	20.0
H	6	5.9	6	16.2	2	7.4	14	8.5
S	13	12.9	5	13.5	1	3.7	19	11.5
R	0	0.0	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0	0	0.0
2 drugs	15	14.9	0	0.0	7	25.9	22	13.3
HR	1	1.0	0	0.0	3	11.1	4	2.4
HE	1	1.0	0	0.0	0	0.0	1	0.6
HS	11	10.9	0	0.0	2	7.4	13	7.9
RS	1	1.0	0	0.0	0	0.0	1	0.6
ES	1	1.0	0	0.0	2	7.4	3	1.8
3 drugs	2	2.0	1	2.7	4	14.8	7	4.2
HRE	1	1.0	0	0.0	2	7.4	3	1.8
HRS	1	1.0	1	2.7	2	7.4	4	2.4
4 drugs	16	15.8	2	5.4	2	7.4	20	12.1
HRSE	16	15.8	2	5.4	2	7.4	20	12.1
MDR	19	18.8	3	8.1	9	33.3	31	18.8
H + others	59	58.4	9	24.3	13	48.1	59	35.8
S + others	43	42.6	8	21.6	9	33.3	60	36.4
R + others	20	19.8	3	8.1	9	33.3	32	19.4
E + others	19	18.8	2	5.4	6	22.2	27	16.4

H = isoniazid, S = streptomycin, R = rifampicin, E = ethambutol, MDR = multidrug resistance (resistance to both H and R with or without resistance to other drugs), any resistance = resistance to one or more drugs.

In the present study, the prevalence of acquired drug resistance was much higher than that of primary drug resistance as shown previously in several reports[14,20,21]. Since a wild strain of *M. tuberculosis* that has never been exposed to drugs is almost never resistant[20]. Thus, drug resistant TB has been largely attributed to lapses in the implementation of basic disease control strategies[18]. In primary drug resistance, this information is obtained from cases with effectively no previous treatment. It reflects a failure to prevent transmission of resistant organisms. Whereas, acquired drug resistance reflects more recent case mismanagement. The populations assessed for this were patients who had been treated for a month or longer in the past. Acquired drug resistance results from spontaneously occurring mutations that confer resistance to individual drugs. Although, these mutations occur at a predictable rate, the administration of a combination of effective drugs can prevent the emergence and subsequent dominance of a resistant sub-population of organisms. Errors in choice of drug or non-compliance with prescribed therapy have been recognized as factors that encourage the emergence of drug resistance.

Decreases in public health funding, poor training of medical personnel in the treatment of TB, lapses in infection control techniques, worsening socio-economic conditions, and the ongoing HIV epidemic have all combined to increase the occurrence of TB and resistance to antituberculous agents[17]. For these reasons, most prisoners have the same characteristics as many people enter prison from a disadvantaged socio-economic background. They, therefore, enter prison already with a high risk of infection with TB. Because of prison conditions, imprisonment puts prisoners at high risk of acquiring infection and developing disease. Because prison health services often fail to implement effective TB control and guarantee a cure of TB, prisoners are at a high risk of leaving prison with drug resistant TB.

Table 5. Anti-tuberculosis susceptibility patterns among *M. tuberculosis* strains isolated from prisoners in three prisons as classified by type of drug resistance.

Drug resistance	Primary		Acquire		Both	
	N	%	N	%	N	%
Total number of strain tested	119	100	46	100	165	100
Susceptible to all 4 drugs	69	58.0	14	30.4	83	50.3
Any resistance	50	42.0	32	69.6	82	49.7
1 drug	28	23.5	5	10.9	33	20.0
H	12	10.1	2	4.4	14	8.5
S	16	13.4	3	6.5	19	11.5
R	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0
2 drugs	15	12.6	7	15.2	22	13.3
HR	1	0.8	3	6.5	4	2.4
HE	1	0.8	0	0.0	1	0.6
HS	10	8.4	3	6.5	13	7.9
RS	0	0.0	1	2.2	1	0.6
ES	3	2.5	0	0.0	3	1.8
3 drugs	2	1.7	5	10.9	7	4.2
HRE	1	0.8	2	4.4	3	1.8
HRS	1	0.8	3	6.5	4	2.4
4 drugs	5	4.2	15	32.6	20	12.1
HRSE	5	4.2	15	32.6	20	12.1
MDR	8	6.7	23	50.0	31	18.8
H + others	31	26.1	28	60.9	59	35.8
S + others	35	29.4	25	54.3	60	36.4
R + others	8	6.7	24	52.2	32	19.4
E + others	10	8.4	17	37.0	27	16.4

H = isoniazid, S = streptomycin, R = rifampicin, E = ethambutol, MDR = multidrug resistance (resistance to both H and R with or without resistance to other drugs), any resistance = resistance to one or more drugs.

The rates of mono- and multi-drug resistance among the three prisons seem to be different, because these prisons have different characteristics. However, the authors could not compare the difference in drug resistant patterns between these prisons by statistics due to some limitations, i.e., low number of TB patients at some prisons or no information regarding previous history of treatment of some patients so their specimens were excluded from the study. The BC prison had prisoners who had the death penalty and a sentence of more than 30 years or a life sentence. Patients referred to other prisons were rarely found, so these patients were completely treated. The HIV status was documented negative in more than 75 per cent. In addition, implementation of DOTS in this prison was successful. The treatment outcome of new patients with a positive smear at cohort 3/2000 (October, 1999 - January, 2000) was 95 per cent cure rate and 5 per cent transferred out.

The KC prison had prisoners who were sentenced for less than 30 years. This prison had a high turnover of prisoners through repeated transfers within the prison system, and most prisoners had previous detention or were referred from other prisons because there is a central hospital taking care prisoners who were severe patients or transferred from other prisons. HIV infection was documented in 63 of 91 TB patients (69%) with a high mortality rate. The treatment outcome of new patients with a positive smear at cohort 3/2000 was 45.0 per cent cure rate, 37.4 per cent death rate, 13.2 per cent transferred out and 4.4 per cent failure rate.

The CI had prisoners who committed an offense against the narcotic law, or some were still on remand or had already been sentenced. This prison also had a high turnover of prisoners through repeated transfers within the prison system, released and recidivism. Also patients who had been transferred or released while being treated. Some patients continued their treatment, but some were noncompliant or had no further treatment. Most prisoners had previous detention, IV drug user and HIV infected. The treat-

Table 6. Primary drug resistance among 119 *M. tuberculosis* strains isolated from prisoners in three prisons; Klongprem Central prison (KC), Bangkwang Central prison (BC), and the Correctional Institutional (CI) for Male Drug Addicts-Bangkok.

Drug resistance	Prisons						Total	
	KC		BC		CI			
	N	%	N	%	N	%	N	%
Total number of strains tested	73	100	33	100	13	100	119	100
Susceptible to all 4 drugs	42	57.5	21	63.6	6	46.2	69	58.0
Any resistance	31	42.5	12	36.4	7	53.9	50	42.0
1 drug	15	20.6	11	33.4	2	15.4	28	23.5
H	4	5.5	6	18.2	2	15.4	12	10.1
S	11	15.1	5	15.2	0	0.0	16	13.4
R	0	0.0	0	0.0	0	0.0	0	0.0
E	0	0.0	0	0.0	0	0.0	0	0.0
2 drugs	10	13.7	0	0.0	5	38.4	15	12.6
HR	0	0.0	0	0.0	1	7.7	1	0.8
HE	1	1.4	0	0.0	0	0.0	1	0.9
HS	8	10.9	0	0.0	2	15.4	10	8.4
ES	1	1.4	0	0.0	2	15.4	3	2.5
3 drugs	1	1.4	1	3.0	0	0.0	2	1.6
HRE	1	1.4	0	0.0	0	0.0	1	0.8
HRS	0	0.0	1	3.0	0	0.0	1	0.8
4 drugs	5	6.8	0	0.0	0	0.0	5	4.2
HRSE	5	6.8	0	0.0	0	0.0	5	4.2
MDR	6	8.2	1	3.0	1	7.7	8	6.7
H + others	19	26.0	7	21.2	5	38.5	31	26.1
S + others	25	34.2	6	18.2	4	30.8	35	29.4
R + others	6	8.2	1	3.0	1	7.7	8	6.7
E + others	8	11.0	0	0.0	2	15.4	10	8.4

H = isoniazid, S = streptomycin, R = rifampicin, E = ethambutol, MDR = multidrug resistance (resistance to both H and R with or without resistance to other drugs), any resistance = resistance to one or more drugs.

ment outcome of new patients with a positive smear at cohort 3/2000 was about 47.0 per cent cure rate, 3 per cent death rate and 50 per cent transferred out.

In conclusion, there has been a marked increase in drug-resistant tuberculosis among prisoners in these prisons. Since drug resistance has complicated efforts to control tuberculosis, improvements in tuberculosis control programs in prisons are urgently needed. It is recommended that the public health sector and prison authorities work in close collaboration and co-ordination to rapidly detect cases upon entry, at least by microscopy, and by sustaining a good quality of TB services. Drug susceptibility testing should be performed for all positive initial cultures especially isolates from patients with a history of previous treatment. Tuberculosis medications should always be administered by directly observed therapy to ensure patient adherence to treatment, facilitate monitoring of drug side effects, and encourage patient education. Moreover, discharged prisoners with tuberculosis should be appropriately referred to hospitals or TB control centers. Some approaches taken include education programmes for correctional staff, technical development, statutory regulation and surveillance of drug resistance in all correctional institutions.

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วัณโรคดื้อยาในผู้ต้องขังของเรือนจำ 3 แห่ง ในเขตกรุงเทพ ฯ และปริมณฑล

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การศึกษาเพื่อหาระดับความชุกของวัณโรคที่ดื้อยาต้านวัณโรคหลัก และปัจจัยที่มีความสัมพันธ์ต่อการดื้อยาในกลุ่มผู้ต้องขังของเรือนจำ 3 แห่ง ในเขตกรุงเทพ ฯ และปริมณฑล ได้แก่ เรือนจำกลางคลองเปรม เรือนจำกลางบางขวางและทัณฑสถานบำบัดพิเศษกลาง ผลการตรวจความไวของเชื้อวัณโรค จำนวน 165 สายพันธุ์ ที่แยกได้จากผู้ต้องขังของเรือนจำทั้ง 3 แห่ง พบว่า อัตราการดื้อต่อยาวัณโรค 1 ชนิดหรือมากกว่า พบได้ร้อยละ 49.7 ซึ่งแยกเป็นการดื้อยา 1, 2, 3 และ 4 ชนิด คิดเป็นร้อยละ 20, 13.3, 4.2 และ 12.1 ตามลำดับ และอัตราการดื้อยาหลายขนาน (MDR-TB) ร้อยละ 18.8 ซึ่งพบในกลุ่มดื้อยาปฐมภูมิ ร้อยละ 6.7 และกลุ่มดื้อยาทุติยภูมิ ร้อยละ 50 ส่วนการดื้อยาปฐมภูมิในเรือนจำแต่ละแห่ง พบอัตราการดื้อยาวัณโรค 1 ชนิดหรือมากกว่า ในเรือนจำกลางคลองเปรม, เรือนจำกลางบางขวางและทัณฑสถานบำบัดพิเศษกลาง คิดเป็นร้อยละ 42.5, 36.4 และ 53.9 ตามลำดับ และอัตราการดื้อยาหลายขนาน คิดเป็น ร้อยละ 8.2, 3.0 และ 7.7 ตามลำดับ จากปัจจัยหลาย ๆ อย่าง ที่ทำการศึกษาในครั้งนี้ พบว่าการเคยมีประวัติการรักษาวัณโรคมาก่อน เป็นเพียงปัจจัยเดียวที่มีความสัมพันธ์กับการดื้อยา อย่างมีนัยสำคัญทางสถิติ ($p < 0.05$) ข้อมูลการศึกษานี้สรุปได้ว่า วัณโรคในระยะแพร่เชื้อในเรือนจำมีความชุกของการดื้อยาสูง ซึ่งจะส่งผลให้ปัญหาวัณโรคในเรือนจำ มีความรุนแรงและซับซ้อนมากขึ้น ควรมีนโยบายและสนับสนุนให้มีการค้นหาผู้ป่วยวัณโรคในระยะแพร่เชื้อโดยเร็ว รวมทั้งการรักษาโดยกลวิธีการกำกับการรักษา (Directly Observed Treatments, Short course: DOTS) และจัดให้มีระบบส่งต่อที่เหมาะสม และสามารถติดตามผู้ป่วยที่พ้นโทษ ไม่ให้เกิดการระบาดไปยังชุมชนอีก โดยมีความร่วมมือกันแก้ปัญหาโดยหน่วยงานสาธารณสุขและเรือนจำต่อไป

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