



Tuberculosis Behind Bars in Israel: Policy Making Within a Dynamic Situation

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Abstract

Background: The crowded environment of correctional facilities may enhance infectious diseases transmission, such as tuberculosis.

Objectives: To define the tuberculosis burden in prisons in Israel, a country of low TB incidence (7.9 cases/100,000 population in 2004), in which about 13,000 inmates are being incarcerated annually, and to recommend policy adaptations for TB control.

Methods: All prison clinic lung records from 1998 through 2004 in Israel were reviewed to identify pulmonary TB patients. Additionally, we reviewed TB epidemiological investigation files from one northern prison (years 2002 through 2005) to evaluate possible transmission of the disease.

Results: During the study period 23 Israeli inmates had pulmonary TB (25 cases/100,000 prisoners), which was 3.5 times higher than in the general population. Of those, 18 (78%) were born in the Former Soviet Union and immigrated to Israel after 1990. Four pulmonary TB cases in the evaluated prison were reported, and 22% (149/670) of all inmates and staff were referred for treatment of latent TB infection.

Conclusions: To prevent future TB cases, we recommend new prevention measures, including a symptom questionnaire for all new inmates and selective tuberculin skin testing for inmates infected with human immunodeficiency virus/AIDS, those who inject drugs, and those who emigrated from the former Soviet Union after 1990. New staff should be screened by the two-step tuberculin skin test and annual symptoms questionnaire thereafter. Incarceration may be used as a point of detection for TB and a window of opportunity for treatment in this hard-to-reach population.

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For Editorial see page 227

Crowded conditions in correctional settings may facilitate transmission of various infectious pathogens, including tuberculosis [1]. All three aspects of the “epidemiological triangle” are noteworthy in prisons: agent (pathogen), host, and environ-

ment. First, *Mycobacterium tuberculosis* is transmitted by aerosolized droplets exhaled by pulmonary TB patients to persons who have significant (close and prolonged) contact. Second, behavioral and personal attributes of the inmates such as low socioeconomic status, homelessness, drug use, poor nutrition, and physical and mental stress may worsen their health status, either increasing their susceptibility to infection or enhancing reactivation of latent TB infection [2]. Finally, factors such as overcrowding, inadequate ventilation, and frequent rotation of inmates in and between facilities present a favorable environment for TB transmission [3]. All TB control measures should take into consideration these three fundamental determinants.

It is estimated that 8–10 million persons are detained or incarcerated globally [3], yet limited data are available concerning inmates’ health status or TB screening of inmates. The majority of reports of TB outbreaks in correctional facilities are from the United States [4]. TB rates in U.S. prisons were found to be 3–11 times higher than in the general U.S. population [5], and it was estimated that a 1 year stay in the New York City jail system increases the odds of an inmate becoming infected with *M. tuberculosis* by 2.2 [6]. Additional reports from other countries provide further evidence that correctional facilities constitute a potential reservoir of *M. tuberculosis* [2,3,7–9].

Prison staff who develop TB following occupational exposure may further transmit TB to the community. It was found that in New York City jails, one-third of all TB cases were among the prison staff [8]. In one outbreak, molecular epidemiological analysis found that 38 prisoners and five prison staff members shared a common TB strain with 23% of all TB cases in that community [9].

Prompt diagnosis and treatment of TB is necessary for disease control. Missed diagnosis and delayed or inadequate treatment

TB =tuberculosis

may result in *M. tuberculosis* transmission within a facility and also to the non-incarcerated, either from infectious staff or from infectious inmates released into the community [6,10].

Israel is a country of low TB incidence (7.9 per 100,000 population; 2004 data) [11]. The majority of TB-infected individuals are immigrants from endemic countries, notably from Ethiopia and the former Soviet Union [12]. Of all new TB cases diagnosed annually between the years 1998 and 2004, 29.4% were born in the former Soviet Union. The national TB program was implemented in Israel in 1997 [13], but it is not responsible for military personnel or for inmates in prisons.

The Israeli Prison Service operates 19 facilities nationwide. Approximately 13,000 inmates (183 inmates per 100,000 populations) are incarcerated in Israeli prisons at any given time. Routinely, convicted inmates are incarcerated in prison following a detention period spent in jail, which is usually operated by the Israeli police. While in prison, inmates are entitled to free medical care. The medical infrastructure includes an infirmary staffed with a paramedic and a house physician in each prison, in addition to one central prison hospital. Every new inmate is given a medical examination upon incarceration and is screened for human immunodeficiency virus infection. Currently, TB screening policy is practiced inconsistently in a few prisons, upon physician discretion. Each TB patient detected in prison is referred to the respiratory isolation ward in the prison's hospital, where they are treated.

In this study we investigated TB morbidity in Israeli prisons, discuss the different aspects of TB prevention in correctional facilities, and provide TB control recommendations tailored to the local Israeli environment. To our knowledge, this is the first publication describing TB epidemiology in Israeli prisons.

Patients and Methods

We reviewed all patients' records in the lung clinic at the central prison's hospital for 1998 through 2004 to locate pulmonary TB patients. All cases were then verified by being cross-matched with the national computerized TB registry at the Ministry of Health. In addition, following reports of four pulmonary TB cases in a prison in northern Israel, extensive epidemiological investigations for additional cases were conducted by the local district health office in collaboration with the regional TB clinic and prison authorities. The files of these four cases were reviewed for the results of screening and active case finding among inmates and staff.

Each patient with suspected pulmonary TB was referred to an airborne infection isolation ward located in the prison hospital, and therapy was recommended. Each individual with significant exposure to pulmonary TB was considered a close contact, questioned regarding TB symptoms, and evaluated with a tuberculin skin test, and if indicated either by symptoms or by TST¹ results, a chest X-ray was performed.

For close contacts whose initial TST reaction was < 5 mm of induration, the procedure was repeated after 2 weeks. If the

second TST result was negative, the person was considered uninfected. Inmates or personnel who were close contacts of an infectious TB patient and had a TST reaction ≥ 5 mm were considered infected. For all others, a TST reaction of ≥ 10 mm was considered positive. Prior BCG (Bacille Calmette-Guérin) immunization was not considered when evaluating the TST results.

The evaluation for TB disease included examination of at least two sputum samples collected on consecutive days. *M. tuberculosis* isolates were tested for susceptibility to first-line anti-tuberculosis drugs. IS6110 restriction fragment length polymorphism analyses and spoligotyping were carried out according to standard procedures [14] on the first positive culture for each patient. RFLP² and spoligotyping patterns were compared with the profiles available in the national mycobacterium reference center database to identify similar patterns (clusters) in strains of *M. tuberculosis*.

Programmatic evaluations of patient medical files are not deemed to be human subject research by the Israeli Department of Tuberculosis and AIDS, consequently no institutional review board approval was required. The non-Israeli author became engaged in the activity in the analytic phase of the project and had no access to identifiable information.

Results

Pulmonary TB in Israeli prisons

During the study period, the majority of inmates were males (97%), and the average length of imprisonment was 6 years. Among all prisoners, 77% were born in Israel and 12% originated from countries of the former Soviet Union, who immigrated to Israel after 1990 (similar to their proportion in the general population) [15]. There are no reliable data concerning drug-using habits inside the prison; however, 10% of all prisoners were incarcerated for drug-related felonies (Dr. Alex Adler, Israeli Prison Services, personal communication).

Between the years 1998 and 2004 a total of 23 male patients with active pulmonary TB were identified. As none of the patients were screened prior to incarceration, it is unknown whether they developed the disease prior to or during their confinement. None of the patients were HIV³ infected or had any additional pulmonary morbidity. The average age at the time of TB diagnosis was 34 years (range 21–65). Two patients were born in Israel, two in Africa, and 18 in the former Soviet Union; one patient's nationality was not specified. Among the non-Israeli born, the average time elapsed from immigration to Israel to TB diagnosis was 4.7 years (range 0.2–12.8). The average annual TB incidence in prisons for the period 1998–2004 was 25 cases per 100,000 prisoners, which was 3.5 times higher than for the general population. All patients successfully completed a full course of treatment by directly observed therapy.

TB contact investigation in a northern Israeli prison

Between the years 2002 and 2005, four patients with active pulmonary TB were reported from a low security prison in northern

RFLP = restriction fragment length polymorphism

HIV = human immunodeficiency virus

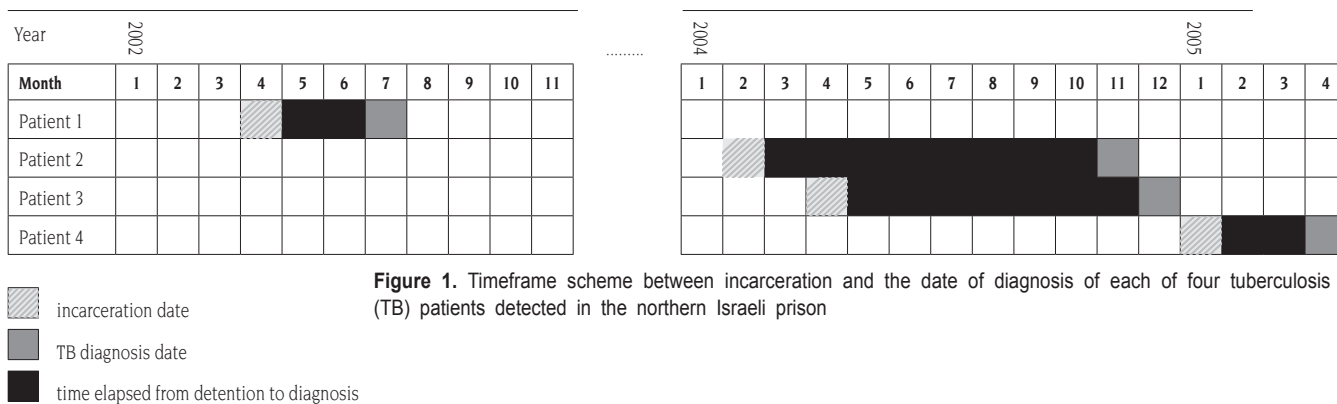


Figure 1. Timeframe scheme between incarceration and the date of diagnosis of each of four tuberculosis (TB) patients detected in the northern Israeli prison

Israel that houses 550 prisoners and employs about 120 correctional officers [Figure 1]. During four investigations, 368 contacts were identified and LTBI⁴ treatment was recommended for 149 (40%) of the contacts

Table 1. Findings from TB contact investigations in a northern Israeli prison

Patient No.	Date of investigation	No. of contacts	Total No.	Skin test performed				Chest X-ray performed			Treatment recommended for LTBI
				0-4 mm	5-9 mm	10-14 mm	> 15 mm	Total No.	Normal	Pathologic findings	
1	July 2002	45	43	14	3	9	17	28	23	5	27
2	Nov 2004	17	17	3	1	6	7	11	11	0	9
3	Dec 2004	53	43	2	0	14	27	43	39	4	39
4	April 2005	253	216	113	21	35	47	87	81	6	74
Total		368	319	132	25	64	98	169	154	15	149

[Table 1]. Two of the four TB patients were detected during contact screening performed in that prison. None of the TB patients were infected with HIV and all had culture confirmation of their disease. In all patients the isolates were susceptible to first-line anti-TB drugs.

Owing to the close contact among the TB patients, genotyping tests using RFLP and spoligotyping were performed. Matching patterns demonstrated 93% identity, as one band (fragment) difference was found between the 14 bands of the isolates of two patients. No epi-link was detected, as those patients were incarcerated in different time periods. A conservative evaluation does not allow us to prove a definite inmate-to-inmate transmission.

Following detection of the third case, the correctional officers in that prison were screened with a TST. Skin testing was performed on 95 correctional officers (79.1%), and 35 (36.8% of those screened) had a positive TST result. Twelve correctional officers were recommended for treatment of LTBI.

Discussion

The average annual TB incidence in Israeli prisons for 1998 through 2004 was 3.5 times higher than in the general population. This higher rate among prisoners is consistent with reports from other countries [7]. Several explanations can be suggested for this higher rate:

- A disproportionate number of prisoners may have risk factors for previous exposure to *M. tuberculosis*, or for progressing to pulmonary disease if infected [16]. Compared to the general population, prison residents are characterized by

a lower socioeconomic status, birth in or originating in a TB-endemic country, homelessness, psychiatric disorders, HIV infections, drug and alcohol abuse, and a history of prior incarceration [2,17].

- The prison infrastructure may facilitate *M. tuberculosis* transmission by its crowded environment, inadequate ventilation, and frequent turnover of prisoners in and between facilities.
- Certain behaviors practiced by prisoners, such as hiding their symptoms, may delay diagnosis. The fear of stigma associated with the disease and the need to isolate the patient may be perceived by the inmate as a means of punishment [2], and thus may inhibit an inmates' disclosure of typical TB symptoms. Other inmate behaviors such as bartering or selling their TB drugs, added to the mistrust between inmates and prison authorities, may jeopardize their adherence to screening and treatment [2].

In Israel, inmates are inconsistently screened for TB upon incarceration in only a few correctional facilities. One possible consequence of the partial screening process assessed in our study was a delay in diagnosis in the northern prison: two additional pulmonary TB patients were detected only during the contact investigation of two other TB cases. Because no data were available on initial TST results of inmates and staff, we could not compare the post-exposure TST results with the baseline status. Thus, TST values during contact investigations were considered to be positive at ≥ 5 mm induration for close contacts, and ≥ 10 mm induration for other inmates and staff screened. Using this conservative evaluation process, preventive treatment was recommended to nearly 40% of all contacts.

LTBI = latent TB infection

Routine screening of detainees accomplishes two goals [18]. The first is identification of TB disease, which threatens both the prisoner's health and that of his or her contacts during the infectious period. Initiation of respiratory isolation and prompt treatment for infectious inmates is recommended. The second is detection of LTBI and referral to treatment. Lifelong risk for TB reactivation is estimated to be 5–10%, depending on the patient's immunological status and the time since infection [19]. LTBI therapy is effective in preventing reactivation of disease. The optimal screening program in a prison setting may differ from one country to another [20], depending on cost-effectiveness calculations, TB rates, and availability of resources.

Although Israel is a country of low TB burden, immigrants from countries of the former Soviet Union represent a population that has higher TB rates (15 cases per 100,000 populations vs. < 1.5 per 100,000 among Israeli born, 2004 data; Ministry of Health, Israel). This immigrant population should receive special attention in correctional facilities, since 18 of the 23 TB patients in prison (78%) emigrated from the former Soviet Union after 1990. Thus, the symptom review should be translated into Russian, and periodic TST should be performed for inmates who recently emigrated from endemic countries. Also, since 10 of the 18 TB patients (55%) who originated from the former Soviet Union were present or past injecting drug users, special attention should be given to inmates' substance-using habits at incarceration. Screening should be performed in a socially sensitive and culturally competent manner to prevent stigmatization. As immigration patterns are subject to change, reevaluation of TB among foreign-born inmates is recommended every few years.

TB in industrialized and low TB burden countries tends to be concentrated in subgroups such as prisoners. Inmate populations often have limited interaction with the health care system prior to incarceration [20]. Thus, diagnosis and treatment in correctional facilities represent a window of opportunity for lowering the TB burden in this hard-to-reach population, and concomitantly fulfils a moral duty to improve the inmates' health status. Since inmates are captive populations in many senses, incarceration may be used for detection and for prompt and efficient treatment of TB.

As TB is identified in distinctive groups of prisoners, such as immigrants from the former Soviet Union, the authors recommend performing selective rather than universal screening of all new inmates and all staff of Israeli prisons:

- For inmates, the type of examination should be tailored to the inmate's complaints and physical findings. All prisoners should have a TB symptom review upon incarceration [21,22] as a first line against introduction of an infectious inmate into the prison population [Table 2]. Those who complain of symptoms should have a chest X-ray. The inmate should be isolated until sputum-smear results are proven negative. This symptom questionnaire offers a rapid, simple and low cost means for detecting TB; however, its ability is limited among immigrants owing to linguistic and cultural barriers. In addition, as mentioned above, inmates may learn the answers they should give in order to achieve their own

Table 2. TB symptoms questionnaire

Upon incarceration, each inmate should be asked these questions by a medical staff member. If any is positive, refer the prisoner to the prison's physician for further evaluation:

- Productive prolonged cough for more than a month
- Hemoptysis
- Fever lasting more than a month
- Weight loss for unknown reason during the last 3 months
- Night sweats
- Prior active tuberculosis

purposes, such as avoiding detection of illness. The questionnaire offers a rapid, simple and low cost instrument for initial TB screening rather than chest radiography.

A single-step TST or an interferon-gamma release assay should be performed upon incarceration for certain inmate populations: the HIV infected, injecting drug users, and individuals who emigrated from countries of the former Soviet Union after 1990. Those who have positive TST results should have a chest X-ray. Inmates with an abnormal finding should have sputum specimens collected for microscopy and culture. TST results should be recorded as a baseline for further evaluation.

- For prison staff, a two-step TST upon employment is recommended; routine skin tests should be done in accordance with the frequency of TB outbreaks in the facility in which they are employed.
- Symptom review should be completed periodically in both inmates and staff to detect pulmonary TB.

Routine communication between prisons, local public health offices, and regional TB clinics is fundamental for TB control. Regular contact with the civil medical system is important during the prisoner's discharge in order to establish a follow-up treatment plan and to prevent transmission to the community. To supplement the screening process, health education is recommended for inmates and prison staff to increase awareness about TB symptoms and the routes of transmission, improve adherence to treatment for TB and LTBI, and ensure access to health care.

Although HIV infection is a powerful risk factor associated with pulmonary TB [23], fortunately none of the TB patients in the study had HIV infection, in contrast to previous studies among prisoners in other countries [24]. This finding may reflect the relatively low prevalence rate of HIV among the general population in Israel (0.1% among the adult population, 2004 data) [25] and may also be due to the policy of incarcerating HIV-infected prisoners in an isolated ward.

Conclusions

The correctional facility population and environment present favorable conditions for the transmission of *M. tuberculosis*. The correctional setting also provides the opportunity to approach high risk and hard-to-reach populations for early detection and treatment of TB and LTBI. Selective screening of designated

populations with high incidence rates of infection is an important measure in TB containment efforts. In order to detect inmates with TB disease, symptom review should be completed upon incarceration of inmates and for all new staff members, and should be repeated periodically. In addition, we recommend a TST upon incarceration for inmates who are HIV infected, injecting drug users, and individuals who emigrated from the former Soviet Union after 1990. Prison staff should be examined by the two-step TST process as a baseline for further medical evaluation.

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