Prevalence and predictors of default from tuberculosis treatment in Hong Kong

Objective. To determine the prevalence and risk factors of default from tuberculosis treatment in Hong Kong.

Design. Retrospective study.

Setting. Data were obtained from programme forms completed by physicians in the Hong Kong Government Tuberculosis and Chest Service and from medical records from Hong Kong chest clinics.

Patients. In all, 5917 patients registered for antituberculous drug therapy in 1996; medical records of 5757 patients were reviewed.

Main outcome measures. Patients who defaulted treatment were defined as those who had failed to collect medication for more than 2 consecutive months after the date of the last attendance during the course of treatment. Demographic and clinical characteristics, including history, treatment, and outcome, were compared between defaulters and non-defaulters, both among the whole group and among those with pulmonary disease.

Results. There were 442 (8%) patients who defaulted from treatment. Forty-five percent of those who defaulted did so in the first 2 months of treatment. Key risk factors associated with non-compliance were a history of default, male sex, and a history of concomitant liver disease or lung cancer. Among patients with pulmonary tuberculosis (381 defaulters and 1537 non-defaulters), multiple drug resistance was also associated with default from treatment. Among defaulters with pulmonary disease, 39% were still bacteriologically positive at the time of default.

Conclusion. Default from treatment may be partially responsible for the persistent high rates of tuberculosis in Hong Kong in the past decade. Health professionals should ensure that all barriers to treatment be removed and that incentives be used to encourage treatment compliance.
**Introduction**

Tuberculosis is a leading cause of morbidity and mortality worldwide.\(^1\) In Hong Kong, the incidence of tuberculosis was very high in late 1940s, at nearly 700.0 cases per 100 000 population. With the effective control programme of the Government Tuberculosis and Chest Service of the Hong Kong Special Administrative Region (Chest Service) and the progressive improvement in the socio-economic situation, the notification rate of tuberculosis decreased to 100.9 per 100 000 in 1995. Since then, the incidence of tuberculosis has increased progressively—to 101.0 in 1996, 109.0 in 1997, and 113.7 per 100 000 in 2000.\(^2\) Although the rise in incidence may merely reflect the increased awareness among the medical profession of the importance of notification,\(^3\) the increase may also be real. Furthermore, the lack of a decline in the notification rate during the past 10 years has to be explained.

Poor case management, often because of non-adherence to treatment, has emerged as the most important factor in the resurgence of tuberculosis and the appearance of multiple drug resistance (MDR).\(^4\) The prolonged duration of treatment, the need for multiple drugs, and socio-economic factors are the main reasons for non-adherence to treatment. The currently recommended minimum duration of treatment is 6 months, which, although much shorter than the previously recommended 12 to 24 months, is still very long. According to the World Health Organization (WHO), directly observed therapy (DOT) ensures successful treatment of patients with tuberculosis. Hong Kong has used DOT since the 1970s and was then one of the few places in the world to have such practice.\(^5\) There are still patients who are not compliant to DOT and default from treatment. In this study, we assessed the prevalence and predictors of default from tuberculosis treatment in Hong Kong.

**Methods**

We studied all patients who were registered for tuberculosis treatment between 1 January 1996 and 31 December 1996 with the Chest Service, which treats about 80% to 90% of all notified cases in Hong Kong each year. To examine the predictors of default from treatment, we used a nested case-control study design. Default was defined as failure to collect medication for more than 2 consecutive months after the date of the last attendance. For each case of default, four controls were randomly selected (using computer-generated random numbers) from cases of completed treatment.

Data of patients treated by the Chest Service were obtained from programme forms that were submitted by physicians of the Chest Service at the onset of tuberculosis treatment and at 6, 9, and 24 months thereafter. The forms had the following information: patient name, starting date of treatment, age, sex, history of treatment, the type of tuberculosis (pulmonary or extrapulmonary), the extent of disease (if pulmonary), and the case category (new, relapse, treatment after default, and treatment after failure). The forms also listed the type of drug regimen used, the frequency of drug treatment, side-effects, bacteriological status before treatment and at 2 and 5 or 6 months from the start of treatment, drug sensitivity of micro-organisms, and the treatment outcome. The following information was not available: socio-economic status, history of drug misuse, and human immunodeficiency virus (HIV) status. In addition, we reviewed medical records at local chest clinics for patients with missing forms, missing information, and inconsistent information between forms. Altogether, 5757 records were reviewed. The definitions used in this study were modified from those according to the International Union Against Tuberculosis and Lung Diseases (Box).\(^6\)

Data were entered into an Epi-Info database (Windows version 6.0; Centers for Disease Control and Prevention, Atlanta, US) and their accuracy was checked. The data were then analysed using the Statistical Package for the Social Sciences (Windows version 6.0; SPSS Inc., Chicago, US). The differences in clinical features between the cases of default and the controls were tested by Chi squared analysis.
or analysis of variance. Multiple logistic regression was used to analyse the association between various risk factors and treatment default. This study was approved by the Ethics Committee of the University of Hong Kong.

**Results**

Of the 5757 patients who were treated by the Chest Service for tuberculosis in 1996, 442 (8%) refused treatment or failed to attend the clinic for more than 2 consecutive months, thereby fulfilling the criteria for treatment default. Approximately 45% of patients who defaulted did so within the first 2 months of treatment.

Of the 442 patients who defaulted, 381 (86%) had pulmonary tuberculosis. Of those with pulmonary disease, 149 (39%) were still bacteriologically positive (51 smear-and culture-positive, 86 culture-positive only, and 12 smear-positive only) at the time of default (Table 1).

From patients who completed treatment, 1768 were randomly selected as controls. The default group had more men than women and a higher proportion with a history of default compared with the control group (Table 2). There was no significant difference in age between defaulters and non-defaulters. Although a similar proportion of cases and of controls had concomitant illnesses, the proportion with diabetes was lower and the proportion with liver disease or lung cancer was higher among those who defaulted from treatment.

Among the controls, 1537 (87%) had pulmonary disease. The differences between defaulters and non-defaulters among patients with pulmonary disease were similar to the overall differences between defaulters and non-defaulters among the whole group in terms of distribution in age, sex, case category, and presence of concomitant illnesses (not shown). There were no differences between cases and controls with pulmonary disease in the extent of disease or presence of cavitation, and similar proportions had positive bacteriology (Table 3). Whereas the proportion with resistance to one or more drugs was similar between cases and controls, the proportion with MDR (defined as those with resistance to at least isoniazid and rifampicin) was higher among cases than among controls. All seven patients with MDR who defaulted were still culture-positive and three of them were also smear-positive at the time of default.

Multiple logistic regression analyses were performed to determine the risk factors associated with default among all patients and among those with pulmonary disease only. For the whole group, important risk factors associated with default included male sex (odds ratio [OR]=1.5; 95% confidence interval [CI], 1.1-2.1), a history of default (OR=8.2; 95% CI, 4.6-14.3), and diabetes (OR=0.6; 95% CI, 0.4-0.9). Among patients with pulmonary disease, the risk factors associated with default were male sex (OR=2.0; 95% CI, 1.2-3.4), a history of default (OR=13.2; 95% CI, 5.2-32.9), and MDR (OR=11.1; 95% CI, 2.0-60.6).
95% CI, 4.7-14.3), liver disease (OR=3.8; 95% CI, 1.5-9.5), and lung cancer (OR=8.1; 95% CI, 2.5-26.3) [Table 4]. A history of diabetes mellitus was associated with a reduced likelihood of default (OR=0.6; 95% CI, 0.3-0.9). For patients with pulmonary disease, in addition to the above risk factors, MDR tuberculosis was associated with default (OR=9.4; 95% CI, 2.1-41.8).

**Discussion**

The Chest Service’s policy is to treat all cases of tuberculosis with DOT. There are 18 chest clinics in Hong Kong, and patients are allowed to move freely between them for convenience. The clinics are open from 8:00 am to 7:30 pm during weekdays and for half-days on Saturdays. The cost of drug treatment is not an issue in Hong Kong, because all antituberculous drugs are free of charge. Thus, the infrastructure for DOT in Hong Kong is very good. Nevertheless, 442 (8%) of patients who registered at the Chest Service for treatment of tuberculosis in 1996 defaulted from treatment. Of the 381 who had pulmonary disease at the time of default, 40% had positive results to smear or culture tests, indicating that they were still potentially infectious. However, the treatment completion rate in Hong Kong in 1996 was about 80% at 12 months and 85% at 24 months, which reaches the target set by the WHO for treatment completion.

According to published studies, one smear- and culture-
positive patient with pulmonary tuberculosis infects, on average, about 12 others each year, and while each culture-positive patient infects two others.\textsuperscript{7} Hence, the patients who defaulted from treatment in 1996 might have infected 1032 individuals in the first year after default from treatment. Furthermore, about 10\% to 15\% of infected individuals develop the disease after infection and half of them may be infectious and in turn can transmit the disease to others.\textsuperscript{10} Thus, because the rate of default from treatment has varied by 7\% to 8\% each year during the past decade in Hong Kong,\textsuperscript{11} these defaulters might have added substantially to the pool of infectious people.

Because of other factors, such as death, natural remission, retreatment of some cases, and the effect of partial treatment on the viability of the bacilli, it is not possible to delineate exactly the impact of default from treatment to the overall rate of tuberculosis in Hong Kong. We also found that concomitant lung cancer was also a predictor of defaulting from treatment. The high mortality of lung cancer may have shortened the period of infectivity. Because the mean duration of infectivity of each case of tuberculosis is estimated to be 2 years,\textsuperscript{12} the additional annual risk of infection attributable to patients who defaulted from treatment in Hong Kong is about 0.03\%. Default from treatment is unlikely to be solely responsible for the current stagnant rate of tuberculosis at a relatively high level. Other factors, such as the high rate of tuberculosis among the elderly, together with the ageing population in Hong Kong, are probably also important.\textsuperscript{13}

In this study, we found that a history of default from treatment is the strongest predictor of non-compliance, followed by the presence of concomitant lung cancer, liver disease, and male sex. Thus, a history of default should alert the health professional to give special attention to ensure removal of all barriers to treatment. Most published studies have shown that HIV infection, homelessness, smoking, alcohol and drug misuse, psychiatric illness, and poverty are all risk factors for non-compliance to treatment.\textsuperscript{14,15} In our study, data on alcohol and drug abuse, HIV status, and socio-economic status were not available in the programme forms of the Chest Service. Additionally, patients with lung cancer and liver disease might have been hospitalised or died, but such information was not available to us.

Among patients with pulmonary disease, the risk of MDR tuberculosis was significantly higher among defaulters than non-defaulters, which is consistent with most of the published results.\textsuperscript{14,15} This finding is especially worrisome, because all patients were still bacteriologically positive at the time of treatment default. However, the surveillance of antituberculous drug resistance in Hong Kong between 1986 and 1999 showed a significant decline in overall drug resistance.\textsuperscript{16} Multiple drug resistance decreased from 2.7\% to 1.0\% for new cases and from 15.9\% to 8.3\% for retreated cases.

Legal sanction against defaulters has been attempted, but only mainly in the United States in the mid-1980s, when there was a dramatic rise in the rate of tuberculosis and MDR tuberculosis among HIV-infected individuals.\textsuperscript{17} Although there was widespread support for such legal action, there were concerns that these powers might be abused for use as a means of social control, and many believed that it was unfair to detain patients when their ability to comply with treatment was affected by the lack of housing, primary health care, and services for substance users.\textsuperscript{17,18} In the United Kingdom, legislation allows for the detention of an individual with a notifiable disease that is a threat to others, but this legislation is rarely used.\textsuperscript{19} The moral issues in the use of coercion and detainment in dealing with non-adherence in the diagnosis and treatment of tuberculosis have been widely debated.\textsuperscript{19,21} Although coercion and detainment have been found by ethicists to be a morally acceptable strategy to fight the spread of tuberculosis, their use to support strategies that improve treatment compliance must be sensitive to national and cultural differences and not simply be based on perceived successes elsewhere. Due regard must be paid to the possibility that such negative measures may aggravate the social stigma and discrimination that still surround this important airborne disease. Even if we can achieve 100\% case-holding, the strategy will still not work unless patients come forward for treatment in the first place.

On the other hand, it has been shown that successful DOT programmes with a high rate of treatment completion (86%-97\%) are those that provide incentives such as shelter for the homeless, methadone and rehabilitation programmes for drug abusers, food coupons, and money for transportation; some programmes also provide educational opportunities, while others make use of occupation settings to administer the drugs.\textsuperscript{22-25} Directly observed therapy programmes without such incentives are less successful, with treatment completion rate of 85.0\% to 87.5\%.\textsuperscript{29,30}

The current DOT programme in Hong Kong uses a combination of incentives and enablers, which include education for patients and their families, intermittent client-focused regimens, money for food, referrals for other social services, as well as use of outreach teams and the tracing of defaulters. Greater efforts are required in the education of the patients and public to increase their understanding of the importance of treatment completion for patients with tuberculosis.

**Conclusion**

In Hong Kong, the rate of default from tuberculosis treatment in 1996 was 8\%—unchanged from the rate during the past decade. The defaulters probably contributed to the pool of infectious patients in the community and may be partially responsible for the persistent high rate of tuberculosis locally. A history of default from treatment should alert health professionals to ensure that all barriers to treatment be removed, and that incentives be used to encourage treatment compliance.
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References