ORIGINAL ARTICLE

Delayed presentation and treatment of newly diagnosed pulmonary tuberculosis patients in Hong Kong

Eric CC Leung 梁中正
CC Leung 梁子超
CM Tam 譚卓明

Objective To measure patients' and providers' delays in the presentation and treatment of newly diagnosed pulmonary tuberculosis.

Design Retrospective study using structured questionnaires.

Setting Tuberculosis and Chest Service, Centre of Health Protection, Department of Health.

Participants Tuberculosis patients notified to the Department of Health, selected by systematic sampling of all notifications in the first 2 weeks of every even month in the year 2004.

Main outcome measures Health-seeking behaviour of pulmonary tuberculosis patients, including respective demographic, clinical, and disease factors.

Results Of a total of 6262 notified tuberculosis patients in 2004, 1662 (26.5%) were recruited into the study; of these, 42.6% first presented to private doctors, and 57.4% to the public sector. The diagnosis of tuberculosis was made in 13.7% of these patients by the former and 86.3% by the latter. The median patient delay (elapsed time from symptoms to medical consultation) and provider delay (elapsed time from medical consultation to treatment) were both 20 days; 25th to 75th percentiles being 7-37 and 6-55 days, respectively. Longer patient delay was associated with positive sputum smear and culture, and more extensive radiological disease. On multiple regression analysis, unemployment independently predicted longer patient delay, while haemoptysis predicted shorter patient and total delay. Patients older than 60 years, with no initial sputum and chest X-ray examination predicted longer provider and total delays.

Conclusions Our patient and provider delays compared favourably with those of other countries, and very likely reflect easy service access. Adverse social factors and non-specific presentations prolong patient delay, whilst older age and unavailable bacteriological/radiological evidence delay diagnosis and treatment.

Key words
Diagnosis; Time factors; Tuberculosis, pulmonary

Hong Kong Med J 2007;13:221-7

TB and Chest Service, Centre of Health Protection, Department of Health, Hong Kong
ECC Leung, MB, BS, FHKAM (Medicine)
CC Leung, MB, BS, FHKAM (Medicine)
CM Tam, MB, BS, FHKAM (Medicine)

Correspondence to: Dr ECC Leung
E-mail: eric_leung@dh.gov.hk

Introduction

Effective case-finding and prompt initiation of treatment is the primary strategy in the control of tuberculosis (TB). Hong Kong is a densely populated metropolitan city and is classified by the World Health Organization as "a place with an intermediate tuberculosis (TB) burden and a good infrastructure to provide TB control",[1] where TB is a statutory notifiable disease. About 6000 new TB cases are notified annually, the majority by passive case-finding among those presenting with symptoms. A multitude of patient and provider factors affect health care–seeking behaviour and their outcomes. Delay in presentation or diagnosis or initiation of treatment is likely to increase the risk of transmission, especially in an overcrowded urban environment. In a pilot survey performed in Hong Kong in 1977, Allan et al[2] described the symptoms of newly diagnosed pulmonary TB and patient attitudes towards the disease and delays of its treatment. The major symptom was cough (81%) and most patients (76%) attended their first source of treatment or investigation within 1 month of symptom onset. However, only 35% attended the Government Chest Clinics. The authors concluded that the delay between the patients' first attendance at the

香港肺結核新診病人在延遲求診和治療時間延誤上的情況

目的 量度肺結核新診病人在求診和治療上，因病人和醫者兩方面引致的阻延。

設計 以結構問卷進行的回顧性研究。

安排 衛生署衛生防護中心的結核及胸肺科服務。

參與者 以系統抽樣方式，抽取2004年雙數月份頭兩星期呈報衛生署的結核病例作為研究範圍。

主要結果測量 肺結核病人的求醫行為，包括相關的人口學資料、臨床和疾病因素。

結果 2004年呈報衛生署的6262名結核病人中，1662(26.5%)人參與是次研究。這些病人中，先向私家醫生求診的有42.6%，而先向公立醫院醫生求診的則有57.4%。診斷方面，由私家醫生診斷患有結核病的佔13.7%，由公立醫院醫生診斷出來的則佔86.3%。病人引致的阻延（即由出現病徵至求診之間的時間差）和醫者引致的阻延（即由求診至獲得治療之間的時間差）的中位數皆為20日；而其25至75百分位的阻延日數分別為7至37日及6至55日。因病人引致較長的阻延與以下因素有關：痰液抹片和培植檢查呈陽性，和有較嚴重的放射性疾病。多元回歸分析顯示，單是失業這項因素已可以預測由病人引致較長的阻延，而病人出現咯血則會令病人引致的阻延和病人及醫者的總阻延縮短。六十歲以上、無初步痰及胸肺X光檢查的病人，可估計因其醫者會引致較長的阻延，以及因病人及醫者引致較長的總阻延。

結論 本研究發現因病人和醫者引致阻延的情況與其他國家接近，這很可能與本地醫療服務十分方便有關。不利的社會因素和病徵缺乏特異性會延長因病人引致的阻延，相反，年長和沒有細菌學和放射性診斷證據，則會延長因醫者引致的阻延。

source of treatment and the Government Chest Clinics was important; because, outside the chest clinic, only 49% were investigated by chest X-ray (CXR) and only 7% by sputum bacteriology. This study subsequently led to a publicity campaign launched by the Government to educate the public about symptoms of TB and the free-of-charge Government Chest Service. Since 27 years has elapsed after the previous study (when the TB notification rate was 150/100 000 populations), it is time to restudy the health-seeking behaviour and delays in presentation and treatment of TB patients in Hong Kong.

Methods

The patients were recruited through systematic sampling of all TB cases notified to the TB registry of Hong Kong on the first 14 days of every even calendar month in 2004. In order to minimise delay and simplify logistic arrangements, systematic sampling was employed instead of random sampling. Altogether, data equivalent to a total of 3 months' notification were collected.

Trained public health nurses administered a structured questionnaire, through a face-to-face interview. If the patient was not available, a telephone interview was conducted. Demographic data (age, gender, ethnicity, residency status, working status, smoking status); clinical factors (date and nature of initial symptoms, symptom prompting patient to seek medical care, date and nature of first medical care, initial investigations, number of doctor consultations, the doctor first diagnosing TB, the date TB treatment was started); and disease factors (sputum smear and culture, radiological findings on presentation) were collected. Patient delay was defined as the time interval from the appearance of the first symptom to the first visit to a health care provider; provider delay was defined as the time from the first consultation to the initiation of anti-TB treatment. To ensure accuracy in recall, all interviews were carried out within the first 2 weeks of TB notification.

Data were analysed using the Statistical Package for the Social Sciences (Windows version 10.0; SPSS Inc, Chicago [IL], United States). Potential covariates were first identified by univariate analysis using the Chi squared test for categorical variables and Mann-Whitney rank sum test for continuous variables. For the logistic regression analysis where a longer delay (>the median value) was the outcome of interest, the predictor variable with a P value of <0.05 from the univariate analysis was selected. The backward stepwise approach was adopted with the probability to retain being <0.5 and probability to remove being >0.1.

Results

A total of 1662 notifications (26.5% of all TB notifications) in 2004 were sampled; two were duplicate entries. Another 190 patients were totally asymptomatic (incidental finding on pre-employment, pre-emigration, other body-check and active case-finding). Thirty-two (1.9%) patients had already died before the interview so details of their symptomatology and health-seeking behaviour were not available, and 189 had extrapulmonary TB. Thus, altogether 413 cases were excluded, leaving 1249 patients with pulmonary TB for analysis.

The demographic characteristics of these patients are shown in Table 1. For their TB symptom, 57.4% of them first presented to the public service and 42.6% to the private sector. However, 86.3% of our study population had their TB diagnosed by doctors in public institutions (Fig 1). Overall 63% of all patients had a CXR and 36% had sputum examination carried out for their TB symptoms at their initial presentation (Fig 2). Compared to those attending the public sector for their initial presentation, in the private sector a significantly smaller proportion of patients had a CXR (35% vs 84%, P=0.001) and sputum examination (10% vs 55%, P=0.01).

The median total delay from onset of symptoms

TABLE 1. Demographic summary of the 1249 pulmonary tuberculosis patients

	No. (%)
Newly diagnosed/re-treatment	1133 (90.7)/116 (9.3)
Male/female	854 (68.4)/395 (31.6)
Age-group (years)	
0-19	52 (4.2)
20-39	266 (21.3)
40-59	335 (26.8)
≥60	596 (47.7)
Residency status	
Permanent resident	1187 (95.0)
Chinese new immigrant	30 (2.4)
Imported worker	24 (1.9)
Tourist	4 (0.3)
Illegal immigrant	4 (0.3)
Ethnicity	
Chinese	1199 (96.0)
Other Asians	32 (2.6)
Whites	2 (0.2)
Others	16 (1.3)
Employment	
Full-time	350 (28.0)
Part-time	49 (3.9)
Retired	469 (37.6)
Unemployed	149 (11.9)
Housewife	165 (13.2)
Student	60 (4.8)
Unknown	7 (0.6)
Smoking	
Never smoker	574 (46.0)
Ex-smoker	403 (32.3)
Current smoker	272 (21.8)

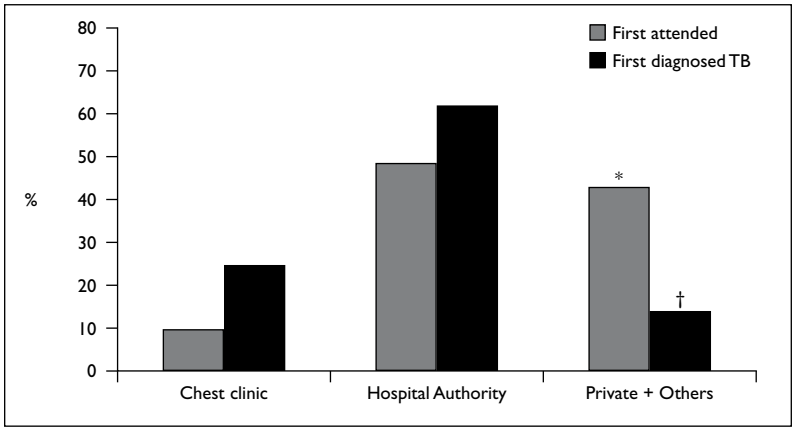

FIG 1. Percentages of patients who first attended and were first diagnosed at various health care facilities

* Among 42.6% presented to "Private + Others": private doctors=36.3%, Chinese herbalists and acupuncturists=2.1%, doctors in Mainland China=2.5%, and others including medical doctors overseas=1.7%

† Among 13.7% diagnosed by "Private + Others": private doctors=11%, Chinese herbalists and acupuncturists=0.16%, doctors in Mainland China=1.7%, and others including medical doctors overseas=0.8%

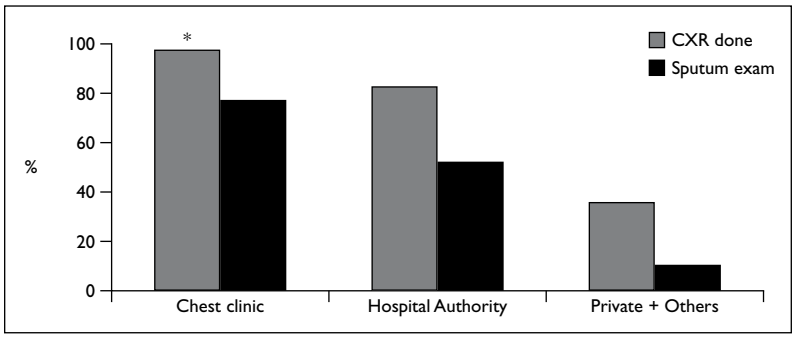

FIG 2. Percentages of chest X-ray (CXR) and sputum examinations undertaken by first medical provider

* Reasons for not taking a CXR in the chest clinic: (1) it was taken elsewhere (eg accident and emergency department), (2) in some women with a history of 'missed period'

to initiation of treatment was 49 days (25th to 75th percentile, 20-80 days). The median patient delay was 20 days (25th to 75th percentile, 7-37 days). The median provider delay was also 20 days (25th to 75th percentile, 6-55 days). The patient and provider delays varied with the bacteriological status and radiological extent of disease at presentation (Table 2). The patient delay was significantly longer among smear-positive patients (26 vs 17 days, P=0.02) and those with more extensive lesions on CXR (30 vs 17 days, P=0.01).

According to univariate analyses of these data, patient and provider delays were found not to vary with ethnicity, residency status, or whether patients were new or re-treatment cases. Age, employment status, smoking status, haemoptysis as a symptom were found to influence patient delay, whilst age, gender, nature of first medical doctor seen, and initial investigations undertaken were shown to influence the provider delay (Table 3).

On multivariate analysis in which all significantly associated variables noted in the univariate analysis were entered as predictors (Table 4), unemployment independently predicted patient delay of 20 days or more, whilst patients with haemoptysis had shorter delays. Age of 60 years or older, no initial sputum test, and no CXR performed at the first consultation were independent predictors of a provider delay of more than 20 days. Age of 60 years or older, no initial sputum test, and no CXR independently predicted total delays of 50 days or more, whilst haemoptysis predicted a significantly shorter total delay.

TABLE 2. Patient and provider delays categorised according to sputum and chest X-ray (CXR) status

Categories	Total No.	Patient delay (days) Median (25th-75th percentile)	Provider delay (days) Median (25th-75th percentile)
Sputum status*			
Smear +ve Culture +ve	384	26 (10-45)	14.5 (3-40)
Smear +ve Culture –ve	13	15 (9-28)	15 (3-63)
Smear –ve Culture +ve	404	16 (4-37)	31 (10-70)
Smear –ve Culture –ve	158	17 (7-35)	19.5 (7)
CXR status (extent of radiological lesion)†			
>RUL‡	124	30 (13-61)	21.5 (3-50)
=RUL	290	20 (7-32)	20 (6-54)
<RUL	467	17 (5-37)	27 (7-69)

* **Patients without bacteriology results were excluded**
† **Patients without CXR were excluded**
‡ **RUL denotes extent of right upper lobe**

Discussion

As TB often presents insidiously with non-specific symptoms, effective case-finding presents an important challenge to the integrity and efficiency of any health care infrastructure. Even in the US, 5.1% of TB was diagnosed at postmortem.[3] In this study, patient and provider delays (both 20 days) compared favourably with those of UK (Blackburn,[4] London[5,6]) and US (New York[7]) studies which showed patient delays of 35 and 25 days; and provider delays of 20 and 15 days, respectively. These studies were all performed in metropolitan cities with good transport facilities, where easily accessible and free or affordable diagnostic and treatment services contribute to relatively short delays.

However, health care behaviour is often complex. Despite the overall availability of health care services, adverse social factors tend to affect access in underprivileged segments of the community. Although a recent study in Hong Kong did not reveal any association between unemployment and the standard TB notification rate,[8] this study showed that unemployment was an independent risk factor for delay in seeking treatment, in line with studies carried out in California,[9] Ukraine,[10] and Brazil.[11] Once again these findings highlight the close association between poverty and TB, which was noted ever since the outbreak of the TB epidemic in the 17th century.

In this study, patients with haemoptysis presented significantly earlier, which was similar to findings recently reported from Taiwan.[12] Very likely this symptom is often perceived as unusual and severe, especially among Chinese patients.[13] On the other hand, active smokers had a longer patient delay (according to our univariate analysis), despite being more likely to have cough and dyspnoea, as reported in a local study.[14] A similarly longer patient delay was also found among smokers in New Zealand.[15] In such patients, the threshold for seeking medical attention could have been raised, as smoking is often perceived as associated with non-specific 'smokers' cough'.

For effective control of TB, it is equally important that the attending clinician promptly deals with patients presenting with symptoms of TB. Our study showed that being aged 60 years or above were independently associated with a longer provider delay. Atypical presentations might have rendered recognition more difficult and delayed the diagnosis.[16,17] It is also possible that in such patients the higher rate of co-morbidities (including chronic symptoms such as cough) decreased the suspicion of TB (by both patients and clinicians).[18]

In Hong Kong, there is relatively heavy reliance on the use of CXR for case-finding. Over 80% of TB patients at their initial presentation in public facilities and one third of those first seen in the private sector had a CXR. The ageing population with other co-morbidities, and the affordability of capital investment in a metropolitan city, might account for this strategy. Not taking a CXR at initial presentation was associated with a longer provider delay in this and other similar studies from developed parts of the world, including New York,[7] New Zealand,[15] Taiwan,[12] and Japan.[19]

Half of our TB patients initially presenting to the public sector underwent sputum examination but only 10% of those first presenting to the private sector did so (Fig 2). This marked difference very likely reflects different clinical practices or availability of laboratory support among the various health care sectors. From our field experiences, some patients (especially those with early disease) mainly present with dry cough and have difficulty in producing satisfactory sputum samples for

TABLE 3. Univariate analysis of variables associated with patient and provider delays

Variable	No.	Patient delay Median (days)	P value
Patient delay			
Age-group (years)			
0-19	52	11	0.001
20-39	266	19	
40-59	335	29	
≥60	596	16	
First symptom noticed			
Haemoptysis	113	5	0.0001
No haemoptysis	1136	21	
Employment			
Unemployed	149	30	0.038
Employed + student + retired + housewife	1100	17	
Accommodation			
Elderly home resident	55	17	0.004
Non–elderly home resident	1194	22	
First provider attended			
Hospital Authority or chest clinic	735	17	0.01
Others	514	23	
Smoking			
Non-smoker + ex-smoker	977	17	0.018
Current smoker	272	23	
Provider delay			
Gender			
Male	854	19	0.031
Female	395	22	
Age-group (years)			
0-19	52	11	0.007
20-39	266	16	
40-59	335	21	
≥60	596	24	
First provider attended			
Hospital Authority or chest clinic	735	16	0.0001
Private + herbalist + doctor in China	514	26	
Chest X-ray taken at first consult*			
Taken	831	15	0.0001
Not taken	337	31	
Sputum test at first consult*			
Done	495	17	0.001
Not done	589	23	
Referral to other doctor at first consult*			
+ve	348	15	0.002
-ve	672	25	

* **Patients who could not recall the information were excluded**

examination. We always encourage such patients to expectorate some sputum early in the morning (before eating) after attempting a deep cough. Such specimens are usually acceptable for acid-fast staining and culture.

TABLE 4. Independent predictors of longer patient, provider, and total delays revealed by the logistic regression analysis*

Outcomes/Independent predictors at initial presentation	P value	Odds ratio	95% CI
Patient delay >20 days			
Unemployed	0.002	1.7	1.2-2.5
Haemoptysis	0.001	0.4	0.2-0.6
Provider delay >20 days			
Age ≥60 years	0.004	1.5	1.1-2.0
Sputum not tested	0.001	1.9	1.4-2.5
Chest X-ray not done	0.001	2.5	1.8-3.3
Total delay >50 days			
Age ≥60 years	0.007	2.6	1.3-5.1
Haemoptysis	0.019	0.6	0.3-0.9
Sputum not tested	0.001	2.3	1.7-3.1
Chest X-ray not done	0.001	2.2	1.5-3.1

* **All variables significantly associated with longer patient, provider, and total delays in univariate analysis were entered as predictors of their respective outcomes. Only independent predictors are shown**

Locally, only around 30% of all notified TB cases are sputum smear-positive.[20] The relatively low proportion of smear-positive disease might have discouraged the wider use of sputum examination as an initial screening tool, especially in the private sector. In line with other studies,[6,7,12] the absence of a positive sputum examination was associated with a longer provider delay. Studies in Japan[21] showed that use of the nucleic acid amplification helped to shorten the delay in those with smear-negative but culture-positive sputum specimens, but the general applicability and cost-effectiveness of such an approach await further clarification.

Chest X-ray and sputum examinations remain important tools in case-finding locally. However, a major disparity was observed in their utilisation associated with initial consultations in the public and private sectors. Our study showed that 42.6% of TB patients in Hong Kong first presented to private doctors for their symptoms, yet private practitioners tend to take a CXR and order sputum examination less often than their counterparts in the public sector (Fig 2; CXR: 35% vs 97%, P<0.0001 and sputum examination: 10% vs 76%, P<0.0001). According to a previous study,[22] most (67.9%) patients attending private doctors were told they might have pulmonary TB, yet the referral times by private doctors varied widely: 11% were referred without delay, 60% by 1 month, and 17% after 3 months. The underlying reason why TB was not more readily diagnosed in the private sector could be related to the extra costs for X-ray and sputum examination. If such financial barriers cannot be easily overcome, private doctors should promptly refer corresponding patients to a chest clinic or public hospital.

Compared to the study by Allan et al in 1977,[2] there have been significant changes in the demographic and clinical features of TB patients over these 27 years. Although both the mean and median ages of our patients were still 54 years, in our study 47.7% were elderly (age ≥60 years), whereas 65% were aged 45 years or above, and 21.8% were current smokers. This contrasts with Allan et al's[2] findings in which the mean age of the patients was 38 years; those aged 45 years or above comprised only 38%, and 42% of the patients were smokers. Moreover, besides being younger, their patients presented with more respiratory symptoms. A changing demographic pattern has also been observed in other studies in Hong Kong.[23] Although the overall TB notification rate has dropped from 159 to 91.5 per 100 000 over these 27 years, the age-specific rate in the elderly has remained high (162.5/100 000 for the age-group 65-69 years in 2003[20]). Allan at al's study[2] did not report patient delay and provider delay as such. However, 75% of patients presented within 30 days of symptoms onset, while in the present study the corresponding figure amounted to 73%. The proportion of patients presenting to government institutions within 30 days was higher in the present study (64% in 2004 vs 43% in 1979). Thus, awareness of the chest clinic among the newly diagnosed TB patients has also improved with time.

Admittedly, any analysis of this type must be retrospective and limited to patients actually known to the health care system. To minimise recall bias, a structured questionnaire was employed after pilot testing and all interviewers were trained in its administration. Attempts were also made to minimise the delay between notification and interview, including the use of systematic sampling and electronic/fax/telephone transmission of notification records. To maximise the coverage, the statutory territory-wide TB notification registry for a whole year was used for such sampling, and patients not attending for interview were contacted by phone.

Conclusions

The patient and provider delays in Hong Kong compare favourably with other countries. Despite overall easy service access, adverse social factors and non-specific presentations prolong patient delay, while older age and unavailable bacteriological/radiological evidence delay the diagnosis, especially in the private sector. Further studies are required to address these issues to promote better control of TB in our community.

Declaration

The authors have not received any financial support for this study or been involved with any organisations with financial interest in the subject matter.

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