Short Report

How much does tuberculosis cost? An Australian healthcare perspective analysis

EC Chan, A Nolan, JT Denholm

Abstract

Tuberculosis (TB) remains a disease of high morbidity in Australia, with implications for both public health and the individual. Cost analyses is relevant for programmatic evaluation of TB. There is minimal published TB cost data in the Australian setting. Patients with drug sensitive active pulmonary TB (DS-PTB) and latent TB (LTBI) were enrolled in a single tertiary referral centre to evaluate healthcare provider costs. The median cost of treating drug susceptible pulmonary TB in this case series was 11,538 AUD. Approximately 50% of total costs is derived from inpatient hospitalisation bed days. In comparison, the average cost of managing latent TB was 582 AUD per completed course. We find the median provider cost of our DS-PTB treatment group comparable to costs from other regions globally with similar economic profiles. A program designed to detect and treat LTBI to prevent subsequent disease may be cost effective in appropriately selected patients and warrants further study.

Keywords: Tuberculosis, TB, Healthcare cost, Management, Latent tuberculosis

Background

Despite significant advances in tuberculosis (TB) worldwide, globally it remains a disease of high morbidity and mortality[1-2]. In Australia TB incidence is low but has not declined in recent years, and it continues to have an important impact on affected individuals, families and healthcare systems[3]. While outcome assessment is critical for programmatic management of TB, economic evaluation is equally important, including assessment of population-level interventions to treat and prevent disease, with unavoidable pressures within most healthcare systems to optimise the allocation of limited resources.

ABBREVIATIONS

AUD	Australian dollars
DS-PTB	Drug sensitive pulmonary tuberculosis
HREC	Human research ethics committee
LTBI	Latent tuberculosis infection
MBS	Medicare Benefits Scheme
MDR TB	Multidrug resistant tuberculosis
PTB	Pulmonary tuberculosis
TB	Tuberculosis
VTP	Victorian Tuberculosis Program

Recent meta-analyses provide a global perspective of TB management costs[4-5]. While data regarding TB management in developing world settings are readily available, less data has been produced in Australia with the most recent published estimates of management cost now two decades old[6]. Timely and locally specific information is required to inform current healthcare practices, and guide effective and efficient programmatic management. This paper therefore seeks to provide an accurate and contemporaneous cost evaluation of managing TB in an Australian setting.

Methods

The aims of this study were to calculate healthcare system-level costs for the treatment of cases of pulmonary TB (PTB) and latent TB (LTBI) in an Australian setting.

Ten patients with drug sensitive (DS) PTB were sequentially included in this retrospective record review. All patients received care at the Royal Melbourne Hospital, a single tertiary referral centre providing both inpatient and outpatient management care of TB. Patients were eligible for inclusion if they had completed treatment in the previous 12 months. There were no specific exclusion criteria. A single case of multidrug resistant (MDR) TB within the same enrolment time period was included to broadly illustrate the differences in cost. Finally, a prospectively collected

consecutive series of 100 patients commencing LTBI therapy at the same institution had their management costs reviewed[7].

All costs were calculated in Australian Dollars (AUD). Costs were calculated from first presentation to the hospital for investigation of suspected pulmonary TB, until completion of treatment care. Costs were calculated from the perspective of the healthcare system, defined as provider costs. The 2014 Medicare Benefits Scheme (MBS) item numbers were used to provide fee structures for diagnostic investigations. Hospitalisation costs were taken from previously published Australian costing studies, reporting a cost per bed day of 562 AUD for general medical admissions, and 3,021 AUD per Intensive Care Unit bed day[8-9]. Direct pharmaceutical costs for TB therapy were provided by the Victorian Tuberculosis Program (VTP).

In addition to direct medical costs, all individuals diagnosed with TB in Victoria have public health management conducted by the VTP. This individualised VTP service encompasses contact tracing, adherence, and psychological support. Entries from electronic case notes were used to review the public health activities associated with each case, in order to attribute a cost figure. Aggregated VTP ancillary costs, including administrative and transport expenses, were averaged over a three-year period (2012-2014) and distributed evenly across all patients diagnosed with TB. As some variation was anticipated between individual cases, median costs are presented.

This report was approved by Melbourne Health human research ethics committee (HREC) as a quality-assurance project, (QA2012219). VTP data was incorporated as a programmatic audit, and as such, no additional ethics approval was required under the rules of our institution.

Results

The age of patients who completed standard therapy for DS-PTB ranged between 21 and 71, with a median age of 35. Other patient characteristics are shown in table 1.

The median cost of treating DS-PTB in this case series was 11,538 AUD [range 5,820 – 170,119]. It was noted that one outlier case cost AUD 170,119. Eight out of ten cases cost less than AUD 17,000. Median provider subset costs and the relative percentage of the total cost are listed in Table 2. Hospital admission is the single largest component of provider costs. Community-based VTP services account for around less than 15% of the total cost.

The total cost of managing a single multidrug resistant TB patient was calculated to be 258,089 AUD. Of the 100 consecutive latent TB patients enrolled for treatment, 93 successfully completed their treatment course, with an average completed treatment cost of 582 AUD (Table 2).

Discussion

This report has considered costs in managing TB at a healthcare system level in contemporary, metropolitan Australia. For drug sensitive pulmonary TB cases, approximately 50% of cost was derived from inpatient hospitalisation bed days. Efforts to reduce the duration of hospital stay would correspondingly reduce associated costs. This however, must be counterbalanced against potential harms, such as increasing the risk of community TB transmission. In our experience, outreach nursing support programs, such as one provided by the VTP are an invaluable resource. Further work should be done to ascertain the cost-effectiveness of such programs.

Cost of MDR TB management in an Australian setting has not previously been estimated. We

Table 1: Characteristics of patients in this study managed for drug-sensitive pulmonary TB, and latent TB infection

Demographics and clinical characteristics	DS pulmonary TB (median and range)	Latent TB (median and range)
n	10	100
Age, years	35 (21-71)	29 (16-72)
Male (%)	6 (60%)	58 (58%)
Australian born (%)	1 (10%)	14 (14%)
Bronchoscopic evaluation (%)	3 (30%)	NA
Duration of hospitalisation (days)	8.5 (0-226)	NA
Duration of anti-TB therapy (months)	6 (6-9)	9 (1-9)
Number of outpatient medical reviews	11 (4-15)	4 (1-6)

Table 2: Representation of the breakdown of provider costs by subset for latent TB (n=100), pulmonary TB (n=10), and MDR TB (n=1).

Provider subset cost	Latent TB		Active pulmonary TB		Multidrug resistant TB	
	AUD	%	AUD	%	AUD%	total
Diagnostic	141	24	1,408	12	6,250	2.4
Inpatient hospitalisation	-	-	4,777	43	129,822	50.3
Outpatient clinics	313	54	831	5	2,486	1.0
Medications	128	22	840	7	112,813	43.7
VTP outreach service	-	-	1,640	12	5,124	2.0
VTP ancillary costs	-	-	1,594	14	1,594	0.6
Total		**582**		**11,538**		**258,089**

As median values were used for active pulmonary TB, the sum of costs and percentages do not add up to 100%.

provide a brief snapshot here by examining the cost of managing one patient. Although MDR-TB accounts for less than 3% of active TB cases diagnosed in Australia, the disproportionate cost simply highlights how such cases may impact on local healthcare systems[10]. Typically, 85-90% of diagnosed TB cases in Australia occur in individuals born overseas[3]. Our report found that the cost of LTBI treatment was approximately 1/20th of DS-PTB, suggesting that a program designed to detect and pre-emptively treat LTBI to prevent subsequent disease may be cost effective in appropriately selected patients. Further cost-effectiveness analyses of specific strategies targeting LTBI in our local context is currently underway.

The median cost of our DS-PTB treatment group is consistent with results from a recent meta-analysis of TB management costs globally[4]. Our study only examined cases of pulmonary TB, which perhaps factored in our lower overall cost. In general, the lower median cost from our report suggests a cost-effective TB program in Victoria, Australia. It is difficult to reconcile our findings with historic cost analysis conducted locally[6]. Aside from methodological differences that may have underestimated costs previously, comparisons made on the basis of real-dollar terms over two decades is less likely to be reliable. One case in our cohort had pulmonary TB complicated by development of a brochoesophageal fistula. This necessitated multiple endoscopic surgeries and a prolonged inpatient hospitalisation spanning 226 days. This was the principle factor in the inordinate total cost attributable to this case.

Our report is strengthened by inclusion of detailed individual-level costs and consideration of both public health and clinical management expense. In this low-incidence setting with limited drug resistance, we are limited by small patient numbers, and a focus on adult cases. We noted that most of our PTB cohort had similar durations of hospitalisation, medication treatment, type and frequency of investigations, and number of ambulatory care visits. Hence a larger sample size may not yield substantially different cost findings.

Finally, it should be remembered that the financial burden of TB is not borne merely by healthcare systems but also by the individual. Although TB is treated without charge in Australia, regardless of residency status, patients may have some direct costs (ie. transport costs) and more significantly, indirect and opportunity costs such as loss of capacity to work. These intangible patient costs are challenging to standardise and attribute in monetary terms. However, they form an important component of the true cost of TB and future evaluation of patient-level costs should be a priority.

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