

## Preplanned Studies

## Financial Burden of Tuberculosis Patients — China, 2020

Caihong Xu<sup>1</sup>; Yinyin Xia<sup>1</sup>; Dongmei Hu<sup>1</sup>; Xiaomeng Zhang<sup>2</sup>; Yanlin Zhao<sup>1,†</sup>**Summary****What is already known about this topic?**

Tuberculosis (TB) is often referred to as “a disease of poverty,” yet the information regarding the financial burden of TB care is limited and regionally representative.

**What is added by this report?**

This manuscript reported the national representative total and breakdown costs associated with TB care in China. The total cost per patient was 1,185 USD, of which 88% was direct cost and 37% was incurred prior to TB treatment.

**What are the implications for public health practice?**

TB patients experience a significant financial burden, and disparities exist among different regions and populations. Current TB care policies and packages are not sufficient to address this issue.

Tuberculosis (TB) is often regarded as “a disease of poverty”. In China, a basic package of free services (including chest radiography, sputum smear test, and first-line drugs) is provided to TB cases, while other costs are covered by public-funded medical insurance schemes. However, there is limited information available on whether the current policy is sufficient to avoid the heavy economic burden of TB care. To address this, a cross-sectional study involving primary data collection was conducted in 41 counties in China in 2020 to obtain a nationally representative assessment of the financial burden of TB care. The results showed that the direct costs, indirect costs, and total costs due to TB care were 1041.3 USD, 12.7 USD, and 1185.5 USD per patient, respectively. Direct costs accounted for 88% and 37% of costs incurred before patients arrived at TB-designated hospitals. Governments need to increase TB investment and improve medical insurance levels. Doctors from TB-designated hospitals should conduct TB diagnosis and treatment in accordance with norms and guidelines to reduce total costs. Health staff of

general hospitals should also improve awareness of TB and refer presumptive TB patients to TB-designated medical facilities in a timely manner, thus reducing delays in TB care and costs before they reach TB-designated hospitals.

The End TB Strategy aims to ensure that by 2020, no households affected by TB will experience catastrophic costs due to the disease (1). This is in line with the World Health Organization’s (WHO) policy to move health systems closer to universal health coverage (UHC) (2). Despite the availability of free TB care services and public-funded medical insurance systems, TB patients in some regions still face a heavy financial burden. However, there is no nationally representative data on this issue in China.

This TB patient cost survey was part of a comprehensive evaluation of the National Tuberculosis Prevention and Control Plan (2016–2020). The survey was conducted between October and December 2020, in accordance with the WHO recommended methodology (3). The study population was defined as drug-susceptible pulmonary TB patients who had received at least two weeks of therapy under the National Tuberculosis Programme (NTP). Assuming a catastrophic cost due to TB of 50%, a relative precision of 0.2, and an alpha error of 0.05, the average cluster size (defined at the county level) for each designated TB medical institution was calculated as 0.83, and the effective response rate was set at 80%. Thus, the sample size was determined to be a total of 2,250 patients in 41 institutions. The main stratification factors considered in multistage stratified sampling were urban and rural areas. According to the proportion of registered tuberculosis patients in urban and rural areas in 2019 (51.9% and 48.1%), the number of designated medical institutions in urban and rural areas was determined to be 21 and 20, respectively. Face-to-face interviews were conducted by trained investigators using a structured questionnaire. Patients presented health insurance cards and treatment fee documents, if available. Data were

double-entered and validated using EpiData (version 3.1 EpiData Association, Odense, Denmark). The analysis was conducted using STATA (version 12.1, copyright 1985–2011 StataCorp LP USA). A currency exchange rate of 645 CNY to 100 USD (December 2020) was used. The operational definitions were as follows: 1) Direct medical costs: Out-of-pocket (OOP) medical expenditures associated with TB diagnosis, treatment, and treatment-seeking; 2) Direct non-medical costs: OOP costs for transportation, accommodation, and food of the patients and family members; 3) Direct costs: Direct medical and direct non-medical costs combined; 4) Indirect costs: Productivity and economic costs of a patient and their household incurred as a result of TB care visits and hospitalization during the TB episode; 5) Total costs: Direct and indirect costs combined.

A total of 3,286 TB patients were surveyed, of whom 2,201 (67.0%) were male. The median (interquartile range, IQR) monthly income per capita was 148 USD (61.7–246.7). The incomes of 704 (21.4%) households were below the poverty line. The New Rural Cooperative Medical Scheme (NRCMS) covered 2,394 (72.8%) of the patients (Table 1). The total TB care costs were 1185.5 USD (596.0–2230.8). The total TB care costs were relatively high among people over 65 years old ( $\chi^2=50.3$ ,  $P<0.0001$ ), divorced and widowed ( $\chi^2=52.6$ ,  $P<0.0001$ ), those in the western region ( $\chi^2=14.4$ ,  $P=0.0008$ ), those in rural areas ( $\chi^2=9.2$ ,  $P=0.0025$ ), those with education below primary school ( $\chi^2=16.6$ ,  $P=0.0023$ ), those without insurance ( $\chi^2=44.9$ ,  $P<0.0001$ ), and those in low-income household ( $\chi^2=40.6$ ,  $P<0.0001$ ) (Table 1). The median (IQR) direct, indirect, and total costs due to TB care were 1041.3 USD (534.5–1965.0), 12.7 USD (0.2–194.3), and 1185.5 USD (596.0–2230.8) per patient, respectively (Table 2). The direct costs accounted for 88.0% of the total costs, while the direct medical costs accounted for 69% of total costs. Of the total costs, 37% were incurred before patients arrived at TB-designated hospitals (Figure 1).

## DISCUSSION

The national representative TB cost survey showed that the total costs and direct medical costs of TB patients in China are relatively high despite the basic

free-TB care package and public-funded medical insurance schemes in China. Besides the first-line drugs and smear sputum tests, the government needs to expand free TB care package to include some adjuvant drugs, bacteriological examinations, and adverse reaction therapy support. Also, the reimbursement level for TB care should be increased. The economic burden differed among different groups, regions, insurance schemes, and incomes. People older than 65 years, divorced and widowed, residing in west regions, residing in rural areas, having education below primary school, having no insurance, and those in low-income households incurred a heavier economic burden. Medical and social assistance policies are needed to improve the equity of TB services and reduce the economic burden of vulnerable groups in key areas and populations, especially for vulnerable populations such as those with income below poverty line, a wider health welfare is needed. The cost before referral to the TB-designated medical institution accounts for a large proportion of the total cost, which suggests a significant delay in TB diagnosis and transfer. On the one hand, further training for the general hospital (that are not authorized to diagnose and treat TB) doctors are needed to improve the identification capacity and referral awareness for TB and presumptive TB cases. Health promotion for the public also needs to be enhanced to reduce delays in seeking medical consults. The median costs that TB patients incurred in China (1185.5 USD) were higher than those in Vietnam (1,054 USD) (4), Ghana (429.6 USD) (5), and Indonesia (133 USD) (6). Nearly 40% of the costs were spent before TB treatment initiation, which was higher than in Ghana (7%) and Indonesia (11%) (5–6), but was consistent with findings from the systematic reviews by Tanimura T, et al. (7) and Ukwaja KN, et al. (8). The most significant driver of costs was direct medical costs (69%) which were much higher than in Vietnam (44%) and Ghana (18.2%) (4–5). In August 2021, the Ministry of Finance of the National Medical Insurance Administration issued “Establishment of a medical security benefits list system”. Tuberculosis was listed as a chronic disease in outpatient department, which can refer to the management and reimbursement of hospitalization, thus improving the reimbursement ratio of tuberculosis to a certain extent and reducing the economic burden of patients. The data was collected through a face-to-face questionnaire survey. Some patients may not

TABLE 1. Demographic of the patients and costs due to TB care incurred by patients enrolled in TB patient cost survey, China, 2020 (N=3,286).

Variable	Demographic profile		Costs (USD)	Kruskal-wallis test	
	N	Prevalence (%)	Median (IQR)	$\chi^2$ value	P value
Total	3,286	100.0	1185.5 (596.0–2230.8)		
Age (years)					
<15	51	1.6	1079.9 (444.0–2597.2)	50.3	<0.0001
15–44	1,155	35.2	1016.5 (468.7–1960.5)		
45–64	1,211	36.9	1234.7 (621.6–2299.6)		
≥65	869	26.5	1342.2 (737.8–2366.0)		
Gender					
Male	2,201	67.0	1141.6 (585.8–2166.7)	4	0.0443
Female	1,085	33.0	1273.7 (610.3–2381.0)		
Marital status					
Unmarried	689	21.0	931.8 (428.1–1801.0)	52.6	<0.0001
Married	2,296	69.9	1235.9 (635.6–2293.8)		
Divorced	105	3.2	1378.4 (676.7–3057.5)		
Widowed	195	5.9	1477.1 (804.2–2510.1)		
Region					
East	986	30.0	1107.9 (441.1–2251.1)	14.4	0.0008
Middle	1,270	38.7	1152.1 (689.4–2105.9)		
West	1,030	31.4	1288.1 (602.1–2325.9)		
Residence					
Urban	1,564	47.7	1170.6 (490.0–2209.3)	9.2	0.0025
Rural	1,718	52.4	1192.4 (645.8–2246.0)		
Education					
Illiterate or not completed primary school	517	15.7	1416.0 (697.4–2299.6)	16.6	0.0023
Completed primary school	1012	30.8	1218.0 (615.0–2314.9)		
Completed middle school	962	29.3	1116.3 (574.0–2089.5)		
Completed high school	444	13.5	1081.5 (516.3–2071.7)		
Completed college and above	350	10.7	1168.8 (558.5–2330.6)		
Insurance					
None	85	2.6	1704.4 (713.8–3655.8)	44.9	<0.0001
UEBMI	771	23.5	972.7 (279.9–2325.9)		
NRCMS	2,394	72.8	1223.5 (657.9–2180.5)		
Other insurance	36	1.1	943.4 (444.8–1349.5)		
Economic activity					
Formal sector	671	20.4	1211.3 (634.5–2370.7)	4.3	0.1189
Informal sector	1,660	50.5	1133.9 (566.5–2145.8)		
Economically inactive	954	29.1	1245.9 (618.5–2264.4)		
Migrant status (Yes)*	59	1.8	1106.7 (614.0–1941.4)	0	0.8594
Low income line (Yes)†	704	21.4	972.3 (360.7–1956.0)	40.6	<0.0001
Prime income earner (Yes)	1,269	38.6	1153.7 (604.2–2325.9)	0.6	0.4384

Abbreviation: TB=tuberculosis; USD=US dollar; IQR=interquartile range; UEBMI=urban employee basic medical insurance; NRCMS=new rural cooperative medical scheme.

\* Migrant stays for less than six months at the residence at the time of diagnosis.

† Low income line in China is annual per capita household income less than 430 USD.

TABLE 2. Costs due to TB care incurred by patients at different stages enrolled in TB patient cost survey, China, 2020 (N=3,286).

Costs (USD)	Before-TB designated hospital		After-TB designated hospital		TB care overall	
	Median	(IQR)	Median	(IQR)	Median	(IQR)
Direct costs*	210.2	(34.0–747.4)	494.0	(206.5–1154.3)	1041.3	(534.5–1965.0)
Direct medical costs <sup>†</sup>	148.8	(22.2–579.1)	369.4	(149.8–883.0)	786.8	(385.6–1520.6)
Direct non-medical costs <sup>§</sup>	26.6	(2.2–133.2)	104.8	(33.8–268.4)	206.9	(89.1–443.7)
Transport	5.9	(0–22.2)	25.2	(12.1–59.2)	39.9	(18.2–91.4)
Food	7.4	(0–77.0)	33.8	(7.7–149.3)	113.5	(32.6–249.3)
Accommodation	0	(0–0)	0	(0–1.6)	0.1	(0–7.3)
Nutritional supplement	0	(0–14.8)	5.7	(0–29.5)	17.2	(0.5–48.8)
Indirect costs <sup>¶</sup>	0	(0–29.6)	2.8	(0.1–64.2)	12.7	(0.2–194.3)
Total costs**	230.1	(38.5–849.5)	551.0	(223.5–1297.6)	1185.5	(596.0–2230.8)

Abbreviation: TB=tuberculosis; USD=US dollar; IQR=interquartile range.

\* Direct medical and direct non-medical costs combined.

<sup>†</sup> Out of pocket (OOP) medical expenditures associated with TB diagnosis, treatment and treatment seeking.

<sup>§</sup> OOP costs for transportation, accommodation and food of the patients and family members.

<sup>¶</sup> Productivity and economic costs of a patient and his/her household incurred as a result of TB care visits and hospitalization during the TB episode.

\*\* Direct and indirect costs combined.

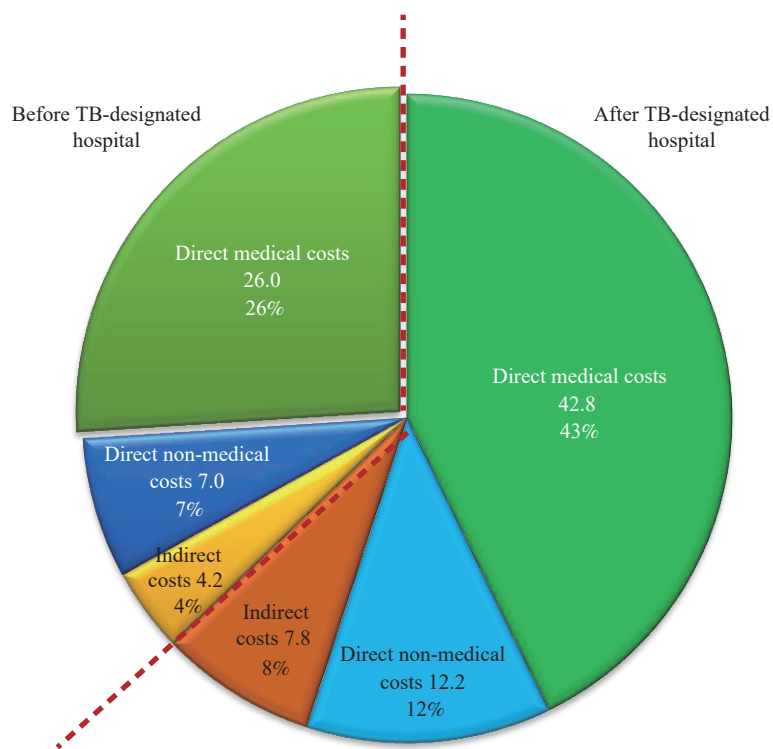


FIGURE 1. Contribution of each component of costs due to TB care as a proportion of total costs among patients enrolled in TB patient cost survey, China, 2020 (N=3,286).

accurately remember the exact costs incurred. We attempted to minimize recall limitations by surveying patients still on treatment and imputing costs to the entire episode assuming that all patients would complete treatment. This might overestimate the costs

considering some patients may fail treatment or be lost to follow-up. Most patients could not provide the breakdown of direct medical costs. Therefore, detailed information on components of direct medical costs is not presented.

The costs of TB patients in China are relatively high despite the basic free TB care package and public-funded medical scheme. The significant differences among different regions and populations indicate the geographic and economic disparities in health equity. It is urgent to increase government investment and social security measures to reduce the economic burden of TB patients and move health systems closer to UHC.

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