The financial burden of tuberculosis-affected households in China, 2017

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Abstract

Background

Drug-susceptible pulmonary tuberculosis patients notified and treated under national tuberculosis program, China

Methods

We conducted a cross-sectional study in six provinces in 2017 to assess the burden and distribution of health expenditure costs among tuberculosis-affected households and analyze related risk factors. The data was collected through face-to-face questionnaire survey. Intensity of financial burden was the median positive overshoot beyond a threshold that defined as annual total (direct and indirect) costs exceeding 20% of the pre-TB annual household income.

Results

Of 1147 patients, median (interquartile range) total costs due to tuberculosis care were US$965.5(461.8, 2059.3). Costs due to pre-treatment care accounted for 46.3% and direct costs accounted for 82.5% for total costs. Median (interquartile range) intensity of catastrophic costs was 32%(11%, 88%). Living below poverty line, household size less than four, employment in informal sector, receiving treatment from tuberculosis dispensary and hospitalization were independent predictors of associated with higher financial burden.

Conclusion

Despite free tuberculosis care services, the health expenditure due to tuberculosis were high among tuberculosis-affected households.

Trial registration

The Ethics Committee of Chinese Center of Disease Control and Prevention approved the study (No.201625, dated 22 November 2016).

Background

The End TB strategy targets that, by 2020, no TB-affected household should face catastrophic costs due to TB.[1] This is in line with policy to move health systems closer to universal health coverage (UHC).[2]

The World Health Organization (WHO) issued *TUBERCULOSIS PATIENT COST SURVEYS: A HAND BOOK*[3] to guide patient cost survey in TB high burden counties. Following the manual , Viet Nam, Ghana and Myanmar carried out their national-wide survey and reported that six in ten households affected by TB or

multidrug-resistant TB incurred catastrophic costs due to TB care.[4–6] Indonesia and Philippines reported that more than three in ten households incurred catastrophic costs.[6,7]

China accounts for 8.6% of the global TB burden and 50% of the burden in Western Pacific region.[6] Despite free TB care services, and the availability of public-funded insurance systems, TB patients in China bear heavy financial burden.[8] The information in China about the extent and determinants of catastrophic costs due to TB in TB-affected households was limited.[8–11] This information is vital to monitor the progress towards achieving End TB targets.

We report the intensity of financial burden due to TB care (pre-treatment and treatment phases) in TB affected households and related factors in China in 2017.

Methods

Study design

This was a cross-sectional study involving primary data collection.

Setting

Health financing in China

China is a developing country with a per capita gross national product of 7 941 US$ in 2016. The total expenditure on health in 2016 was six percent of the gross national product.[12] The health care delivery system is “mixed” with a dominant role for public sector institutions.[13]

Public funded health insurance schemes (urban employee basic medical insurance (UEBMI), urban resident basic medical insurance (URBMI), and new rural cooperative medical scheme (NCMS) cover more than 95% of the population.[14] There is limited cost coverage for outpatient care.[15]

National TB Programme (NTP)

The prevalence of TB in the western region is 1.7 times and 3.2 times that of the middle and eastern region, respectively.[16] The National center for tuberculosis control and prevention (NCTB), which belongs to China center for disease control (CDC), manages the NTP. TB management units are established at provincial, prefecture and county levels (basic management units (BMU) at county level). One authorized TB designated medical facility (TB designated hospital, TB dispensary or CDC) is responsible for TB diagnosis and treatment at each BMU level.

TB patients are provided free chest radiography, sputum smear test and first-line drugs in TB designated medical facilities. TB care services at referral hospitals and other general hospitals may be charged.

Patient population

The TB patient cost survey was conducted between March and June 2017, in line with the WHO recommended methodology.[3] Drug-susceptible pulmonary TB patients who had received at least two weeks of intensive phase therapy under NTP were included.

Sample size

Assuming 30% TB patients' total annual direct and indirect costs exceeding 20% of the household's annual pre-TB income ,[17] relative precision as 0.2 and α error as 0.05, average cluster (defined at county level) size of 50, between-cluster variation of 0.4, design effect of 4.36 and anticipating a non-response rate of 10%, the final sample size was 1086, to be sampled from 22 clusters. **(**see **Suppl Annex I, Figure I)**

Sampling methodology

We adopted multi-stage stratified cluster sampling. The stratifying factors were region and residence (**see Suppl Annex II** for the per capita GNP of the six provinces sampled). The steps followed in sampling have been summarized in **Suppl Annex III.**

Data collection and Management

Data collection

The face-to-face interview (at BMU in county) was done by trained investigators using a structured questionnaire (see **Suppl Annex IV**). Patients presented health insurance card and treatment fee documents if available. Baseline characteristics were collected at diagnosis. Costs related information was collected from symptom onset up to the day of interview.

Data management and analysis

Data were double entered and validated using EpiData (version 3.1 EpiData Association, Odense, Denmark) during July to December 2017. The analysis was conducted using STATA (version 12.1, copyright 1985-2011 StataCorp LP USA).

The calculated average monthly direct medical cost, direct non-medical costs and indirect costs during treatment were used to impute treatment costs of patients within the county for the remainder of treatment (six months for new and eight months for previously treated patients).

The analysis was weighted for multi-stage design and weighted results are presented.[18] The analysis (described below) was done separately for the pre-TB treatment phase (from symptom onset to treatment start), treatment phase (from treatment start to completion) and TB care overall (pre-TB treatment phase and treatment phase combined). Costs were described using the median and interquartile range (IQR). Intensity of catastrophic costs was measured as the median positive overshoot beyond the 20% threshold (subtracting 20% from the total costs expressed as a proportion of annual pre-TB household income).[19] Operational definitions used in this study have been summarized in **Box**. [3]

Generalized linear model (Poisson regression) was built using forward stepwise method for factors associated with intensity of catastrophic costs. Age, gender and variables with unadjusted p value <0.20 were added. Decision to retain a variable in the model at each step was taken based on LR test (yes if p<0.05). In the final model, adjusted prevalence ratios (0.95 CI) were used to summarize (infer) the association.

Results

Patient profile

Of 1147 patients, 811(70.7%) were male, their mean age was 51 years (range 12-89 years) and 364(31.7%) patients were interviewed during the intensive phase. New TB patients accounted for 91.6% of all the respondents and 414(36.1%) reported at least one episode of hospitalization. The median (IQR) monthly income per capita was US$190(46,243). The incomes of 223(19.4%) households were below the poverty line. The mean(standard deviation) family size was 3.5(1.9). The patient was the prime income earner in 684(59.7%) households. NCMS covered 864(75.3%) of the patients **(Table I)**.

TB care costs

The median (IQR) direct, indirect and total costs due to TB care were US$812.1 (398.3, 1691.1), US$70.4(24.6, 296.2) and US$965.5(461.8, 2059.3) respectively **(Table II)**. The direct costs accounted for 82.5% of the total cost, while the direct medical costs accounted for 64.6% of total costs **(Table III)**. Of the total costs, 46.3% was incurred during the pre-treatment stage.

Intensity and factors associated with of catastrophic costs due to TB care

The median (IQR) intensity of catastrophic costs due to pre-TB treatment, TB treatment and TB care overall were 27% (10%, 68%), 22% (8%, 60%) and 32% (11%, 88%), respectively **(Figure II)**.

Family size less than four and living below the poverty line were associated with high catastrophic costs due to pre-treatment, treatment and TB care overall. Hospitalization as well as working in informal sector was associated with catastrophic costs due to treatment and TB care overall. Registration at a TB dispensary was an independent predictor for catastrophic costs due to pre-treatment care and TB care overall. Registration at CDC and age more than 65 years were independent predictors for catastrophic costs due to pre-treatment care only. Patients from middle region were less likely to incur catastrophic costs due to pre-treatment care when compared to east and west. (**Table IV**)

Discussion

This was a TB patient cost survey from China based on the WHO recommended methodology.[3] Data quality was ensured through double data entry and validation, standard data cleaning and management

procedures at various levels. The data analysis was robust accounting for sampling weight and post-stratification adjustment weight.

Our key findings were that patients incurred high costs for both diagnosis and treatment despite the free TB care policy. Direct medical costs accounted for more than three-fifths of the total costs. The intensity of catastrophic costs for TB-affected households during diagnosis and treatment were high. Risk factors for catastrophic costs were also identified.

Limitations

The data was collected through face-to-face questionnaire survey. Some patients may not accurately remember the exact costs incurred. We attempted to minimize recall limitation by surveying patients still on treatment and imputing costs to the entire episode assuming that all patients complete treatment. This might overestimate the costs considering some patients may fail treatment or be lost to follow up. On the other hand, as we did not include multidrug resistant tuberculosis patients, our results could be an underestimate.

Most patients could not provide the breakdown of direct medical costs (>60% of total costs). Therefore, detailed information on components of direct medical costs is not presented.

Interpretation of key findings

High absolute costs

The median costs that TB patients incurred in China(US$966) were lower when compared with Viet Nam(US$1054)[5], higher than the results in the systematic review by Tanimura et al(US$379),[20] Ghana(US$429.6),[4] Indonesia(US$133)[7]and a previous study conducted by Zhou et al. of China(US$637) in 2012.[9] However, it is hard to directly compare our findings with previous studies in China considering the different costs definitions adopted.

The most significant driver of costs was direct medical costs(65% of total costs) which was much higher than Viet Nam(44%) and Ghana(18.2%).[4,5] High direct medical costs pointed towards prescription of high-end investigations (besides sputum examination and radiography which are free) and unnecessary treatment (besides free TB drugs). These costs are paid out-of-pocket by the patients. The high direct medical costs also indicated that the TB service package and reimbursement rates of insurance schemes did not significantly reduce the financial burden of TB patients.[8,11]

Nearly half of the costs was spent before treatment initiation, which was higher than in Ghana(7%) and Indonesia(11%),[4,7] but was consistent with findings from the systematic review by Tanimura et al[21] and Nigeria[22]. This suggests that TB patients incurred substantial costs before they reach TB designated medical facilities. The high pre-treatment costs may be due to poor TB awareness among patients as well as general hospitals (that are not authorized to diagnose and treat TB). This might had delayed TB care

seeking and transfer out to TB designated medical facilities.[23] Many patients, especially migrants, were notified and probably managed for a significant period of time at a referral hospital before possible transfer out to TB designated medical facilities.[24] This might had contributed to the high direct costs.

High intensity of catastrophic costs

Our study calculated median intensity of catastrophic costs based on WHO's TB-specific catastrophic cost definition. Intensity of catastrophic costs based on different definitions (catastrophic cost defined as direct cost exceeding 10% of household income) has been reported elsewhere, such as China(40.8%),Nigeria(8.3%) and Benin(14.8%).[9,22,27]Our finding showed higher intensity of catastrophic costs than Nigeria and Benin, apart from the different definition, there usually was some international or domestic special funding support for TB care in other TB high burden countries.[7]

Risk factors for catastrophic costs

Family size less than four and poverty were predictors for catastrophic costs(pre-treatment, treatment and overall) which was consistent with other studies in China and Indonesia.[7,9] Households with four or more members were less likely to incur catastrophic costs because in larger families, the total household income might be higher than smaller size families, thus reducing the impact of costs incurred towards TB care of one person on the household. In our study, the proportion of TB patients living below the poverty line was greater than in the general population (19.4% vs. 3.1%),[12] and was also a significant factor associated with catastrophic costs in all stages. Poverty suggests low capacity to pay, even lesser costs might be catastrophic.

About 36% of the TB cases reported at least one episode of hospitalization for TB care. Hospitalization was a significant predictor of catastrophic costs during treatment and care overall. The higher reimbursement rate of inpatients in insurance schemes might lead to the high rate of hospitalization, even as high as 55%,[9] thus leading to high costs and catastrophic costs.

When compared to TB designated hospitals, receiving treatment at CDC and TB dispensary were risk factors for catastrophic costs due to pre-treatment care. TB designated hospitals are specific general hospitals that are authorized to manage TB. Majority of people reach CDC and TB dispensary after seeking diagnostic care in other general hospitals (not designated for TB management).

As found in other studies, economic situation is related to catastrophic costs.[8,9] Our study also found that not working in formal sector (unemployed or working in informal sector) was associated with catastrophic costs due to TB treatment. High indirect costs due to loss of wages are common in informal sector.[28]

Policy implications

The high proportion of direct medical costs among total costs hints that moving towards universal health coverage is much likely to reduce the number of households incurring catastrophic costs in China. Expanding the benefit package for patients with TB and increasing reimbursement rate for outpatient care among insurance schemes may also help in reducing catastrophic costs during TB treatment. [15]

Indirect medical costs and indirect costs also account for considerable amount of the total costs. Some provinces in China have implemented nutritious breakfast and travel allowance for TB patients, which can be expanded nationwide. Countries like India have implemented a TB-specific cash transfer scheme,[29,30] China may consider the same, at least among those living below poverty line.

Reducing the high pre-treatment costs requires strengthening of TB health promotion to improve TB awareness, training the health staff of general hospitals to identify and refer presumptive TB patients to BMU and issue regulations to general hospitals to transfer TB patients to TB designated medical facilities at BMU.

Conclusion

Despite TB diagnosis and treatment being provided free of cost in China, TB patients still incur substantial costs, which hints that the current TB care policy and package are not sufficient. High direct medical costs and high prevalence of catastrophic costs, both during diagnosis and treatment, show that UHC and social protection need to be reinforced urgently, if China is to meet the End TB targets of zero catastrophic costs due to TB care by 2020.[1]

Declarations

Ethical Approval and Consent to participate

The she Ethics Committee of Chinese Center for Disease Control and Prevention approved the study. (No.201625, dated 22 November 2016). The written informed consent process and the provision 15 US$ to patients as reimbursement for costs related to travel for the interview were approved by the ethics committee. The study was also was approved by the Ethics Advisory Group of The Union, Paris, France (EAG number 22/18, dated 2 May 2018).

Consent for publication

Written informed consent for publication was obtained from all participants.

Availability of supporting data

The dataset and codebook used in this study are available on request from the corresponding author (zhanghui@chinacdc.cn, huizhang1974@126.com)

Competing interests

No competing interests was reported by the authors.

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Authors' contributions

Conception and study design: CX, **YL, LW, HZ, HDS, JK, YLZ**

Development and piloting the data collection tools: CX, **YL, LW, HZ, YR, YX, LXW**

Data collection: CX, **YL, YR, YX**

Data entry: CX, **YL, YR, YX**

Data analysis and interpretation: CX, **YL, HDS, JK, LW, HZ**

Preparing the first draft: CX, **YL, LW, HZ, HDS, JK,YLZ**

All authors critically reviewed the first draft and approved the final draft. Senior author providing overall supervision and guidance.

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Tables

Box. Operational definitions used in nationally representative TB* patient cost survey in China (2017) [3]

Direct medical costs	Out of pocket medical expenditures associated with TB diagnosis, treatment and treatment seeking (i.e. costs for outpatient registration, hospitalization, investigations, medicines etc.); and co-payments
Direct non-medical costs	Out-of-pocket costs for transportation, accommodation and food of the patients and family members
Direct costs	Direct medical + direct non-medical costs
Indirect costs	Productivity and economic costs of a patient or household incurred as a result of TB health care visits and hospitalization during the TB episode. Indirect costs are estimated total period of absence in hours multiplied by the hourly wage rate of the absent worker.
Total costs	Direct + indirect costs.
Catastrophic costs due to TB	Total annual costs due to TB (TB diagnosis, TB treatment and TB care overall) exceeding 20% of pre-TB annual household income. (if the duration of TB care exceeded one year, total costs were annualized while calculating catastrophic costs)
Pre-TB treatment	Between symptom onset and treatment initiation
TB treatment	From treatment initiation up to treatment completion
TB care	Pre-TB treatment and treatment phases combined

TB- drug-susceptible pulmonary tuberculosis

Table I. Demographic and socio-economic profile of patients enrolled in China's TB* patient cost survey (2017)

Variable		N	(%)
Total		1147	(100)
Demographic			
Age group in years	<15	6	(0.5)
	15-44	352	(30.7)
	45-64	497	(43.3)
	≥65	292	(25.5)
Gender	Male	811	(70.7)
	Female	336	(29.3)
Marital status	Married	157	(13.7)
	Unmarried	653	(56.9)
	Divorced	34	(3.0)
	Widowed	84	(7.3)
	Missing	219	(19.1)
Region	East	422	(36.8)
	Middle	322	(28.1)
	West	403	(35.1)
Residence	Urban	407	(35.5)
	Rural	740	(64.5)
Family size [mean (SD)]		3.5	(1.9)
Migrant status (Yes)**		89	(7.8)
Socio-economic			
Education	Illiterate or not completed primary school	194	(16.9)
	Completed primary school	330	(28.8)
	Completed middle school	374	(32.6)
	Completed high school	176	(15.3)
	Completed college and above	73	(6.4)
Economic activity	Formal sector (regular salary)	288	(25.1)
	Informal sector (irregular earning)	501	(43.7)

	Economically inactive	358	(31.2)
Monthly income per capita in US$ (Median (IQR))***		190	(46, 243)
Below poverty line (Yes)****		223	(19.4)
Prime income earner (Yes)		684	(59.7)
Insurance	None	40	(3.5)
	Urban employee basic medical insurance	114	(9.9)
	Urban residence basic medical insurance	116	(10.1)
	New rural cooperative medical scheme	864	(75.3)
	Others	13	(1.1)
Clinical			
TB Category	New	1051	(91.6)
	Previously treated	96	(8.4)
Place of registration	TB designated hospital	730	(63.6)
	CDC hospital	219	(19.1)
	TB dispensary	198	(17.3)
Sputum status at diagnosis	Positive	352	(30.7)
	Negative	743	(64.8)
	Unknown	52	(4.5)
Hemoptysis at diagnosis	Yes	144	(12.6)
	No	860	(75.0)
	Unknown	143	(12.5)
Weight loss at diagnosis	Yes	200	(17.4)
	No	804	(70.1)
	Unknown	143	(12.5)
HIV	Positive	12	(1.0)
	Negative	379	(33.0)
	Unknown	756	(65.9)
Comorbidity	Diabetes Mellitus	117	(10.2)

	Chronic liver diseases	34	(3.0)
	Chronic renal disease	20	(1.7)
	Anemia	37	(3.2)
	Hypertension	132	(11.5)
	None	668	(58.2)
Hospitalization during pre-treatment or treatment (Yes)		414	(36.1)

SD – standard deviation; IQR – interquartile range; US$ – United States Dollars; CDC – centre for disease control; HIV – human immunodeficiency virus

*drug-susceptible pulmonary tuberculosis;

***A currency exchange rate of Chinese RMB 687 Yuan to US$100 Yuan (December 2018);

****Poverty line in China is Annual per capita household income less than US$ 430

Table II. Costs due to TB care incurred by patients enrolled in China's TB* patient cost survey (2017) [N=1147]

	Pre-TB treatment		TB treatment		TB care overall	
	Median	(IQR)	Median	(IQR)	Median	(IQR)
Direct costs**	233.8	(37.2, 764.2)	354.3	(198.3, 788.4)	812.1	(398.3, 1691.1)
Direct medical costs	177.2	(17.5, 607.1)	257.5	(114.2, 579.2)	608.7	(286.1, 1301.8)
Direct non-medical costs	35.5	(2.9, 130.9)	84.2	(42.8, 167.2)	160.5	(74.4, 315.2)
Transport	4.4	(0.0, 17.5)	14.1	(8.2, 28.2)	24.2	(11.7, 54.4)
Food	5.4	(0.1,72.7)	14.1	(9.4, 37.1)	47.7	(13.7, 149.8)
Accommodation	0.0	(0.0, 1.5)	12.5	(7.1, 23.2)	15.7	(8.1, 36.5)
Nutritional supplement	0.0	(0.0, 6.7)	0.0	(0.0, 50.4)	0.0	(0.0, 60.4)
Indirect costs (wages / income lost)	7.5	(0.0, 108.4)	37.0	(17.9, 91.7)	70.4	(24.6, 296.2)
Total costs	283.5	(41.8, 945.7)	413.1	(231.9, 927.8)	965.5	(461.8, 2059.3)

IQR – interquartile range

*TB – drug-susceptible pulmonary tuberculosis;

**A currency exchange rate of Chinese RMB 687 Yuan to US$100 Yuan (December 2018)

Table III. Contribution of each component of costs due to TB care as a proportion of total costs among patients enrolled in China's TB* patient cost survey (2017) @[N=1147]

	Pre-TB treatment □%□	TB treatment □%□	TB care overall □%□
Direct costs	83.3	81.7	82.5
Direct medical costs	68.1	61.5	64.6
Direct non-medical costs	15.2	20.2	17.9
Transport	2.4	3.7	3.1
Food	7.9	8.1	8
Accommodation	1.7	3.1	2.5
Nutrition supplement	3.2	5.3	4.3
Indirect costs (wages / income lost)	16.7	18.3	17.5

*TB – drug-susceptible pulmonary tuberculosis

Table IV. Factors associated with catastrophic costs due to TB care (in pre-treatment phase, treatment phase and both phases combined) among TB affected households enrolled in China's TB patient cost survey (2017) @ [N=1147]

Variables*		Pre-treatment		Treatment		TB care overall[#]	
		aPR	(95% CI)	aPR	(95% CI)	aPR	(95% CI)
Total							
Age in years	<15	1.60	(0.38-6.80)	1.58	(0.64-3.92)	1.63	(0.66-4.07)
	15-44	ref		ref		ref	
	45-64	1.30	(0.92-1.84)	1.14	(0.92-1.43)	1.14	(0.91-1.43)
	≥65	1.57	(1.05-2.34) ^	1.19	(0.92-1.54)	1.19	(0.92-1.55)
Marital status	Married	ref		-		-	
	Unmarried	1.11	(0.71-1.72)	-		-	
	Divorced	1.35	(0.68-2.69)	-		-	
	Widowed	1.00	(0.56-1.78)	-		-	
	Missing	0.65	(0.34-1.23)	-		-	
Region	East	ref		-		-	
	Middle	0.21	(0.08-0.54) ^	-		-	
	West	1.02	(0.74-1.41)	-		-	
Residence	Urban	ref		-		-	
	Rural	1.02	(0.76-1.37)	-		-	
Family size	Less than 4	1.37	(1.07-1.75) ^	1.28	(1.08-1.51) ^	1.24	(1.05-1.47) ^
	≥4	ref		ref		ref	
Migrant status	Yes	-		-		0.87	(0.60-1.25)
	No	-		-		ref	
Education	Illiterate	ref		ref		ref	

	Completed primary school	0.94	(0.46-1.92)	0.97	(0.62-1.49)	1.00	(0.64-1.56)
	Completed middle school	0.82	(0.41-1.63)	1.02	(0.67-1.54)	1.04	(0.68-1.59)
	Completed high school	0.79	(0.40-1.53)	1.02	(0.68-1.52)	1.02	(0.68-1.53)
	Completed college	0.67	(0.33-1.37)	0.87	(0.57-1.34)	0.89	(0.57-1.37)
Economic activity	Formal sector	ref		ref		ref	
	Informal sector	1.26	(0.87-1.82)	1.38	(1.08-1.75) ^	1.33	(1.04-1.71) ^
	Economically inactive	1.23	(0.84-1.82)	1.29	(1.01-1.66) ^	1.27	(0.99-1.63)
Below poverty line	Yes	1.91	(1.48-2.48) ^	1.68	(1.39-2.02) ^	1.68	(1.39-2.02) ^
	No	ref		ref		ref	
Insurance	None	1.23	(0.58-2.64))	-		-	
	NCMS	1.30	(0.86-1.97)	-		-	
	Other insurance	ref		-		-	
Place of registration	TB designated hospital	ref		-		ref	
	CDC	5.86	(2.09-16.4) ^	-		1.00	(0.81-1.22)
	TB dispensary	1.88	(1.32-2.68) ^	-		1.24	(1.01-1.52) ^
Comorbidity	Yes	-		1.09	(0.92-1.28)	1.10	(0.93-1.30)
	No	-		ref		ref	
Hospitalization	Yes	-		1.79	(1.52-2.09) ^	1.72	(1.47-2.02) ^
	No	-		ref		ref	

TB – drug-susceptible pulmonary tuberculosis; aPR – adjusted prevalence ratio; CI – confidence interval; NCMS -New rural cooperative medical scheme; CDC – centre for disease control

[@]analysis was weighted for the multi-stage design and weighted results have been presented;*Generalized linear model (Poisson regression) built using forward stepwise method: one model each for pre-TB treatment, TB treatment and TB care overall (total three models). Age, sex and variables with unadjusted p<0.2 were considered. aPR of variables retained in the model are presented; variables not included in this table either had unadjusted p>0.2 or were considered but not retained in all three models; [#] pre-treatment and treatment phase combined; ^statistically significant

Figures

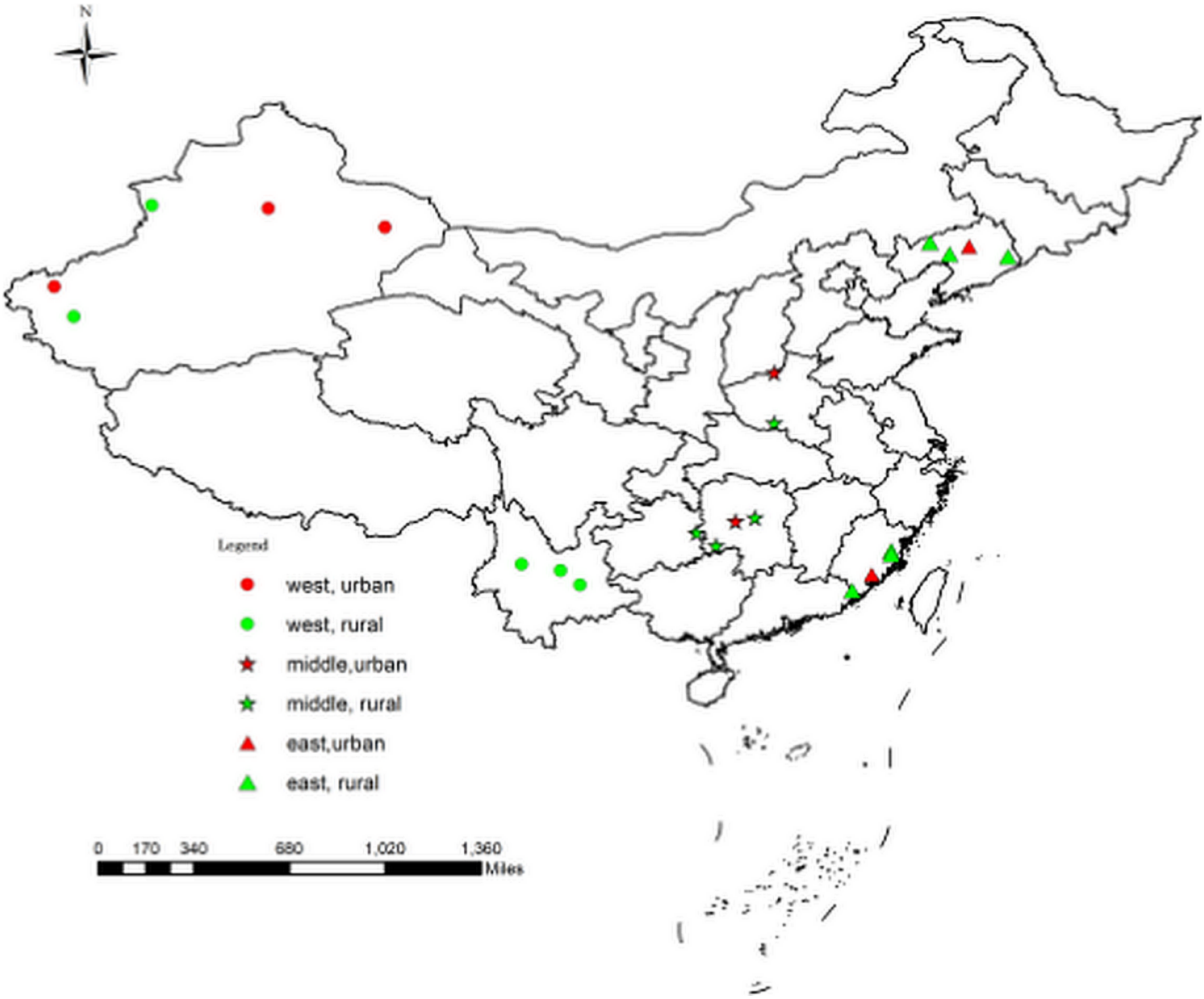

Figure 1

Map of China depicting the randomly sampled counties for the TB patient cost survey (2017) TB – drug-susceptible pulmonary tuberculosis. Note: The designations employed and the presentation of the

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