

Estimating the pre- and post-diagnosis costs of tuberculosis care for adults in Karachi, Pakistan: Household economic impact and strategies for meeting the costs

Shama Razaq (✉ shama.razzak@gmail.com)

Jinnah Sindh Medical University <https://orcid.org/0000-0002-0801-5894>

Aysha Zahidie

Air University

Zafar Fatmi

Aga Khan University

Research

Keywords: Household expenditure, Pre- and post-diagnostic costs, TB care, Adults

Posted Date: June 16th, 2021

DOI: <https://doi.org/10.21203/rs.3.rs-615524/v1>

License: © ⓘ This work is licensed under a Creative Commons Attribution 4.0 International License. [Read Full License](#)

Abstract

Background

Despite of free TB care in Pakistan, patients still have to bear high costs which push them more into poverty. This study estimated the types of costs households bear for TB care, and coping mechanisms used for bearing TB expenditures among adults ≥ 18 years in Karachi, Pakistan.

Methods

A total of 516 TB patients with completion of at least one month intensive treatment were recruited from four public sector hospitals in Karachi, Pakistan. A standardized questionnaire to estimate patient's costs was administered. Direct medical and non-medical costs incurred as out-of-pocket and indirect costs (loss of income) during pre-diagnostic, diagnostic, treatment and hospitalization phase were estimated.

Results

Out of 516 participants, 52.1% were female with a mean age of 32.4 (± 13.7) years. The median costs per patient borne during the pre-diagnostic, diagnostic, treatment and hospitalization was estimated at USD63.8/ PKR7377, USD24/ PKR2755, USD10.5/ PKR1217 and USD349.0/ PKR40300, respectively. The total household median costs was estimated at USD129.2/ PKR14919 per patient. The median indirect costs were estimated at USD52.0/ PKR5950 per patient. First point of care was a private provider by 54.1% of patients, 36% attended public service, 5% and 4.1% went to dispensary and pharmacy, respectively.

Conclusion

TB patients bear substantial out-of-pocket costs before they are enrolled in publically funded TB program. There should be provision of transport and food vouchers, also health insurance for in-patient treatment. This advocates a critical investigation into an existing financial support network for TB patients in Pakistan with an eye towards easing the burden.

Key Messages

Implications for policy makers:

Out-of-pocket payments for tuberculosis (TB) care among adults in Pakistan cause substantial financial burden for households despite of "Free TB care" policy. Therefore, inclusion of social support for TB care is required in currently functioning "Ehsaas Policy", a safety net program for poor in Pakistan. Policy makers in coordination with National TB control program should perform the assessment of basic socio-economic status of TB patients so to include them in the social program.

Implications at programmatic level:

National TB control Program should identify gaps in the current program with respect to costs and address them timely. In our study, a major burden is the cost of hospitalization, food and transport and loss of income. TB care support by the program may consider insurance coverage policy for in-patients and food and transport vouchers to reduce direct non-medical costs. Furthermore, TB patients may be assisted with leave compensations to reduce the indirect costs. Additionally, social mobilizers/ health workers can dispense medications among TB patients at home, thus reducing indirect costs incurred while travelling and waiting.

Implications for public healthcare services:

Quality care in affordable price rates has remained worst at government healthcare facilities in Pakistan. There is a need to improve the quality of such facilities so that people attend them as a first point of care with confidence and encourage others also to avail those affordable facilities and that is how pre-diagnostic costs can be reduced which is higher in our studies due to utilization of private services at first place by majority of patients.

Implications for individual level:

Non-Governmental Organization (NGOs) and philanthropists can support National program linking household poverty within community which would help in restructuring program related to costs. They can also assist in increasing awareness through mass media campaigns helping in reducing taboos, assuring timely diagnosis, providing effective treatments and reducing bacterial transmission through unidentified and untreated cases.

Background

Tuberculosis (TB) leads to poverty and the second leading cause of mortality worldwide among infectious diseases, resulting in more than one million deaths every year. Most of the burden of TB occurs in low and low-middle income countries [1].

Pakistan ranked 5th among the 30 high TB burden countries, bearing approximately 60% of the TB burden of the Eastern Mediterranean Region (EMR). The estimated prevalence rate for all types of TB cases was 342 and the incidence rate was 275 per 100,000 population [2]. The case detection rate for all types of tuberculosis was 64% of estimated new cases i.e. approximately 510,000 new TB cases reported annually. Extra-pulmonary TB (EPTB) was also increasing and accounted for 15% of the total TB cases [3, 4]. Pakistan's National TB control program (NTP) adopted directly observed therapy short course strategy (DOTS) aims for adherence to treatment and better treatment outcome to include free first line anti-TB medicines, free or low cost investigations, and no administrative charges [5]. Despite the free treatment plan for TB DOTS program, the patient still bears substantial additional costs. These include travel to seek care, loss of earnings due to absence from work, pre-diagnostic investigation cost due to delay or miss-diagnosis, accommodation and food costs for in-patient care, and costs for drug-resistant and extra-pulmonary TB treatment [6, 7].

TB mostly affects the poorest of the poor and substantially contributes to the disease-poverty trap as it has a huge economic impact on the household [8]. According to the latest survey of Planning Commission of Pakistan, 24.3% of the population (55 million, approximately) were living below the poverty line during 2015–2016 [9]. Out-of-pocket healthcare payments were made by 57.6% of households in Pakistan [10, 11]. The majority of people in Pakistan (> 80%) seek health care from the private sector, which puts an extra economic

burden on households [5]. Although a small scale study was conducted recently in Karachi to estimate TB expenditure, it has several methodological limitations and thus raised questions about its validity. Moreover, direct and indirect costs were reported in the form of a mean with no standard deviation [12]. Hence, we designed a study to determine household expenditures in-depth including direct and indirect costs of TB care for pre- and post- diagnostic periods among adults 18 years and older and cared for by a public sector health facility in Karachi, Pakistan.

Methods

Study setting and design

This cross-sectional study was conducted in four public sector health facilities of two institutes (Civil Hospital and Ojha Institute of Chest Diseases, Dow University of Health Sciences) visited by a large majority of TB patients. Most of these patients are low and middle income.

Study Participants and sampling strategy:

Male and female patients ≥ 18 years and diagnosed with TB (pulmonary or extra-pulmonary) who have experienced at least 1 month of treatment in the intensive phase, were recruited from February 2018 till September 2018 using a non-probability consecutive sampling method.

Sample size estimation

The sample size required in the study was calculated to be 516 participants, estimated based on median costs of USD24.78 i.e. PKR 2725, and variance of 178.75 and bound by an error rate of 5%, assuming approximately 5% of refusal rate or data incompleteness due to sensitivity of ascertaining costs related data [13].

Data collection tool

A standardized structured questionnaire titled, "Tool to estimate the patient's cost" was developed from the Poverty sub-working group of the Stop TB Partnership [14]. This tool was adapted, modified, translated to the local language, i.e., *Urdu*, and pretested on a small group ($n = 25$) of participants before administration. This questionnaire addressed three types of direct and indirect costs: 1. charges for health services during the pre-diagnostic, diagnostic and treatment phases, 2: the cost of travel to seek health care and charges for food, and 3. estimated cost expenditures in connection with loss of income, travel time, waiting, and seeing health care providers as well as loss of productivity due to absence from work [15].

Cost estimation

Costs were estimated for each phase separately, i.e. the pre-diagnostic phase when the patient was symptomatic but not yet diagnosed and the post-diagnostic phase beginning when the patient was diagnosed, had treatment advised, and follow-up. Cost details are provided in Table 1. Direct medical and non-medical costs per patient were calculated as the product of the patient's reported cost parameter (e.g. administrative, investigation or medication costs) and frequency (e.g. number of visits). Indirect costs were calculated by tabulating the total number of hours commuting to and spent in a healthcare setting. Taking into account an average working day of 8 hours, the monthly household income reported by the patient was used to derive an

hourly wage rate to determine the indirect costs [16]. All costs data were collected in PKR and reported in USD and PKR both (Mid Exchange Rate as of 2018: USD 1 = 115.5 PKR).

Table 1
Operational definitions for cost categories:

Variables	Definitions
Direct medical and non-medical cost	Out-of-pocket expenditure for TB treatment such as consultation, investigations, travel and food costs.
Indirect cost	Income loss of patient because of absence from work due to TB and/or time to seek care (includes time for travel, waiting and consultation and/or during hospitalization).
Pre-diagnostic costs	Costs incurred during the phase from onset of symptoms till the diagnosis of TB.
Diagnostic costs	Costs incurred by patient and household for diagnosis.
Treatment costs	Costs related to DOTs, fetching medicines from health facility and costs related to any other medicines such as multivitamins.
Follow-up costs	Costs associated with investigation, any other medication, and travel and food costs during follow up visits.
Hospitalization costs	Costs for hospitalized patients including treatment, administrative (bed), laboratory investigation and medicine, food and travel costs and loss of income due to absence from work.

Data management and analysis

Data were double entered into EpiData v3.1 and then, for cleaning and analysis were exported to SPSS version 21. The data were explained using proportions for categorical variable, mean (standard deviation) for continuous variable, and median (interquartile range) was calculated for costs determination for each phase and category.

Ethical considerations

The Ethics Review Committee of Aga Khan University provided the approval for study (ERC# 4026-CHS-ERC-16). The Institutional Review Board (IRB) of Dow University of Health Sciences also approved the study (IRB-679/DUHS/Approval/2016/152). Prior to the interview, the purpose and nature of the study was explained and written informed consent was obtained from each study participant. Clinical records of patients were extracted with the permission of their health care facilities.

Results

Socio-demographic characteristics: A total of 516 TB patients aged ≥ 18 years were recruited of which 269 (52.1%) were females, of which 382 (74.0%) were or had been married, and 32.1% belonged to most common ethnicity living in the city, i.e., Urdu. The mean age of the participants was 32.35 years (\pm SD 13.7 years). Out of total, 215 (41.7%) never attended school and 221 (42.8%) were employed. The mean household income (including patients' plus income of all other members of the household) was 17453 PKR (\pm SD 15192PKR). 113

(21.9%) of participants were living in a highly crowded household, with more than 5 members per room. These characteristics are summarized in Table 2.

Table 2
Socio-demographic characteristics of adult (≥ 18 years)
tuberculosis patients at public sector TB health care facility
in Karachi, Pakistan (n = 516)

Characteristics	n = 516 (%)
Age in years [(Mean (SD))]	32.35 (13.7)
Gender	
Male	247 (47.9)
Female	269 (52.1)
Marital status	
Never Married	134 (26.0)
Ever Married	382 (74.0)
Ethnicity	
Urdu	165 (32.1)
Punjabi	91 (17.6)
Sindhi	103 (19.9)
Pushto	83 (16.1)
Baluchi	74 (14.3)
Religion	
Muslims	492 (95.3)
Non-Muslims	24 (4.7)
Education	
Didn't attend school	215 (41.7)
Madrassa only	18 (3.5)
Primary class	73 (14.1)
Secondary class	154 (29.8)
Intermediate	41 (7.9)
Graduation	15 (2.9)
Employment status	
Employed	221 (42.8)
House lady	202 (39.1)
Unemployed	30 (5.8)

Characteristics	n = 516 (%)
Student	30 (5.8)
On sick leave	27 (5.2)
Retired	6 (1.2)
Household income in PKR (mean[SD])	17453 (15192)
House ownership	
Own	275 (53.3)
Rented	241 (46.7)
Crowding index	
≥ 5 Members per room	113 (21.9)
< 5 Members per room	403 (78.1)

Health-seeking behavior and TB profile: Out of the total, 54.1% of the patients first visited a private health facility after the onset of illness. About 49.6% (256) were pulmonary smear + ve, 21.7% (112) smear -ve and 28.7% (148) were extra-pulmonary TB case. Of them 77.5% (400) and 22.5% (116) were given Cat I and Cat II treatment regimen, respectively. Patients under treatment during the intensive and continuous phases, respectively, were 27.3% and 72.7%. Nearly all, 91.8% of the participants had not had their contacts screened. A summary of the TB profiles is presented in Table 3.

Table 3

Description of type of TB and its treatment, health seeking among adult (≥ 18 years) patients at public sector TB health care facility in Karachi, Pakistan (n = 516)

Characteristics	n = 516(%)
Type of TB	n (%)
Pulmonary, smear + ve	256 (49.6)
Pulmonary, smear -ve	112 (21.7)
Extra pulmonary	148 (28.7)
Treatment regimen	
Cat I	400 (77.5)
Cat II	116 (22.5)
Type of patient	
New	400 (77.5)
Relapse	70 (13.6)
Treatment after default	19 (3.7)
Treatment after failure	19 (3.7)
Transfer-In	03 (0.6)
Treatment after loss to follow up	05 (1.0)
Treatment phase	
Intensive phase	141 (27.3)
Continuous phase	375 (72.7)
Total duration of planned treatment	
6 months	307 (59.5)
8 months	85 (16.7)
> 8 months	91 (17.8)
No of contacts screened	
None screened	472 (91.5)
≥ 1 member screened	44 (8.5)
First contact for seeking TB care	
Private hospital/clinic	279 (54.1)
Government hospital	186 (36.0)

Characteristics	n = 516(%)
Dispensary	30 (5.8)
Pharmacy/drug store	21 (4.1)

Pre-diagnostic costs: Before diagnosis, TB patents incurred a median (IQR) cost of USD63.8 (44.7–90.5). Direct medical and non- medical costs amounted to median (IQR) USD25 (12.1–35) and USD5.2 (4.3–6.5). Indirect cost amounted to median (IQR) USD 29.2 (19.5–47) (Table 4).

Table 4

Summary of direct and indirect median costs [IQR] associated with TB care among adult (≥ 18 years) tuberculosis patients at public sector TB health care facility in Karachi, Pakistan (n = 516)

Total Costs		Direct Medical Costs		Direct Non-Medical Costs		Indirect Costs	
USD	PKR	USD	PKR	USD	PKR	USD	PKR
Costs summary for Outpatient care (n = 516)							
Pre-Diagnostic Costs (Median Costs [IQR])							
63.8 [44.7– 90.5]	7377 [5168– 10450]	25 [12.1– 35]	2875 [1400– 4000]	5.2 [4.3– 6.5]	600 [500– 750]	29.2 [19.5– 47]	3375 [2250– 5400]
Diagnostic Costs (Median Costs [IQR])							
24 [15- 35.5]	2755 [1686– 4095]	8.0 [0.3– 18.2]	900 [40– 2100]	4.3 [3.0- 12.1]	500 [350– 1400]	6.5 [4.0- 9.5]	750 [450– 1100]
Treatment Costs (Median Costs [IQR])							
10.5 [6.5– 15.6]	1217 [750– 1800]	0.00 [0–0]	0.00 [0–0]	3.1 [1.7– 5.5]	355 [200– 637]	6.0 [3.5– 10.1]	698 [400– 1170]
Follow up Costs (Median Costs [IQR])							
15.7 [8.8– 32.4]	1816 [1020– 3747]	2.7 [1.3- 9.0]	315 [150– 1035]	3.5 [1.3– 7.8]	400 [150– 900]	4.9 [2.6– 8.7]	561 [300– 1000]
Total Household Costs (Median Costs [IQR])							
129.2 [99.0- 172.2]	14919 [11415– 19892]	42.0 [26.4– 68.4]	4835 [3050– 7895]	22.8 [15.6– 3.63]	2635 [1800– 4187]	52.0 [36.1– 72.0]	5950 [4172– 8304]
Costs summary for Inpatient care (n = 91)							
349.0 [147.2- 463.2]	40300 [17000– 53500]	284.0 [121.2- 450.2]	32800 [14000– 52000]	56.3 [23.4– 130.0]	6500 [2700– 15000]	8.7 [4.7– 18.2]	1000 [540– 2100]

Post-diagnostic costs: After diagnosis, TB patients incurred a median (IQR) cost for treatment and follow-up of USD 10.5 (6.5–15.6) and USD 15.7 (8.8–32.4), respectively (Table 4).

The total household median (IQR) cost was estimated to be USD 129.2 (99.0-172.2). Whereas, in-patient costs were amount to median (IQR) was 349.0 (147.2- 463.2). Out of total, 17.6% of the patients were hospitalized during treatment with mean (\pm sd) length of stay during hospitalization was 6.5 days (\pm 3.2 days) (Table 4).

Coping mechanism: For the purpose of seeking TB care, 59.9% of the patients drew from household income followed by 27.9%, 25% and 17.2% who cut down food expenditure, borrowed money from relatives and utilized cash saving, respectively, to cope with the TB care expenditure (Fig. 1).

Contribution of each costs category during different phases of TB Care: Out of grand total household costs, indirect costs shared the most i.e. 42.1%, followed by direct medical costs i.e. 36.5% and direct non-medical costs i.e. 21.4%. During pre-diagnostic phase out of total costs, indirect costs shared 50% and direct medical costs shared 40.2%. During diagnostic, treatment and follow-up phase, indirect costs contributed 34%, 62.7%, 39.8%, respectively, out of the total of respective phases. Share of direct non-medical costs during diagnostic, treatment and follow-up phase, respectively, was 30.7%, 37.3% and 31.9% (Fig. 2).

Discussion

This study revealed that a substantial financial cost is incurred across pathways to TB care by patients and their families in a country with a significant burden of TB and poverty and where TB services are free of charge. The total median (IQR) household costs for TB care per patient including both direct and indirect costs amounted to USD129.2 (99.0-172.2)/ PKR14919. Overall, our study estimate is relatively comparable to a total median cost amounting to USD171 (75.6–387) ascertained in a population in China [17]. But our cost estimates were found to be comparatively lower total median costs than those reported in Ghana, Viet Nam and the Dominican Republic i.e. USD202, USD758 and USD742, respectively [18]. This could be possibly due to a heavy reliance on out of pocket expenses and inequality in healthcare distribution in low-income countries [19].

This study estimated indirect median costs amounting to USD52.0 (36.1–72.0)/ PKR5950 which is a significant contributor (42.10%) of the total household costs for TB care. This finding is comparable to a study conducted in a neighborhood which found estimated median indirect costs at USD78 [17]. A study conducted in Nigeria reported that indirect costs incurred per patient was USD79.13, which is relatively comparable to our study estimates [20]. Furthermore, looking at the pattern of costs contribution during different phases of TB care (Fig. 2), it is evident that indirect costs is relatively higher as compared to other costs categories during different phases and it is the highest contributor during treatment phase i.e. 62.7%. Our findings for higher indirect costs throughout is comparable to the findings in India which estimated an indirect costs by 54% of patients [21]. These costs could be due to the long course of disease and recovery pathway, sometimes occupied by complications leading to the loss of productivity. Among Thai adults, a study reported that approximately 20% experienced a decline in income due to the patients' or their guardians' reduced ability to work (23).

The substantially higher median (IQR) cost during the pre-diagnostic phase as identified in the study amounted to USD63.8 (44.7–90.5)/ PKR7377, which is 49% of the total household out of pocket payment for TB care. This could be due to informal care such as self-treatment and the practice of seeking health care from private

facilities, which demand sizeable amounts of direct medical costs compared to public facilities where medical costs have been minimum and more tolerable. In our study, patients sought care from private hospitals (54.1%), dispensaries (5.8%), and drug stores (4.1%) when first contracting TB. Higher estimates before diagnosis was also reported in Ghana, Viet Nam, Dominican Republic and Zambia [18, 22]. Indirect median (IQR) costs in pre-diagnostic phase was USD29.2 (19.5–47)/ PKR3375 which has a significant contribution i.e. 50% out of total pre-diagnostic cost. Indirect costs have also been higher and contributed significantly as shown in earlier studies [18].

Diagnostic Median (IQR) costs were reported in this study at USD24 (15-35.5)/ PKR 2755 where direct medical costs shared 35.3% of it, which is significant. A systematic review for assessing the economic burden of TB reported direct medical median (IQR) costs for diagnostic phase amounting to USD30 [6]. This might be due to laboratory investigation costs and availing such services from private laboratories since people tended to have low confidence on the quality of services provided by public providers.

Besides the direct medical costs, indirect median (IQR) costs during the diagnosis phase reported in this study shared higher contribution USD 6.5 (4.0-9.5)/ PKR750. A comparable estimate of indirect median costs amounting to USD9.2 was reported in Ethiopia [23]. This might be because of time taken off from work for diagnostic tests and visits to receive the final diagnosis and for the prescription of treatment accordingly. During this phase, the patient either takes sick leave or resigns depending on the severity of illness, either way facing loss of income.

During the treatment and follow-up phase, the median (IQR) costs reported was USD10.5 (6.5–15.6)/ PKR1217 and USD15.7 (8.8–32.4)/ PKR1816, respectively. The finding is slightly higher as reported in Kenya where treatment costs amounted to USD3 only but comparable to follow-up costs amounting to USD23.43 as reported in Nigeria [24, 25]. It might be due to the greater share of indirect costs 62.70% and 39.8% during treatment and follow-up duration, respectively, as the patient had to take medications under the supervision or patients or their guardian had to visit the facility to pick up the drug. The follow-up costs in this study are slightly higher than the treatment costs since follow up visits require lab work to determine progress towards recovery.

Patients hospitalized at one point in time during the course of treatment were 17.6% (n = 91). This is less than the 33% and 23% reported in Ghana and Viet Nam [18]. Estimated hospitalization median (IQR) costs in this study amount USD 349.0 (147.2- 463.2)/ PKR40300. This estimate is considerably higher compared to findings reported in Ghana and Viet Nam which amounted to USD42 and USD118, respectively [18]. The possible reasons for the higher costs reported among hospitalized patients in our study might be due to the severity of symptoms which occurred resulting in direct hospitalization and causing high expenditures. It also could be associated with a relative delay in seeking care, i.e. after five to six weeks, and hence, a late diagnosis could lead to an advanced stage of the disease and turn into complications. Another reason could be the difference in costs of providing care from the provider's perspective which might vary from one country to the other.

This study reported common coping modalities patients and their families have chosen to bear with the financial burden due to TB care. A substantial proportion of participants i.e. 94% used any mechanism available to finance their TB care thus further impoverishing their household's ability to cope with the illness. Further, this study reported the distribution of different mechanisms of covering costs; the majority of the participants 59.5% utilized cash savings. However, our study finding was higher than one previously conducted study in Thailand

which stated that 22% of participants were utilizing their own savings, this the most common mechanism found in Thailand [26].

Strengths & limitations: This study has certain strengths. This study is unique in Pakistan in reporting TB expenditure estimates in detail, comprising of costs incurred in different phases such as pre-diagnostic, diagnostic and treatment along with estimating indirect costs (loss of productivity). In addition, this study used a standardized questionnaire specifically developed for estimating patients' costs for tuberculosis care comprehensively covering all aspects and phases for expenditure. This is among the few studies conducted on cost estimation for treatment of TB patient. The study sample was statistically calculated to determine the median costs from a regional study.

Certain limitations of the study need to be kept in mind while interpreting the costs. First, this facility-based study which was conducted in four public sectors where the majority of participants come from low and middle socio-economic groups. However, some patients who utilized the private sector and those unable to visit even the public sector hospital due to poverty are not included in this study. Second, this study was carried out in an urban setting where the socio-economic and socio-demographic status is different (may be higher) than in rural areas. Third, questions about costs and income are subject to recall bias and seasonal fluctuation, where validation of costs is difficult, particularly for those who had a number of visits to hospitals during pre-diagnosis and for those who required retreatment. Fourth, although patient cost surveys in different parts of the world somehow showed similar estimates, costs cannot be compared directly due to different methodologies employed in other studies and costs ascertained at different time periods.

Conclusion

TB patients bear substantial out-of-pocket pre-diagnostic and diagnostic costs even before they are enrolled in TB programs. After enrollment in public sector TB programs they still bear a substantial burden of direct non-medical costs. Furthermore, for those TB patients who require admission, the in-patient cost can be overwhelming. TB patients require adequate support for diagnosis, and insurance for direct non-medical and in-patient costs coverage. This work should serve as a strong encouragement to revisit the financial support network provided for TB patients. We hope this research will contribute to understanding the need of introducing social protection mechanisms to address the catastrophic payments experienced by patients suffering from tuberculosis in Pakistan.

Declarations

Acknowledgments:

I would like to express my thanks to patients and their families for their cooperation in participating in this study and providing valuable information. We appreciate the efforts of the field staff that collected the cost related data.

Funding:

The data collection for the study was supported by the Pakistan Health Research Council. The funding source did not have any role in the design, conduct, reporting and publication of this study.

Availability of data and material:

The data analyzed during the current study will be available from the corresponding author upon reasonable request. All data generated or analyzed in this study are contained in this published article

Authors' contributions

SR conceived the concept and designed the study, collected and analyzed the data, and prepared the manuscript. AZ supervised the data collection procedure, analyzed, reviewed and approved the manuscript. ZF reviewed the concept, offered guidance during protocol development, data collection and analysis, and critically reviewed and approved the final version of the manuscript.

Ethics approval and consent to participate

The Ethics Review Committee of Aga Khan University provided the approval for study (ERC# 4026-CHS-ERC-16). The Institutional Review Board (IRB) of Dow University of Health Sciences also approved the study (IRB-679/DUHS/Approval/2016/152). Prior to the interview, the purpose and nature of the study was explained and written informed consent was obtained from each study participant. Clinical records of patients were extracted with the permission of their health care facilities.

Consent for publication

Not applicable

Competing interests:

The authors declare that they have no competing interests of any kind associated with this current work.

References

1. Kyu HH, Maddison ER, Henry NJ, Mumford JE, Barber R, Shields C, et al. The global burden of tuberculosis: results from the Global Burden of Disease Study 2015. *Lancet Infect Dis*. 2018;18(3):261–84.
2. Qadeer E, Fatima R, Yaqoob A, Tahseen S, Haq MU, Ghafoor A, et al. Population based national tuberculosis prevalence survey among adults (> 15 years) in Pakistan, 2010–2011. *PLoS One*. 2016;11(2):e0148293.
3. Fatima R, Harris R, Enarson D, Hinderaker S, Qadeer E, Ali K, et al. Estimating tuberculosis burden and case detection in Pakistan. *Int J Tuberc Lung Dis*. 2014;18(1):55–60.
4. National TB control Program. Annual Report 2016. Islamabad: Ministry of National Health Services Regulations and Coordination; 2016. p.5–7. Available from: http://ntp.gov.pk/ntp-old/uploads/NTP_Annual_Report_2016.pdf.
5. Akhtar S, Rozi S, White F, Hasan R. Cohort analysis of directly observed treatment outcomes for tuberculosis patients in urban Pakistan. *Int J Tuberc Lung Dis*. 2011;15(1):90–6.
6. Ukwaja K, Modebe O, Igwenyi C, Alobu I. The economic burden of tuberculosis care for patients and households in Africa: a systematic review [Review article]. *Int J Tuberc Lung Dis*. 2012;16(6):733–9.
7. Tanimura T, Jaramillo E, Weil D, Raviglione M, Lönnroth K. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review. *Eur Respir J*. 2014;43(6):1763–75.

8. Ahn DI, Organization WH. Addressing poverty in TB control: options for national TB control programmes. Geneva: World Health Organization; 2005.
9. Planning Commission. National Poverty Report 2015-16. Islamabad: Ministry of Planning, Development & Reform; 2018. p.1–3. Available from: [https://www.pc.gov.pk/uploads/report/National_Poverty_Report_2015-16_12-07-18\(Formatted_by_JACC\)1.pdf](https://www.pc.gov.pk/uploads/report/National_Poverty_Report_2015-16_12-07-18(Formatted_by_JACC)1.pdf).
10. Hina N, Whitney E, Mahrt K. Poverty trends in Pakistan. WIDER Working Paper; 2015. Report No.: 9292560255. Available from: <https://www.econstor.eu/bitstream/10419/129443/1/84553985X.pdf>.
11. Pakistan Bureau of Statistics. National Health Accounts Pakistan 2015-16. Islamabad: Pakistan Bureau of Statistics, Statistic Division Government of Pakistan; 2018. p.15–16. Available from: http://www.pbs.gov.pk/sites/default/files/NHA-Pakistan%202015-16%20Report_0.pdf.
12. Rizvi M, Shyum Naqvi B, Abbas A. Financial burden of pulmonary tuberculosis (TB) in Pakistan. *World J Pharm Res.* 2015;4(2):65–78.
13. Aspler A, Menzies D, Oxlade O, Banda J, Mwenge L, Godfrey-Faussett P, et al. Cost of tuberculosis diagnosis and treatment from the patient perspective in Lusaka, Zambia. *Int J Tuberc Lung Dis.* 2008;12(8):928–35.
14. Stop TB, Partnership. DOTS Expansion Working Group (TB and Poverty subgroup). Tools to estimate patient costs. Geneva, Switzerland: WHO. Available: http://www.stoptb.org/wg/dots_expansion/tbandpoverty/assets/documents/TooltoestimatePatientsCosts.
15. Mauch V, Woods N, Kirubi B, Kipruto H, Sitienei J, Klinkenberg E. Assessing access barriers to tuberculosis care with the tool to Estimate Patients' Costs: pilot results from two districts in Kenya. *BMC Public Health.* 2011;11(1):43.
16. Ahmad I. Labour and Employment Law: A Profile on Pakistan. International Labour Organization, Pakistan, Islamabad. 2009. Available from: https://wageindicator.org/documents/Labour_and_Employment_Law-A_Profile_on_Pakistan.pdf.
17. Pan H, Bele S, Feng Y, Qiu S, Lü J, Tang S, et al. Analysis of the economic burden of diagnosis and treatment of tuberculosis patients in rural China. *Int J Tuberc Lung Dis.* 2013;17(12):1575–80.
18. Mauch V, Bonsu F, Gyapong M, Awini E, Suarez P, Marcelino B, et al. Free tuberculosis diagnosis and treatment are not enough: patient cost evidence from three continents. *Int J Tuberc Lung Dis.* 2013;17(3):381–7.
19. Van Doorslaer E, O'Donnell O. Measurement and explanation of inequality in health and health care in low-income settings. *Health Inequality: Springer*; 2011. pp. 20–44.
20. Umar NA, Fordham R, Abubakar I, Bachmann M. The indirect cost due to pulmonary Tuberculosis in patients receiving treatment in Bauchi State—Nigeria. *Cost Eff Resour Alloc.* 2012;10(1):6.
21. Brinda E, Rajkumar A, Enemark U, Prince M, Jacob K. Nature and determinants of out-of-pocket health expenditure among older people in a rural Indian community. *Int Psychogeriatr.* 2012;24(10):1664.
22. Needham D, Godfrey-Faussett P, Foster S. Barriers to tuberculosis control in urban Zambia: the economic impact and burden on patients prior to diagnosis. *Int J Tuberc Lung Dis.* 1998;2(10):811–7.
23. Mesfin MM, Newell JN, Madeley RJ, Mirzoev TN, Tareke IG, Kifle YT, et al. Cost implications of delays to tuberculosis diagnosis among pulmonary tuberculosis patients in Ethiopia. *BMC Public Health.* 2010;10(1):173.

24. Sitienei J, Mutai J, Munui E. The Socio – Economic Burden of Tuberculosis on Households of Machakos District, Kenya. *Am J Respir Crit Care Med.* 2009;179:A1420.
25. Umar N, Abubakar I, Fordham R, Bachmann M. Direct costs of pulmonary tuberculosis among patients receiving treatment in Bauchi State, Nigeria. *Int J Tuberc Lung Dis.* 2012;16(6):835–40.
26. Kamolratanakul P, Sawert H, Kongsin S, Lertmaharit S, Sriwongsa J, Na-Songkhla S, et al. Economic impact of tuberculosis at the household level. *Int J Tuberc Lung Dis.* 1999;3(7):596–602.

Figures

CONTRIBUTION OF EACH COSTS CATEGORY DURING DIFFERENT PHASES OF TB CARE

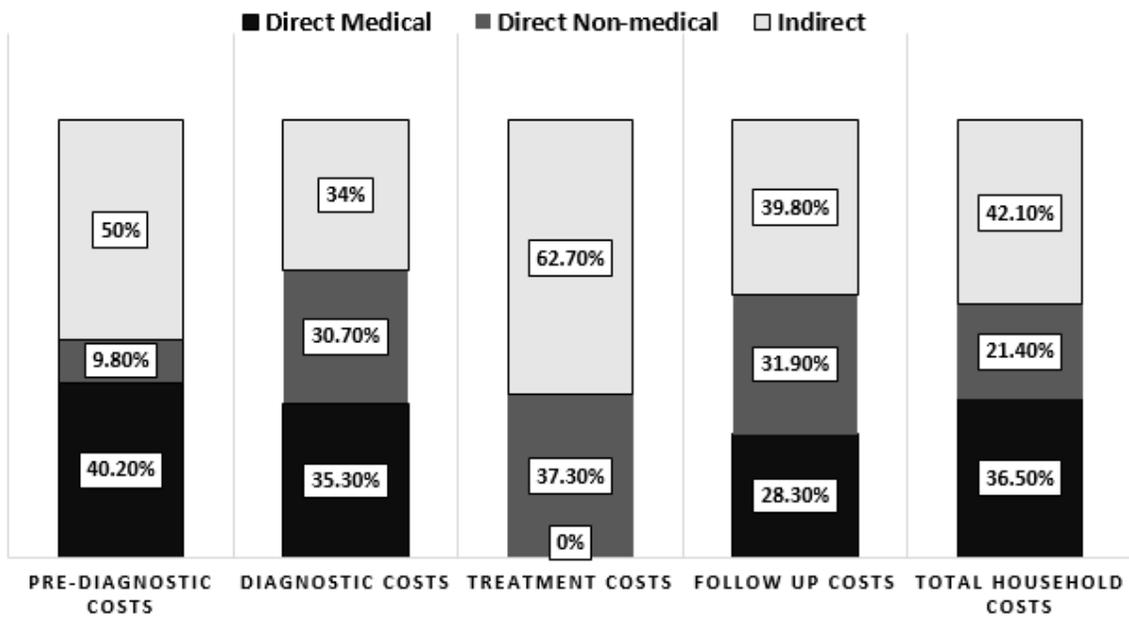


Figure 1

Summary of coping mechanism among study participants (≥ 18 years) attending government health care facility for TB care in Karachi, Pakistan (n= 516)

Coping mechanism for seeking TB care

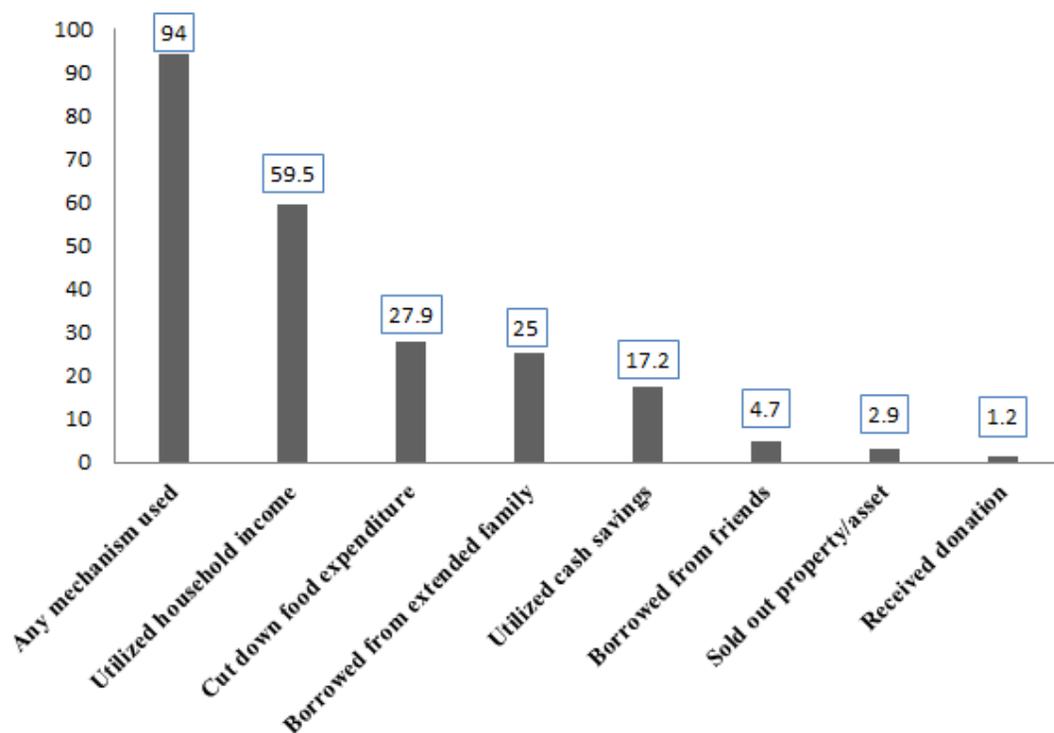


Figure 2

Summary of contribution of each costs category during different phases of among study participants (≥ 18 years) attending government health care facility for TB care in Karachi, Pakistan (n= 516)