CATASTROPHIC EXPENDITURE OF MULTI-DRUG RESISTANCE TUBERCULOSS ON HOUSEHOLD IN PAKISTAN - A CROSS-SECTIONAL STUDY

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ORIGINAL ARTICLE

Background: The Catastrophic Expenditure of Multi-Drug Resistant Tuberculosis on the household in Pakistan. A Cross-sectional study. Patients with MDR-TB incur huge costs associated with the disease while pursuing and receiving health care. Such costs make access and adherence barriers that affect health outcomes and increase the transmission of disease. **Objective:** The current research ascertained the percentage of Pakistan MDR-TB-affected households experiencing catastrophic expenditures and key cost drivers. **Methodology:** A cross-sectional survey with retrospective data collection and projections was conducted in 2022. A total of 212 multidrug-resistant (MDR) TB patients were consecutively enrolled 2 weeks into the intensive or continuation phase of treatment. across two districts and three healthcare facilities, all patients were enrolled in these PMDT sites where MDR-TB treatment facilities were in place. **Results:** Of the 212 respondents, for every single TB episode, patients on average incurred costs of PKR 0.36 million Multidrug-resistant tuberculosis (MDR TB) episodes. Up to 74 % of households borrowed, used savings, or sold assets to defray these costs. More than half (95.28) of TB-affected households experienced TB-related costs above 20% of their annual household expenditure, with the main cost drivers being non-medical expenditures such as travel, nutritional supplements, and food. It was observed that the cost of MDR-TB care is catastrophic for more than 95% (95 by human capital approach and 98% output approach) of the MDR-TB-affected households in Pakistan; our findings support the results from other surveys recently conducted in other countries. **Conclusion:** Collaborative efforts across health, employment, and social welfare sectors are imperative to minimize household costs due to TB disease and improve access to care, patient adherence, and outcomes.

INTRODUCTION

Tuberculosis (TB) leads to poverty and is the second leading cause of death globally among infectious diseases, causing more than one million deaths every year, whereas, the majority of the world's TB burden is found in low-middle-income countries [1]. Multidrug-resistant tuberculosis (MDR-TB) is an infection due to Mycobacterium tuberculosis that is resistant to at least isoniazid and rifampicin [2]. Therapy often lasts two years and is expensive [3]. One of the most important aspects required to end tuberculosis in the community is to develop better knowledge of the prevalence of medic-ation resistance among the community and healthcare providers. Tuberculosis has a major public health impact all over the world due to cross-infection through respiratory droplets, especially in underd-eveloped countries Until the emergence of the Novel Coronavirus, tuber-culosis was one of the leading causes of mort-ality from a single micro-organism, ranking above AIDS[4]. Numerous reasons are responsible for the development of MDR cases. These include non-adherence to therapy, lack of directly observed treatment, limited, or interrupted drug supplies, poor quality of drugs, widespread availability of anti-TB drugs without prescription, and poor medical man-agement[5].

A recent study has summarized multiple reasons for MDR-TB drug resistance as **(i)** late diagnosis, **(ii)** lack of timely and correct administration of effective drugs, **(iii)** lower availability of less toxic, inexpensive and effective drugs, **(iv)** long treatment duration, **(v)** nonadherence to drug regimen and **(vi)** evolution of drug-resistant TB strains[6]. Thus, resistance to antibiotics, when combined with other conditions, increases morbidity and death from TB. Moreover, TB drug-resistant strains are quickly spreading around the globe[7] due to non-adherence and financial burden on patients. Globally, tuber-culosis has high infection rates that contribute to significant morbidity and mortality It is estimated that about 110.0 million people have got infected with tuberculosis in 2020. Despite advanced modern treatment facilities, tuberculosis cont-inue to be leading cause of death in individuals, with 0.214 million AIDs persons and 1.3 million non-AIDs people dying from it in 2020[2].

According to National Tuberculosis Surveillance data 2017, TB incidence rate in Pakistan is 268 per 100,000 population. The Global burden of disease (GBD) reported that 4.18% (3.55%-5.13%) of the total death and 3.2% of total Disability Adjusted Life Years (DALYs) are due to tuberculosis[2]. Almost 95% of tuberculosis patients lost their lives in the most productive years due to the complication of tuberculosis in developing countries[8]. Disease has huge economic and social implications. TB not only reduces the productive years of a household but also puts upward pressure on the overall productive capacities of the human factor [9].

It was estimated that in lower- and middle-income countries, households suffering from TB consume more than half of their household income on the treatment of TB. In a contextual sense, TB has the highest adversity for the lower socio-economic classes. This decreases the total labour surplus to zero surplus thus decapitalizing the non-visible incentives. Internationally, WHO documented an unprecedented rise in not just multidrug-resi-stant (MDR) TB but also XDR TB (extreme drug-resistant TB). Persons with low socioeconomic status are significantly affected by MDR-TB which forces them into a disastrous poverty-disease cycle [10].

As a consequence, patients are reluctant to start or complete treatment due to financial hardship[11]. Worldwide, low enrolment and treatment success rates are challenging issues that foster further drug resistance, the excessive transmission of MDR-TB, and high mortality[2]. According to the World Health Organization (WHO), in EMRO region (Iran and Bangladesh) research studies state that, the prevalence of 3.5% and 20.5% of new and previously treated TB cases were estimated to have MDR-TB;in 2015 it was estimated that 480,000 people developed MDR-TB[12]. However, in 2017, MDR tuberculosis acco-unted to an estim-ated 14% of tuberculosis deaths worldwide[13]. With an estimated 25,000 cases, Pakistan is ranked fourth among 30 countries with a high drug-resistant tuberculosis (DR) burden worldwide in 2a with the prevalence of 4.2% among new cases and 7.3% among previously treated cases[14].

The study conducted in India found that patients have ascertained with heir out-of-pocket costs and discovered that they spent more than their typical annual salary before enrolling in the government program[15]. The combination of lost income and additional expenses is typically devastating if the patient is the family's primary provider. Therefore, based on the established cost reduction possibilities, the government should make relieving the financial load a top priority[16]. The proportion of TB-impacted households bearing costs of more than 20% of their yearly income in Viet Nam is high, posing excessive barriers to access diagnosis and treatment[17]. Despite receiving complimentary TB services through the National TB Programme, TB patients in the Philippines are nonetheless required to pay a significant amount of money ($601) because of their illness. 42% of TB-affected households had to pay exorbitant expenses because of the disease[18]. The present low, case identification and treatment completion rates for tuberculosis patients in Thailand may in part be

the result of their inability to manage the financial effects of their diagnosis and treatment[19].

A study in Bangladesh shows that, despite a TB care, the patient incurred a significant amount of CHE due Tuberculosis due to direct and indirect income loss. The major cost was due to income loss of the patient and the caregiver. The direct cost is variable according to the socioeconomic conditions, which leads to the CHE of many households. In 2015, in a move to spur worldwide progress toward universal health coverage and the end of the TB strategy, the World Health Organization (WHO) launched a series of surveys investigating costs incurred due to Tb[10].

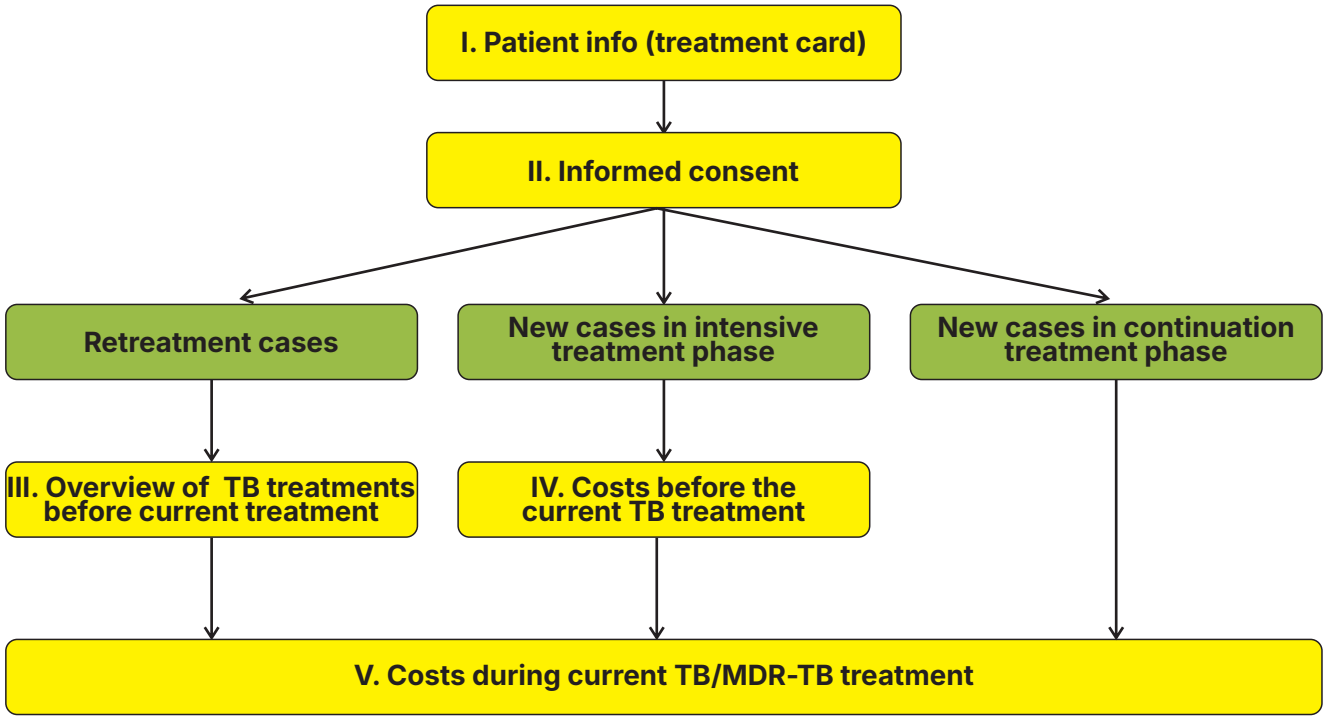
By July 2019, the survey has been completed in fourteen nations, although only 12 has had reported their results, excluding Pakistan[2]. Furthermore, the measurement of the costs for MDR-TB was insufficient[20]. In 2018, an estimated 3.4% of new cases and 18% of previously treated cases had MDR/RR-TB [2]. The context of the study is to explore and document the different factors which are incurred by MDR-TB patients, their households in Pakistan. The Global End TB Strategy 2015 reflects that there should be no catastrophic expenditure due to TB to end TB globally. TB patients incur sev-eral hidden costs, besides the medical which are the main barrier in the outcomes. The increased prevalence of TB in Pakistan, even though, the provision of free diagnostic and treatment facilities by National TB Control Program (NTP), is a major concern. Pakistan ranks 4th among 30 high Drug Resistant (DR) TB burden countries in the world with an estimated 25,000 cases DR-TB cases in 2019 with a prevalence of 4.2% among new cases and 7.3% among previously treated cases [14]. The current services provided for MDR-TB in Pakistan includes free diagnostic and treatment facilities by NTP as well as minimal financial support (travel and food). The study explores the major hidden expenditure and their magnitude incurred by patients and their households in Pakistan.

MATERIALS AND METHODS

Settings: The study was conducted in the three National TB Control Program (NTP) network sites namely Pakistan Institute of Medical Sciences (PIMS) from Islamabad, Rawalpindi Leprosy Hospital, Rawalpindi, and Samli Sanatorium Murree. **Study Design:** This was a cross-sectional quantitative study with retrospective data collection. **Duration of the study:** was six months from June 2022 to December 2022. **Participants:** The study population included all patients (including children accompanied by a guardian) who were on MDR-TB treatment (in the continuation or intensive phase) within the NTP network of Islamabad and Rawalpindi Division (these were a total of 212 patients) at the time of research. Sampling was done among public health facilities that treat and notify MDR-TB in line with the guidelines of the national TB program. **Sampling technique:** Non-probability convenient sampling technique. **Inclusion criteria:** Inclusion and exclusion criteria are defined according to the population of interest described in the survey objectives. Eligible patients are all consecutive patients registered for MDR-TB treatment.who are attending a sampled facility and who are a minimum of 14 days into the present intensive or continuation treatment phase. **Exclusion criteria:** Newly diagnosed patients, not started treatment, are not eligible for the survey. Ineligible patients are patients treated in facilities that are unconnected to the NTP, confirmed MDR-TB cases who have not yet started MDR-TB treatment or have been in the current treatment phase for less than two weeks, and children under 15 years old without their guardian. **Data Collection Procedure:** WHO's generic tool for the meas-urement of catastrophic health expenditure was used, which consists of 5 parts (World Health Organization, 2015)(attached with annex-1). **Part I-** Patient information was obtained from the MDR-TB treatment card before the interview (for all patients). **Part II**- Informed consent, inclusion/exclusion criteria, and checklist for which parts of the questionnaire to fill for different patients treated under different MDR-TB treatment categories and phases (for all patients). **Part III-** Overview of MDR-TB treatments before current treatment, up to 2 years before the current treatment started (for re-treatment cases

only). **Part IV-** Costs before the current MDR-TB trea-tment (for new cases interviewed in the intensive phase only). **Part V-** Cost during current TB/MDR-TB treatment (for all patients).

Fig-1:



Data analysis plan:

Approach 1 OOPs for TB diagnosis and treatment (Direct medical cost) are done by the TB patient's household which is denoted by _ ^(,) where "i" denotes patient and h denotes household. The non-medical direct expenditure like transport, accommodation, and food (Direct Non-Medical costs) denoted by _ ^(,) are net of any reimbursement. Indirect costs incurred due to the loss of time by both patient and household member net of any welfare payment are total indirect costs and denoted by _ ^(,). The percentage of patients' households exceeding the threshold of 20% of their annual income has also been calculated **Approach 2** The second method determines the proportion of households that are "dissaving" (such as taking a loan or selling property). By definition, this proxied indicator shows that a household's finances are deteriorating.

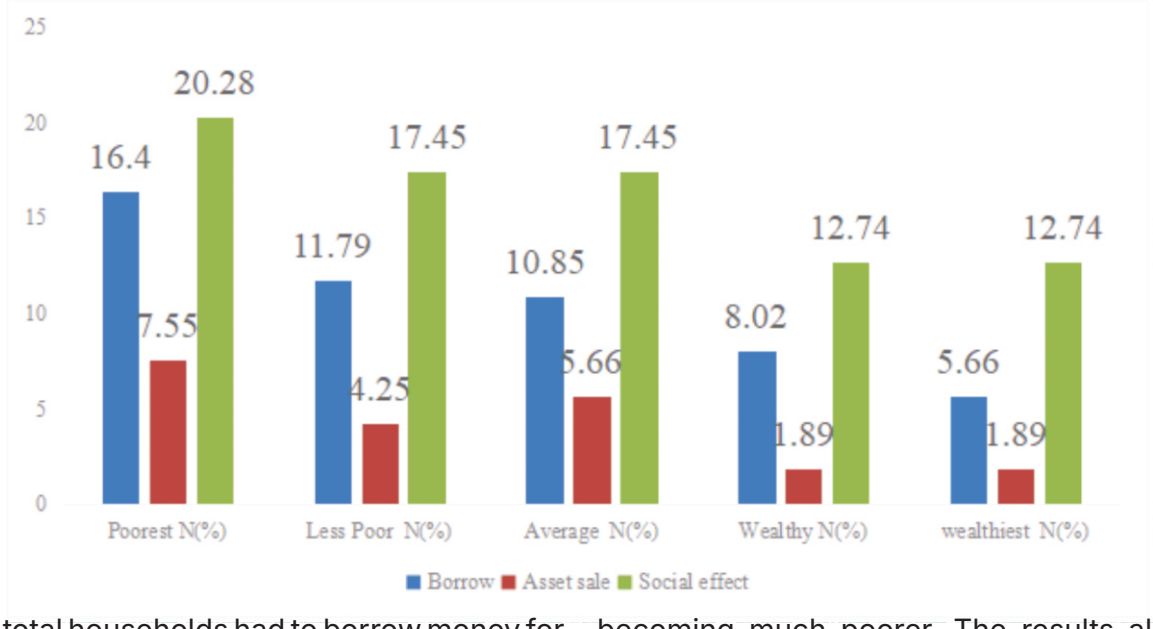
RESULTS

Among the 212 MDR TB patients, the sex-wise distribution was 50% males and 50% females. Ninety-three (93%) percent of the participants were adults (15 – 71 Years), and the remaining seven (7%) percent were children (aged less than 14 years). For paediatric cases, the interviews were taken from their guardians. Depending on the treatment regimen, at the time of interview 46% (n =97) were in the intensive phase of the treatment while 54% (n =115) were in the contin-uation phase. Based on the treatment regist-ration group, more than half (54%) of the partici-pants were on the first line of new MDR-TB treat-ment and the rest of the respondents were either MDR relapse or retreatment after loss to follow-up or retreatment after failure. The number of poor people according to the given definition was 95 for the given study. However, when accounting for catastrophe cost, the number of patients who

RESULTS

were considered poor rose to around 182. This shows an increase of 92% in the number of people who were considered poor. The number of participants who were considered not poor in explicit terms was 117, however post accounting for catastrophe cost, the number of these patients was reduced to 30 thus showing an overall decline of more than 70% in the group that was initially considered not poor. This shows that the catastrophic cost impacts the MDR-TB burden by more than 50% thus making it a significant implicit cost. The analysis calculated the reported income of all participants using a mean income measure. This showed that DR-TB patients incurred a mean direct medical cost of PKR 2137. A mean direct non-medical cost of PKR 2043 and an indirect medical cost of PKR 1342 were borne by DR-TB patients before the diagnosis and the registration of tuberculosis patients with NTP. All the costs are in annual frequency. After the diagnosis of the disease, the direct medical cost increased to PKR 3850. A current total food cost of PKR 2371 and a current cost of nutritional supplement of PKR 295017 was borne by the tuberculosis patients throughout the current episode of tuberculosis. The total indirect cost (time lost) costs calculated through Human Capital Approach was PKR 10787 after diagnosis was incurred by the patients. In some, the total direct cost incurred by the patients throughout one tuberculosis episode was PKR 348094, and the total indirect cost was PKR 11895. The total cost of health expenditure was PKR 359989.

Fig-2:



52% of total households had to borrow money for the cost of treatment whereas 21% of total households had to sell any of their assets to bear the cost of the disease (MDR-TB). The results also showed that 24% of the poorest households faced assets sale and borrowed money as a coping mechanism when on treatment. Socio-economic impacts of MDR-TB interpreted as 81%of total household becoming socially affected followed by dissaving experience with 59%, facing delay in treatment with 53%, 52% of the total household becoming poorer with 18 % becoming much poorer. The results also indicated that 30% of total households remain unchanged with no or minimal socioeconomic impact. It further elaborates that poor population is more prone to suffer from social effects and what are the dissaving mechanisms to cope with their daily livings.

DISCUSSION

The catastrophic expenditure due to MDR-TB in Pakistan shows a high economic effect on patients as well as on households. The study also shows that all income quintiles are equally

affected by MDR-TB, making health-seeking very challenging for the patient. The catastrophic health expen-diture of more the 95% by the human capital approach and 98% by the output approach. Similar findings were recorded in research conducted in Africa, and South East Asia 21, 22. A study cond-ucted on MDR-TB in China showed that the catastrophic cost inci-dence was 87% and its inte-nsity was found 68.3% 23. The similar study cond-ucted in the Lao Republic found that the CHE due to MDR-TB was 81.1% which is significantly high 24. The Global End TB strategy 2015 has recom-mended that there should be no catast-rophic cost borne by anyone in any country. Tuberculosis has numerous impacts on household from direct cost to indirect costs in the form of various factors as mentioned in the analysis section. The current study showed that patient of MDR-TB cope their financial needs by borrowing from the relatives and selling their expensive household assets, that is the major economic and social impact imposed by tuberculosis on the patients. The similar impli-cations was found in the study of Lao Repu-blic that the patients rely on the borrowing and selling of household assets 24. In Pakistan, health insurance program (Sehat Sahulat) has started which covers most of the population for various diseases, but TB is not enlisted in the program. Inclusion of TB in the said program may help to address the National goal of end TB 2035 and provide sustainability. However, the cost related to non-medical cost need enhanced social support to decrease the catastrophe caused by TB. The study also found that about 52% of the TB patients went into impoverishment after getting the disease. Which is a significant impact posed by MDR-TB on population, the Uganda study have found 11.8% people went into impoverishment which is very low as compared to our study. their need to have a policy change regarding the management of MDR-TB treatment in Pakistan 21. The findings of the study suggest that public health interventions such as decentralization of PMDT sites, special incentives to women, increase in existing incentives and more inclusive social security to the patients are needed to reduce the economic burden of MDR-TB and to improve the quality of life of individuals and households affected by MDR-TB. The results indicate that It is very alarming and needs special focus by the program and other institutions (Bait-ul-Mal) working on poverty elevation. The current study's finding is similar to the research conducted in other middle and low-middle-income countries.

CONCLUSION

For the first time in Pakistan, this study has done an effort to provide the cost estimates and identified a range of potential drivers of costs and of catastrophic cost for MDR-TB patients and their households. Even though, free diagnostic and treatment services are being offered under the national TB programme, households with members suffering from TB are exposed to significant out of pocket expenditure, resulting in catastrophic health expenditure, and impoverishment. This can inform programmatic and policy decisions and enable effective translation of the findings into actions.

Author's contribution

NA: Write Up, literature search, analysis,
TA: Analysis and write up

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