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ORIGINAL RESEARCH

Economic-Clinical Burdens of Tuberculosis Treatment in Vulnerable Patients in a Provincial General Referral Hospital in Lubumbashi, DR Congo

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Background: According to an analysis of the catastrophic costs incurred by people with tuberculosis, 56% of households in the Democratic Republic of Congo bear the economic burden of tuberculosis. The objective of this study was to determine the clinical and economic burdens of tuberculosis treatment in vulnerable patients.

Methods: A descriptive, cross-sectional study was conducted at Janson Sendwe Provincial General Referral Hospital between September and December 2023, a four-month period. Data collection was based on a previously developed survey form with several parameters.

Results: In this study, 59 tuberculosis cases with vulnerability factors were recorded. Male sex was the most prevalent with 62.71%, the average patient age was 33.37 ± 9.92 (15–68) years, TB/HIV coinfection was the most prominent with 94.92%, the average total cost was 56.74 ± 20.81 USD, direct costs were 10.61 ± 0.00 and indirect costs were 47.75 ± 19.23 USD. The average direct costs were 1.56 ± 0.19 USD.

Conclusion: Catastrophic costs for tuberculosis patients can be addressed by improving the delivery and financing of tuberculosis services and strengthening social protection for tuberculosis patients.

Keywords: tuberculosis, clinical economic burdens, vulnerable patients, Lubumbashi

Introduction

Tuberculosis (TB) is an infectious disease caused by a mycobacterium, Mycobacterium tuberculosis (known as Koch's bacillus), which most often affects the lungs (pulmonary tuberculosis) but can also affect other organs (extrapulmonary tuberculosis). It is transmitted from a sick person to a healthy person via the airborne route, via the respiratory forms of the disease.[1] In 2023, TB was reported by the World Health Organization (WHO) as the leading cause of death from a single infectious agent worldwide, surpassing COVID-19.[2] Globally, an estimated 10.6 million people developed TB in 2023, with 1.3 million deaths among HIV-negative individuals.[3]

The TB is a disease linked to poverty, generally linked to socioeconomic disadvantage, particularly among those who come from poor areas, those with scarce health resources and precarious economic conditions.[2] Although free TB control policies are in effect worldwide,[3] many patients continue to bear a considerable economic burden;[4] they face repeated requests for investigations (blood tests, X-rays, and even CT scans, and prescriptions for liver-protective and ancillary drugs)[5] and distressing side effects such as nausea, hearing loss, and fatigue. All of these effects impair the patient's quality of life and ability to work and discourage treatment adherence.[6,7]

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In this context, the World Health Organization (WHO) has included in the End TB Strategy the goal of reducing the percentage of households experiencing catastrophic TB-related costs to zero by 2035.[8] Catastrophic costs are defined as expenditures exceeding 20% of annual household income, resulting in severe economic insecurity.[9]

The Democratic Republic of Congo (DRC) ranks among the 22 countries most affected by tuberculosis; the WHO estimates that the incidence of TB was 321 cases per 100,000 people in 2018. Of the 270,000 people who reportedly fell ill with TB, only 171,682 were diagnosed.[9,10] In Lubumbashi, the country's second largest city, economic constraints and limitations of the provincial health system further exacerbate inequalities in access and follow-up. However, few studies in Central Africa, particularly in the DRC, have simultaneously assessed the clinical and economic burdens within this conceptual framework, particularly among vulnerable populations (the poor, the unemployed, women, HIV-positive patients, etc.) who are most exposed to these costs.

The objective of this study was to determine the clinical and economic burdens associated with TB treatment in vulnerable patients.

Methodology

We conducted a cross-sectional descriptive study at the Janson Sendwe Provincial General Referral Hospital in Lubumbashi, between September and December 2023, a four-month period. The city of Lubumbashi is located in the Haut Katanga province of DR Congo.

Our study population consisted of 59 tuberculosis patients undergoing anti-tuberculosis treatment, presenting one or more vulnerability factors, and who consented to participate in the study.

The study population included patients receiving anti-tuberculosis treatment at the CDT during the study period. Eligible participants were adults or adolescents who: had confirmed TB, presented at least one vulnerability factor according to the PATI 6 (a stratification system of the PNLT grouping six categories of high-risk or vulnerable populations) classification of the National Tuberculosis Control Program, and provided written informed consent. Participants were approached consecutively during their routine clinic visits. A trained nurse from the CDT explained the study objectives, obtained consent, and conducted face-to-face interviews using a structured questionnaire.

Patient data were collected at the Tuberculosis Screening and Treatment Center (CDT) at Jason Nsendwe Hospital using a vulnerability criteria form defined in PATI 6 (a stratification system of the PNLT grouping six categories of high-risk or vulnerable populations); namely, HIV/TB co-infection, children and adolescents, pregnant and breastfeeding women, household contacts, healthcare workers, populations living in closed communities (persons in detention, refugees), homeless people, and drug users.

Data were collected at the Tuberculosis Screening and Treatment Center (CDT) at Jason Sendwe Hospital using a structured form that included sociodemographic characteristics, clinical variables (type and location of TB, treatment regimen), and economic components of treatment: direct costs, indirect costs, and total costs. Costs were converted into US dollars using the average exchange rate for the month of the survey.

Operational cost definitions were adapted from the Heinrich and WHO frameworks.[11,12] Direct costs (DC) included medical and non-medical expenses paid by patients or covered by the government: consultations, laboratory tests (smear, GeneXpert, X-ray), medications, hospitalization, transportation, and food during care.

Indirect costs (IC) corresponded to income loss related to illness and treatment. They were estimated by multiplying:

- The average number of days absent from work × daily income reported by the patient (or estimated from the provincial minimum wage if income was unknown). For patients without formal employment, daily income was estimated from reported informal economic activity (commerce, transportation, small services).

The total cost (TC) corresponded to the sum of direct and indirect costs:

- TC = CD + CI.

To measure the relative economic burden, the average total cost per patient was compared to the Gross Domestic Product (GDP) per capita based on purchasing power parity (PPP) in the DRC for the year 2023, ie, USD 649.[13]

A catastrophic cost was defined according to the WHO threshold as expenditures exceeding 20% of annual household income.[8,9,14] Unit costs for tests and medications were obtained from hospital billing receipts, official CDT pricing schedules, and, for medications provided free of charge, from estimated acquisition costs based on data from the National Tuberculosis Control Program (PNLT).

The data were entered into Epi Info version 7.2.6.0. Statistical and epidemiological analyses were performed using Epi Info and Microsoft Excel 2016. The economic burden was calculated by dividing costs per patient by GDP per capita based on purchasing power parity in the DRC.[13]

An ethical approval was granted by the ethics committee of the University of Lubumbashi registered under number CEM N°19/2024. Free and informed consent was obtained in French. The ethical regulations set out in the Declaration of Helsinki were respected throughout the study. Data were stored on a password-protected laptop and in a locked cabinet, and only the principal investigator and the study supervisor had access to the data.

Results

Sociodemographic Characteristics (Table 1)

Of the 59 patients, males were the most prevalent, representing 62.71% of the patients compared to females (37.29%), and the average age was 33.37 ± 9.92 (15–68) years, with a minimum age of 15 and a maximum age of 68. The most affected age group was 18 to 45 years (86.44%). The majority of patients had a secondary education (59.32%, 35 cases), followed by university (32.20%) and primary education (5.08%, respectively). The majority of patients were self-employed (71.19%), and 11.86% were unemployed.

Clinical Characteristics of Tuberculosis Patients (Table 2)

The vast majority of cases (83.05%) were confirmed by GenXpert, compared to only 16.95% by smear. Pulmonary forms remained predominant (69.49%), followed by extrapulmonary lymph node (20.34%) and pleural (10.17%) forms. Almost all patients (98.31%) had received the RHZE regimen as first-line treatment. Only one case (1.69%) had received the

Table 1 Sociodemographic Characteristics of Patients

Variables	Effectif (n = 59)	Fréquence (%)
Sex		
Female	22	37.29
Male	37	62.71
Age		
< 18	1	1.69
18 −45	51	86.44
45-65	6	10.17
> 65	1	1.69
Level of Education		
Uneducated	2	3.39
Primary	3	5.08
Secondary	35	59.32
University	19	32.20
Employment		
Unemployed	7	11.86
Salaried	10	16.86
Self-employed	42	71.19

Table 2 Clinical Characteristics of Tuberculosis Patients

Variables	Number (n = 59)	Frequency (%)
Type		
Smear	10	16.95
Gen Xpert	49	83.05
Localisation		
Extrapulmonary lymph node	12	20.34
Extra pulmonaire pleura	6	10.17
Pulmonary	41	69.49
Regiments Therapies		
Intensive phase		
RHZ (60/30/150ng)	1	1.69
RHZE (150/75/400/275ng)	58	98.31
Continuation phase		
RH (150/75ng)	56	94.91
RH (60/30 ou 75/50ng	3	5.08

RHZ regimen. The standard RH regimen (150/75 ng) was used in 94.91% of patients. The remainder (5.08%) received lower formulations (RH 60/30 or 75/50ng), likely related to age or body weight.

Vulnerability Factors of Tuberculosis Patients (Table 3)

This table shows that the majority of diagnoses were performed by the GeneXpert test (83.05%), while the smear was only used in 16.95% of cases. The pulmonary form remains the most frequent with 69.49% of cases, followed by the extra-pulmonary lymph node (20.34%) and pleural (10.17%) locations. Regarding the therapeutic phase, the majority of patients were in the intensive phase.

Tuberculosis Patient Care (Table 4)

This table highlights the economic costs of tuberculosis care, distributed between patients and the government, taking into account coinfections.

On the government side, direct costs are very low, with an average of USD 1.56 ± 0.19, which represents only 0.24% of GDP per capita. The majority of this expenditure is devoted to medications for both treatment phases (intensive which is defined as 2 months of treatment with bactericidal drugs: USD 0.95 and continuation which is defined as a 4-month period aimed at eliminating residual bacilli: USD 0.63).

However, the financial burden for patients is significantly higher, with an average direct cost of USD 10.61 for X-rays alone, and an average indirect cost of USD 47.75 ± 19.23, mainly related to transportation during the treatment phases. The average total cost for patients reached USD 56.74, or 8.74% of GDP per capita.

Table 3 Vulnerability Factors of Tuberculosis Patients

Variable	Number (n = 59)	Frequency (%)
Presence of factor		
VIH Co-infection	56	94.92
VIH/Diabète coinfection	1	1.69
VIH/Drug use coinfection	1	1.69
VIH/Diabetes/Drug use coinfection	1	1.69

Table 4 Tuberculosis Patient Care

Cost Categories (USD)	N = 59	Means ± SD	Min	Max	GDP, Per, Capita, %
Government					
Direct cost	59	1,56 ± 0.19	0,85	2,04	0.24
Intensive Phase Drugs	59	0,95 ± 0.08	0,81	0,99	
Continuation Phase Drugs	59	0,63 ± 0.12	0,51	1,05	
Patients					
Direct Cost	59	10,61 ± 0.00	–	–	1.63
X-ray cost	59	10,61 ± 0.00	-	-	
Indirect Cost	58	47,75 ±19,23	18,39	91,94	7.36
Transportation cost, intensive phase	57	40,40 ±16,27	15,56	77,79	
Transportation cost, continuation phase	57	7,35 ± 2,96	2,83	14,15	
Total cost	59	56,74 ± 20,81	10,61	102,55	8.74
Parameters	N	Mean ± SD	Minimum	Maximum	P
Patients					
Indirect cost	58	47,75 ± 19,23	18,39	91,94	
HIV coinfection	52	45,97 ± 19,95	18,39	91,94	0.30
HIV/Diabetes/Drug use coinfection coinfection	6	55,17 ± 20,97	27,58	73,55	
Total cost	59	56,74 ± 20,81	10,61	102,55	
VIH coinfection	53	55,72 ± 20,74	10,61	102,55	0.28
HIV/Diabetes/drug use co infection Drug use	6	65,77 ± 20,97	70,37	84,16	
Government					
Direct cost	59	1,56 ± 0.19	0,85	2,04	
VIH co-infection	53	1,55 ± 0.18	0,85	2,04	0.34
HIV/Diabetes/Drug Use Co-infection	6	1,64 ± 0.23	1,32	2,04	

Finally, when analyzing the impact of co-infections (HIV, diabetes, drug use), a slight increase in costs is observed, particularly among patients with multiple comorbidities, where the average total cost reached USD 65.77. However, the cost differences between groups were not statistically significant (p values > 0.05).

Discussion

In our study, we recorded more men than women, 62.71% versus 37.29%. The age group between 18 and 45 years was the most represented, with 51 cases (86.44%) with a mean age of 33.37 ± 9.92 (15–68). This compares to the results reported by Amadou et al, where the mean age was found to be 42.3 years, with a range of 13 months to 85 years.[15] This study is similar to our results, confirming the contagious nature of the disease, affecting subjects of all ages depending on their exposure. This male predominance has also been reported by other authors.[16] However, David Lupande et al and Esthel Lee Presley Bemba et al in the Democratic Republic of Congo reported a female predominance of tuberculosis in their studies.[17],100% of cases were receiving antituberculosis medication, and all began treatment 24 hours after diagnostic confirmation. 83.05%

of pulmonary tuberculosis cases were confirmed by GenXpert molecular testing. Several authors have found different results, including Christian Kakisingi Ngama et al in the Democratic Republic of Congo, who reported a lower rate than we found, namely 31.9%.[16] In contrast, Diallo et al in Mali reported a rate of 73.9%.[18]

HIV coinfection was more pronounced in 56 cases, or 94.92%. This corroborates with data from the literature. Tuberculosis infection was indicative of HIV infection in all our patients. Thus, screening for HIV infection should be performed in all cases of tuberculosis, especially if it is disseminated or severe. This could be explained by the fact that the highest rates of HIV infection among tuberculosis patients in Africa are observed in Southern and Central Africa, but also by the fact that HIV infection promotes the reactivation of latent M. tuberculosis infection into TB disease, and M. tuberculosis promotes HIV replication and thus accelerates the natural progression of infection toward immunosuppression.[15]

According to the literature, people living with HIV are at greater risk of developing TB, although the spread of antiretroviral therapy since 1996 has had a major impact on reducing the incidence of TB in these patients. According to the WHO, in 2012, 13% of people who developed TB worldwide were HIV-positive. The African region accounted for 75% of all cases of TB/HIV coinfection. It is particularly smear-negative pulmonary or extrapulmonary form.[19]

Vulnerable patients had reached an average total cost of $56.74 per episode, which is equivalent to 8.74% of the annual household income. Our results are lower than those reported in two studies in sub-Saharan Africa by Assebe LF et al in Ethiopia[20,21] and Foster N et al in South Africa;[22] who found 21 and 22% respectively. This difference would come from the non-inclusion of expenses related to food and other types, in cases of clinical diagnoses, only transportation costs were included in the indirect cost analysis with an average of $47.75 ± $19.23 and only the cost of the X-ray whose unit price was $10.61.

In our series, the government cost was USD 649.1. Some studies conducted in certain countries have the following results: the total government costs of diagnosis and the current treatment episode for tuberculosis patients were estimated at USD 260 in Ethiopia and USD 169 in Indonesia, which appears lower than our cost.[14,23,24]

This study, while informative, is not without limitations. The small number of participants (n = 59) reduces the scope and representativeness of the conclusions. Similarly, the very small subgroups (n = 6) limit the robustness of cost comparisons between forms of coinfection. The cross-sectional and single-center design of the study does not allow for observation of changes in the economic burden over time, and patient reporting may contain inaccuracies, particularly for often overlooked non-medical expenses. Despite these constraints, this research highlights an often-ignored human reality: the financial burden that vulnerable patients continue to bear, even when treatment is supposed to be free. Beyond the figures, it highlights the painful gap between the promise of free care and the real cost of survival. These results call for a rethinking of tuberculosis control policies in light of the "catastrophic costs" framework, in order to ensure genuine social protection for the most vulnerable.

Conclusion

The survey results show that, although tuberculosis diagnosis and treatment are free, tuberculosis patients and their families in the Democratic Republic of Congo bear substantial costs and lack financial protection.

With non-medical and indirect costs accounting for the majority of these costs, free tuberculosis care is clearly not sufficient.

The catastrophic costs for tuberculosis patients can be addressed by improving the delivery and financing of tuberculosis services and strengthening social protection for tuberculosis patients.

Therefore, the government should prioritize alleviating the financial burden based on the identified cost-mitigation options.

Disclosure

The authors report no conflicts of interest in this work.

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