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The economic burden of TB faced by patients and affected families in Papua New Guinea

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SUMMARY

BACKGROUND: The costs associated with TB disease can be catastrophic for patients, affecting health and socioeconomic outcomes. Papua New Guinea (PNG) is a high TB burden country and the costs associated with TB are unknown.

METHODS: We undertook a national survey of TB patients to determine the magnitude of costs associated with TB in PNG, the proportion of households with catastrophic costs and cost drivers. We used a cluster sampling approach and recruited TB patients from health facilities. Descriptive statistics were used to analyse the costs and cost drivers and multivariate logistic regression to determine factors associated with catastrophic costs.

RESULTS: We interviewed 1,000 TB patients; 19 (1.9%) of them had multidrug-resistant TB (MDR-TB). Costs due to TB were attributable to income loss (64.4%), non-medical (29.9%) and medical (5.7%) expenses. Catastrophic costs were experienced by 33.9% (95% CI 31.0–36.9) of households and were associated with MDR-TB (aOR 4.47, 95% CI 1.21–16.50), hospitalization (aOR 3.94, 95% CI 2.69–5.77), being in the poorest (aOR 3.52, 95% CI 2.43–5.10) or middle wealth tertiles (aOR 1.51, 95% CI 1.03–2.21) or being employed (aOR 2.02, 95% CI 1.43–2.89).

CONCLUSION: The costs due to TB disease were catastrophic for one third of TB-affected households in PNG. Current support measures could be continued, while new cost mitigation interventions may be considered where needed.

KEY WORDS: tuberculosis; costs; economic burden

TB is a major public health concern in many low- and middle-income countries worldwide.[1] According to the WHO an estimated 10 million people develop TB annually.[2] The Western Pacific Region is home to almost one-fifth of the world's TB burden, with major epidemics and high TB incidence rates noted in several countries, including Papua New Guinea (PNG).[2]

With 441 cases per 100,000 population (2020), PNG has one of the highest estimated TB incidence rates in the Western Pacific Region and is among the 30 high TB burden countries globally. It is also considered as a high multidrug-resistant TB (MDR-TB) country due to the burden of this form of TB[2] PNG is a lower middle-income country where approximately 40% of the population live in poverty.[3,4] Healthcare can be hard to access, although it is offered free of charge in the public sector.

Globally, the financial costs to patients due to TB diagnosis and care are thought to be a significant impediment to further improving TB care.[5] Previous studies have documented that TB patients often incur large costs related to their illness and healthcare seeking.[6,7] A recent systematic review, which assessed the results of 49 studies on the costs of care to TB patients, concluded that these costs ranged from USD55 to USD8,198 per TB episode.[6] Income loss comprised the greatest proportion of all costs at 60% (range 16–94), with another 20% (range 0–62) due to direct medical costs and the remaining 20% (range 0–84) due to direct non-medical costs.[6] The total costs amounted to 39% (range 4–148) of annual household income.[6] Costs were higher for patients with lower incomes and for people with MDR-TB.[6]

The End TB Strategy includes the measurement of "catastrophic costs" as a high-level indicator by which to measure progress towards the overall goal of ending TB as a public health problem.[8] Costs are defined as catastrophic when a patient spends 20% or more of their annual household income on TB

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diagnosis and care.[8] This indicator is designed to estimate the costs due to TB disease for households, thereby enabling governments to address demand-side cost barriers, which may be mitigated through a range of interventions.[9,10]

As costs associated with TB disease are unknown in PNG, we undertook a national TB patient cost survey in 2018–2019. The aim of the present survey was to determine the financial burden of TB care for a representative sample of TB patients and their households in the country, including the types and magnitude of the costs, and the proportion of households that incurred catastrophic costs due to TB.

METHODS

Study design and study population

We conducted a nation-wide, cross-sectional, health facility-based survey. The survey population included all TB patients (adults and children with all types of TB) receiving TB treatment within the National TB Programme (NTP) network. People who had not been put on TB treatment or had been on treatment for less than 2 weeks in either the intensive or continuation phase at the time of interview were not included in the survey.

Sampling strategy

We used a cluster, facility-based sampling strategy, whereby health facilities which provide TB services represented the unit being sampled. We used a probability-proportional-to-size cluster sampling technique to select clusters; therefore, not all health facilities were included in the survey. The sample size calculation was based on an estimated proportion of households experiencing catastrophic costs, required precision and the number of TB notifications in 2016 ($n=29{,}356$),[11–13] and was determined to be 1,000 TB patients recruited from 40 clusters, 25 patients each.

Data collection and analysis

During interviews, data were recorded on paper forms which were based on the standard WHO questionnaire adjusted for the PNG context. Interviews were conducted in the facility during regular patient visits for TB care, or occasionally in the hospital. Each patient was interviewed once; parents or guardians answered the questions for children under 18 years. Patients were not offered any incentives to participate in the survey.

We collected information on TB-related costs incurred by respondents and their households, their clinical, demographic, socio-economic characteristics, as well as information on household assets and expenditures. TB-related costs included direct medical (consultation fees, medicines, diagnostic tests), direct non-medical (travel fees, accommodation and food), and indirect (self-reported income loss during TB episode and time lost while seeking and receiving care) costs. The costs were collected for the treatment phase the patient was in at the time of interview. Patients in the intensive phase were also asked about costs incurred from the onset of symptoms until start of treatment (pre-diagnosis phase).

Information from completed paper forms was entered into an electronic Epi-Info/Access database by trained data entry personnel. Analysis was carried out using Stata v15 (StataCorp 2017; College Station, TX, USA).

We analysed data following recommendations of the WHO Patient Cost Surveys Handbook.[11] We described the study population using descriptive statistics and calculated mean out-of-pocket direct medical, direct non-medical and indirect costs (with 95% confidence intervals [CIs]). The output approach was implemented to assess the indirect costs; we used self-reported income as the method of choice for determining income.[11] To estimate the average annual income of the households that reported no income, we imputed household income data using an assets-based regression model with an imputation technique recommended by the WHO, whereby missing cost data for a particular phase of TB treatment are replaced by the median values obtained from other survey participants in the same phase.[11] Catastrophic costs were defined as "medical and non-medical out-of-pocket payments and indirect costs exceeding a given threshold (20%) of the household's income".[8] We conducted sensitivity analyses to assess different thresholds of "catastrophic", i.e., we used the agreed threshold of 20% but also determined what proportion of TB patients spend a larger proportion of their household income on TB (up to 70% of annual household income). We adjusted for cluster sampling design when estimating catastrophic costs using the output approach at the 20% threshold. We undertook a stepwise multivariate logistic regression analysis to determine factors independently associated with catastrophic costs.

Ethical considerations

Ethical approval for the survey was provided by the Papua New Guinea Medical Research Advisory Council (Project number: 17.38), the WHO Western Pacific Region Office Ethics Review Committee (Project number: 2017.22.PNG.2.STB), the Australian National University Human Research Ethics Committee (Project number: 2017/878) and the US Centers for Disease Control and Prevention (CDC), Centers for Global Health (Project number: 2018-277).

The study protocol was reviewed in accordance with the US CDC human research protection procedures and approved for implementation. CDC investigators did not interact with human subjects or

have access to identifiable data or specimens for research purposes. Written informed consent or assent was obtained from all participants.

RESULTS

Patient characteristics

A total of 1,000 TB patients participated in the survey; the mean age of participants was 28.9 years, and 49.1% were male (Table 1). Almost 40% (38.6%) of participants were unemployed. The mean monthly household income was USD346 (95% CI 317–374), equivalent to 1,132.56 Papua New Guinean Kina (PGK; 95% CI 1,039.64–1,225.48). There were 19 patients with MDR-TB (1.9% of the sample) and 49 patients were co-infected with HIV (4.9%).

Income loss associated with TB care

Overall, patients lost 36.5% (USD551) of their annual individual income and 15.8% (USD657) of their annual household income during the TB episode (Table 2). Patients with MDR-TB lost a higher proportion of annual individual income compared to patients with drug-susceptible TB (DS-TB) (a reduction of 59.1% for MDR-TB patients compared to 36.1% among DS-TB patients). There was no such gap when comparing annual household income between these two groups (14.8% reduction for MDR-TB patients compared to 15.9% among DS-TB patients) (Table 2).

Costs and drivers of TB care

The mean cost of a TB diagnosis and care was USD619.1: USD571.3 for patients with DS-TB and USD3,084.5 for MDR-TB patients (Table 3). Overall, almost two-thirds of costs (64.4%) were attributable to income loss, while costs for post-diagnosis nutrition, travel and accommodation represented respectively 11.4%, 10.1% and 4.6% of costs. Non-medical costs before diagnosis comprised 3.8% of overall costs. Although TB treatment is offered free of charge to patients in PNG, medical costs comprised 5.7% of all costs overall (1.5% pre-diagnosis and 4.2% post-diagnosis).

Coping strategies and socio-economic consequences of TB care

Overall, 26.4% of patients took out a loan or sold assets to fund TB care (Table 4). The main socio-economic consequences were food insecurity (33.5%), social exclusion (31.7%) and loss of job or unemployment (23.0%). Patients with MDR-TB were more likely to receive a food or travel voucher: 42.1% reported receipt of a voucher vs. 4.3% of patients with DS-TB. Only 3.3% patients had access to health insurance.

Catastrophic costs associated with TB care

The proportion of households experiencing catastrophic costs was 33.9% (95% CI 31.0–36.9): 84.2% (95% CI 60.4–96.6) for households with MDR-TB patients and 32.9% (95% CI 30.0–36.0) for households with DS-TB patients (Table 5). Table 6 outlines the proportion of households experiencing catastrophic costs by selected sub-group and their associated odds ratios (ORs) and 95% CIs. In multivariate analysis, being in the lowest (poorest) wealth tertile (adjusted OR [aOR] 3.52, 95% CI 2.43–5.10), or the middle wealth tertile (aOR 1.51, 95% CI 1.03–2.21), hospitalisation (aOR 3.94, 95% CI 2.69–5.77), having MDR-TB (aOR 4.47, 95% CI 1.21–16.50) or being employed (aOR 2.02, 95% CI 1.43–2.89) were independently associated with catastrophic costs.

DISCUSSION

We have identified that the cost of TB care is catastrophic for one-third of TB-affected households in PNG, although TB services are provided free of charge in the country. The proportion of households facing catastrophic costs was higher for patients with MDR-TB (84.2%) vs. those with DS-TB (32.9%). Over one quarter of TB patients had to sell an asset or take out a loan to finance TB care, and only a small proportion of patients (3.3%) had health insurance or received any form of socio-economic protection. The direct medical costs during treatment were greater for patients with DS-TB than for those with MDR-TB; this may be due to the fact that patients with MDR-TB receive vouchers from the international non-governmental organisation, World Vision, through The Global Fund.

The latest WHO Global TB Report provides an overview of the results of other TB patient cost surveys. Based on results from 17 countries, the percentage of TB-affected households that experienced catastrophic costs ranged from 19% (95% CI 15–25) in Lesotho to 83% (95% CI 76–86) in Timor-Leste.[2,14] Overall, the pooled average of catastrophic costs was 49% (95% CI 34–63).[2] In our survey, the overall proportion of patients with catastrophic costs was 33.9%, which is lower than all but one (Kenya) of the 12 countries for which results were available.[15]

The Global TB Report 2020 also highlights the importance of measurement of the service coverage index as the Universal Health Coverage (UHC) indicator.[2] The service coverage index is 40 out of 100 for PNG, indicating that further progress could be made on UHC.[2] Direct medical costs may be directly impacted if UHC is further expanded. However, some costs, such as income loss may still remain even if UHC is fully available.[5]

In our survey, we found that very few patients had

Table 1 Sociodemographic and clinical characteristics of 1,000 TB patients recruited for the Papua New Guinea TB patient cost survey

Characteristics	*n* (%)
Sociodemographic characteristics	
Sex	
Male	491 (49.1)
Female	509 (50.9)
Age group, years	
0–14	198 (19.8)
15–24	215 (21.5)
25–34	240 (24.0)
35–44	162 (16.2)
45–54	105 (10.5)
55–64	63 (6.3)
≥65	17 (1.7)
Mean age, years, (95% CI)	28.9 (27.9–30.0)
Region	
Southern	325 (32.5)
Momase	250 (25.0)
Highlands	175 (17.5)
Islands	250 (25.0)
Education status	
Did not attend school	173 (17.3)
Primary school	345 (34.5)
Secondary school	265 (26.5)
Graduate/high school	149 (14.9)
University	40 (4.0)
Other	14 (1.4)
Missing	14 (1.4)
Employment status pre-TB	
Unemployed	386 (38.6)
Formal paid work	184 (18.4)
Informal paid work	189 (18.9)
Student	93 (9.3)
Retired	6 (0.6)
Other	142 (14.2)
TB patient was the main income earner	360 (36.0)
Household size, mean (95% CI)	6.8 (6.6–7.1)
Monthly household income,* $PGK, mean (95% CI)	1,133 (1,040–1,225)
Monthly household income,* USD, mean (95% CI)	346 (317–374)
Living in poverty pre-TB diagnosis†	880 (88.0)
Clinical and treatment characteristics	
Type of TB	
Pulmonary, bacteriologically confirmed	250 (25.0)
Pulmonary, clinically diagnosed	279 (27.9)
Extrapulmonary	471 (47.1)
Drug resistance status	
Drug-susceptible	981 (98.1)
Multidrug-resistant	19 (1.9)
Phase of TB treatment	
Intensive	342 (34.2)
Continuation	658 (65.8)
HIV status	
Positive	49 (4.9)
Negative	688 (68.8)
Not tested	230 (23.0)
Unknown	33 (3.3)
Retreatment status	
New TB patient	951 (95.1)
Retreatment or relapse	49 (4.9)
Health facility (where TB diagnosis was made)	
Public hospital	631 (63.1)
Public primary health care facility	286 (28.6)
Non-governmental organisation (health centre)	66 (6.6)
Other health facility	17 (1.7)
Mode of TB treatment supervision in intensive phase ($n = 338$)	
DOT	111 (32.8)
SAT	187 (55.3)
Combination of SAT and DOT	40 (11.8)
Mode of TB treatment supervision in continuation phase ($n = 658$)	
DOT	170 (25.8)
SAT	405 (61.6)
Combination of SAT and DOT	83 (12.6)

Table 1 (*continued*)

Characteristics	*n* (%)
Hospitalisation	
Hospitalised at time of interview	62 (6.2)
Previous hospitalisations during current phase	121 (12.1)
Number of previous hospitalisations in current phase, mean (95% CI)‡	1.2 (1.1–1.3)
Diagnosis delay§	
Diagnosis delay >4 weeks	192 (19.2)
Diagnosis delay, weeks, mean (95% CI)	5.4 (4.9–6.0)

* This is pre-TB household income; it includes an imputed income based on assets for those with zero income ($n = 170$).
† Defined using USD1.60 per day, converted to PGK6.65186.
‡ Among those who were hospitalised at the time of interview.
§ Defined as time from symptom onset to TB diagnosis.
CI = confidence interval; PGK = Papua New Guinean kina; USD = United States dollars; DOT = directly observed therapy; SAT = self-administered treatment.

access to any form of socio-economic protection or health insurance, and income loss accounted for two-thirds of all costs. However, a recent World Bank health financing options paper concluded that the introduction of a broader social health insurance is not feasible or sustainable in PNG.[16] A limited middle-class, under developed financial markets, and weak regulatory oversight and management skills suggest that voluntary insurance schemes will remain limited in the medium-to-long term.[17] In this context, the NTP recommended continued provision of current socio-economic support to patients with MDR-TB and of alternative forms of support to other TB patients according to need. Our study has highlighted the importance of current support provided to patients with MDR TB by World Vision (Principal Recipient of the Global Fund grant) and other agencies. This support, as well as the provision of social or financial assistance to patients with DS-TB, could be included in any future funding applications with the priority allocated to the poorest patients. If PNG does consider the introduction of broader social health insurance in the future, TB patients could be covered by this insurance and an appropriate mechanism could be put in place to cover those working in the informal sector and those who are unemployed due to TB disease. However, we also noted that those who were employed were more likely to experience catastrophic costs, and while the exact reasons for this are not known, it may have been due to self-employment or informal employment and a combination of high indirect costs and a lack of social protection measures.[18] Sickness insurance and other legal mechanisms protecting workers from losing employment during the disease could be considered. Resolving the issue of indirect costs or income loss requires collaboration across multiple sectors of the government, such as health and social welfare, and employment or labour sectors.

Strengths and limitations

This survey is the first nationally representative study on the costs associated with TB care in PNG, involving a large number of patients. The survey

Table 2 Changes in annual household and individual income for 1,000 TB patients recruited for the Papua New Guinea TB patient cost survey by drug susceptibility status

	Amount		
Annual household and individual income per year	DS-TB USD	MDR-TB USD	All USD
Household income			
Reported annual household income, pre-TB, USD, mean (95% CI)	4,112 (3,779 to 4,446)	5,962 (579 to 11,346)	4,147 (3,807 to 4,488)
Reported annual household income, post-TB, USD, mean (95% CI)	3,458 (3,150 to 3,765)	5,081 (–124 to 10,285)	3,489 (3,173 to 3,804)
Difference in annual household income pre- and post-TB, USD (95% CI, % reduction)*	653 (546 to 759) (15.9)	881 (–112 to 1,874) (14.8)	657 (551 to 763) (15.8)
Individual income			
Reported annual individual income pre-TB, USD, mean (95% CI)	1,507 (1,363 to 1,652)	1,508 (27 to 2,990)	1,507 (136 to 1,652)
Reported annual individual income post TB, USD, mean (95% CI)	963 (846 to 1,081)	617 (–596 to 1,830)	957 (839 to 1,074)
Difference in annual individual income pre- and post-TB, USD (95% CI, % reduction)*	544 (453 to 635) (36.1)	892 (–105 to 1,888) (59.1)	551 (460 to 642) (36.5)
Total patients, *n*	981	19	1,000

* These changes in income are annual and unadjusted for treatment duration, thus are different from the total indirect costs given in Table 3.
DS-TB = drug-susceptible TB; MDR-TB = multidrug-resistant TB; USD = United States dollars; CI = confidence interval.

Table 3 Costs of TB care for 1,000 TB patients recruited for the Papua New Guinea TB patient cost survey by drug susceptibility status

Type of costs	Costs, USD		
	DS-TB Mean (95% CI)	MDR-TB Mean (95% CI)	All Mean (95% CI)
Pre-diagnosis			
Direct medical	9.4 (7.2 to 11.5)	16.3 (–9.2 to 41.8)	9.5 (7.4 to 11.6)
Direct non-medical	23.2 (20.2 to 26.2)	41.7 (21.4 to 76.8)	23.5 (20.5 to 26.5)
Total pre-diagnosis	32.5 (28.6 to 36.4)	57.9 (7.7 to 107.0)	33.0 (29.1 to 37.0)
Post diagnosis			
Direct medical	26.1 (11.8 to 40.4)	3.0 (–2.7 to 8.7)	25.6 (11.7 to 39.6)
Direct non-medical	137.4 (112.1 to 162.7)	1,423.5 (330.5 to 2,516.5)	161.8 (128.7 to 194.8)
Travel	49.6 (40.5 to 58.8)	738.9 (–266.7 to 1,744.4)	62.7 (42.3 to 83.2)
Accommodation	25.6 (7.2 to 43.9)	177.8 (92.2 to 263.3)	28.5 (10.4 to 46.5)
Food	62.1 (52.7 to 71.6)	506.9 (309.1 to 704.7)	70.6 (60.0-81.1)
Total direct	163.4 (133.0 to 194.0)	1,426.6 (344.2 to 2,518.9)	187.4 (150.5 to 224.4)
Total indirect (income loss)*	375.3 (316.9 to 433.8)	1603.0 (–263.9 to 3,469.9)	398.7 (332.1 to 465.2)
Total post-diagnosis	538.8 (473.1 to 604.5)	3,029.6 (1,064.7-4,994.4)	586.1 (510.3 to 662.0)
Total pre- and post-diagnosis	571.3 (501.7 to 640.9)	3,084.5 (1,072.4 to 5,101.4)	619.1 (539.4 to 699.0)
Total patients, *n*	981	19	1,000

* Income loss was assessed only at the post-diagnosis period.
USD = United States dollars; DS-TB = drug-susceptible TB; MDR-TB = multidrug-resistant TB; CI = confidence interval.

provides baseline information that can be used for national planning. It included a sub-sample of patients with MDR-TB, which reflects the current epidemiological situation in PNG, where an estimated 3.4% of new cases and 26% of retreatment cases have MDR-TB.[19] To ensure high-quality data, we double-entered a large sample of our data and carried out a data validation process to reduce the likelihood of errors; we were therefore able to attain data completeness for a large range of variables in the database.

The survey has several limitations. We presented disaggregated results for the MDR-TB group, although the MDR-TB sample was not nationally representative. Stratification to obtain MDR-TB-specific estimates was not done for this reason. We included only patients who accessed NTP-linked healthcare facilities. However, as the private healthcare sector is relatively under-developed in PNG, the majority of TB patients are treated in public facilities. This was a cross-sectional study with forward extrapolations on patient costs, which may not reflect

Table 4 Coping mechanisms and socio-economic consequences reported by 1,000 TB patients recruited for the Papua New Guinea TB patient cost survey by drug susceptibility status

Coping strategy and socio-economic consequences	DS-TB *n* (%)	MDR-TB *n* (%)	All *n* (%)
Financial coping mechanism			
Took out a loan	222 (22.6)	0 (0)	222 (22.2)
Sold assets	79 (8.1)	0 (0)	79 (7.9)
Took out a loan or sold assets	264 (26.9)	0 (0)	264 (26.4)
Heath insurance			
None	949 (96.7)	18 (94.7)	967 (96.7)
Private health insurance	4 (0.4)	0 (0)	4 (0.4)
Government health insurance	2 (0.2)	0 (0)	2 (0.2)
Family or community support	16 (1.6)	0 (0)	16 (1.6)
Reimbursement scheme	3 (0.3)	1 (5.3)	4 (0.4)
Other	7 (0.7)	0 (0)	7 (0.7)
Socio-economic consequences			
Food insecurity	326 (33.2)	9 (47.4)	335 (33.5)
Divorce or separated from spouse or partner	29 (3.0)	1 (5.3)	30 (3.0)
Loss of job or employment	225 (22.9)	5 (26.3)	230 (23.0)
Child interrupted schooling	134 (13.7)	5 (26.3)	139 (13.9)
Social exclusion	308 (31.4)	9 (47.4)	317 (31.7)
Other socio-economic consequence	101 (10.3)	1 (5.3)	102 (10.2)
Any socio-economic consequence	610 (62.2)	16 (84.2)	626 (62.6)
Self-reported financial impact			
Unchanged	356 (36.3)	1 (5.3)	357 (35.7)
Changed	625 (63.7)	18 (94.7)	643 (64.3)
Household received social welfare after TB diagnosis	6 (0.6)	0 (0)	6 (0.6)
Household received voucher after TB diagnosis	42 (4.3)	8 (42.1)	50 (5.0)
Total, *n*	981	19	1,000

DS-TB = drug-susceptible TB; MDR-TB = multidrug-resistant TB.

Table 5 Proportion of households experiencing catastrophic costs among 1,000 TB patients recruited for the Papua New Guinea TB patient cost survey by drug susceptibility status

	Households facing catastrophic costs		
Catastrophic cost threshold*	DS-TB *n* (%)	MDR-TB *n* (%)	All *n* (%) (95% CI)
20%	323 (32.9)	16 (84.2)	339 (33.9) (31.0–36.9)
30%	244 (24.9)	14 (73.7)	258 (25.8) (23.1–28.6)
40%	195 (19.9)	13 (68.4)	208 (20.8) (18.3–23.4)
50%	146 (14.9)	13 (68.4)	159 (15.9) (13.7–18.3)
60%	85 (8.7)	13 (68.4)	98 (9.8) (8.0–11.8)
70%	71 (7.2)	12 (63.2)	83 (8.3) (6.7–10.2)
Total	981	19	1,000

DS-TB = drug-susceptible TB; MDR-TB = multidrug-resistant TB; CI = confidence interval.

true costs, although this method is recommended by the WHO and is practical. We used a tailored imputation method to estimate the average annual income of households that reported no income; this was additionally refined beyond the standard recommendations provided by the WHO, which may have led to a downward adjustment of the proportion of patients who experienced catastrophic costs. Recall bias is a concern when recalling costs incurred in the past; however, we used prompts as much as possible to assist patients in recalling expenditure. We did not interview patients who were "lost to follow-up", as these patients may have abandoned care due to its high cost;[11,20] we also did not interview relatives of

Table 6 Factors associated with catastrophic costs due to TB diagnosis and care for 1,000 TB patients recruited for the Papua New Guinea TB patient cost survey

Risk factor	Total (n = 1,000)	Proportion who incurred catastrophic costs %	OR (95% CI)	*P* value	aOR (95% CI)	*P* value
Age group, years						
0–14	198	31.8	0.87 (0.58–1.29)	0.483	0.95 (0.62–1.45)	0.803
15–24	215	27.9	0.72 (0.48–1.07)	0.105	0.77 (0.50–1.20)	0.249
25–34	240	35.0	Referent	—	Referent	—
35–44	162	42.0	1.34 (0.89–2.02)	0.158	1.33 (0.85–2.07)	0.211
45–54	105	31.4	0.85 (0.52–1.39)	0.519	0.90 (0.53–1.52)	0.699
55–64	63	39.7	1.22 (0.69–2.16)	0.491	1.18 (0.64–2.19)	0.597
≥65	17	35.3	1.01 (0.36–2.84)	0.980	1.21 (0.40–3.64)	0.739
Sex						
Female	509	32.2	Referent	0.253		
Male	491	35.6	1.17 (0.90–1.51)			
Education (n = 986, 14 missing)						
No education	173	41.6	1.45 (1.08–1.96)	0.013*		
Primary school education	345	37.1	1.76 (1.22–2.52)	0.002*		
High school education and higher	468	28.9	Referent	—		
Occupation						
Unemployed	386	31.6	Referent	—	Referent	—
Employed (formal or informal sector)	184	37.8	1.32 (0.97–1.77)	0.073	2.02 (1.43–2.89)	<0.001*
Other (retired, student, home duties, etc.)	241	31.5	1.00 (0.71–1.41)	0.985	0.98 (0.66–1.45)	0.906
Household income tertile						
Highest (wealthiest)	333	23.7	Referent	—	Referent	—
Middle	290	29.7	1.36 (0.95–1.94)	0.095	1.51 (1.03–2.21)	0.035*
Lowest (poorest)	377	46.2	2.76 (1.99–3.81)	<0.001*	3.52 (2.43–5.10)	<0.001*
Insurance						
Any insurance	17	23.5	Referent	—		
No insurance	967	34.0	1.68 (0.54–5.18)	0.370		
Family or community support	16	37.5	1.95 (0.43–8.83)	0.386		
Household size						
0–6 people	570	36.5	Referent	0.046*		
≥7 people	430	30.5	0.76 (0.58–0.96)			
Hospitalisation						
Never hospitalised	837	28.2	Referent	<0.001*	Referent	<0.001*
Hospitalised during the current TB episode	163	63.2	4.37 (3.07–6.22)		3.94 (2.69–5.77)	
Drug susceptibility						
Drug-susceptible TB	981	32.3	Referent	<0.001*	Referent	0.025*
Multidrug-resistant TB	19	84.2	10.86 (3.14–37.56)		4.47 (1.21–16.50)	
HIV status						
HIV-negative, not tested or unknown	951	33.7	Referent	0.461		
HIV-positive	49	38.8	1.25 (0.69–2.25)			
Type of TB						
Pulmonary	529	34.4	Referent	0.721		
Extrapulmonary	471	33.3	0.95 (0.73–1.24)			
Delay in diagnosis (n = 352, 648 missing)						
No delay (diagnosed within 4 weeks of symptom onset)	160	32.5	Referent	0.019*		
Delay of ≥4 weeks	192	44.8	1.69 (1.09–2.61)			

* Statistically significant difference ($P < 0.05$).
OR = odds ratio; CI = confidence interval; aOR = adjusted OR.

patients who had died. Finally, we used self-reported income as the measure of income in this survey. Other methods of estimating income may be more relevant to low- and middle-income countries, and future methodological work on measuring income is needed.[21]

While not a limitation of the survey per se, it is also not known how the impact of the ongoing COVID-19 pandemic affected the proportion of TB patients with catastrophic costs, and this is an area for future consideration.

CONCLUSION

The costs of TB care are catastrophic for a third of TB patients in PNG. Households of patients with MDR-TB, those who were poor, or those hospitalised for TB treatment had a higher likelihood of experiencing catastrophic costs due to the disease. Current mitigation measures, such as the provision of vouchers to patients with MDR-TB, could be continued while new approaches may be considered for those in need.

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RÉSUMÉ

CONTEXTE : Les coûts associés à la TB peuvent être catastrophiques pour les patients, affectant les résultats sanitaires et socio-économiques. La Papouasie-Nouvelle-Guinée (PNG) est un pays à forte charge de TB et les coûts associés à la TB sont indéterminés.

MÉTHODES : Nous avons entrepris une enquête nationale auprès des patients atteints de TB afin de déterminer l'ampleur des coûts associés à la TB en PNG, la proportion de ménages ayant des coûts et des facteurs de coûts catastrophiques. Nous avons utilisé une approche d'échantillonnage en grappes et recruté des patients atteints de TB dans des établissements de santé. Des statistiques descriptives ont été utilisées pour analyser les coûts et les facteurs de coûts et une régression logistique multivariée pour déterminer les facteurs associés aux coûts catastrophiques.

RÉSULTATS : Nous avons interrogé 1 000 patients atteints de TB ; 19 (1,9%) d'entre eux étaient atteints de TB multirésistante (MDR-TB). Les coûts dus à la TB étaient attribuables à la perte de revenu (64,4%), aux dépenses non médicales (29,9%) et médicales (5,7%). Les coûts catastrophiques ont été subis par 33,9% (IC 95% 31,0–36,9) des ménages et étaient associés à la MDR-TB (OR ajusté [aOR] 4,47 ; IC 95% 1,21–16,50), à l'hospitalisation (aOR 3,94 ; IC 95% 2.69–5,77), au fait d'appartenir aux tertiles de richesse les plus pauvres (aOR 3,52, IC 95% 2,43–5,10) ou tertiles moyens (aOR 1,51 ; IC 95% 1,03–2,21) ou d'avoir un emploi (aOR 2,02 ; IC 95% 1,43–2,89).

CONCLUSION : Les coûts dus à la TB maladie étaient catastrophiques pour un tiers des ménages touchés par la TB en PNG. Les mesures de soutien actuelles pourraient être maintenues, tandis que de nouvelles interventions visant à atténuer les coûts pourraient être envisagées si nécessaire.