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Can patients afford the cost of treatment for multidrug-resistant tuberculosis in Ethiopia?

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SUMMARY

SETTING: Ethiopia has a high prevalence of tuberculosis (TB) and is one of the countries with the highest burden of multidrug-resistant TB (MDR-TB).

OBJECTIVE: To understand the costs that patients incur in obtaining diagnosis and treatment for MDR-TB.

DESIGN: In March 2013, interviews were conducted with 169 MDR-TB patients at three hospitals in Ethiopia to identify the cost to patients and the impact on employment and family income.

RESULTS: The average MDR-TB patient incurred a total cost of US$1378, which represented 25 months of a mid-treatment household income of US$54. The impact on the patient's employment and on overall patient and family income was generally catastrophic: 74% of all respondents reported losing their jobs, 66% of patients lost household income, and household income was reduced by 38%. To help cover the costs, 38% of patients sold some type of property, while 7% leased out property and 41% took out loans, any of which could jeopardize their future financial situation even further.

CONCLUSION: Despite services being officially free of charge, most patients incurred catastrophic costs and suffered significant income loss as a result of obtaining diagnosis and treatment for MDR-TB.

KEY WORDS: TB; MDR-TB; patient costs; catastrophic costs

TUBERCULOSIS (TB) is one of the ten leading causes of death worldwide. It is a costly disease, with an estimated total economic burden to society of over US$8 per capita, according to a recent study conducted in Indonesia.[1] The study also found that the main reason for the high cost is the large number of untreated cases every year, including multidrug-resistant TB (MDR-TB) cases, which have higher death rates and place a greater burden on the health system and the patients' families. One reason why people with TB do not seek or complete treatment is the costs that they incur.[2–8] These costs can also drive families into poverty, and an important goal of the post-2015 global TB strategy is that no families affected by TB should face catastrophic costs.[9,10] A recent systematic review showed, however, that despite diagnosis and treatment services being officially free of charge, the financial burden to patients is often high,[10] especially for patients with MDR-TB.[11,12] Policy makers need to understand patient costs to address causes and develop mitigation policies.[13] However, data on the financial burden and cost drivers for MDR-TB diagnosis and treatment are currently limited, and more research is needed.

Ethiopia is one of the high TB and MDR-TB burden countries. According to the World Health Organization's 2016 global TB report, the TB incidence rate in 2015 was 192 per 100 000 population (including TB among people living with the human immunodeficiency virus [HIV]), and 2.7% of new and 14% of retreatment cases of TB were MDR-TB. From 2009 to June 2013, 29% of the patients diagnosed with MDR-TB in Ethiopia did not start treatment, and 3% of the 890 patients who did start treatment were lost to follow-up. Several reasons have been identified for delays in seeking, starting and continuing treatment in Ethiopia, and in some cases patient costs have been identified.[3,5,6,14–17]

The present study presents evidence on the impact of MDR-TB diagnosis and treatment on the economic status of patients and their families. The study was undertaken to inform the development of policies that could provide greater patient support, as part of a three-country study conducted by TB CARE I; the

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other two were carried out in Kazakhstan in September–October 2012 and in Indonesia in February–March 2013. Details on the methods used and the results from each country are available in the individual country reports, and in a summary report and journal article.[13,18–21]

STUDY DESIGN, POPULATION AND METHODS

At the time of the present study, in March 2013, there were only three facilities in Ethiopia that treated MDR-TB patients. These were the University of Gonder Hospital in Gonder (northern Ethiopia), Saint Peter's TB Specialized Hospital in Addis Ababa and the All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre (ALERT) Hospital, also in Addis Ababa. Since starting to provide MDR-TB treatment, the Gonder, Saint Peter's and ALERT hospitals had treated accumulated totals of respectively 140, 627 and 123 cases by March 2013.

Given the challenge of collecting data for, or after, the period of MDR-TB diagnosis and treatment, which often takes as long as 2 years, a cross-sectional approach was used, under which a minimum of 50 patients would be interviewed in each of three phases: diagnosis, intensive treatment and continuation treatment. A cross-sectional approach is common for this type of study and was used in several of the studies cited here.[3,5,6,12,14–17] This approach should provide reasonable estimates of costs, data collection should be relatively inexpensive and fast, and results can be available quickly for use by policy makers and program managers to address issues in a timely way.

Interviews were conducted for 1 month starting in March 2013. Patients were interviewed consecutively as they became available—while they were inpatients or at the time that they visited as outpatients. Interviews during the diagnosis phase were conducted with patients who had been diagnosed within the previous 1 month, and there was no limit on the period of recall. During the intensive and continuation phases, the only patients interviewed were those who had been on intensive or continuation treatment for at least 3 months, and data were mainly collected for a period of 3 months before each interview.

Each patient was interviewed once at the health facility using a questionnaire adapted for MDR-TB from a tool previously used for cost interviews of drug-susceptible TB patients in other countries.[22] The questionnaire was translated from English into Amharic, adapted to the local context for some questions, and translated back into English by a different person to check for translation and interpretation consistency. The questionnaire was pretested on a few patients to check for clarity before it was finalized. The questionnaire included cross-checks, and the interviewers were trained to double-check unusually high costs reported by patients.

Data were collected on both the direct and indirect costs of seeking and obtaining diagnosis and treatment. Direct, out-of-pocket, cost data covered costs paid to service providers as well as the cost of transport, accommodation and food supplements. Indirect costs related to diagnosis were pre-treatment income losses reported by patients due to time spent seeking and receiving a diagnosis, but did not include the valuation of opportunity costs for time spent where income losses were not reported. Indirect costs related to treatment were calculated by multiplying the reported time lost by the reported mid-treatment income. The indirect costs of time spent unproductively due to illness were not included as costs, but were covered to some degree under reduction in income. To determine the cost of diagnosis, the average cost per visit was multiplied by the number of visits to obtain a total cost. To determine treatment costs, monthly average costs were developed and these were extrapolated over the complete treatment period using the internationally defined durations of the intensive and continuation treatment phases for MDR-TB patients, i.e., 8 and 12 months, respectively.[23,24] Data were also collected on companion costs but were not considered to be very reliable or significant and are not included in the figures shown in the present study.

In terms of impact, patients were asked questions about loss of employment and income, whether they were reimbursed through insurance and whether they received vouchers or other financial support. They were also asked how they financed the costs, such as by selling assets or taking out loans. These questions covered the whole period of diagnosis and treatment through the time of interview, and were not limited to the final 3 months of treatment.

We excluded patients who did not consent to the study and patients aged <21 years, assuming that they were not generally economically independent. As we interviewed patients when they visited the facilities, patients who had died, were transferred out or were lost to follow-up were not included. Not interviewing patients at home could mean that patients who were lost to follow-up were not included and that they could be among the poorest of MDR-TB patients.

Data entry clerks entered the data into EpiData Entry v 3.1 (EpiData Association, Odense, Denmark; www.epidata.dk) and used double data entry to ensure accuracy. The original analysis was done in Statistical Package for the Social Sciences v 15.0 (SPSS, Chicago, IL, USA) and a later analysis was done using Microsoft Excel™ (MicroSoft, Redmond, WA, USA). As the distributions of almost all costs were skewed toward higher values, median values with 25th and 75th percentiles (interquartile range

Table 1 Characteristics of MDR-TB patients interviewed according to hospital

	Total *n* (%)	St Peter's *n* (%)	ALERT *n* (%)	Gonder *n* (%)
Total interviews	169 (100)	93 (55)	30 (18)	46 (27)
Patient group				
Just diagnosed	27 (16)	14 (15)	7 (23)	6 (13)
Intensive phase	79 (47)	39 (42)	17 (57)	23 (50)
Continuation phase	63 (37)	40 (43)	6 (20)	17 (37)
Sex				
Male	92 (54)	45 (48)	18 (60)	29 (63)
Female	77 (46)	48 (52)	12 (40)	17 (37)
Age group, years				
18–29	97 (58)	52 (56)	18 (60)	27 (59)
30–39	43 (25)	26 (28)	8 (26)	9 (20)
40–49	16 (9)	6 (6)	2 (7)	8 (17)
⩾50	13 (8)	9 (10)	2 (7)	2 (4)
Type of MDR-TB				
Pulmonary smear-positive	160 (95)	90 (97)	28 (94)	42 (92)
Pulmonary smear-negative	2 (1)	0	1 (3)	1 (2)
Extra-pulmonary	6 (3)	3 (3)	1 (3)	2 (4)
No information	1 (1)	0	0	1 (2)
HIV				
Positive	25 (15)	13 (14)	2 (7)	10 (22)
Negative	138 (82)	76 (82)	28 (93)	34 (74)
Not tested	2 (1)	2 (2)	0	0
No information	4 (2)	2 (2)	0	2

MDR-TB = multidrug-resistant tuberculosis; ALERT = All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre; HIV = human immunodeficiency virus.

[IQR]) were used for the analysis. For each type of cost we calculated four indicators: the interquartile mean (IQM), the median, IQR and the number of responses. The IQM eliminates the outliers in the bottom 25% and top 25% of the figures which, given the presence of many zeros and some abnormally high costs, makes the results more robust. Financial data were collected in Ethiopian *birrh* and were converted into US dollars using the average daily midpoint exchange rate for March 2013 (18.60 Ethiopian birrh = US$1.00). All figures shown in the present study are expressed in $US.

Approval for the study protocol was obtained from the Armauer Hansen Research Institute/ALERT Ethics Review Committee, Addis Ababa, on 10 December 2012 (Protocol PO35/12). Written informed consent was provided by patients before they were interviewed. Interviews were conducted by hospital staff, who wore N95 respirators when interviewing. Interviews were conducted in separate rooms or in a private area outside the building if such a room was not available to ensure confidentiality. Data were stored and analyzed without personal identifiers.

RESULTS

A total of 169 patients were interviewed, with 93 (55%) from Saint Peter's Hospital, 30 (18%) from ALERT Hospital and 46 (27%) from Gonder Hospital (Table 1). These figures represent the numbers of patients who were qualified and available for interview during the month and are representative of the total numbers of MDR-TB patients treated at those hospitals. A total of 27 (16%) of the interviewed patients had just been diagnosed, 79 (47%) were in the intensive phase and 63 (37%) were in the continuation phase. The aim was to interview 50 patients in each phase, but the cohort of patients who had just been diagnosed with MDR-TB was smaller than the numbers of patients in the other two phases. In terms of other characteristics, 54% were male and 46% were female, 58% were aged 18–29 years, 95% were pulmonary smear-positive, and 15% were HIV-positive.

The total cost of diagnosis and treatment incurred by a MDR-TB patient was US$1378, comprising US$83 during the pre-diagnosis period and respectively US$661 and US$634 during the intensive and continuation periods (Table 2). The total cost represented 17 months of the pre-diagnosis household income of US$81 and 25.5 months of the mid-treatment household income of US$54. Most of these costs (US$1348) were direct, out-of-pocket costs, and included US$155 paid for medical services, including follow-up tests and non-TB medicines. Median indirect costs were zero for all three phases. These figures are, however, based on reported income losses due to time spent seeking and obtaining diagnosis and treatment and do not include opportunity costs related to time lost where income loss was not reported. Of the 17 patients who reported time lost during the diagnosis phase, only five reported losing income. Of 48 intensive-phase and 63 continuation-

Table 2 Costs of diagnosis and treatment of MDR-TB patients ($US)

	MDR-TB, $US			MDR-TB Months of mid-treatment median household income
	Patients *n*	Median (range)	IQM	
Number of interviews	169	169		
Direct costs				
Direct pre-/diagnosis	21	75 (40–191)	107	
Direct intensive treatment	85	639 (259–968)	640	
Direct continuation treatment	63	634 (458–1048)	731	
Total		1348	1478	25.0
Indirect costs				
Indirect pre-/diagnosis	17	0 (0–8)	2	
Indirect intensive treatment	85	0 (0–0)	0	
Indirect continuation treatment	63	0 (0–0)	0	
Total		0	2	0
Total costs				
Total pre-/diagnosis	21	83 (40–206)	118	
Total intensive treatment	85	661 (269–968)	659	
Total continuation treatment	63	634 (458–1048)	731	
Total direct and indirect costs	169	1378	1508	25.5

MDR-TB = multidrug-resistant tuberculosis; $US = US dollar; IQM = interquartile mean.

phase patients who reported lost time, only 8 and 1, respectively, reported losing income.

There were significant differences in costs by diagnosis and treatment location, with a total direct cost of US$1634 per patient in Addis Ababa, which was 80% higher than the total of US$906 in Gonder (Table 3). The biggest difference was in patient food costs (US$392 in Addis Ababa compared with US$53 in Gonder). The costs of treatment of adverse events, patient transport, patient accommodation and supplementary food were also higher in Addis Ababa.

Direct costs were compared by income level by dividing the patients into three equal groups using pre-diagnosis household income levels (Table 4). Patients in the lower income group incurred a direct cost of US$909, those in the middle income group incurred US$1437 and those in the upper income group incurred US$2210. The poorer group spent less on most elements of TB care, for example on food, which is understandable, as they had less income. Of the patients in the lower income group, the majority (83%) were patients at Saint Peter's Hospital.

Significant time was spent in getting a diagnosis, with medians of three visits and 22 h per visit, including travel time (Table 5). The greatest time spent was in Gonder, with 156 h per visit. Significant time was also spent during hospitalization—82% of the patients were hospitalized, and each spent on average 80 days in the hospital. During the continuation phase, patients visited Saint Peter's Hospital once per month, but visited the ALERT and Gonder hospitals four times per month.

Impact on patient employment and on overall patient and family income was significant. Of the 169 patients, 74% reported losing their jobs due to the illness, 66% of patients experienced household income loss, and household income was reduced by 34% (from US$81 before TB to US$54 at the time of the interview) (Table 6).

The costs of seeking and obtaining diagnosis and treatment were financed in various ways. Health

Table 3 MDR-TB direct patient costs by city (2013 $US)

Type of cost	Addis Ababa median $US (IQM)	Gonder median $US (IQM)
Number of interviews	123	46
Health care costs: diagnosis (administrative charges, laboratory tests, X-rays, medicines)	0 (4)	1 (7)
Health care costs: hospitalization	1 (6)	9 (10)
Health care costs: adverse events and follow-up fees, tests and medicines	183 (218)	117 (129)
Patient transport	115 (205)	9 (22)
Patient food	392 (478)	53 (113)
Patient accommodation	94 (107)	4 (7)
Dietary supplements	774 (908)	619 (655)
Relocation	75 (75)	94 (132)
Other	0 (2)	0
Total*	1634 (2003)	906 (1075)

* Differences are due to rounding.
MDR-TB = multidrug-resistant tuberculosis; $US = US dollar; IQM = interquartile mean.

Table 4 Direct patient costs by household income level, 2013 ($US)

	Lower-income group (US$16–53/month) ($n = 56$) median $US (IQM)	Middle-income group (US$54–107/month) ($n = 55$) median $US (IQM)	Upper-income group (US$108–833/month) ($n = 56$) median $US (IQM)
Health services	101 (126)	134 (171)	139 (145)
Transport	47 (63)	99 (194)	91 (144)
Food	109 (138)	189 (265)	552 (677)
Accommodation	77 (84)	106 (140)	121 (124)
Dietary supplements	516 (585)	839 (894)	1,032 (1,122)
Relocation	59 (59)	67 (72)	275 (244)
Other	0 (1)	3 (2)	0
Total	909 (1055)	1437 (1739)	2210 (2455)

$US = US dollar; IQM = interquartile mean.

insurance was not generally available in Ethiopia and only one of the patients interviewed had coverage; that patient had not received any reimbursement of costs at the time of the interview (Table 6). Vouchers were received by 63% of patients, mostly for food, transport, and house rent. Each patient received an average of four vouchers, with a total value of US$33; 30% of the patients who received vouchers also sold property or took out loans, indicating that the value of the vouchers was insufficient. Property was sold by 38% of patients, while 7% leased property and 41% took out loans. Almost all of the loans were without interest, indicating that they were from family or friends.

DISCUSSION

The core findings from the study showed that, although MDR-TB diagnosis and treatment services are officially free in Ethiopia, most patients incurred catastrophic costs. Patients incurred an average cost of US$1378 over the period of diagnosis and treatment, with higher costs suffered by patients in Addis Ababa than in Gonder due to higher costs of food, transport and accommodation. Poorer patients incurred lower costs than better-off ones, for example on food, but this is not a positive finding because they had less disposable income and would have suffered more financially. Some patients suffered high indirect costs in obtaining a diagnosis due to the lengthy time spent, especially in Gonder. Significant time was also spent during hospitalization, with 82% of patients hospitalized and an average stay of 80 days. Higher numbers of patients were admitted to Saint Peter's Hospital than at the other hospitals, and they stayed in hospital longer. Some patients also spent a lot of time on out-patient treatment visits, especially at ALERT Hospital, where they made daily visits of 90 min during the intensive phase and weekly visits of the same duration during the continuation phase.

In addition to the costs incurred, most patients lost their jobs and most households lost income. While more than half the patients received financial assistance in the form of vouchers, the value of the vouchers was much smaller than the costs incurred. Without sufficient financial assistance, many patients sold or leased property and took out loans, providing further evidence that the costs were catastrophic.

The findings of the present study are comparable with the results of the two MDR-TB patient cost studies in Indonesia and Kazakhstan that used the same methodology.[13] In Indonesia, the median total cost of diagnosis and treatment was US$2342, which was 11 months of the pre-diagnosis household income of US$206 and 19 months of the household income of US$124 at the time of interview. In Kazakhstan, the total cost was US$3125, which was 9 months of the median pre-diagnosis household income of US$489 per month. In both countries, the

Table 5 Time spent seeking and receiving diagnosis and treatment for MDR-TB

	Saint Peter's *n*	ALERT *n*	Gonder *n*	Total *n*
Visits to obtain a diagnosis, median	3	3	3	3
Time spent per diagnostic visit, median h	13	5	156	22
Patients hospitalized, %	94	90	54	82
Duration of stay for patients who were hospitalized, median days	90	75	60	80
Visits per week: intensive phase	NA	7	5	NA
Hours per visit: intensive phase	NA	1.5	1.0	NA
Visits per month: continuation phase	1	4	4	2
Hours per visit: continuation phase	7	1.5	1.2	4.0

MDR-TB = multidrug-resistant tuberculosis; ALERT = All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre; NA = not available.

Table 6 Financial impact of MDR-TB and coping mechanisms

Description	Saint Peter's %	ALERT %	Gonder %	Total %
Patients who lost their jobs	76	75	67	74
Patients who reported household income loss due to TB	45	85	79	66
Median monthly household income before TB, $US	54	134	74	81
Median monthly income at time of interview, $US	51	54	48	54
Patients with health insurance	0	3	0	0.5
Patients with health insurance who received reimbursements	0	0	0	0
Patients who received vouchers	53	67	83	63
Median number of vouchers per patient	1	11	6	4
Median total value of vouchers, $US	16	70	34	33
Patients who sold property	34	10	70	38
Patients who leased property	1	7	20	7
Patients who took out loans	37	37	52	41

MDR-TB = multidrug-resistant tuberculosis; ALERT = All Africa Leprosy, Tuberculosis and Rehabilitation Training Centre; $US = US dollar.

total costs were higher than in Ethiopia but represent fewer months of household income.

A systematic review of the financial burden for TB patients found three studies which detailed MDR-TB costs.[10] The total cost as a percentage of pre-diagnosis patient income was 223% in Ecuador and 76% in Cambodia, and in Brazil, the cost was 34% of reported income after TB diagnosis. Only in Ecuador was the cost burden higher than in Ethiopia. An additional study conducted in the Dominican Republic identified a total cost per MDR-TB patient of US$3557, which represented 132 months of pre-diagnosis household income for a medium-income group of patients.[25] No previous studies of MDR-TB costs were found for Ethiopia.

Several limitations should be taken into account. First, costs were probably underestimated due to the difficulty of recalling all the costs related to seeking diagnosis because: 1) treatment duration may have sometimes exceeded the normative period; and 2) some costs may have been incurred during previous treatments. Second, the number of just-diagnosed MDR-TB patients interviewed was only 27 out of the planned sample of 50 because this was a smaller cohort. Third, and perhaps most importantly, it was not feasible to interview people with TB who did not attend a facility during the period of the study, for example, patients lost to follow-up. The study population may therefore have under-represented poorer people.

Economic impact can be measured in different ways, and it is not yet clear which method constitutes best practice. We calculated total cost in terms of months of pre-diagnosis household income, and mid-treatment household income. We also calculated the same figures as percentages of annual household income to enable comparison with results from other studies, although caution should be used with comparing these figures as MDR-TB costs are generally incurred over 2 years. Using household income appears to be a better indicator of economic burden than patient income, as the burden generally falls on a family rather than an individual. Using mid-treatment income appears to provide a better indicator of the economic burden experienced by the household during the course of treatment, as the pre-diagnosis income had fallen after treatment had started.

While there is no universal definition of catastrophic costs, one proposed option is for any cost over 10% of annual household income to be considered catastrophic.[10] With an average cost of US$1378 over approximately 2 years, which is 142% of the average annual income of US$972 before TB and 213% of the average income of US$648 at the time of interview, it is clear that for most of the households with an MDR-TB patient, the costs were catastrophic.

CONCLUSIONS

Although MDR-TB diagnosis and treatment services are officially free for patients in Ethiopia, patients incur significant costs and often lose their jobs and suffer major reductions in income. If the patient is the breadwinner of the family, the combination of lost income and extra costs is generally catastrophic. A high financial burden may cause patients not to obtain a diagnosis, not to start treatment, or to stop treatment, leading to prolonged transmission of the disease to others and the development of increased drug resistance. The findings of the present study indicate the need for policies and practices that reduce the economic burden for MDR-TB patients and their families.

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RÉSUMÉ

CONTEXTE : L'Ethiopie a une prévalence élevée de tuberculose (TB) et elle est l'un des pays les plus touchés du monde par la TB multirésistante (TB-MDR).
OBJECTIF : Comprendre les coûts subis par les patients pour obtenir un diagnostic et un traitement de TB-MDR.
SCHÉMA : En mars 2013, des entretiens ont été réalisés avec 169 patients TB-MDR dans trois hôpitaux d'Ethiopie afin d'identifier les coûts subis par les patients et l'impact sur leur emploi et les revenus de la famille.
RÉSULTATS : Le patient TB-MDR moyen subit un coût total de US$1378, ce qui représente, à mi traitement, 25 mois de revenus d'un foyer de $US54 par mois. L'impact sur l'emploi des patients et sur le revenu d'ensemble du patient et de la famille a été généralement catastrophique : 74% de tous les répondants ont rapporté avoir perdu leur travail, 66% des patients ont perdu le revenu du foyer, et le revenu du foyer a été réduit de 38%. Pour contribuer à couvrir les coûts, 38% des patients ont dû vendre certains biens, tandis 7% ont loué leur propriété et 41% ont contracté des emprunts, chacune de ces stratégies pouvant compromettre encore plus leur situation financière future.
CONCLUSION : En dépit du fait que les services sont officiellement gratuits, la majorité des patients ont subi des coûts catastrophiques et une perte significative de leurs revenus à la suite du diagnostic et du traitement de la TB-MDR.

RESUMEN

MARCO DE REFERENCIA: Etiopía tiene una alta prevalencia de tuberculosis (TB) y es uno de los países con alta carga de morbilidad por tuberculosis multirresistente (TB-MDR) en el mundo.
OBJETIVO: Comprender los costos que deben sufragar los pacientes con el fin de obtener el diagnóstico y el tratamiento de la TB-MDR.
MÉTODO: En marzo del 2013, se entrevistaron 169 pacientes con TB-MDR en tres hospitales en Etiopía, con objeto de reconocer el costo que genera la enfermedad a los pacientes y su repercusión en el empleo y el ingreso familiar.
RESULTADOS: En promedio, el paciente con TB-MDR sufraga un costo total de US$1378, que corresponde a 25 meses de ingreso familiar a la mitad del tratamiento, el cual es de US$54. En general, la repercusión sobre el empleo del paciente y el ingreso global del paciente y su familia fue extremadamente grave: el 74% de todos los pacientes que respondieron refirió haber perdido el empleo, el 66% de los pacientes sufrió pérdida del ingreso familiar y el ingreso familiar se redujo un 38%. Con el propósito de cubrir los costos, el 38% de los pacientes vendió algún tipo de propiedad, el 7% arrendó propiedades y el 41% recurrió a un préstamo; en todos los casos la solución ponía aún más en peligro su futura situación económica.
CONCLUSIÓN: Pese a que oficialmente los servicios son gratuitos, la mayoría de los pacientes sufragó costos extremadamente altos y sufrió una pérdida considerable del ingreso familiar como consecuencia de la obtención del diagnóstico y el tratamiento de la TB-MDR.