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Cost of tuberculosis diagnosis and treatment from the patient perspective in Lusaka, Zambia

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SUMMARY

SETTING: Urban primary health centres in Lusaka, Zambia.

OBJECTIVES: 1) To estimate patient costs for tuberculosis (TB) diagnosis and treatment and 2) to identify determinants of patient costs.

METHODS: A cross-sectional survey of 103 adult TB patients who had been on treatment for 1–3 months was conducted using a standardised questionnaire. Direct and indirect costs were estimated, converted into US$ and categorised into two time periods: 'pre-diagnosis/care-seeking' and 'post-diagnosis/treatment'. Determinants of patient costs were analysed using multiple linear regression.

RESULTS: The median total patient costs for diagnosis and 2 months of treatment was $24.78 (interquartile range 13.56–40.30) per patient—equivalent to 47.8% of patients' median monthly income. Sex, patient delays in seeking care and method of treatment supervision were significant predictors of total patient costs. The total direct costs as a proportion of income were higher for women than men ($P < 0.001$). Treatment costs incurred by patients on the clinic-based directly observed treatment strategy were more than three times greater than those incurred by patients on the self-administered treatment strategy ($P < 0.001$).

CONCLUSION: Clinic-based treatment supervision posed a significant economic burden on patients. The creation or strengthening of community-based treatment supervision programmes would have the greatest potential impact on reducing patients' TB-related costs.

KEY WORDS: patient costs; tuberculosis; Zambia; economics

ALTHOUGH SUB-SAHARAN AFRICA represents only 11% of the world's population, over a quarter of tuberculosis (TB) cases and 31% of TB-related deaths occurred among Africans in 2003.[1] Zambia has one of the highest TB incidence rates in Africa (680 per 100 000 population),[2] as well as one of the highest human immunodeficiency virus (HIV) seroprevalence rates among 15–49 year olds (17%).[3] Case notification data from Zambia indicate that rates of TB infection and disease have increased eightfold over the past two decades, largely due to the concurrent HIV epidemic,[4–6] as in other parts of sub-Saharan Africa[1,7,8]

Despite the usefulness of incidence and prevalence rates for assessing burden of disease and highlighting the seriousness of the epidemic, these indicators may fail to define trends in the social and economic burden of disease.[9] It is important not only to emphasise the urgency of the increasing TB rates in the context of increased HIV prevalence, but also to address the economic and structural barriers that may be acting synergistically to fuel both epidemics.[10,11]

Patient costs are, in part, a function of the structure of the health system, with pre-diagnostic costs reflecting accessibility of diagnosis and post-diagnostic costs reflecting the organisation of TB management and care. In many cases, there is a significant period of delay between the patient's first experience of cough/haemoptysis/fever and a definitive diagnosis, due to either patient or health system delay.[12] As a result of the delay in TB diagnosis, patients incur both the direct costs of diagnostic and treatment services for misdiagnoses, as well as the associated indirect costs due to lost time.

The overall aim of this study was to estimate the costs of TB diagnosis and treatment from the perspective of the patient in Lusaka, Zambia. Specifically, we were interested in determining 1) the largest and most frequently incurred cost items for patients before their diagnosis and during the intensive phase of their TB treatment, and 2) which socio-demographic, economic or clinical factors were associated with higher patient costs. Knowledge of these factors would inform the

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development of targeted interventions, such as modifications to the delivery of TB services, to reduce the economic burden on patients and society due to TB.

METHODS

The study was conducted at four primary health care centres in Lusaka, Zambia: Chawama, Kanyama, George and Chipata. These four clinics notify ~40% of the total reported TB cases in Lusaka annually.[4] Lusaka, in turn, notifies approximately one third of total new Zambian cases annually.[4] Inclusion criteria were patients with confirmed active pulmonary or extra-pulmonary TB who had been on treatment for 6–10 weeks and were aged ⩾18 years.

Users of government health facilities must pay a registration fee to access consultation and diagnostic fees for laboratory tests and radiography.[13] TB patients in Zambia receive standardised treatment according to previous treatment history following the World Health Organization (WHO) recommendations for DOTS-based programmes.[14] The majority of patients in Lusaka are on a clinic-based directly observed treatment (DOT) strategy where patients are observed swallowing their pills at the clinic. At the time of this study, a minority of patients were under community-based DOT, where a designated treatment supporter observes pill swallowing at home.[15] Most urban clinics in Lusaka did not yet offer community-based DOT; however, they were in the process of implementing this model. In the interim, patients on clinic-based DOT in some cases switch to self-administered treatment (SAT).

Data collection

Consecutive eligible patients were invited to participate in the study by clinic staff between 10 and 26 July 2006 at each study site. The enrolment rate was 91% (103/113). Refusal rates were low primarily because interviews were conducted while patients were waiting to receive pills. Locally recruited research assistants who had participated in a standardised training session explained the study and obtained informed consent from the patient. A standardised questionnaire was used from a previous study.[16] Interviews were conducted in private rooms and assistants translated questions into local languages (primarily Nyanja and Bemba) according to patient preferences.

Ethics

This study was approved by the ethics committees of the University of Zambia and the London School of Hygiene & Tropical Medicine.

Data analysis

Data were double entered into Microsoft Access XP (Microsoft, Redmond, WA, USA). Statistical analyses were performed using STATA, version 9.2 (StataCorp, College Station, TX, USA).

Cost estimation

Costs were estimated separately for the time when patients were not yet diagnosed but were symptomatic (pre-diagnosis) and from the moment they were diagnosed with TB, up to the time of interview (post-diagnosis period). Cost category definitions are shown in Table 1. Direct cost estimates were calculated as the product of the patient-reported cost parameter (e.g., consultation fee) and frequency (e.g., number of clinic visits). Indirect costs were estimated by tabulating the total number of hours spent travelling, waiting and receiving health services. Assuming that an average unskilled labourer in Zambia would work 21 days a month, 8 h per day, we used the monthly incomes reported by patients to derive an hourly wage rate.[17] All costs are reported in 2006 US$ (1 US$ = 3855 Zambian kwacha).

Sensitivity analyses

A set of sensitivity analyses were performed to explore the degree of uncertainty associated with the indirect cost estimation according to standard methods.[18] We varied the hourly wage rate and assumptions about the number of hours worked per month in 10% increments up to 50% more or less than the

Table 1 Definitions used in the study

Cost categories, terms	Definition
Care-seeking factors	
Patient delay	Period between onset of patient symptoms and first encounter with the health service
Health encounter	Any visit to any health service (government health centre, pharmacy or private clinic)
Timing of costs	
Pre-diagnostic ('diagnosis seeking')	Costs incurred during time between self-reported first health encounter and laboratory or radiologically confirmed diagnosis
Post-diagnostic ('treatment seeking')*	Costs incurred during intensive phase of treatment. Includes any clinic visit preceding the diagnosis (including referrals before treatment) and subsequent medical follow-up visits
Categories of costs	
Direct	Out-of-pocket expenditures for TB services as well as those incurred to access the service. Per patient costs were categorised as travel costs, registration and paperwork fees, consultation fees, blood test fees, medication fees, X-ray fees, food costs and other costs
Indirect	Patients' lost income due to time to receive care. Includes travel time for return trips to clinics/hospital, waiting time and time for consultation with a physician, nurse or treatment supporter

* We report only the actual costs incurred by patients up to and including 2 months of treatment, with no extrapolation to the entire 6–8 month treatment period.

base case value (average reported individual income of $65.79 per month before diagnosis), while holding all other values constant.

Affordability assessment

To assess affordability, direct costs incurred by patients were converted to a percentage of their actual reported household incomes before TB diagnosis. As suggested by Russell, we chose a direct expenditure threshold of ⩾10% of household monthly income as representing a significant financial impact.[19]

Statistical analyses

The normality of cost data distribution was assessed using Kolmogorov-Smirnov tests. Costs were non-normally distributed. The statistical significance of differences between patient sub-groups was assessed using χ^2 tests for categorical variables and non-parametric (Wilcoxon rank-sum) tests for quantitative variables. We examined the relationship between costs and socio-demographic, economic, clinical and care-seeking factors using log-transformed linear stepwise regression analysis and a generalised linear model with a log link.

RESULTS

One hundred and three patients were enrolled, completed interviews and were included in the costing analysis. As summarised in Table 2, 57% were males and the mean age was 32 years (range 18–53). Forty-seven patients (62% males) originally assigned to a supervised strategy (DOT) indicated that they had switched to a self-administered strategy (SAT), leaving a total of 56 patients on DOT. Of the 52 with smear-negative or extra-pulmonary TB, 49 (94%) went on SAT, compared to 6/59 (11%) with smear-positive TB.

As seen in Table 3, the median total cost for each patient amounted to $24.78 (interquartile range [IQR] 13.56–40.30), of which indirect costs comprised 62% and direct costs 34%. Our estimate of the total indirect costs incurred by patients was not sensitive to changes in the assumption of wage rate used nor the number of days worked. In the pre-diagnosis period, direct costs comprised 66% of patients' costs —mostly for government health insurance user fees, X-ray fees and public transport. In the post-diagnostic period, the travel and time costs associated with clinic visits for DOT or pill collection comprised 95% of patients' costs.

Affordability

The total direct costs, expressed as a proportion of median individual income (Table 4), were 92% higher for women than for men ($P < 0.001$). This is largely a reflection of the lower wages earned by women (the median reported monthly individual income for females was $5.10 compared to $77.82 for males).

Table 2 Demographic, socio-economic and clinical characteristics of patients studied

Variable*	Female ($n = 44$) n (%)†	Male ($n = 59$) n (%)†	Total ($n = 103$) n (%)†
Age, years			
18–24	7 (16)	7 (12)	14 (14)
25–34	22 (50)	28 (48)	50 (49)
35–44	13 (30)	18 (31)	31 (30)
⩾45	2 (5)	6 (10)	8 (8)
Household size, persons			
1–4	11 (25)	24 (41)	35 (34)
5–6	22 (50)	21 (36)	43 (42)
7–10	7 (16)	10 (17)	17 (17)
>10	4 (9)	4 (7)	8 (8)
Education			
None	2 (5)	3 (5)	5 (9)
Primary school	27 (62)	23 (39)	50 (49)
Some secondary school (grade 9)	13 (30)	27 (46)	40 (39)
Finished secondary school (grade 12)	1 (2)	1 (2)	2 (2)
College/university	1 (2)	5 (9)	6 (6)
Current employment status			
Unemployed	36 (82)	30 (51)	66 (64)
Employed	8 (18)	29 (49)	37 (36)
Income ($n = 102$)			
Monthly income before TB, US$			
<$5	22 (51)	9 (15)	31 (30)
$5–$75	17 (40)	20 (34)	37 (36)
>$75	4 (9)	30 (59)	34 (33)
Current monthly income, US$			
<$5	35 (81)	25 (42)	60 (59)
$5–$75	7 (16)	19 (32)	26 (25)
>$75	1 (2)	15 (25)	16 (16)
Household income ($n = 93$)			
Monthly income before TB			
<$75	16 (44)	16 (28)	32 (34)
$75–$150	15 (42)	19 (33)	34 (37)
>$150	5 (14)	22 (39)	27 (29)
Current monthly income, US$			
<$75	22 (59)	27 (47)	49 (52)
$75–$150	9 (24)	17 (30)	26 (28)
>$150	6 (16)	13 (23)	19 (20)
Form of TB			
Pulmonary smear-positive	26 (59)	33 (56)	59 (57)
Pulmonary smear-negative	12 (27)	16 (27)	28 (27)
Extra-pulmonary	6 (14)	10 (17)	16 (15)
History of treatment			
New case or never treated	41 (93)	49 (83)	90 (87)
Retreatment or previously treated	3 (7)	10 (15)	13 (13)
Treatment supervision strategy			
Directly observed treatment	26 (59)	30 (51)	56 (54)
Self-administered treatment	18 (41)	29 (49)	47 (46)

* For each descriptive variable, $n = 103$ patients unless otherwise indicated.
† Totals may not amount to 100% due to rounding.
TB = tuberculosis.

Variation in patient costs

As shown in Table 5, patient delay in seeking care ($P < 0.01$), treatment supervision strategy ($P < 0.0001$) and smear status ($P < 0.001$) were associated with total patient costs in univariate analyses. Patient costs were not significantly associated with age, male

Table 3 Direct and indirect costs incurred by patients during the pre- and post-diagnostic periods (all costs in 2006 US$)

Timing and type of cost	Patients reporting expenditure		All patients (n = 103)
	n (%)	Median (IQR)	median (IQR)
Pre-diagnosis			
Direct			
Medical			
Government health insurance user fees	69 (67)	1.43 (1.30–1.43)	1.30 (0–1.42)
Consultation fees	13 (13)	2.59 (2.59–3.89)	0 (0–0)
Chest radiograph	58 (55)	5.19 (2.59–5.19)	2.59 (0–5.19)
Non-TB medication	6 (6)	11.02 (6.49–15.56)	0 (0–0)
Hospitalisation	6 (6)	9.99 (2.72–13.80)	0 (0–0)
Other	9 (9)	0.26 (0.26–1.55)	0 (0–0)
Total medical*	87 (84)	4.02 (1.42–6.74)	3.89 (1.43–6.61)
Non-medical			
Transport	53 (51)	2.08 (1.04–5.19)	0.30 (0–2.59)
Food	5 (5)	2.59 (0.79–5.19)	0 (0–0)
Total non-medical	55 (53)	2.59 (1.04–5.19)	0.52 (0–2.59)
Sub-total	93 (90)	6.61 (3.11–9.47)	5.45 (2.59–9.34)
Indirect			
Value of time for return trips to clinic	91 (88)	2.35 (1.17–3.52)	2.35 (0.78–3.13)
Value of time spent in hospital	8 (8)	14.10 (10.97–29.76)	0 (0–0)
Sub-total	93 (90)†	8.44 (5.00–15.33)	2.35 (0.78–3.92)
Total pre-diagnosis			8.31 (4.68–15.08)
Post-diagnosis			
Direct			
Transport for pill collection visits	17 (17)	8.30 (2.85–20.75)	0 (0–0)
Clinic-based DOT	5 (5)	22.98 (17.79–25.20)	0 (0–0)
SAT	12 (12)	3.34 (2.30–14.32)	0 (0–2.15)
Transport for follow-up visits	11 (11)	2.59 (1.43–2.85)	0 (0–0)
Total direct cost	24 (23)	4.39 (2.63–19.07)	0 (0–0)
Indirect			
Value of time for pill collection visits	103 (100)	7.83 (4.70–23.50)	7.83 (4.70–23.50)
Clinic-based DOT	56 (54)	19.97 (15.66–32.63)	19.98 (15.66–32.63)
SAT	47 (46)	4.70 (3.13–7.83)	4.70 (3.13–7.83)
Value of time for follow-up visits	43 (42)	1.57 (0.87–1.57)	0 (0–1.17)
Total indirect cost	103 (100)	9.33 (4.70–23.50)	9.33 (4.70–23.50)
Total treatment-related			11.75 (5.29–27.41)
Total patient costs			
Total direct	100 (97)	7.91 (4.02–12.45)	7.00 (3.11–11.93)
Total indirect	103 (100)	15.27 (7.96–28.59)	15.27 (7.96–28.59)
Total			24.78 (13.56–40.30)

* Totals may not always be equivalent to sum of component costs up due to rounding.
† Although all patients (N = 103) spent time on return clinic visits to access their diagnosis, 10 patients reported total time costs less than one hour. This was converted to a monetary value of zero dollars.
IQR = interquartile range (25th to 75th percentile); TB = tuberculosis; DOT = directly observed treatment; SAT = self-administered treatment.

sex, household size, employment status, individual patient incomes, the number of health encounters before diagnosis, hospitalisation or form of TB. In multivariate linear regression, being male, longer patient delays and clinic-based DOT were associated with higher costs, and together explained at least 25% of individual patient costs (Table 6).

Variation in patient characteristics and costs by treatment strategy

An unexpected finding was that total costs incurred by patients on clinic-based DOT were almost four times greater compared to those who had switched to SAT ($P < 0.001$). Although not our primary objective, we wanted to explore the reasons for the variation in

Table 4 Median out-of-pocket expenditures by sex as a percentage of median monthly incomes earned by patient households (all costs in 2006 US$)

Timing of cost	Female (n = 44)		Male (n = 59)	
	Median (IQR)	% of MMI	Median (IQR)	% of MMI
Pre-diagnosis	5.77 (2.66–9.14)	113	5.44 (2.07–9.34)	7.0
Post-diagnosis	0 (0–0)	—	0 (0–2.59)	—
Total direct	6.73 (2.92–11.67)	132	7.91 (3.63–15.56)	10.1

IQR = interquartile range (25th to 75th percentile); MMI = household median monthly income.

Table 5 Factors associated with increased total patient costs: univariate linear regression analysis with and without log-transformed costs (all costs in 2006 US$)

		Linear regression		Linear regression with log-transformed cost	
Independent variables	Median US$	Coefficient US$	*P* value	Coefficient US$*	*P* value
Demographic					
Sex					
Male	26.73	7.73	0.18	1.25	0.11
Female	22.99				
Age, years*					
<34	25.13	4.85	0.34	1.12	0.43
⩾34	24.46				
Socio-economic					
Household size, number of persons†					
⩽4	24.25	2.15	0.67	0.98	0.89
>4	24.77				
Education					
Primary school or no education	24.26	0.31	0.95	0.88	0.36
Some secondary school or higher	24.77				
Current employment status					
Employed	22.99	0.07	0.99	1.15	0.32
Unemployed	27.00				
Monthly income before TB, US$†					
<$50	25.41	2.61	0.61	1.04	0.78
⩾$50	22.70				
Clinical					
Each additional month of patient delay in care seeking‡	—	1.31	<0.001	1.02	0.01
Each additional health encounter before diagnosis‡	—	1.83	0.19	1.05	0.23
Hospitalisation					
Yes	40.30	32.24	<0.001	1.88	0.63
No	23.23				
Form of TB					
Pulmonary	27.38	0.25	0.97	1.33	0.13
Extra-pulmonary	17.34				
Smear					
Smear-positive	33.00	9.99	<0.001	1.54	<0.001
Smear-negative	17.35				
Treatment strategy					
DOT	32.71	9.67	<0.001	1.55	<0.0001
SAT	16.35				

*Adjusted difference was retransformed back to 2006 US$. Results of generalised linear model with a log link did not alter significance and therefore is not reported here.
†Dichotomisation based on median values.
‡Denotes continuous variable.
TB = tuberculosis; DOT = directly observed treatment; SAT = self-administered treatment.

Table 6 Factors explaining variation in total patient costs: multivariate stepwise linear regression with and without log-transformed costs (all costs in 2006 US$)

	Additive model linear regression			Multiplicative model linear regression with log-transformed cost		
Independent variables*	Coefficient US$	*P* value	R^2	Coefficient US$†	*P* value	R^2
Male sex‡	9.42	0.028		1.28	0.053	
Patient delay in seeking diagnosis§	1.49	<0.001	0.398	1.70	<0.0001	0.254
Clinic-based DOT‡	16.62	<0.001		1.02	<0.0001	

* Hospitalisation and smear status were no longer independent predictors of the variation in patient costs when adjusted for the effect of male sex and patient delay.
† Adjusted difference was retransformed back to 2006 US$.
‡ Denotes categorical variable.
§ Denotes continuous variable.
DOT = directly observed treatment.

costs between these two patient groups: clinic-based DOT (95% smear-positive) and self-administered (87% smear-negative). Pre-diagnostic costs were somewhat higher for the SAT group ($17 vs. $9, $P = 0.10$). Post-diagnostic costs, however, were significantly higher for the clinic-based DOT group ($25 vs. $8, $P < 0.0001$). The difference in cost between these groups was accounted for by the time cost associated with DOT visits, and not in other components, such as the cost of drugs, hospitalisation, chest radiography, blood tests or consultation fees. For patients on DOT, the median time per DOT visit was 90 min (IQR 60–128), including both travel time (60 min [IQR 0–120]) and waiting time (15 min [IQR 10–30]). For patients not on DOT, the median time per pill collection visit was 105 min (IQR 65–150), with average travel and waiting times of respectively 60 min (IQR 0–120) and 30 min (IQR 30–60). The finding that total costs for DOT patients were higher than those for SAT patients is therefore directly attributable to the frequency of visits rather than per visit costs.

DISCUSSION

TB diagnosis and treatment posed a significant economic burden on patients in terms of both cost and affordability. The three largest predictors of patient costs were treatment supervision strategy (clinic-based DOT), patient delay in seeking care and male sex.

The most striking finding is the substantial economic burden associated with clinic-based DOT. Although it was the form of disease that dictated the choice of treatment supervision, we observed that the increased costs experienced by these smear-positive patients on clinic-based DOT were accounted for by the time required for treatment supervision and not due to differences in other component costs, pre- or post-diagnosis. We are confident, therefore, that differences in cost were attributable to the supervision strategy and not the actual disease form.

An important policy question emerging from these results is whether it is justified to require patients to spend on average >1 h per day for treatment supervision visits, particularly when patients may have extreme difficulty affording daily trips to the clinic. A community-based DOT strategy could improve patient adherence to treatment while reducing patient costs. Community-based care for TB has already been found to be cost-effective in a number of African settings.[15,20–25]

Longer patient delays between first experience of symptoms and first health service encounter were also associated with higher costs. A possible explanation may be that those who delay in presenting to the health centre are more ill than those who present for earlier consultation, and therefore incur higher related treatment costs. An alternative explanation may be that those who delay in seeking care are at a further distance from the clinic, and therefore incur higher related transport and time costs. Given that longer patient delays were predictive of higher patient costs, it follows that an intervention that enables diagnosis of TB closer to where patients live, such as community-based enhanced case finding, could reduce the economic burden on patients before their diagnosis. We have also observed that the existence of user fees means that although in theory TB diagnostic services are provided free of charge, in practice it is impossible for an individual to receive these 'free' services without first paying to access their diagnosis. Under the current DOTS strategy in Zambia, TB patients are detected through passive case finding. Enhancing TB case finding by promoting awareness of the symptoms of TB in the community, encouraging individuals to present early to health centres and providing quality-assured sputum collection points at strategic locations in the neighbourhood is currently being tried in these communities in the Zambia and South Africa Tuberculosis and AIDS reduction (ZAMSTAR) trial.[26,27] This may lead to lower patient diagnostic costs as well as more rapid diagnosis of TB.

We also found that men spent more money in accessing care than women; however, TB diagnosis and treatment was nonetheless more affordable for males when taken in the context of their ability to pay. Were future research to demonstrate that direct costs differentially selected against the care-seeking behaviours of women, a targeted intervention may be warranted to reduce transport costs and user fees as a barrier to TB diagnosis and treatment.

Our study had four major limitations. First, a large proportion of patients (98%) did not know their HIV infection status. Obstacles to knowing the HIV status of patients include health system factors (availability of voluntary counselling and testing [VCT], cross-linking databases between clinics), patient factors (perception of risk, ability to access VCT) and societal factors (stigma surrounding the disease). However, given that we were assessing costs due to diagnosis and care seeking (and not the cost of morbidity or mortality), we do not believe that adjusting for HIV comorbidity would substantially alter our cost estimates or conclusions. Costs reported by patients may have been biased due to patients' failure to recall certain expenditures or the time spent in seeking care. We would expect in most cases that this type of recall bias would lead to an underestimation of patient costs. Given the sufficiently detailed assessment of unit costs, we believe our cost estimates represent a relatively reliable distribution of costs between patients. Finally, although we cannot exclude the possibility of omitted variable bias, multi-collinearity or interaction between variables that was not controlled for in our multiple linear regression analysis, our regression diagnostic tests suggested that our model predicted the best linear unbiased estimate based on our data.[28]

One strength of this survey is the ability to compare our data with previous costing estimates from the same geographical location. A study of patient costs due to TB diagnosis was conducted at the University Teaching Hospital (UTH) in Lusaka in 1995.[29] At the time of this study, TB diagnostic facilities were centralised at the UTH Chest Clinic, and out-patients therefore required referral from a peripheral residential clinic to be diagnosed. Due in part to the organisation of TB services, this study found that patients incurred a mean total cost representing 76.2% of their average monthly income ($47, 1995 US$) before their diagnosis.[29] Our data suggest that current pre-diagnosis costs now represent only 11.5% of average monthly income, strongly suggesting that TB diagnosis in Lusaka is now more affordable from the patient perspective. Given that the average monthly income reported in 1995 was $47 and the monthly income reported in this study was $66, we believe this represents a real difference in patient costs. The most plausible explanation is that decentralisation of TB diagnostic services between 1995 and 2006 has increased the geographical accessibility of TB diagnostic services.[30,31]

CONCLUSION

TB diagnosis and treatment posed a significant economic burden on patients in terms of both cost and affordability. Despite the strengths of the existing TB control strategy promoted by the WHO, we have observed that clinic-based DOT may contribute disproportionately to the costs incurred by patients. To reduce patient costs, we recommend the creation or strengthening of community-based TB treatment supervision in settings with high TB incidence.

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References

1 Corbett E L, Marston B, Churchyard G J, De Cock K M. Tuberculosis in sub-Saharan Africa: opportunities, challenges and change in the era of antiretroviral treatment. Lancet 2006; 367: 926–937.
2 World Health Organization. Global tuberculosis control—surveillance, planning, financing, 2006. WHO/HTM/STB/2006. 37. Geneva, Switzerland: WHO, 2006.
3 Joint United Nations Programme on HIV/AIDS. Report on the global HIV/AIDS epidemic. Geneva, Switzerland: UNAIDS, 2006.http://data.unaids.org/pub/GlobalReport/2006/2006_GR_ANN2_en.pdf Accessed May 2008.
4 Government of Zambia. National TB reporting database. Lusaka, Zambia: Government of Zambia, 2006.
5 Mwaba P, Maboshe M, Chintu C, et al. The relentless spread of tuberculosis in Zambia—trends over the past 37 years (1964–2000). S Afr Med J 2003; 93: 149–152.
6 Godfrey-Faussett P, Ayles H. Can we control tuberculosis in high HIV prevalence settings? Tuberculosis 2003; 83: 68–76.
7 Corbett E L, Watt C J, Walker N, et al. The growing burden of tuberculosis: global trends and interactions with the HIV epidemic. Arch Internal Med 2003; 163: 1009–1021.
8 Floyd K, Wilkinson D. Tuberculosis in the HIV/AIDS era: interactions, impacts and solutions. AIDS Analysis Africa 1997; 7: 5–7.
9 Ogden J. The resurgence of tuberculosis in the tropics. Improving tuberculosis control—social science inputs. Trans Roy Soc Trop Med Hygiene 2000; 94: 135–140.
10 Floyd K, Blanc L, Raviglione M, Lee J W. Resources required for global tuberculosis control. Science 2002; 295: 2040–2041.
11 McIntyre D, Thiede M, Dahlgren G, Whitehead M. What are the economic consequences for households of illness and of paying for health care in low- and middle-income country contexts? Soc Sci Med 2006; 62: 858–865.
12 Walker D, McNerney R, Mwembo M K, Foster S, Tihon V, Godfrey-Faussett P. An incremental cost-effectiveness analysis of the first, second and third sputum examination in the diagnosis of pulmonary tuberculosis. Int J Tuberc Lung Dis 2000; 4: 246–251.
13 Lusaka District Health Management Board. Action plan and budget for the years: 2006–2008. Lusaka, Zambia: Lusaka District Health Management Board, 2006.
14 World Health Organization. An expanded DOTS framework for effective tuberculosis control. Geneva, Switzerland. WHO, 2002.
15 Maher D. Community contribution to TB care: policy and practice. Geneva, Switzerland. WHO, 2003.
16 Schwartzman K, Oxlade O, Barr R G, et al. Domestic returns from investment in the control of tuberculosis in other countries. N Engl J Med 2005; 353: 1008–1020.
17 Ministry of Finance and National Planning. Economic report 2001. Lusaka, Zambia: Ministry of Finance and National Planning, 2002.
18 Fox-Rushby J, Cairns J. Economic evaluation. 1st ed. Oxford, UK: Oxford University Press, 2005.
19 Russell S. The economic burden of illness for households in developing countries: a review of studies focusing on malaria, tuberculosis and human immunodeficiency virus/acquired immunodeficiency syndrome. Am J Trop Med Hygiene 2004; 7 (Suppl 2): S147–S155.
20 Floyd K. Costs and effectiveness—the impact of economic studies on TB control. Tuberculosis 2003; 83: 187–200.
21 Floyd K, Skeva J, Nyirenda T, Gausi F, Salaniponi F. Cost and cost-effectiveness of increased community and primary care facility involvement in tuberculosis care in Lilongwe District, Malawi. Int J Tuberc Lung Dis 2003; 7 (Suppl 1): S29–S37.
22 Fryatt R J. Review of published cost-effectiveness studies on tuberculosis treatment programmes. Int J Tuberc Lung Dis 1997; 1: 101–109.
23 Nganda B, Wang'ombe J, Floyd K, Kangangi J. Cost and cost-effectiveness of increased community and primary care facility involvement in tuberculosis care in Machakos District, Kenya. Int J Tuberc Lung Dis 2003; 7 (Suppl 1): S14–S20.
24 Okello D, Floyd K, Adatu F, Odeke R, Gargioni G. Cost and cost-effectiveness of community-based care for tuberculosis patients in rural Uganda. Int J Tuberc Lung Dis 2003; 7 (Suppl 1): S72–S79.
25 Sinanovic E, Floyd K, Dudley L, Azevedo V, Grant R, Maher D. Cost and cost-effectiveness of community-based care for tuberculosis in Cape Town, South Africa. Int J Tuberc Lung Dis 2003; 7 (Suppl 1): S56–S62.
26 Golub J E, Mohan C I, Comstock G W, Chaisson R E. Active case finding of tuberculosis: historical perspective and future prospects. Int J Tuberc Lung Dis 2005; 9: 1183–1203.
27 CREATE Consortium, 2006. Baltimore, MD, USA: Create, 2006. www.tbhiv-create.org/ Accessed May 2008.

28 Koop G. Analysis of economic data. 2nd ed. Leicester, UK: John Wiley & Sons, 2005.
29 Needham D M, Godfrey-Faussett P, Foster S D. Barriers to tuberculosis control in urban Zambia: the economic impact and burden on patients prior to diagnosis. Int J Tuberc Lung Dis 1998; 2: 811–817.
30 Hjortsberg C A, Mwikisa C N. Cost of access to health services in Zambia. Health Policy Plan 2002; 17: 71–77.
31 Blas E, Limbambala M. User-payment, decentralization and health service utilization in Zambia. Health Policy Plan 2001; 16 (Suppl 2): 19–28.

RÉSUMÉ

CONTEXTE : Centres de santé primaires urbains de Lusaka, Zambie.
OBJECTIFS : 1) Estimer les coûts-patient du diagnostic de la tuberculose (TB) et de son traitement et 2) identifier les éléments déterminant les coûts du patient.
MÉTHODES : Enquête transversale conduite grâce à un questionnaire standardisé chez 103 patients adultes atteints de TB qui avaient été sous traitement pendant 1 à 3 mois. Les coûts directs et indirects ont été estimés, convertis en US$ et calculés pour deux périodes : période « pré-diagnostic/recherche de soins » et période « post-diagnostic/traitement ». Les facteurs déterminants des coûts-patient ont été analysés par régression linéaire multiple.
RÉSULTATS : Le coût total médian par patient pour le diagnostic et 2 mois de traitement a été de 24,78 US$ (IC95% 13,6–40,3) par patient, ce qui équivaut à 47,8% du revenu mensuel médian des patients. Le sexe, le délai-patient dans la recherche de soins et la méthode de supervision du traitement ont été des facteurs prédictifs significatifs du coût-patient total. Les coûts totaux directs en proportion des revenus ont été plus élevés pour les femmes que pour les hommes ($P < 0,001$). Les coûts de traitement encourus par les patients sous une stratégie de traitement directement observé basé sur la clinique ont été plus de trois fois supérieurs à ceux encourus par les patients lors d'une stratégie de traitement auto-administré ($P < 0,001$).
CONCLUSION : La supervision du traitement basée sur une clinique impose aux patients un fardeau économique significatif. La création ou le renforcement de programmes de supervision basés sur la collectivité aurait le plus grand impact potentiel sur la diminution des coûts-patient liés à la TB.

RESUMEN

MARCO DE REFERENCIA : Centros primarios urbanos de atención de salud en Lusaka, Zambia.
OBJETIVOS : 1) Calcular los costos incurridos por el paciente en el diagnóstico y tratamiento de la tuberculosis (TB) y 2) definir los factores determinantes de los costos para el paciente.
MÉTODOS : Fue este un estudio transversal de 103 pacientes adultos con TB, quienes recibieron tratamiento durante 1 a 3 meses y respondieron a un cuestionario estandarizado. Se calcularon los costos directos e indirectos, que se convirtieron en dólares estadounidenses y se categorizaron en dos períodos : la etapa de prediagnóstico y búsqueda de atención y la etapa posterior al diagnóstico y de tratamiento. Se analizaron los factores determinantes de los costos para el paciente mediante un análisis de regresión linear multifactorial.
RESULTADOS : La mediana de los costos totales incurridos por el paciente en diagnóstico y 2 meses de tratamiento fue de 24,78 dólares (IQR 13,6–40,3) por paciente (lo cual equivale al 47,8% del ingreso mensual de los pacientes). El sexo y el retraso del paciente en buscar atención constituyeron factores significativos de predicción del costo total incurrido por él. Los costos directos totales, expresados como proporción del ingreso, fueron superiores para las mujeres que para los hombres ($P < 0,001$). Los costos de tratamiento asumidos por el paciente con el tratamiento directamente observado en el consultorio fueron tres veces superiores a los costos con el sistema de tratamiento autoadministrado ($P < 0,001$).
CONCLUSIÓN : La supervisión del tratamiento en el consultorio implica una carga económica considerable para los pacientes. La creación o fortalecimiento de programas de supervisión del tratamiento en la comunidad podría dar lugar a una reducción importante de los costos relativos al tratamiento antituberculoso para los pacientes.