

## Can TB patients in resource-constrained settings afford chest x-rays?

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Short sentence summarising findings: In many low- and middle-income countries chest x-rays are not free of charge for TB patients.

1 **To the Editors:**

2

3 Even when tuberculosis (TB) care is free, impoverished patients, and their  
4 households, continue to incur unmanageable costs due to seeking and staying in  
5 care for the full duration of anti-tuberculosis treatment (1). By aggravating  
6 household vulnerability, these costs can prevent or delay diagnosis, treatment and  
7 successful outcome, leading to increased TB transmission, morbidity and mortality  
8 (2-4). The new World Health Organization (WHO)'s End TB Strategy places greater  
9 emphasis on ensuring universal free access to care, and it includes a target of  
10 elimination of associated catastrophic costs for TB patients and their households by  
11 2020 (5).

12

13 Data from prevalence surveys has led to a renewed interest in CXRs as a triage test  
14 and a tool for active case finding (6, 7). Today CXRs are employed in many settings  
15 both for screening and as part of the diagnostic algorithm and follow-up. If,  
16 however, CXRs are not provided free of charge to the patient, there is a risk that  
17 these may aggravate costs incurred by patients during their path to a TB diagnosis.

18

19 We sought to provide a snapshot of current accessibility of CXRs to TB patients and  
20 patients accessing care with symptoms suggestive of TB (presumptive TB cases(8))  
21 both geographically and financially. We consulted experts from 44 low and middle-  
22 income countries; of these, 12 are from the 30 high TB burden and 10 from the 30  
23 high MDR-TB burden countries (Table 1), through an online survey with open and  
24 multiple-choice questions. The questionnaire was sent via email to staff working in  
25 National Tuberculosis Programmes (NTPs) or consultants and researchers working  
26 closely with NTPs. We received a response from 27 of them (61.4%).

27

28 The survey asked about the availability and cost of CXR in public health facilities, role  
29 of CXR in the country's diagnostic algorithm, provision of health insurance or other  
30 forms of social protection to TB patients and presumptive TB cases (Box 1).

31

32 In most countries (19/27), CXRs are part of the routine diagnostic algorithm and  
33 follow-up. In over half of the countries (15/27, 55%) patients have to pay for a CXR

34 examination in the public service. The cost for a CXR varies between USD 1.5 and  
35 USD 42 (median USD 7.8). The highest costs were reported from African countries  
36 (Figure 1). Costs were reported to vary even within countries: prices ranged  
37 between USD 8.4 and 42 in Senegal, USD 5 and 20 in Zimbabwe dependent on the  
38 facility and the region. Some patients were exempt from payment: MDR-TB patients  
39 (Bolivia, Burkina Faso, Senegal), patients co-infected with HIV (Ghana, Burkina Faso),  
40 children under 5 (Bolivia, Burkina Faso, Viet Nam), patients categorised as very poor  
41 by their *kebele* (“neighbourhood”) leaders (Ethiopia) and patients under follow-up  
42 (Kyrgyzstan). In contrast sputum smear microscopy is provided free of charge in all  
43 countries. In countries where CXRs are also employed for monitoring progress during  
44 treatment, this exposes patients to even higher costs as they had to pay not only for  
45 diagnostic but also for follow-up CXR examinations.

46

47 TB diagnostics and treatment is free of charge with the exception of CXRs in most  
48 low-income countries without a national health insurance scheme (such as  
49 Zimbabwe). The same holds true for middle-income countries (Viet Nam, Dominican  
50 Republic, Indonesia, Peru). However, those countries often have health insurance  
51 schemes covering the costs of CXRs. Health insurance schemes based on a  
52 contributory model (such as in Ghana) are only accessible to individuals employed in  
53 the formal sector. Hence the poorest, who are at greatest risk of TB, are left out of  
54 the health insurance scheme and are unable to access CXRs free of charge.

55

56 Our analysis has limitations. It is likely that we underestimated the costs of CXRs for  
57 patients as we only considered direct medical costs, but hidden direct “out of  
58 pocket” costs such as transport costs (especially when CXR facilities are not on site)  
59 and food, as well as indirect costs due to loss of productivity, tend to account for a  
60 sizable proportion of expenditure on seeking and receiving care (1). Patient costs  
61 surveys that are currently under way will provide useful insights and more  
62 comprehensive estimates.

63

64 We focused on the public sector only. The private sector often represents the first  
65 point of care for most TB patients in many Asian countries (8). Data reported from

66 Pakistan show that CXR costs in the private sector can be up to four times higher  
67 than in public health facilities (USD 2.5-8.0 vs. USD 1.5-2.0).

68

69 Our survey is not representative of the global level, nor did it intend to. However, we  
70 covered 12 of the 30 high TB burden and 10 of the 30 high MDR-TB burden  
71 countries. Furthermore, we included countries from the three most affected  
72 continents (Figure 1).

73

74 As prevalence surveys have shown, expanding the use of CXR has a great potential as  
75 a screening/triage tool and can contribute to achieving the ambitious targets set in  
76 the End TB Strategy (6). However, the TB community needs to be aware that  
77 widespread use of CXRs might potentially aggravate costs for patients and  
78 presumptive TB cases. CXRs, similar to sputum smear microscopy and Xpert  
79 MTB/RIF, should be easily accessible and free of charge if employed for TB diagnosis  
80 and follow-up. A recently published WHO policy document on chest radiography  
81 aptly states that CXRs should be free of charge and/or fully reimbursed by health  
82 insurance (9). Practical approaches to mitigate patient costs should also be provided  
83 to NTPs. Harmonisation within and across countries and donors will be necessary.  
84 Another potential avenue to reducing the costs for patients is the extension of social  
85 protection interventions (such as cash transfers and health insurance) to cover all  
86 costs associated with TB diagnosis and treatment. This will require strong political  
87 commitment and dedicated resource, and it will be difficult to implement in the near  
88 future.

89

90 In conclusion, the direct costs of CXR for patients are high. In many of the countries  
91 participating in this survey a large proportion of their population lives on less than  
92 USD 1.9 per day (10). Efforts are made to reduce financial barriers for patients by  
93 providing smear microscopy, Xpert/MTBRIF and treatment free of charge. A similar  
94 approach is necessary if CXRs become part of the diagnostic algorithms.

95

96

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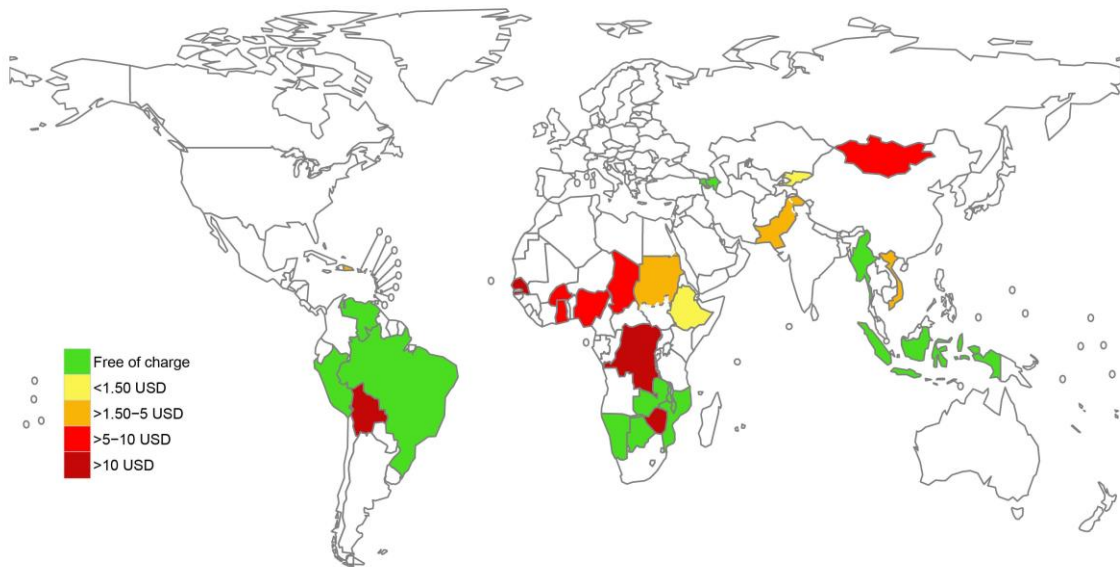
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**Box 1:** Main topics covered by the survey questionnaire

<b>Question</b>	<b>Domain</b>
Where can patients get a CXR, e.g. public hospital, private provider?	Coverage and access of CXR
Is CXR free in the public service?	Access and cost CXR
If CXR is not provided free of charge, how much does it cost?	Cost of CXR
Are there certain circumstances when CXR is provided free of charge, e.g. for children?	Cost of CXR
Is CXR part of the diagnostic algorithm in your country?	Role of CXR in diagnostic algorithm
Is smear microscopy provided free of charge in the public service in your country?	Cost of diagnosis by smear microscopy
Are TB patients in your country covered by a national health insurance scheme or other forms of social protection (e.g. cash transfer to cover the cost of TB diagnosis and treatment)?	Availability of social protection/health insurance in the country
If so, does the national health insurance cover the cost of CXR for TB patients?	Coverage of TB patients by health insurance

**Figure 1: Levels of costs reported by country experts**



World Bank income classification <sup>1</sup>	Country included in the survey	TB HBC List <sup>2</sup>	MDR-TB HBC List <sup>2</sup>
Low-income economies	Burkina Faso		
	Chad		
	Congo, Dem. Rep.	•	
	Ethiopia	•	•
	Malawi		
	Mozambique	•	•
	Senegal		
	Zimbabwe	•	•
Lower-middle-income economies	Armenia		
	Bolivia		
	Ghana		
	Indonesia	•	•
	Kyrgyzstan		•
	Mongolia		
	Myanmar	•	•
	Nigeria	•	
	Pakistan	•	•
	Sudan		
	Vietnam	•	•
	Zambia	•	
Upper-middle-income	Azerbaijan		•
	Botswana		
	Brazil	•	
	Dominican Republic		

	Namibia	•	
	Peru		•
	Venezuela		

<sup>1</sup> World Bank country classification by income: low-income economies are defined as those with a gross national income (GNI) per capita, calculated using the World Bank Atlas method, of \$1,025 or less in 2015; lower middle-income economies are those with a GNI per capita between \$1,026 and \$4,035; upper middle-income economies are those with a GNI per capita between \$4,036 and \$12,475.

<sup>2</sup> HBC countries list for TB and MDR-TB used by WHO for the period 2016-2020(11)