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## Title

Measuring economic burden for patients and households affected by tuberculosis: differences between the End TB Strategy and the Universal Health Coverage framework

## Authors

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**Running head:** Measuring TB economic burden for TB patients

**Key words:** tuberculosis; patient costs; financial protection, affordability

## Abstract

Tuberculosis (TB) is a disease of poverty. Ensuring access to health care without risk of financial hardship due to out-of-pocket health care expenditures (Universal Health Coverage; UHC) is essential for providing accessible care for underprivileged populations, but it is not enough.

The End TB Strategy promotes both patient-centred TB services and social protection measures, which aim to mitigate economic hardship on TB patients and their households due to direct medical and non-medical expenditures, as well as lost income. The Strategy includes a target that no families should face catastrophic total costs due to TB. The indicator linked to this target aims to capture the total economic burden linked to TB care, and thus differs from the “catastrophic expenditure on health” indicator, a key component of the UHC monitoring framework, aligned to the Sustainable Development Goals.

Countries, especially high TB-burden countries, are expected to conduct nationally-representative TB patient cost surveys to establish baseline measurements for the catastrophic costs indicator. Findings from these surveys should also help identify entry points to develop policies to ensure better financial and social protection for TB patients. In this paper, we define the key measurable concepts for TB patient cost surveys, notably the types of costs that are captured and related affordability measures. We discuss the methods for measuring these notions in the UHC framework and contrast them with how they are measured in TB patient cost surveys.

## 1. Introduction and background

Tuberculosis (TB) remains a major threat to global public health (1). Poor people in resource-constrained settings are most at risk of the disease and its devastating economic consequences (2). In low- and middle-income countries (LMICs), health care financing is heavily reliant on out-of-pocket payments. Despite basic TB care being officially free of charge, often partly through vertical funding mechanisms, TB patients often struggle to afford TB care and incur costs considered to be “catastrophic” (3-5).

Universal Health Coverage (UHC), which means that everyone can access the quality health services they need without financial hardship (6), has long been on the global TB control agenda. Free diagnosis and treatment have been the cornerstone of global TB control strategies since 1994. The DOTS Strategy emphasises the use of low-cost, cost-effective tools and interventions to enable affordable access to quality TB care, which has resulted in 53 million lives saved. Yet, this has been shown to be insufficient in mitigating economic consequences since non-medical costs and income losses, which account for a large part of the economic burden for households, are not accounted for within the UHC monitoring framework (7-9).

Aligned to the Sustainable Development Goals (SDGs), the World Health Organization’s (WHO) End TB Strategy has an increased focus on poverty alleviation strategies and social protection initiatives that cover costs beyond medical expenses, including income security. It also includes a target of no TB-affected families suffering from catastrophic total costs due to the disease (9, 10). To monitor progress towards this target, the WHO Global TB Programme convened a task force of experts in 2015 to develop a field-testing protocol and survey instrument for nationally-representative, health-facility-based surveys of costs faced by TB patients and their households (in shorthand, “TB patient cost surveys”), building upon the Tool to Estimate Patients’ Costs (11). After field-testing, WHO developed a Handbook for TB patient cost surveys (10). Countries, especially countries with a high burden of TB, are expected to adapt and implement these surveys to document the magnitude and main drivers of costs incurred by TB patients (and their households) and the percentage of TB patients who incur catastrophic costs as a result of the costs of care, and to monitor these metrics over time. Findings from these surveys should also help identify entry points to develop policies to ensure better financial and social protection for TB patients (7).

As of July 2018, eleven countries had conducted a TB patient cost survey using the WHO methodology and instrument (12), four surveys are ongoing or near completion, and thirteen countries are planning

36 and mobilising funding to conduct such surveys (Figure 1).

37

38 In this paper, we describe the key notions that are measured using these TB patient cost surveys,  
39 notably the types of costs that are captured, and measures of the affordability of these costs in  
40 relation to household income, expressed as occurrence of catastrophic costs and impoverishment. We  
41 discuss the standard methods for measuring these concepts and how they have been adapted in the  
42 TB patient cost survey Handbook, and conclude by highlighting areas for consideration for those  
43 implementing TB patient cost surveys going forward.

44

## 45 **2. Defining economic burden for patients and households**

46 At the heart of the UHC paradigm, is the concept that families should not face undue financial hardship  
47 by accessing health care. This is referred to as financial protection, and it builds on the notion of  
48 affordability of care (13, 14).

49

50 WHO and the World Bank track financial protection through two indicators: high (or catastrophic)  
51 health spending and impoverishment (6). Catastrophic health spending quantifies the proportion of  
52 the population whose resources would be catastrophically reduced by spending on health care (15).  
53 When health care expenditures exceed a given percentage of available income (or expenditure  
54 capacity), they are considered “catastrophic”. The impoverishment approach estimates the  
55 proportion of the population that would be pushed below a defined poverty line due to seeking and  
56 receiving care (16). Generally, catastrophic spending and impoverishment rates are calculated using  
57 household level data captured through population-based surveys.

58

## 59 **3. Measuring catastrophic health spending**

60

61 When measuring catastrophic health spending, there are two key variables underlying this approach:  
62 a) total household out-of-pocket payments for health care (numerator, see sections 3.1 and 3.3); b) a  
63 measure of household resources (denominator, see section 3.2). A ratio of health care costs to a  
64 measure of ability to pay can then be generated (section 3.3), which is compared to a threshold  
65 (section 3.4).

66

### 67 **3.1. Measuring and valuing household costs**

68

69 While the UHC indicator uses household surveys to capture health care expenditures (medical costs)  
70 for all conditions, the TB indicator aims to capture instead the total economic burden related to one

71 diagnosed health condition only (TB). The UHC indicator focuses on direct out-of-pocket medical costs  
72 only.

73

74 TB patient cost surveys measure three types of cost: **direct medical costs, direct non-medical costs**  
75 **and income loss (indirect costs or opportunity costs)**. Direct medical costs represent the money  
76 actually spent out of pocket by the patient on medical services such as prescribed medications,  
77 consultation fees, hospitalisation and laboratory tests. These costs are the same as the direct medical  
78 costs measured in the UHC framework.

79

80 Patients (and their carer) often incur other direct costs associated with the utilisation of health care,  
81 such as transport costs to and from the health facility, costs for accommodation and food, which are  
82 referred to as **direct non-medical costs**. Direct costs are valued by asking patients to recall their actual  
83 expenditure.

84

85 When seeking care and when sick, individuals also incur costs associated with lost productivity due to  
86 illness/disability and time spent seeking care, or looking after a patient instead of working (i.e. carers).  
87 These opportunity costs are referred to as **indirect costs** in the End TB monitoring framework. Two  
88 approaches are typically employed to value indirect costs to households: the human capital approach  
89 and the output-based approach (17).

90

91 The human capital approach involves valuing an individual's time by multiplying the number of hours  
92 spent seeking and receiving care/caring for by their reported or estimated hourly wage rate(18). If  
93 based on reported income, this method can have equity concerns, as it then implicitly values the time  
94 of more productive (higher income) individuals more highly and doesn't take into account the value  
95 of time lost by individuals who are performing unpaid work or are unemployed or retired (19). This  
96 can be corrected by using a standard estimated income for these individuals (e.g. the mean for the  
97 lower quintiles based on national statistics or the minimum civil servant wage).

98

99 The output-based approach considers reported changes in income/production (20). This approach is  
100 recommended by WHO for settings predominately characterised by formal economies, where  
101 individuals can reliably report income in monetary terms.

102

103 WHO's generic instrument for TB patient cost surveys collects data that allows the valuation of both  
104 indirect costs using the human capital approach and the output-based approach (Table 2)(12). The

105 End TB Strategy indicator is generally computed based on the output-based approach, with the human  
106 capital approach used in sensitivity analysis. The reason for capturing these data in TB patient cost  
107 surveys is to encourage the valuation of TB-related indirect costs, as such evidence is currently limited  
108 (12, 21-23). Researchers to date have generally employed the human capital approach to value  
109 productivity losses associated with TB, with varying precision in the estimations of time and income.  
110 However, over one-third of studies included in one recent systematic review that presented indirect  
111 costs did not clearly explain the methods that were used to calculate them (24).

112

113 The economic burden of illness can be measured on the individual level, but it usually makes sense to  
114 look at the economic impact on the whole household especially since other household members also  
115 contribute to direct expenditures and may take time off work to care for the ill person or take their  
116 children out of school to contribute to the household income (25). The affordability of TB costs is also  
117 analysed at the household level due to the impact that TB potentially has on households, as we discuss  
118 below.

119

### 120 **3.2 Measuring ability to pay**

121 Ability to pay is usually measured in terms of income, consumption or expenditure. Income refers to  
122 earnings from employment and sale of assets and receipt of transfers. Consumption refers to spending  
123 on resources (goods and services) consumed by the household. Expenditure excludes consumption  
124 that is not based on market transactions (e.g. home production), and refers to goods or services  
125 purchased but not immediately consumed by the household. (26).

126

127 While reported income is the gold standard measure of ability to pay, in low-income settings, where  
128 employment is mainly outside the formal sector and income is hard to measure reliably, consumption  
129 expenditure is often believed to be a more valid measure of economic resources than income.  
130 However, both remain difficult and costly to collect (27-30).

131

132 In the UHC framework, consumption expenditure is often used rather than income to measure  
133 catastrophic expenditure and impoverishment (6). It can be argued that deducting food spending from  
134 consumption (non-food expenditure) can better capture a household's ability to pay for health  
135 expenditures (6). Alternatively, no deduction for necessities is made.

136

137 TB patient cost surveys capture either income or consumption expenditure or both. The TB indicator  
138 is computed using the measure of income that is more robust in the specific country setting. For

139 countries collecting more than one measure, the more robust will be used for main analysis and the  
140 alternative measures in sensitivity analysis.

141

### 142 **3.3 Generating a ratio of health care costs to a measure of ability to pay**

143 When computing catastrophic spending within the UHC monitoring framework, the numerator is  
144 restricted to direct medical costs (31), and does not measure direct non-medical and indirect costs, as  
145 UHC is mainly about moving towards progressive and equitable health care financing, and national  
146 financing schemes (tax or insurance-based) covering direct medical costs.

147

148 The End TB monitoring framework, on the other hand, is designed to also collect data that can guide  
149 policies on patient-centred service delivery models that can reduce both direct and indirect costs, as  
150 well as social protection schemes for income security and social support. A key element of innovation  
151 of the End TB Strategy “zero catastrophic costs” indicator is thus that the numerator comprises both  
152 direct medical, non-medical and indirect costs. In TB care, indirect costs have been found to account  
153 for a sizeable proportion of total costs (on average 60% of total costs (range: 16-94%) in low- and  
154 middle-income countries (32)), and therefore they are important elements to capture all care-related  
155 expenditures and the economic impact on TB patients from the onset of symptoms to the end of TB  
156 treatment. The denominator is further defined as annual household income or annual household  
157 consumption expenditure, as outlined in section 3.2 (33). The resulting ratio is then compared to the  
158 thresholds defined below to determine whether spending is catastrophic.

159

### 160 **3.4 Defining thresholds for catastrophic payments**

161 The catastrophic payment threshold is set as a proportion of income (i.e. households should not spend  
162 more than a pre-specified fraction of their income on health care). When a household’s healthcare  
163 payments exceed a pre-defined threshold, they are defined as catastrophic (15). The choice of the  
164 threshold is so far arbitrary. Various thresholds have been used in the literature: 10% (34), 15% (35)  
165 of household annual income, or 40% of household non-food expenditure (31, 36). WHO and World  
166 Bank now track catastrophic spending on the basis of out-of-pocket expenditures exceeding 10% or  
167 25% of household total income or consumption(6).

168

169 For global monitoring of the End TB Strategy “zero catastrophic costs” indicator, in 2017, WHO has  
170 chosen to use a threshold of 20% of annual household income (12), which was set through expert  
171 opinion voting in the task force. This is the threshold that is currently used by National TB Programmes  
172 (NTP) implementing TB patient cost surveys and which is annually reported to WHO (1, 37). Countries  
173 that are conducting national TB patient cost surveys are encouraged to undertake sensitivity analyses

174 whereby the 20% threshold is altered so that the proportion of patients facing catastrophic costs can  
175 be assessed at different thresholds, and potentially inform a review of the threshold in the future  
176 (Table 2).

177

178 The threshold can be used to help define two measures of catastrophic health spending, both in the  
179 UHC and End TB Strategy framework. The ***catastrophic payment headcount*** measures the incidence  
180 of catastrophic health care costs (i.e. the number (or fraction) of individuals who have been exposed  
181 to catastrophic expenses). The ***catastrophic payment gap*** (or excess) measure is used to assess the  
182 intensity or severity of catastrophic spending by looking at the extent to which health care costs  
183 exceed the pre-defined threshold (15) (Table 2).

184

185 The proportion of patients incurring catastrophic costs due to TB is derived from the number of TB  
186 patients with catastrophic costs divided by the number of all TB patients treated at facilities linked to  
187 a national TB programme. This means that the sampling frame is notified patients on treatment rather  
188 than all people with TB in the community, or households in a country. This is for practical reasons since  
189 the only available sampling frame is notified TB patients, and household surveys would require a large  
190 sample size in order to include a sufficient number of prevalent TB cases.

191

#### 192 **4. Measuring impoverishment**

193 An additional measure of the affordability of care used for UHC monitoring is ***impoverishment***, or  
194 whether health care costs push households into poverty (or deeper into poverty). In this case, the  
195 threshold is absolute and set in terms of a poverty line. If health care payments cause household  
196 income/consumption expenditure to fall below the poverty line, they are considered “impoverishing”.  
197 The widely used international dollar-a-day poverty line proposed by the World Bank to allow  
198 international comparability, was replaced by USD 1.25-a-day in 2009, at 2005 purchasing power parity  
199 (38). Countries also have their own national poverty lines which may be relevant for comparing  
200 impoverishment over time within a country.

201

202 The ***incidence of impoverishment*** measures the increase in poverty due to health care spending. The  
203 ***poverty gap*** is the short-fall from the poverty line. While these are not included in the End TB Strategy  
204 monitoring, countries can include them in the analyses of TB patient cost surveys. Table 1 provides a  
205 summary of the key measures presented in this section and Section 3.4.

206

207

#### 208 **5. Towards zero families facing catastrophic costs due to TB: areas for consideration**



209

210 The End TB Strategy target is a first important step in broadening the concept and measurement of  
211 affordability to account not only for medical costs but also for the broader economic impact of TB,  
212 including non-medical and indirect costs.

213

214 However, as illustrated above, the application of the concepts and standard methods of financial  
215 protection warrants further development in the End TB Strategy. The WHO recently published a  
216 handbook based on the experiences and data from the first round of surveys between 2016 and 2017,  
217 which provides comprehensive guidance for conducting facility-based cross-sectional surveys to  
218 assess TB patient costs (12). This would benefit from periodic methodological updates based on multi-  
219 country analyses of survey findings and strengthened collaboration with health economists, NTPs and  
220 policy makers. These updates include: methods for calculating confidence intervals for key survey  
221 indicators, adjusted for the sampling design; a regression-based approach for imputing missing costs;  
222 recommendations on the design of a household expenditure questionnaire (to derive a household  
223 income measure based on expenditure); adaptation of the survey instrument to high-income settings.

224

225 There are a number of areas for consideration for those implementing TB patient cost surveys going  
226 forward, including: descriptive analyses of costs that unpack direct medical and non-medical costs,  
227 and indirect costs, as they can provide valuable information to identify entry points for appropriate  
228 policies and interventions to minimise these costs; using both the human capital and the output-based  
229 approach to value indirect costs for comparison and correlation; measuring and comparing income  
230 and consumption expenditure to compute financial protection measures. Additional approaches and  
231 metrics to the standard End TB Strategy framework methodology include: measuring impoverishment,  
232 computing the catastrophic payment gap, and sensitivity analyses with different percentages of  
233 income thresholds (Table 2).

234

235 Finally, it is important to bear in mind that the cross-sectional study design for a TB patient cost survey  
236 recommended by WHO inevitably focuses on the economic consequences of TB by using a measure  
237 at one point in time, and therefore it fails to capture the long-term economic consequences of the  
238 disease for the household, including the impact on reduced labour supply and productivity, and  
239 household resilience. Coping mechanisms were originally explored as part of the development of the  
240 TB indicator as deemed to be potentially less labour intensive to collect and easier to integrate in  
241 routine surveillance. However, as coping mechanisms are different in different cultures and societies,  
242 it'd be difficult to consider them as a proxy for catastrophic payments.

243

244 Several research studies are now ongoing that have adapted the WHO generic protocol to a  
245 longitudinal design, including for long-term follow up after TB treatment. These studies will be helpful  
246 for the validation and interpretation of cross-sectional TB patient cost survey data. Separate studies  
247 of non-notified TB patients, e.g. in private care, are required to measure costs in situation where user  
248 charges for clinical care are often higher than in facilities linked to NTPs. Yet other studies sampling  
249 people with TB who are not under treatment at the time of the study are needed as the current  
250 methodology only includes TB patients who are successfully staying in care. Such studies can be  
251 conducted in the context of tracing patients who are lost to follow up (e.g. initial loss to follow up or  
252 loss to follow-up during treatment) by reconnecting them with treatment and explore reasons for loss  
253 to follow up. Assessing costs incurred by such patients may shed light on costs related to the disease  
254 and disability that are not linked to care seeking, and costs of living with TB without getting proper  
255 care.

256

## 257 **Conclusions**

258

259 In this paper, we have described economic burden and affordability concepts and measurements that  
260 underlie the End TB Strategy indicator of “zero catastrophic costs” due to TB, and have highlighted the  
261 novel elements of this indicator in relation to approaches used in the UHC monitoring framework.  
262 Further findings from national surveys, multi-country analyses and research using alternative  
263 approaches will be important in providing further evidence to refine metrics and methodology for  
264 country-level implementation and global monitoring.

265

266 The conventional concepts and measurement of “financial protection” of the UHC monitoring  
267 framework have been taken a step forward in the End TB Strategy to ensure metrics are able to  
268 capture the total economic burden of TB on patients and families. This approach has the potential to  
269 inform the design of financing and implementation of both health care and social protection policies  
270 that aim to prevent both direct and indirect costs of care, and ultimately ensure that TB care is truly  
271 affordable for TB patients.

272

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277

## 278 **Conflict of interest**

279 The authors declare that they have no conflict of interest.

## References

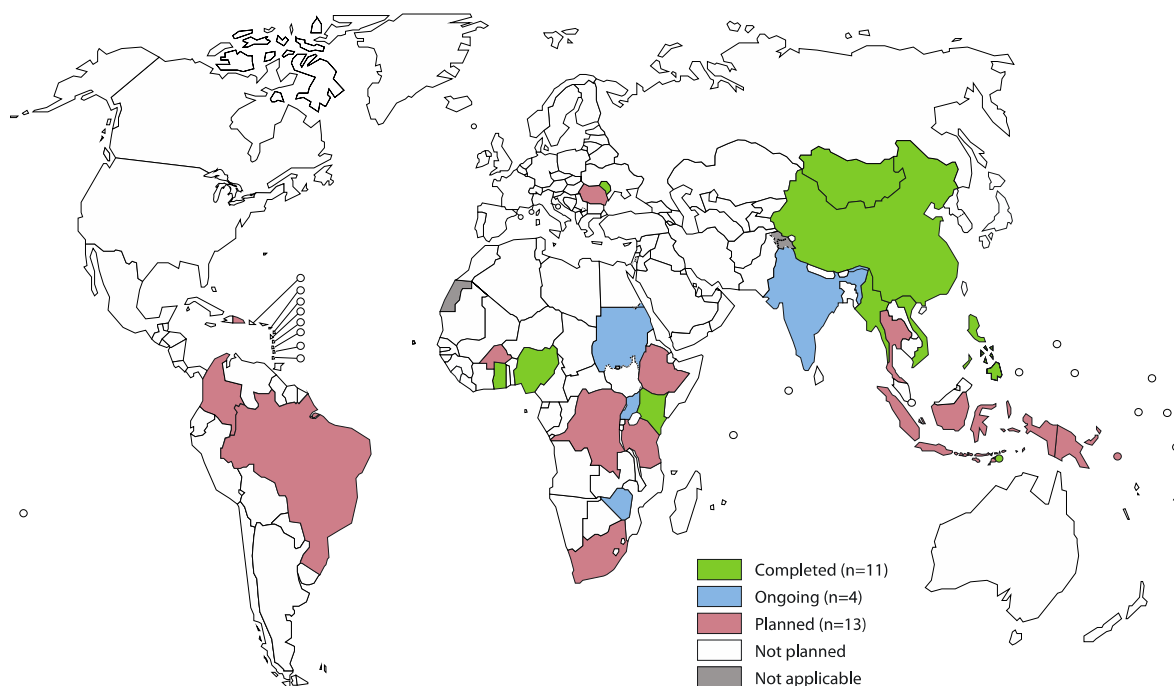
1. World Health Organization. Global Tuberculosis Report 2016. 2017.
2. Dubos RJ, Dubos J. The white plague: tuberculosis, man, and society: Rutgers University Press; 1952.
3. McIntyre D, Garshong B, Mtei G, Meheus F, Thiede M, Akazili J, et al. Beyond fragmentation and towards universal coverage: insights from Ghana, South Africa and the United Republic of Tanzania. *Bulletin of the World Health Organization*. 2008;86(11):871-6.
4. Ukwaja KN, Alobu I, Lgwenyi C, Hopewell PC. The high cost of free tuberculosis services: patient and household costs associated with tuberculosis care in Ebonyi State, Nigeria. *PLoS one*. 2013;8(8):e73134.
5. Mauch V, Bonsu F, Gyapong M, Awini E, Suarez P, Marcelino B. Free tuberculosis diagnosis and treatment are not enough: patient cost evidence from three continents. *The international journal of tuberculosis and lung disease : the official journal of the International Union against Tuberculosis and Lung Disease*. 2013;17.
6. World Health Organization. Tracking Universal Health Coverage. Washington, DC: World Health Organization; 2017.
7. Tanimura T, Jaramillo E, Weil D, Raviglione M, Lönnroth K. Financial burden for tuberculosis patients in low- and middle-income countries: a systematic review. *The European respiratory journal*. 2014;43.
8. Lönnroth K, Glaziou P, Weil D, Floyd K, Uplekar M, Raviglione M. Beyond UHC: monitoring health and social protection coverage in the context of tuberculosis care and prevention. *PLoS medicine*. 2014;11.
9. Uplekar M, Weil D, Lönnroth K, Jaramillo E, Lienhardt C, Dias HM. WHO's new End TB Strategy. *Lancet*. 2015;385.
10. Lönnroth K, Glaziou P, Weil D, Floyd K, Uplekar M, Raviglione M. Beyond UHC: Monitoring Health and Social Protection Coverage in the Context of Tuberculosis Care and Prevention. *PLoS medicine*. 2014;11(9):e1001693.
11. KNCV Tuberculosis Foundation. Tool to estimate patients' costs. The Netherlands: 2008.
12. World Health Organization. Tuberculosis patient cost surveys: a handbook. Geneva, Switzerland 2017.
13. McIntyre DI, Thiede M, Birch S. Access as a policy-relevant concept in low- and middle-income countries. *Health Economics, Policy and Law*. 2009;4(2):179-93.
14. 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? *Social science & medicine (1982)*. 2006;62.
15. Wagstaff A, Doorslaer E. Catastrophe and impoverishment in paying for health care: with applications to Vietnam 1993–1998. *Health Econ*. 2003;12.
16. Niëns L. Affordability in Health Care: Operationalizations and Applications in Different Contexts [Ph.D. thesis]: Erasmus University Rotterdam; 2014.
17. Drummond MF, McGuire A. Economic evaluation in health care: merging theory with practice: OUP Oxford; 2001.
18. World Health Organization. Protocol for survey to determine direct and indirect costs due to TB and to estimate proportion of TB-affected households experiencing catastrophic total costs due to TB

[http://www.who.int/tb/advisory\\_bodies/impact\\_measurement\\_taskforce/meetings/tf6\\_backgroud\\_5a\\_patient\\_cost\\_surveys\\_protocol.pdf](http://www.who.int/tb/advisory_bodies/impact_measurement_taskforce/meetings/tf6_backgroud_5a_patient_cost_surveys_protocol.pdf)2015 [

19. Lensberg BR, Drummond MF, Danchenko N, Despiégl N, François C. Challenges in measuring and valuing productivity costs, and their relevance in mood disorders. *ClinicoEconomics and Outcomes Research: CEOR*. 2013;5:565-73.
20. World Health Organization. WHO guide to identifying the economic consequences of disease and injury; 2009. Geneva: WHO Available from URL: [http://www/who.int/choice/publications/discussion\\_papers/en/index.html](http://www/who.int/choice/publications/discussion_papers/en/index.html) (Accessed 4 June 2010).
21. Foster N, Vassall A, Cleary S, Cunnam L, Churchyard G, Sinanovic E. The economic burden of TB diagnosis and treatment in South Africa. *Social science & medicine* (1982). 2015;130:42-50.
22. Mauch V, Woods N, Kirubi B, Kipruto H, Sitienei J, Klinkenberg E. Assessing access barriers to tuberculosis care with the tool to Estimate Patients' Costs: pilot results from two districts in Kenya. *BMC Public Health*. 2011;11:43.
23. 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. *The international journal of tuberculosis and lung disease*. 2003;7(9):S56-S62.
24. Laurence YV, Griffiths UK, Vassall A. Costs to Health Services and the Patient of Treating Tuberculosis: A Systematic Literature Review. *PharmacoEconomics*. 2015;33(9):939-55.
25. 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. *The American journal of tropical medicine and hygiene*. 2004;71(2 Suppl):147-55.
26. ILO. Household income and expenditure statistics. Geneva: International Labour Organization, 2003.
27. Galobardes B, Shaw M, Lawlor DA, Lynch JW, Davey Smith G. Indicators of socioeconomic position (part 1). *Journal of Epidemiology and Community Health*. 2006;60(1):7-12.
28. Howe LD, Galobardes B, Matijasevich A, Gordon D, Johnston D, Onwujekwe O, et al. Measuring socio-economic position for epidemiological studies in low- and middle-income countries: a methods of measurement in epidemiology paper. *International Journal of Epidemiology*. 2012;41(3):871-86.
29. Galobardes B, Shaw M, Lawlor DA, Lynch JW, Davey Smith G. Indicators of socioeconomic position (part 2). *Journal of Epidemiology and Community Health*. 2006;60(2):95-101.
30. O'Donnell O, van Doorslaer, Eddy, Wagstaff, Adam, Lindelow, Magnus. *Analyzing Health Equity Using Household Survey Data: World Bank Institute Development Studies*; 2007.
31. Ke X. *Distribution of health payments and catastrophic expenditures methodology*. Geneva: WHO Discussion Paper No. 2. 2005.
32. Tanimura T, Jaramillo E, Weil D, Raviglione M, Lönnroth K. Financial burden for tuberculosis patients in low-and middle-income countries: a systematic review. *European Respiratory Journal*. 2014;43(6):1763-75.
33. Ataguba JE, Akazili J, McIntyre D. Socioeconomic-related health inequality in South Africa: evidence from General Household Surveys. *Int J Equity Health*. 2011;10:48.

34. Ranson MK. Reduction of catastrophic health care expenditures by a community-based health insurance scheme in Gujarat, India: current experiences and challenges. *Bulletin of the World Health Organization*. 2002;80(8):613-21.
35. Wyszewianski L. Financially catastrophic and high-cost cases: definitions, distinctions, and their implications for policy formulation. *Inquiry*. 1986:382-94.
36. Kawabata K, Xu K, Carrin G. Preventing impoverishment through protection against catastrophic health expenditure. *Bulletin of the World Health Organization*. 2002;80(8):612.
37. World Health Organization. Tuberculosis country profiles <http://www.who.int/tb/country/data/profiles/en/2017> [
38. Ravallion M, Chen S, Sangraula P. Dollar a Day Revisited. *The World Bank Economic Review*. 2009;23(2):163-84.
39. Saksena P, Hsu J, Evans DB. Financial risk protection and universal health coverage: evidence and measurement challenges. *PLoS medicine*. 2014;11(9):e1001701.

**Figure 1:** Global implementation of tuberculosis patient cost surveys following the World Health Organization methodology, as of July 2018.



Source: WHO Global TB Programme, July 2018

**Table 1:** Summary of key measures of catastrophic health spending and impoverishment for general UHC monitoring.

1. Concept of catastrophic health expenditure: key indicators	
Indicator	What it is measuring
Catastrophic payment headcount (or incidence of catastrophic health expenditure)	Proportion of households in a population who face catastrophic health expenditure
Catastrophic payment gap (or excess or mean positive catastrophic overshoot)	Percentage points by which household spending on health exceeds the threshold for catastrophic health expenditure
2. Concept of impoverishment due to health spending: key indicators	
Indicator	What it is measuring
Incidence of impoverishment	Proportion of households in a population who fall into poverty due to health care spending
Poverty gap (or increase in the depth of poverty)	Percentage points by which a household falls further into poverty due to health care spending

Source: Adapted from Saksena et al 2014 (39).

**Table 2:** Summary of recommended and additional approaches, metrics and valuation methods for TB patient cost surveys based on the World Health Organization methodology (12).

Approach/valuation method/metric			Recommended	Additional
Costs	Direct	Cost disaggregation (medical/non-medical)	•	
	Indirect	Human capital approach	•	
		Output-related approach	•	
Measure of living standard	Income	Reported individual and household income pre and post-TB diagnosis	•	
		Asset-based income	•	
	Consumption expenditure		•	
Measures of financial protection	Catastrophe	Catastrophic Payment Headcount	•	
		Catastrophic payment gap		•
	Impoverishment	Incidence of impoverishment		•
		Depth of poverty		•
Threshold	Catastrophe	20% threshold	•	
		Sensitivity analysis with different percentages of income threshold	•	
	Impoverishment	International poverty lines (e.g. USD 1.25-a-day in 2005 PPPs)		•
		National/locally defined relevant poverty lines		•