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Does Ghana's National Health Insurance Scheme provide financial protection to tuberculosis patients and their households?

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ABSTRACT

Financial barriers are a key limitation to accessing health services, such as tuberculosis (TB) care in resource-poor settings. In Ghana, the National Health Insurance Scheme (NHIS), established in 2003, officially offers free TB care to those enrolled. Using data from the first Ghana's national TB patient cost survey, we address two key questions 1) what are the key determinants of costs and affordability for TB-affected households, and 2) what would be the impact on costs for TB-affected households of expanding NHIS to all TB patients?

We reported the level of direct and indirect costs, the proportion of TB-affected households experiencing catastrophic costs (defined as total TB-related costs, i.e., direct and indirect, exceeding 20% of their estimated pre-diagnosis annual household income), and potential determinants of costs, stratified by insurance status. Regression models were used to determine drivers of costs and affordability. The effect of enrolment into NHIS on costs was investigated through Inverse Probability of Treatment Weighting Analysis.

Higher levels of education and income, a bigger household size and an multi-drug resistant TB diagnosis were associated with higher direct costs. Being in a low wealth quintile, living in an urban setting, losing one's job and having MDR-TB increased the odds of experiencing catastrophic costs. There was no evidence to suggest that enrolment in NHIS defrayed medical, non-medical, or total costs, nor mitigated income loss. Even if we expanded NHIS to all TB patients, the analyses suggest no evidence for any impact of insurance on medical cost, income loss, or total cost.

An expansion of the NHIS programme will not relieve the financial burden for TB-affected households. Social protection schemes require enhancement if they are to protect TB patients from financial catastrophe.

1. Introduction

Universal health coverage (UHC) means that people should receive the health services they need without risking financial hardship (World Health Organization, 2017a). Globally, at least half of the world's population still do not have access to effective and affordable health care (World Health Organization, 2017a). Tuberculosis (TB), one of the tracer indicators to monitor progress towards UHC in terms of coverage of essential health services (World Health Organization, 2017a), is a classic disease of poverty and the world's deadliest infection (World Health Organization, 2019).

In line with the Sustainable Development Goals (SDGs) and policy efforts towards achieving UHC (Lönnroth and Raviglione, 2016), the World Health Organization's (WHO) End TB Strategy calls for multi-sectoral interventions that address social and economic development, and that span beyond the TB sector to complement the biomedical response to the TB epidemic. Nested in its vision of "zero suffering" from the disease, the Strategy aims to prevent TB-affected households from incurring catastrophic costs due to TB (Uplekar et al., 2015). To this end, based on available evidence, WHO developed a methodology and

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instrument to rigorously measure the magnitude, nature and drivers of TB-related costs (World Health Organization, 2017b).

Financial barriers are a key limitation to accessing health services in low- and middle-income countries (LMICs), where health sector financing is often characterised by out-of-pocket payments (user fees) for the individual and limited prepayment mechanisms (e.g. taxation, health insurance) (McIntyre et al., 2008). Generally, basic TB diagnosis and care are officially offered free of charge to presumptive TB cases and TB patients, often financed through special vertical funding mechanisms, that supplement domestic resources. Yet, the TB care pathway remains long and complex, and consequently implies various risks of excessive financial burden on households and patients. The direct and indirect costs associated with TB care seeking often lead to financial distress and impoverishment among low-income households (Tanimura et al., 2014) (Table 1). The reasons for the substantial cost burden for TB are still not fully understood and documented, but it is possible that TB patients pay for services in the private sector, or they may have to pay for adjuvant medicines, hospitalisation or unofficial fees (Tanimura et al., 2014).

One approach that many countries have adopted to protect their populations from the costs of care seeking, is the introduction of national health insurance schemes. Such schemes typically start by enrolling the formal sector, and involve compulsory pre-payment of premiums by beneficiaries which are often matched by employers. The informal sector can sometimes opt in to such schemes. Health insurance can improve equity, expand access, and enhance quality of care, and it has also been found to reduce the likelihood of occurrence of catastrophic health expenditure and provide financial protection (Buigut et al., 2015; Xu et al., 2003; Habib et al., 2016; Spaan et al., 2012; Acharya et al., 2012). An increasing number of African countries are implementing national insurance schemes as a means to provide financial protection against out-of-pocket expenditure and, ultimately, achieve UHC (McIntyre et al., 2006). As many of these countries have a high TB burden, their national TB programmes (NTPs) are starting to consider the relevance of national health insurance for their operations (Wells et al., 2019).

Table 1
Patient cost and social protection: key terminology and definitions used in this paper.

	Definition	Examples
Direct medical cost	The money actually spent out of pocket by the patient on medical services	Consultation fees, prescribed medications, hospitalisation and laboratory tests
Direct non-medical cost	Direct costs associated with the utilisation of health care	Transport costs to and from the health facility, and costs for accommodation and food
Indirect cost (or opportunity cost)	Costs associated with lost productivity due to illness/disability and time spent seeking care, or looking after a patient instead of working	
Catastrophic cost	Total TB-related costs (direct and indirect) incurred by a household exceeding 20% of their pre-disease annual household income	
Catastrophic health expenditure	The UHC indicator that measures health care expenditures (direct out-of-pocket medical costs) for all conditions. In this paper, this indicator is computed using direct medical costs related to TB care, and it is also referred to as "conservative".	
Social protection	A set of initiatives that secure protection aimed at preventing or alleviating poverty, livelihood risks and social exclusion	–
Social insurance or Social security	An initiative to provide transfers to households in the event of adverse economic events, conditional on prior contributions and participation in the labour market	Sickness benefits, unemployment benefits, disability benefits and survivor's benefits
Social health insurance	A form of social insurance. Health insurance schemes with public stewardship and at least some insurance premium contributions from the insured	Ghana (National Health Insurance Scheme); The Philippines (PhilHealth); Kenya (National Hospital Insurance Fund)

Ghana was the first country in sub-Saharan Africa to introduce a National Health Insurance Scheme (NHIS) in 2003. NHIS covers both formal and informal sector workers. Currently, about 40% of Ghana's population is enrolled with a valid membership card (Kusi et al., 2015). Children under 18 years of age constituted the largest proportion (46.5%) of active NHIS members, followed by the informal sector (33.6%) (National Health Insurance, 2013). Beneficiaries can obtain healthcare from all public healthcare providers, faith-based, and private health facilities that have been accredited and operate under contract with the National Health Insurance Authority (NHIA). The benefit package covers about 95% of reported health problems, including TB (Nguyen et al., 2011). Table 2 provides an overview of the main features of NHIS.

Through either NHIS, government or donor funds, TB care is intended to be free of charge to every individual at every level of service delivery in Ghana, i.e. direct payments for medical costs are supposed to be reduced to zero, regardless of whether someone is insured or not. Yet, strikingly the first nationwide cost survey conducted in 2016 among TB patients at health facilities within the NTP's network across Ghana (described elsewhere) found that 64.1% (95% confidence interval: 60.5–67.6%) of TB patients cannot afford TB care (Pedrazzoli et al., 2018): total costs incurred due to an episode of TB (US$ 455) were three times greater than the reported average monthly household income (US $ 144.6), and they were significantly higher for patients with multi-drug resistant (MDR) TB (US$ 659), who require a longer treatment compared to drug-susceptible patients (World Health Organization, 2019). Medical and non-medical costs (e.g. transport and food) represented 18.5% and 47.4% of total costs respectively, while income loss accounted for the remaining 34.1%. About two-thirds (64.1%) of TB patients faced costs deemed catastrophic, defined as total TB-related costs (medical and non-medical costs, and income loss) exceeding 20% of annual household income (World Health Organization, 2017b).

Few studies assessed the impact of NHIS on out-of-pocket health expenditure in Ghana, and showed that the scheme has a protective effect against the financial burden of health care among the general population (Kusi et al., 2015; Nguyen et al., 2011). One study found that NHIS had a protective (although non-significant) effect on the cost of malaria treatment incurred by patients (Dalaba et al., 2014). To our knowledge, no study so far has looked at the impact of health insurance on costs and affordability of TB care in Ghana nor elsewhere.

The WHO End TB Strategy has formally recognised social protection strategies such as health insurance as a key instrument for preventing TB affected households from experiencing financial hardship (Lonnroth et al., 2014). However, evidence on this potential remains limited, thus preventing the swift translation of these recommendations into policy. Given the high coverage of NHIS and the availability of data on cost and affordability of TB care on a nationally representative population sample, Ghana is therefore a good case study to examine whether the strides made towards UHC translate into financial protection for TB patients.

The present paper aims to answer two key questions about TB patient costs and enrolment in the NHIS: 1) what are the key drivers of costs and catastrophic costs for TB-affected households, and 2) if NHIS is a driver, what would be the expected changes in experienced costs of expanding

Table 2
Summary of the current main features and operational principles of the NHIS.

Feature	Description
Stated mission	"To ensure equitable universal access for all residents of Ghana to an acceptable quality of essential health services without out-of-pocket payment being required at the point of service use" (Ghana Ministry of Health, 2004a).
Membership	All Ghanaians, from both the formal and informal sectors, are in principle required to enrol
Funding	• 2.5% VAT. • 2.5% SSNIT contribution. • Money allocated to the NHIF by Parliament. • Income from investments. • Premium from non-SSNIT contributors, registration and administrative fees. • Donations from non-governmental organisation and individuals.
Benefit package	• 95% of diseases reported in health facilities in Ghana are covered, including a wide range of outpatient services with associated drugs and lab tests, inpatient care, treatment of cervical and breast cancers, basic oral health services, eye care, maternal care, and all emergency conditions. • No coinsurance, co-payment, or deductible is required at the point of service.
Premium	Non-SSNIT contributors are expected to pay an income adjusted premium of between GH₵22 (about US$10) and GH₵48 (about US$22) per adult per annum.
Exemptions from paying premium	• People over age 70 • Children under 18 whose parents both enrol • The "core poor," defined as being unemployed with no visible source of income, no fixed residence, and not living with someone employed and with a fixed residence. • All pregnant women (since July 2008). • Mentally challenged individuals (since 2012).
Administration	• DHISs are centrally administered by the NHIA but day-to-day administration is decentralised to the districts. • NHIA functions as the insurer; provides NHIS cards and accreditation to service providers, negotiates benefit packages, cost of care, ensures quality service and pays service providers.
Supervision	• The NHIA regulates premium and registration fees. • Health facilities submit quarterly reports to the NHIA. • DHISs submit annual reports to the NHIA who audits their accounts.
Payment to service providers	- Payment to service providers within four weeks of claim submission to DHISs.

Abbreviations: DHISs, district health insurance schemes; NHIA, National Health Insurance Authority; VAT, value added tax; SSNIT, Social Security and National Insurance Trust; NHIF, National Health Insurance Fund; NHIS, National Health Insurance Scheme; NHIF, National Health Insurance Fund.

the national health insurance scheme to all TB patients?

2. Methods

2.1. Study population and design

To approach these questions, this cross-sectional study used data from the above mentioned 2016 Ghana's national survey of costs faced by TB patients. Detailed methods are described elsewhere (Pedrazzoli et al., 2018). Using an adapted and expanded version of the WHO TB patient cost tool (World Health Organization, 2017b), the survey collected information on the clinical, demographic and socio-economic characteristics of respondents, as well as on the final TB-related costs incurred by them throughout the entire TB episode (i.e., the period of time from "self-reported onset of TB-related symptoms", until end of treatment or death). These costs included direct medical (consultation fees, drugs, laboratory tests) and non-medical (e.g. transport and food) costs, and indirect costs or income loss (the time lost by a patient seeking and receiving care). Indirect costs were estimated using the output-related approach, by which indirect costs were estimated through changes in household annual income pre and post-TB diagnosis (World Health Organization, 2009), thus measuring the effect of TB on income. Respondents were also asked about enrolment in the NHIS.

2.2. Descriptive analysis

We compared the total incurred costs (disaggregated by medical costs, non-medical costs, and income loss) and the proportion of TB-affected households experiencing catastrophic costs across the insured and the uninsured. We also compared the characteristics of the insured and uninsured on variables that are likely to be associated with cost. Potential determinants examined were age, sex, education level, occupation, job loss, place of residence, household income quintile, presence of MDR-TB, place of diagnosis, retreatment status, and enrolment in NHIS.

Consistent with the approach adopted by WHO for the 'zero TB-affected families facing catastrophic costs due to TB' indicator, costs were defined as 'catastrophic' if a household incurred total TB-related costs (direct and indirect) exceeding 20% of their estimated pre-diagnosis annual household income (World Health Organization, 2017b). As health insurance is intended to mainly offset/defray direct medical costs, we also computed the catastrophic health expenditure indicator used for UHC monitoring, which only includes direct medical expenditure in the numerator. We assessed differences in costs, experience of catastrophic costs, and potential determinants of costs (listed above) using chi-square and two-sample Wilcoxon Rank Sum tests. In descriptive analyses we examine both the median and mean cost.

2.3. Determinants of cost and affordability

We sought to determine determinants of costs and affordability through the use of linear and logistic regression models.

Six outcome variables and six corresponding regression models were fit. Linear regression was used to examine drivers of total cost, medical cost, non-medical cost, and income loss, while logistic regression was used to examine drivers of catastrophic costs and expenditure. Cost data are often right skewed and left censored (zeros) and thus may violate the assumption of normality required for standard linear regression techniques (Basu and Manning, 2009). A logarithmic transform is often suggested as a method for handling skewed data but the resulting estimate is not interpretable as a mean cost, even with back-transformation. The number of zero costs in the data also are suggestive that a log transformation is unlikely to be a suitable model (Fig. 1). We thus fit three gamma-distributed generalised linear models with a log link as

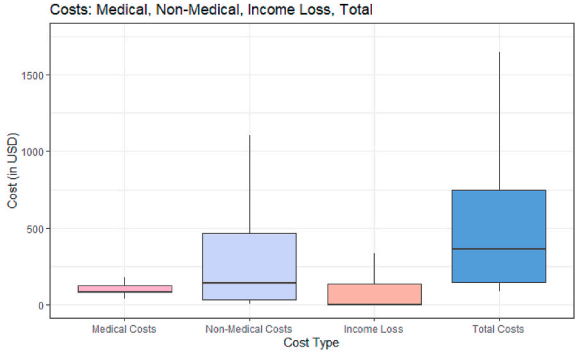

Fig. 1. Costs incurred by TB patients by type of cost – boxplots and violin plots. *These plots inform the rationale for fitting the gamma models in addition to the linear models; they also show that non-medical costs are the biggest contributors to total costs.*

alternative estimators of total cost, medical cost, non-medical cost and income loss to account for the right skew of data. Gamma models were not fit for income loss models due to the presence of a large number of zeros in the data which is not compatible with a gamma model. In the inferential analysis, we model the means instead of the median and skew is accounted for in the parametric assumptions of the model.

2.4. Impact of NHIS on cost

To measure the effect of NHIS on costs, we used propensity score weighting (Austin and Stuart, 2015). We considered enrolment into NHIS as the main exposure on each of the six cost and affordability outcomes.

A logistic regression model was fit to predict the propensity score. The propensity score is the probability of being enrolled in the NHIS given a set of covariates, regardless of whether an individual was actually enrolled or not. We then weighted participants using the inverse of their propensity to be enrolled with the intention of creating a pseudo-population theoretically balanced on their measured covariates (Figs. 2 and 3). In the weighted sample, we calculated the difference in mean costs and the difference in the proportions experiencing catastrophic costs between the insured and uninsured, the average treatment effect (ATE).

Analyses were run in STATA 13.0 (StataCorp, College Station, TX) and R v3.4.1 (ipw package) for the Inverse Probability of Treatment Weighting (IPTW) analysis.

3. Results

3.1. Descriptive analysis

Among survey participants, 46.0% were enrolled in the NHIS at the time of TB diagnosis. A further 35.5% enrolled after diagnosis, and the remaining 18.5% were uninsured throughout the duration of their anti-TB treatment.

The characteristics of patients who were insured and of those who were not did not differ significantly overall, although insured patients were more likely to be older, female, and to live in an urban area (Table 3). The characteristics of individuals who were insured at the time of diagnosis and of those who enrolled in NHIS afterwards did not present significant differences, although patients in the first group were more likely to be slightly younger and to be drug-sensitive (Appendix Table A1).

There was no difference in total costs between insured and uninsured patients, but mean medical costs were higher for insured patients. Patients who were already insured at the time of diagnosis incurred mean

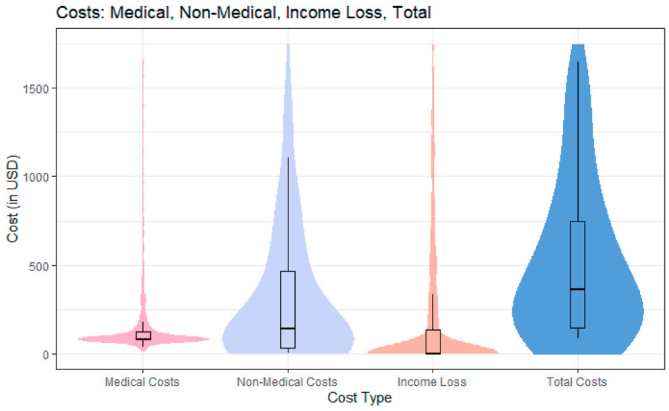

Fig. 2. Overlap in estimated propensity scores between TB patients enrolled in NHIS and those not enrolled, demonstrating good overlap on the propensity score.

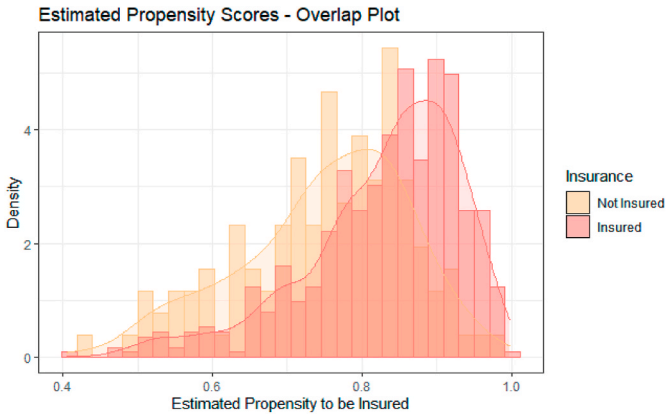

Fig. 3. Change in mean difference in the matched and unmatched groups for each variable. *A smaller difference indicates improved balance between groups; being below the threshold of 0.1 is conservatively considered to be effectively balanced. Balance has been largely improved by matching though some imbalance remains on the urban/rural variable and on the high income variable.*

medical costs before TB diagnosis that were lower compared to the costs of patients who got insured afterwards (mean: US$ 29.3; median (IQR): US$ 26.7 (26.7–26.7) *vs*. mean: US$ 45.4; median (IQR): US$ 26.7 (26.7–27.7) (*P-value* = 0.0002) (Appendix Table A1). The differences in means but similarity in medians suggests that there is a difference in the overall distribution of costs by insurance status, with a set of insured individuals who were insured after diagnosis experiencing particularly high costs. A breakdown of medical costs, by insurance status, can be found in Table A2.

3.2. Determinants of cost and affordability

After adjusting for other relevant variables, there was weak evidence of an association between being a woman and higher medical, non-medical, and total cost. Having a high income was associated with an approximate doubling of non-medical cost, as well as an increase in medical costs, income loss, and total costs. Patients who had been at primary and secondary school incurred nearly 2.5 times higher non-medical and total costs compared to those without education. Those living in an urban area compared to those residing in rural areas experienced a near doubling in non-medical cost (Table 4). Job loss increased income loss by just above US$200, and total costs by just above US$300 (see Appendix Table A3). Larger households had increased medical, non-medical, and total costs compared to smaller households. Having MDR-TB nearly doubled medical, non-medical and total costs. Being a patient experiencing retreatment was also associated with increased non-medical and total costs compared to newly diagnosed patients, suggesting about an additional US$400 of total costs (Appendix Table A3).

Regardless of which of the two measures of catastrophic costs we considered, higher incomes were associated with decreased odds of experiencing catastrophic costs due to TB. Living in an urban environment, losing one's job, and having MDR-TB increased the odds of experiencing catastrophic costs with both definitions. Working in the informal sector or being unemployed reduced the odds of catastrophic costs when using the End TB strategy calculation, while being HIV positive reduced the odds of catastrophic expenditure when using the conservative calculation (Table 5).

3.3. Impact of NHIS on cost

There was no evidence to suggest that enrolment in health insurance defrayed medical, non-medical, or total costs, nor mitigated income loss (Table 6). The marginal effect, interpreted as the difference in mean cost if all individuals in the study had been insured compared to if no

Table 3
Costs incurred during a TB episode, and potential determinants of cost stratified by exposure status.

	Uninsured	Insured	*p-value*
Total (N; % of sample)	128 (19%)	562 (81%)	
Incurred Costs (mean; median (IQR) in USD)			
Total Costs	896; 437 (148–888)	901; 457 (162–1079)	0.66
Medical Costs	133; 83 (83–101)	142; 83 (83–129)	0.03
Non-Medical Costs	454; 151 (31–518)	438; 152 (37–533)	0.74
Income Loss	309; 0 (0–253)	321; 0 (0–202)	0.85
Catastrophic Cost (N experiencing; %)			
Experience of Catastrophic Cost	75 (59%)	367 (65%)	0.15
Experience of Conventional Catastrophic Cost	56 (44%)	282 (50%)	0.19
Potential Drivers of Cost			
Age (median; IQR)	36 (27–45)	42 (30–53)	0.002
Sex (male), N (%)	101 (79%)	364 (65%)	0.002
Education Level, N (%)			
No Education	14 (11%)	122 (22%)	0.05
Primary School	29 (23%)	101 (18%)	
Secondary School/High School	78 (61%)	314 (56%)	
University and Higher	6 (4%)	24 (4%)	
Job Sector, N (%)			
Formal Sector	17 (13%)	86 (15%)	0.36
Informal Sector	75 (59%)	288 (51%)	
Unemployed	31 (24%)	171 (30%)	
Don't Know/No Answer	2 (2%)	15 (3%)	
Job loss (following TB), N (%)	51 (40%)	232 (41%)	0.77
Urban/Rural Place of Residence (urban), N (%)	80 (63%)	411 (73%)	0.03
Household Income Quintile, N (%)			
Low	26 (20%)	135 (24%)	0.90
Low-Middle	30 (24%)	118 (21%)	
Middle	19 (15%)	87 (15%)	
High-Middle	28 (22%)	115 (20%)	
High	25 (20%)	107 (19%)	
MDR-TB (MDR), N (%)	8 (6%)	57 (10%)	0.17
HIV status, N (%)			
Positive	23 (18%)	106 (19%)	0.42
Negative	91 (71%)	371 (66%)	
Unknown	14 (11%)	85 (15%)	
Place of Diagnosis, N (%)			
Teaching Hospital (tertiary)	5 (4%)	20 (4%)	0.01
Regional Hospital (secondary)	12 (9%)	86 (15%)	
District-level Hospital (primary)	79 (62%)	331 (59%)	
Health Center/CHPS Zone (primary)	22 (17%)	44 (8%)	
NGO/Charitable Centre or Hospital/Mission	7 (5%)	50 (9%)	
Private Clinic or Hospital	3 (2%)	28 (5%)	
Household size (median; IQR)	5 (3-11)	4 (6-11)	
Retreatment Status (retreated), N (%)	11 (9%)	60 (11%)	0.47

individuals had been insured, also suggested there was no impact of insurance on medical cost, income loss, or total cost. The analyses suggest that if all TB patients were to be covered with insurance, compared with none, we might expect a mean reduction in non-medical cost of about US$126 (95% CI: -US$33, US$285). Given median non-medical costs are US$152, it is plausible that this mean reduction in costs is largely driven by those who experience higher-than-average costs. The estimated reduction in total costs, however, was smaller than the estimated reduction in non-medical costs and there was little statistical evidence against the null hypothesis of no reduction in total costs.

There was no evidence that the odds of experiencing catastrophic costs would be affected were all TB patients enrolled in health insurance versus not enrolled in health insurance.

4. Discussion

Our study advances the literature on financial protection for TB patients by investigating determinants of costs and affordability for TB-affected households, and by looking at the potential impact of expanding enrolment of TB patients in the NHIS.

Drivers for experiencing catastrophic costs are consistent with those found in other studies (Fuady et al., 2018; Ministry of Health, 2018), and our findings suggest that it is the poorest patients, who have lost their job due to their disease, who are most at risk of confronting financial catastrophe (as defined in the End TB strategy).

Indirect costs for individuals who are unemployed may have been underestimated, which may have resulted in these patients being less likely to incur catastrophic costs, as observed in other studies (Muniyandi et al., 2020).

Patients undergoing treatment for MDR-TB are also more likely to incur catastrophic costs due to the longer duration of treatment. In Ghana, all MDR-TB patients are supposed to benefit from an "enablers' package" which provides them with cash, transport vouchers and/or nutritional support, according to their needs. Evidence on the effectiveness and acceptability of uptake of this intervention by the population is limited (Nortey et al., 2009). Less than a quarter of the MDR-TB patients in our study reported that they received vouchers or goods in kind from the health facility, and this should be further investigated.

In Ghana, the impact of NHIS on household's out-of-pocket payments for health care has been studied quite extensively since its inception (Kusi et al., 2015). This literature does not relate specifically to TB-affected households, and, to our knowledge, our study is the first assessment of the effect of a state-supported health insurance scheme on financial protection of TB patients. Our analyses indicate that the NHIS in its current form is not effective in reducing TB patient cost, and will therefore not protect TB affected households from incurring catastrophic costs due to TB. The marginal association between NHIS and non-medical costs observed in the IPTW analysis suggests a potential impact of non-medical costs but the causal mechanism behind this drop is unclear, as expected impacts should be on mitigating medical costs. One possible explanation could be that individuals who are not insured tend to travel further to a public provider, while individuals who are insured benefit from a greater choice of providers, including private providers, and therefore may not need to travel as far, thus incurring less transport costs (Fiestas Navarrete et al., 2019). We note that while we observed a clear reduction in non-medical costs from NHIS coverage, the estimated mean reduction in total costs was smaller, despite the data demonstrating that non-medical costs make up a large proportion of total cost.

The lack of evidence suggesting that enrolment in the NHIS defrayed medical costs, possibly explains findings from the survey that medical expenditures are still substantial and constitute 18.2% of the total costs incurred by patients, despite the majority (81%) of patients being covered by NHIS. Such medical expenditures include payments for TB diagnostic procedures not covered by the TB programme or NHIS, such as chest radiography (Pedrazzoli et al., 2016), and for co-morbidities (e.g. liver function test), and ancillary drugs (Nguyen et al., 2011) (Appendix Table A2). There is anecdotal evidence that drug stock-outs at public health facilities sometimes have forced patients to buy medications from private providers. In addition, insured patients can still be asked to pay unofficial fees or make cash payments at NHIS accredited health facilities, for example for unapproved prescribed medicines (Kusi et al., 2015; Kotoh et al., 2018; Agyepong and Nagai, 2011).

Health insurance is one of the key strategies to mitigate the financial hardship faced by TB-affected households, and particularly medical expenditure (Tanimura et al., 2014; Lönnroth et al., 2014). Findings from the national TB patient cost survey have stimulated policy action to eliminate financial catastrophe for TB and MDR-TB patients in Ghana, and led to the decision of the Ghana National Health Service and National Health Insurance Authority to enrol all TB patients in the NHIS

Table 4
Results of gamma GLM model - medical, non-medical and total cost.

	Medical Cost		Non-Medical Cost		Total Cost	
Mean Cost (SD)	141 (181)		441 (792)		900 (1343)	
Median Cost (IQR)	83 (83–124)		152 (36–528)		450 (159–1057)	
	Adjusted Coef. (95%CI)	***P-value***	**Adjusted Coef. (95%CI)**	***P-value***	**Adjusted Coef. (95%CI)**	***P-value***
Gender: Female (vs Male)	1.21 (1.01, 1.45)	0.032	1.31 (0.99, 1.43)	0.054	1.19 (0.95, 1.48)	0.099
Age (per year)	1 (1, 1.01)	0.174	1 (0.99, 1.78)	0.443	1 (0.99, 1.01)	0.990
Education: (vs No Education)						
Primary School	0.83 (0.65, 1.07)	0.149	2.42 (1.6, 3.66)	<0.001	1.55 (1.15, 2.09)	0.004
Secondary School/High School	1.03 (0.83, 1.26)	0.809	2.43 (1.72, 3.38)	<0.001	1.56 (1.21, 1.98)	0.004
University and Higher	1.13 (0.73, 1.79)	0.592	1.88 (0.99, 3.87)	0.073	1.14 (0.7, 1.93)	0.626
Urban: Urban (vs Rural)	1.03 (0.85, 1.24)	0.754	1.92 (1.4, 2.59)	<0.001	1.41 (1.12, 1.75)	0.002
Household Wealth: (vs Lowest Income)						
Low Income	1.07 (0.85, 1.35)	0.565	1.45 (0.98, 2.14)	0.050	1.36 (1.02, 1.8)	0.029
Middle Income	1.16 (0.89, 1.5)	0.272	1.27 (0.83, 1.97)	0.249	1.49 (1.09, 2.06)	0.010
High Income	1.28 (1.01, 1.63)	0.045	1.78 (1.19, 2.66)	0.003	2.05 (1.53, 2.75)	<0.001
Highest Income	1.39 (1.08, 1.8)	0.01	2.05 (1.35, 3.14)	<0.001	4.07 (2.98, 5.57)	<0.001
Job Loss: Job Loss (vs No Job Loss)	0.98 (0.83, 1.15)	0.753	1.19 (0.92, 1.57)	0.164	1.28 (1.06, 1.55)	0.010
Job Type: (vs Informal Sector)						
Formal Sector	1.17 (0.93, 1.5)	0.186	0.88 (0.61, 1.29)	0.502	0.79 (0.61, 1.05)	0.1001
Unemployed	1 (0.84, 1.21)	0.97	1.29 (0.95, 1.78)	0.0778	1.03 (0.82, 1.29)	0.77927
Don't Know/No Answer	0.9 (0.58, 1.47)	0.643	0.98 (0.49, 2.26)	0.964	0.65 (0.39, 1.18)	0.117
# Household Members (per member)	1.01 (1, 1.02)	0.089	1.02 (1, 1.04)	0.023	1.01 (1, 1.02)	0.095
Place of Diagnosis: (vs District Level Hospital (Primary))						
Teaching Hospital (Tertiary)	1.24 (0.84, 1.93)	0.302	0.74 (0.4, 1.53)	0.367	0.77 (0.49, 1.29)	0.280
Regional Hospital (Secondary)	1.14 (0.91, 1.44)	0.273	1.07 (0.75, 1.58)	0.699	1.2 (0.91, 1.59)	0.190
Health Centre/CHPS Zone (Primary)	0.84 (0.63, 1.13)	0.238	0.91 (0.58, 1.49)	0.700	1 (0.71, 1.43)	0.994
NGO/Charitable Health Centre or Hospital/Mission	0.93 (0.7, 1.25)	0.607	1.19 (0.74, 1.99)	0.451	1.11 (0.79, 1.6)	0.550
Private Clinic/Hospital	1.28 (0.89, 1.93)	0.205	0.94 (0.53, 1.84)	0.850	1.2 (0.77, 1.95)	0.438
HIV Status (vs HIV Negative)						
HIV Positive	1.05 (0.85, 1.29)	0.658	0.88 (0.64, 1.24)	0.453	0.98 (0.77, 1.26)	0.863
Unknown Status	0.95 (0.75, 1.21)	0.662	0.92 (0.64, 1.36)	0.665	0.96 (0.73, 1.28)	0.794
Drug Resistance: MDR (vs No MDR)	1.31 (0.99, 1.76)	0.053	2.24 (1.47, 3.56)	<0.001	1.74 (1.27, 2.45)	<0.001
TB Retreatment: Retreatment (vs No Retreatment)	1.11 (0.86, 1.45)	0.419	1.61 (1.06, 2.52)	0.021	1.45 (1.07, 1.98)	0.016
Health Insurance: Insured (vs Not Insured)	0.99 (0.8, 1.21)	0.922	1.03 (0.73, 1.41)	0.878	1.04 (0.81, 1.31)	0.758

Values highlighted in light blue colour indicate determinants that are associated with costs in the Gamma model at an arbitrary threshold of $p < 0.10$.
Values highlighted in green indicate determinants that are significantly associated with costs in the Linear model.

free of charge, under the category of indigent people (Pedrazzoli et al., 2019). However, were all TB patients enrolled in the NHIS (in its current form), our analyses suggest no evidence for any impact of insurance on medical cost, income loss, or total cost.

The new policy, which explicitly targets TB, should be rigorously evaluated. The exemption of indigent TB patients from paying the NHIS premium recognises the financial burden caused by TB, and is an important step to ensure all TB patients are covered by the NHIS, but further research is needed to assess to what extent the premium is a barrier to enrolment. It is plausible that if the premium is not subsidised, it remains unaffordable for households who may not be living below the official poverty line, though are still facing financial hardship (van der Wielen et al., 2018; Asuming, 2013). Further, even for individuals who are officially classified as indigent, official exemptions were found to be largely non-functional, preventing access to the poor (Nyonator and Kutzin, 1999; Akazili et al., 2014).

Future studies should investigate the reasons why the NHIS in its current form is not effective in defraying costs for TB patients in order to inform options and future reforms of the scheme. For example, we could argue that NHIS may have a greater effect on costs if coverage among the general population was higher, as it could encourage a more direct patient journey to public health facilities, given that 38.5% of patients in Ghana seek care at private facilities according to the 2013 TB prevalence survey. In our study, although pre-diagnosis costs only accounted for 7.0% of total costs (Pedrazzoli et al., 2018), individuals who enrolled in NHIS only after diagnosis had higher pre-diagnosis costs (medical, non-medical costs, and income loss) compared to those who were already enrolled. Were they enrolled in NHIS because they are indigent or because of expanded coverage, arguably these costs may be lower, and so would be the overall costs incurred by patients. In addition, most TB patients, whose majority belong to the poorest segments of society, could benefit from NHIS prior to being diagnosed with TB, thus reducing diagnostic delays and possibly the severity of the disease.

Mechanisms to refer indigent TB patients identified through NHIS to patient/social support should also be considered. Non-medical costs and income loss accounted for the largest proportion of total costs. Only four (0.6%) of patients in our study were enrolled in the Livelihood Empowerment Against Poverty (LEAP), the national cash transfer programme to extremely poor households (Figure A1). This calls for the establishment and enhancement of social protection measures integrated with TB care, for example by making TB one of the eligibility criteria for LEAP. At the time of writing, discussions between Ghana's NTP and the Ministry of Gender, Children and Social Protection in this regard were ongoing.

Many of these considerations are not specific to TB but apply to many other conditions, and are conducive to ensuring a functional and enhanced health system as countries strive towards UHC. However, as TB is both a critical public health threat and a tracer indicator to monitor progress towards UHC (World Health Organization, 2017a), it can act as a powerful driver for improving TB financing and ensuring financial protection for TB patients.

The main limitation of our study lies in the nature of the cross-sectional data from the national TB patient cost survey that we used for our analyses. These data and their limitations have been discussed elsewhere (Pedrazzoli et al., 2018). For example, it was not possible to perform further disaggregated analyses comparing costs for individuals who enrolled before TB diagnosis and for those who were already enrolled due to insufficient power. In addition, this survey was designed to assess the level and nature of costs incurred by TB patients, and was not designed to specifically assess the impact of enrolment of NHIS on affordability of TB care. However, we employed a weighting approach to control for confounding, which requires fewer assumptions about the

Table 5
Results of logistic models – catastrophic costs.

Proportion Experiencing Catastrophic Cost	Catastrophic Cost			Catastrophic Cost - Conservative		
	64%			49%		
	Crude OR (95%CI)	Adjusted OR (95%CI)	*P-value*	Crude OR (95%CI)	Adjusted OR (95%CI)	*P-value*
Gender: Female (vs Male)	1.29 (0.92,1.82)	1.11 (0.74,1.64)	0.616	1.55 (1.12,2.14)	1.3 (0.87,1.94)	0.198
Age (per year)	1.005 (0.9954,1.0146)	1 (0.9892,1.011)	0.998	1.0008 (0.9917,1.01)	0.9955 (0.9845,1.0067)	0.431
Education: (vs No Education)						
Primary School	0.79 (0.48,1.33)	1.09 (0.61,1.94)	0.771	0.91 (0.56,1.48)	1.35 (0.76,2.41)	0.311
Secondary School/High School	0.82 (0.53,1.25)	1.19 (0.74,1.92)	0.47	0.84 (0.56,1.24)	1.5 (0.93,2.42)	0.096
University and Higher	0.43 (0.19,0.96)	1.07 (0.43,2.69)	0.88	0.55 (0.24,1.25)	2.1 (0.81,5.47)	0.128
Urban: Urban (vs Rural)	1.25 (0.88,1.77)	1.71 (1.12,2.59)	0.012	1.16 (0.83,1.63)	1.86 (1.21,2.86)	0.005
Household Wealth: (vs Lowest Income)						
Low Income	0.2 (0.11,0.36)	0.18 (0.1,0.34)	<0.001	0.2 (0.12,0.35)	0.17 (0.1,0.31)	<0.001
Middle Income	0.18 (0.1,0.34)	0.16 (0.08,0.31)	<0.001	0.15 (0.09,0.27)	0.11 (0.06,0.2)	<0.001
High Income	0.14 (0.08,0.26)	0.12 (0.06,0.23)	<0.001	0.13 (0.07,0.22)	0.09 (0.05,0.16)	<0.001
Highest Income	0.13 (0.07,0.24)	0.11 (0.06,0.22)	<0.001	0.05 (0.03,0.09)	0.03 (0.02,0.06)	<0.001
Job Loss: Job Loss (vs No Job Loss)	1.62 (1.17,2.24)	1.87 (1.3,2.69)	<0.001	1.31 (0.97,1.79)	1.52 (1.06,2.19)	0.023
Job Sector: (vs Informal)						
Formal	0.7 (0.44,1.1)	0.7 (0.42,1.17)	0.17	1.1 (0.71,1.72)	1.24 (0.73,2.11)	0.424
Unemployed	0.9 (0.63,1.3)	0.89 (0.59,1.34)	0.586	1.24 (0.88,1.76)	1.35 (0.89,2.05)	0.153
Don't Know/No Answer	0.45 (0.19,1.1)	0.4 (0.15,1.06)	0.065	1.02 (0.42,2.47)	1.24 (0.44,3.44)	0.684
# Household Members (per member)	1.0032 (0.9819,1.0249)	1.0063 (0.9826,1.0305)	0.606	1.01 (0.99,1.03)	1.02 (1,1.05)	0.067
Place of Diagnosis: (vs District Level Hospital (Primary))						
Teaching Hospital (Tertiary)	0.72 (0.32,1.63)	0.79 (0.33,1.9)	0.603	0.72 (0.32,1.64)	0.87 (0.34,2.22)	0.773
Regional Hospital (Secondary)	1.35 (0.83,2.17)	1.26 (0.74,2.15)	0.387	1.33 (0.85,2.07)	1.23 (0.73,2.07)	0.439
Health Centre/CHPS Zone (Primary)	1.13 (0.65,1.98)	1.37 (0.71,2.66)	0.349	1.27 (0.75,2.16)	1.67 (0.85,3.26)	0.136
NGO/Charitable Health Centre or Hospital/ Mission	0.78 (0.44,1.37)	0.65 (0.34,1.23)	0.185	0.97 (0.56,1.7)	0.93 (0.47,1.82)	0.827
Private Clinic/Hospital	0.98 (0.45,2.11)	1.29 (0.56,2.96)	0.546	0.83 (0.39,1.75)	1.55 (0.66,3.66)	0.319
HIV Status (vs HIV Negative)						
HIV Positive	0.99 (0.65,1.49)	0.84 (0.53,1.34)	0.469	0.82 (0.55,1.21)	0.65 (0.41,1.05)	0.08
Unknown Status	0.67 (0.43,1.05)	0.7 (0.42,1.17)	0.172	0.64 (0.41,1.01)	0.69 (0.4,1.19)	0.18
Drug Resistance: MDR (vs No MDR)	1.6 (0.9,2.86)	2.09 (1.1,3.97)	0.025	1.97 (1.16,3.37)	3.13 (1.66,5.91)	<0.001
TB Retreatment: Retreatment (vs No Retreatment)	1.56 (0.9,2.71)	1.32 (0.72,2.41)	0.365	1.54 (0.93,2.53)	1.32 (0.73,2.39)	0.358
Health Insurance: Insured (vs Not Insured)	1.34 (0.9,1.98)	1.27 (0.81,1.98)	0.293	1.31 (0.88,1.93)	1.21 (0.76,1.91)	0.424

Values highlighted in green indicate determinants that are significantly associated with catastrophic costs or catastrophic health expenditure ("conservative").

Table 6
Results of propensity score weighting.

Cost in USD	Observed Mean Cost Uninsured	Observed Mean Cost Insured	Observed Mean Cost Difference	Predicted Mean Cost (All Uninsured)	Predicted Mean Cost (All Insured)	Average Treatment Effect (Risk Difference)	95% CI
Medical Cost	133.6	143.4	9.8	147.45	140.84	−6.61	(-43.64, 30.43)
Non-Medical Cost	460.1	436.8	−23.3	561	434.97	−126.03	(-285.04, 32.98)
Income Loss	314.39	321.63	7.24	288.7	318.62	29.92	(-165.48, 225.33)
Total Cost	908.5	902.19	−6.31	997	894.28	−102.72	(-368.15, 162.71)
	Observed Proportion Experiencing CCs Uninsured	**Observed Proportion Experiencing CCs Insured**	**Observed Catastrophic Cost OR**	**Predicted Mean Proportion (All Uninsured)**	**Predicted Mean Proportion (All Insured)**	**Average Treatment Effect (Odds Ratio)**	**95% CI**
Conventional Catastrophic Cost	59%	66%	1.34	60%	65%	1.19	(0.78, 1.80)
Conservative Catastrophic Cost	44%	50%	1.31	47%	50%	1.12	(0.75, 1.67)

data compared to a traditional parametric methodology (Rosenbaum and Rubin, 1983; Austin, 2011), and is more robust to estimate treatment effects using observational data (Austin and Stuart, 2015). Specifying the appropriate model for examining drivers of cost is challenging given the distribution of cost data and the zero-inflation in the income loss variable, though both linear and gamma models provide results that are similarly interpreted.

Finally, the aim of a TB patient cost survey should not only be to measure costs but also to lead to interventions and policy changes that help reduce or mitigate these costs; therefore, it is essential that existing and new initiatives to reduce costs and improve access to care are evaluated. While we acknowledge that our results are context and design specific, our study serves as an example of how TB patient cost surveys can drive policy change, and how assessing the most relevant and feasible interventions that can improve affordability of care, should be integral to this process. As a growing number of TB patient cost surveys

are being planned (World Health Organization, 2019), their potential to inform policy and practice should be fully harnessed, and investigators should take full advantage of this opportunity when designing their study.

5. Conclusions

Our analyses show that an expansion of Ghana's NHIS programme to all people with TB will not relieve the financial burden for TB-affected households. Even in countries with well-established state-supported health insurance schemes and free TB care policies such as Ghana, addressing poverty and inequality through enhancing social protection coverage is key to effectively improve access and provide financial protection to people affected by TB.

Credit author statement

DP Conceptualisation, Methodology, Investigation, Formal analysis, Writing - Original Draft, Writing - Review & Editing, Visualization. DC Writing - Original Draft, Methodology, Formal analysis, Data curation, Writing - Review & Editing, Visualization. JB Conceptualisation, Methodology, Formal analysis, Writing - Original Draft. SL Methodology, Writing - Original Draft. DB Conceptualisation, Methodology, Writing - Original Draft, Supervision. RH Funding acquisition, Supervision, Writing - Original Draft, Writing - Review & Editing.

Declarations of competing interest

None.

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Appendix A

Table A1
Costs incurred and potential determinants of cost stratified by exposure status pre-TB diagnosis.

	Insured after TB diagnosis	Insured at time of TB diagnosis	*p-value*
Total (N; % of sample)	197 (35.5%)	358 (64.5%)	–
Incurred Costs before diagnosis (mean; median (IQR) in USD)			
Medical Costs	45; 27 (27–28)	29; 27 (27-27)	0.00
Non-Medical Costs	4; 2.9 (2.9–2.9)	3; 2.9 (2.9–2.9)	0.03
Income Loss	11; 2.2 (0.86–5)	4.7; 1.6 (0.6–3.6)	0.02
Incurred Costs after diagnosis (mean; median (IQR) in USD)			
Medical Costs	126; 74 (56–108)	97; 66 (56–74)	0.07
Non-Medical Costs	510; 230 (51–627)	388; 114 (27–408)	0.01
Income Loss	735; 199 (79–479)	496; 129 (56–318)	0.01
Total Costs	992; 572 (207–1342)	847; 412 (145–964)	0.01
Catastrophic Cost (N experiencing; %)			
Experience of Catastrophic Cost	132 (67%)	230 (64%)	0.51
Experience of Conventional Catastrophic Cost	106 (54%)	172 (48%)	0.19
Potential Drivers of Cost			
Age (median; IQR)	43 (30–52.5)	42 (29–53)	0.002
Sex (male), N (%)	133 (68%)	224 (63%)	0.413
Education Level, N (%)			
No Education	45 (23%)	77 (22%)	0.23
Primary School	29 (15%)	70 (19%)	
Secondary School/High School	117 (60%)	193 (54%)	
University and Higher	5 (2%)	18 (5%)	
Job Sector, N (%)			
Formal Sector	29 (15%)	55 (15%)	0.07
Informal Sector	113 (57%)	173 (49%)	
Unemployed	48 (24%)	121 (34%)	
Don't Know/No Answer	7 (4%)	7 (2%)	
Urban/Rural Place of Residence (urban), N (%)	151 (76.6%)	255 (71.6%)	0.20
Household Income Quintile, N (%)			
Low	37 (19%)	97 (27%)	0.17
Low-Middle	41 (21%)	76 (21%)	
Middle	31 (16%)	56 (16%)	
High-Middle	43 (22%)	68 (19%)	
High	45 (23%)	61 (17%)	
MDR-TB (MDR), N (%)	32 (16%)	25 (7%)	0.00
Household size (median; IQR)	7 (4–12)	6 (4–10)	0.12

Table A2
Medical cost components by insurance status

Medical cost component	Uninsured	Insured	*p-value*
	mean; median (IQR) in USD	mean; median (IQR) in USD	
Chest radiography	23.2; 10.3 (0–44.7)	18.8; 10.3 (0–24.1)	0.86
Consultation fees	4.9; 0 (0–3.8)	4.0; 0 (0–2.6)	0.75
Drugs	72.5; 19.8 (0–92.4)	66.9; 10.7 (0–65.1)	0.50

(*continued on next page*)

Table A2 (*continued*)

Medical cost component	Uninsured	Insured	*p-value*
	mean; median (IQR) in USD	mean; median (IQR) in USD	
Laboratory tests	42.6; 20.6 (3.4–62.0)	21.7; 6.9 (0–20.6)	0.03
Other	29.0; 0 (0–20.6)	8.8; 0 (0–6.4)	0.41

Table A3
Results of OLS model – all types of cost.

	Medical Cost		Non-Medical Cost		Income Loss		Total Cost	
Mean Cost (SD)	141 (181)		441 (792)		318 (1004)		900 (1343)	
Median Cost (IQR)	83 (83–124)		152 (36–528)		0 (0–202)		450 (159–1057)	
	Linear		**Linear**		**Linear**		**Linear**	
	Adjusted Coef. (95%CI)	***P-value***	**Adjusted Coef. (95% CI)**	***P-value***	**Adjusted Coef. (95% CI)**	***P-value***	**Adjusted Coef. (95% CI)**	***P-value***
Gender: Female (vs Male)	32.36 (1.04,63.68)	0.043	93.37 (−38.65,225.38)	0.165	−75.32 (−235.14,84.49)	0.355	50.4 (−161.66,262.47)	0.641
Age (per year)	0.57 (−0.31,1.45)	0.204	0.47 (−3.23,4.16)	0.805	−1.95 (−6.43,2.53)	0.393	−0.92 (−6.86,5.03)	0.762
Education: (vs No Education)								
Primary School	−26.91 (−72.16,18.34)	0.243	219.04 (28.34,409.73)	0.024	−16.95 (−247.8,213.9)	0.885	175.18 (−131.15,481.51)	0.262
Secondary School/High School	6.87 (−30.74,44.49)	0.72	227.39 (68.87,385.92)	0.005	−67.04 (−258.95,124.87)	0.493	167.23 (−87.43,421.88)	0.198
University and Higher	13.74 (−64.71,92.18)	0.731	196.52 (−134.08,527.11)	0.244	−182.54 (−582.76,217.67)	0.371	27.71 (−503.36,558.78)	0.918
Urban: Urban (vs Rural)	1.16 (−32.09,34.4)	0.946	175.74 (35.64,315.85)	0.014	45.04 (−124.57,214.65)	0.602	221.94 (−3.13,447)	0.053
Household Wealth: (vs Lowest Income)								
Low Income	7.75 (−34,49.5)	0.716	79.81 (−96.15,255.77)	0.373	48.24 (−164.77,261.25)	0.657	135.8 (−146.85,418.46)	0.346
Middle Income	14.41 (−31.8,60.61)	0.541	55.72 (−139.02,250.46)	0.574	84.79 (−150.96,320.54)	0.48	154.92 (−157.91,467.75)	0.331
High Income	35.33 (−7.81,78.48)	0.108	184.16 (2.33,365.98)	0.047	202.71 (−17.41,422.82)	0.071	422.2 (130.12,714.28)	0.005
Highest Income	55.96 (10.7,101.21)	0.015	216.77 (26.04,407.49)	0.026	1059.27 (828.38,1290.16)	<0.001	1331.99 (1025.61,1638.37)	<0.001
Job Loss: Job Loss (vs No Job Loss)	−6.01 (−34.46,22.44)	0.678	92.74 (−27.15,212.64)	0.129	219.54 (74.4,364.67)	0.003	306.27 (113.67,498.86)	0.002
Job Type: (vs Informal Sector)								
Formal Sector	31.28 (−10.98,73.55)	0.147	−30 (−208.12,148.12)	0.741	−206.28 (−421.91,9.35)	0.061	−205 (−491.13,81.13)	0.16
Unemployed	0.14 (−32.26,32.55)	0.993	72.59 (−63.98,209.16)	0.297	−153.05 (−318.38,12.27)	0.07	−80.32 (−299.7,139.06)	0.472
Don't Know/No Answer	−32.59 (−114.63,49.45)	0.436	175.85 (−169.91,521.61)	0.318	−466.67 (−885.24,-48.1)	0.029	−323.41 (−878.83,232.01)	0.253
# Household Members (per member)	1.6 (−0.31,3.5)	0.1	10.82 (2.8,18.84)	0.008	−0.46 (−10.17,9.25)	0.925	11.95 (−0.93,24.83)	0.069
Place of Diagnosis: (vs District Level Hospital (Primary))								
Teaching Hospital (Tertiary)	22.99 (−50.52,96.5)	0.539	−45.88 (−355.67,263.9)	0.771	−190.36 (−565.39,184.66)	0.319	−213.26 (−710.89,284.38)	0.4
Regional Hospital (Secondary)	13.93 (−27.02,54.87)	0.504	93.86 (−78.72,266.43)	0.286	105.42 (−103.49,314.33)	0.322	213.2 (−64.02,490.42)	0.131
Health Centre/CHPS Zone (Primary)	−20.96 (−72.62,30.7)	0.426	−41.9 (−259.62,175.82)	0.706	4.19 (−259.38,267.76)	0.975	−58.67 (−408.42,291.07)	0.742
NGO/Charitable Health Centre or Hospital/Mission	−12.88 (−64.1,38.33)	0.621	36.37 (−179.48,252.21)	0.741	−102.32 (−363.62,158.97)	0.442	−78.84 (−425.57,267.89)	0.655
Private Clinic/Hospital	33.53 (−35.54,102.6)	0.341	−55.87 (−346.96,235.21)	0.706	464.33 (111.95,816.72)	0.01	441.99 (−25.61,909.59)	0.064
HIV Status (vs HIV Negative)								
HIV Positive	2.11 (−34.66,38.89)	0.91	−96.01 (−251,58.99)	0.224	174.82 (−12.81,362.45)	0.068	80.92 (−168.05,329.9)	0.524
Unknown Status	−14.93 (−57.5,27.64)	0.491	−106.72 (−286.12,72.68)	0.243	115.9 (−101.27,333.08)	0.295	−5.74 (−293.93,282.44)	0.969
Drug Resistance: MDR (vs No MDR)	58.37 (9.27,107.47)	0.02	425.9 (218.98,632.83)	<0.001	52.5 (−198,303)	0.681	536.77 (204.37,869.17)	0.002
TB Retreatment: Retreatment (vs No Retreatment)	21.2 (−24.55,66.95)	0.363	217.01 (24.19,409.84)	0.027	162.2 (−71.23,395.63)	0.173	400.41 (90.66,710.16)	0.011
Health Insurance: Insured (vs Not Insured)	−3.4 (−39.75,32.94)	0.854	−60.52 (−213.7,92.66)	0.438	11.04 (−174.4,196.48)	0.907	−52.89 (−298.96,193.19)	0.673

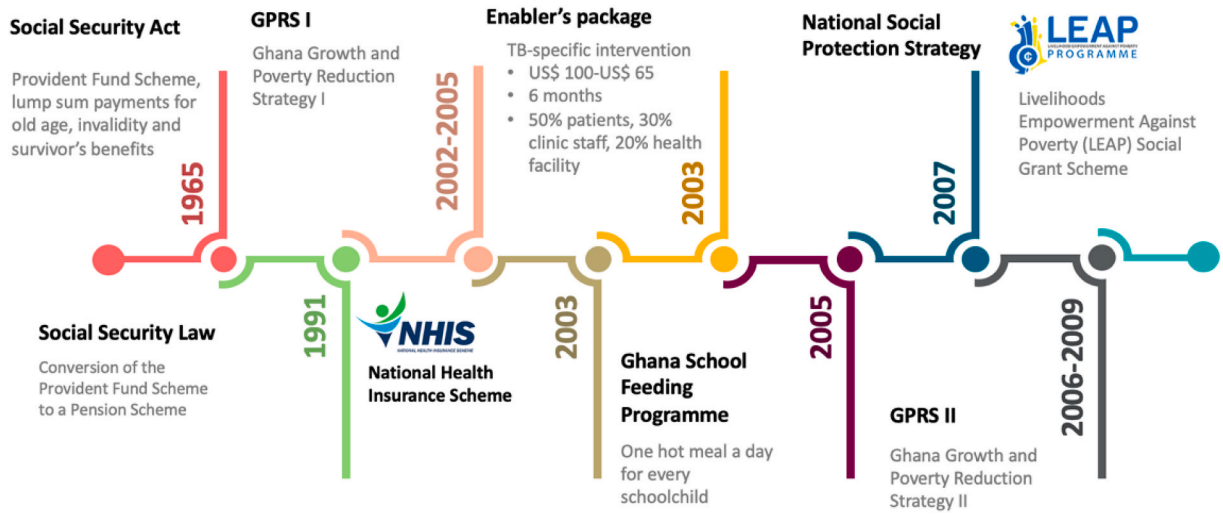

Fig. A1. Social protection landscape in Ghana at a glance.

Appendix B. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.socscimed.2021.113875.

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