Examining Approaches to Estimate Catastrophic TB-Related Costs in South Africa

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Introduction

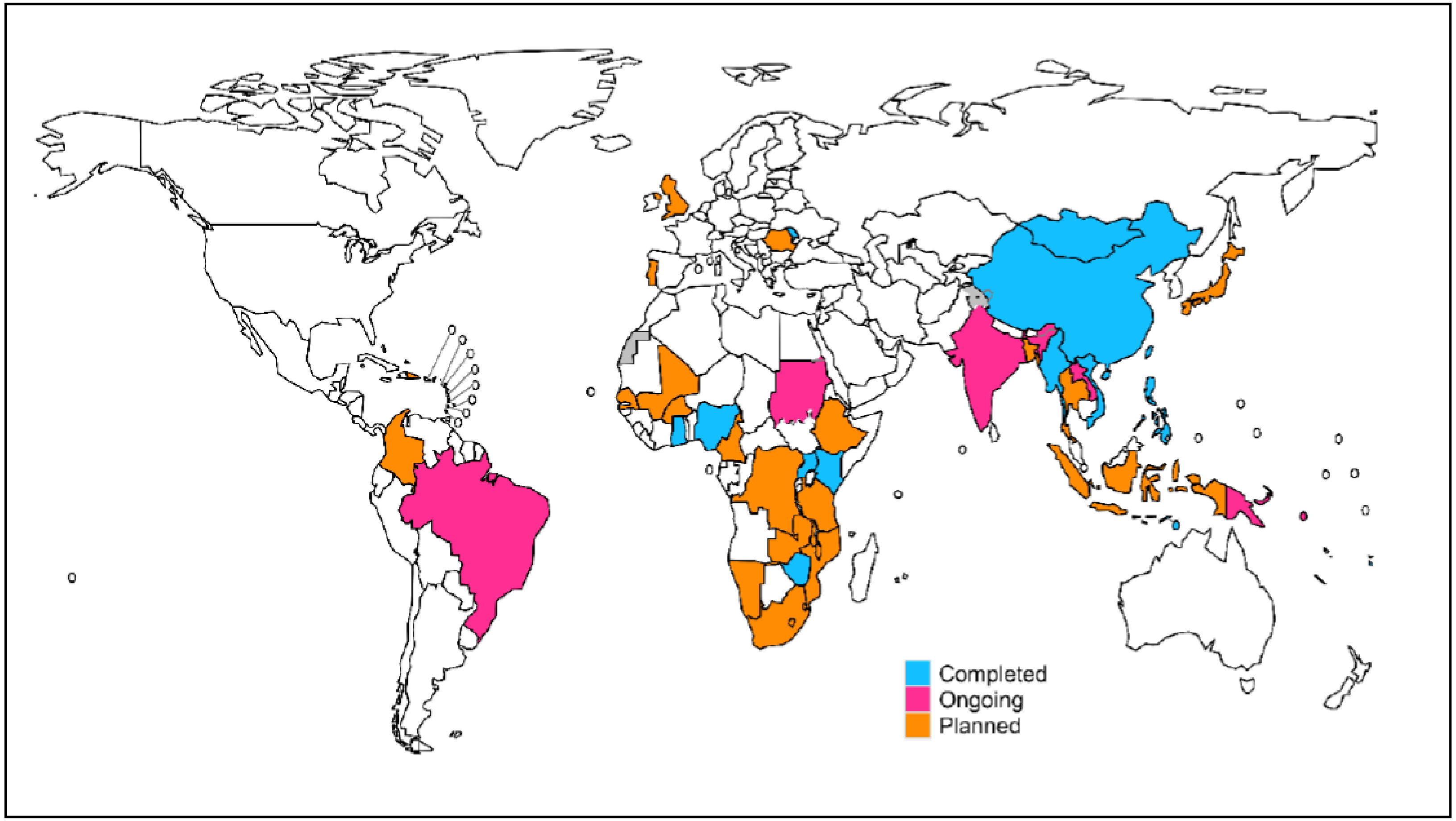
Why estimate disease-specific catastrophic costs?

- Economic evaluation (ECEA)
- Programme evaluation (poverty impact and SDG progress)
- Informing social protection
    - (esp. where poverty <=> disease)

	MILESTONES		TARGETS	
			SDG*	END TB
	2020	2025	2030	2035
Reduction in number of TB deaths compared with 2015 (%)	35%	75%	90%	95%
Reduction in TB incidence rate compared with 2015 (%)	20%	50%	80%	90%
TB-affected families facing catastrophic costs due to TB (%)	0%	0%	0%	0%

Introduction

National surveys of costs faced by TB patients and their households implemented since 2016 and underway or planned in the next year



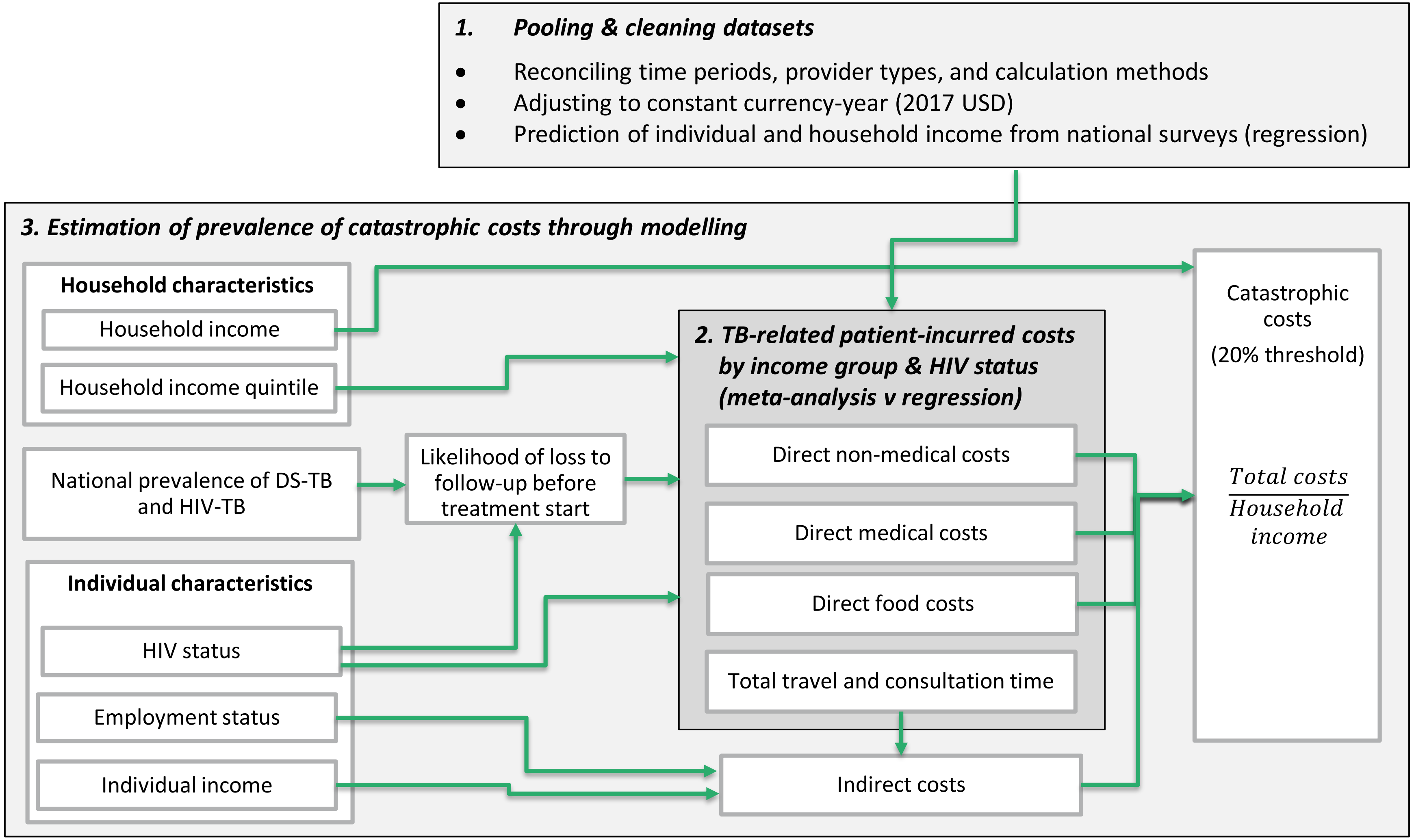
Source: WHO

Aim of this analysis

Aim: to investigate approaches to model estimates of national prevalence of catastrophic costs due to TB

Is it possible to get a ‘reasonable’ estimate of national prevalence of catastrophic cost using few, small and convenient sample studies?

Model description



1. Pooling & cleaning datasets

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- Reconciling time periods, provider types, and calculation methods
- Adjusting to constant currency-year (2017 USD)
- Prediction of individual and household income from national surveys (regression)

GHCC database:

12 papers containing patient cost data
4 excluded: outdated models
1 excluded: no original cost data

7 authors contacted

3 authors agreed to share datasets

Author (Date)	Study Name	Provinces	Sample size (DS-TB patients)
Chimbindi (2005)	REACH	KwaZulu-Natal, Gauteng, Mpumalanga	1,229
Foster (2015)	XTEND	Gauteng, Free State, Eastern Cape, Mpumalanga	175 (cases); 35 (suspects)
Mudzengi (2016)	MERGE	Gauteng	156

1. Pooling & cleaning datasets
Constructing the dataset: Reconciling time frames

Period definitions:									
Symptom onset	Seeking Care	Diagnosis received	Treatment: Intensive phase		Treatment: Continuation phase				
			Month 1	Month 2	Month 3	Month 4	Month 5	Month 6	

Data available:

MERGE (Mudzengi, et al. 2017)
Provinces: Gauteng

XTEND suspects (Foster et al, 2015)
Provinces: Gauteng, Mpumalanga, Eastern Cape, Free State

XTEND cases (Foster et al, 2015)
Provinces: Gauteng, Mpumalanga, Eastern Cape, Free State

REACH (Chimbindi, et al. 2005)
Provinces: KwaZulu-Natal, Gauteng, Mpumalanga

1. Pooling & cleaning datasets
Constructing the dataset: Reconciling cost categories

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	Intensive phase				Continuation phase			
	MERGE n = 1	REACH n = 102	XTEND n = 172	One-way ANOVA (F statistic)	MERGE n = 146	REACH n = 1021	XTEND n = 172	One-way ANOVA (F statistic)
Total direct medical cost								
Study clinic	$0.00	$0.00	$0.00		$0.00	$0.00	$0.00	
Other providers	$0.00	$4.09	$29.33	0.93	$5.24	$12.92	$5.26	3.25*
Direct non-medical cost								
Study clinic	$0.00	$1.65	$0.66	8.27***	$1.00	$2.06	$1.14	1.39
Other providers	$0.00		$4.06	2.61	$4.05		$0.65	18.74***
Transport hours								
Study clinic	4.00	5.97	1.70	17.01***	18.26	14.27	1.31	37.70***
Other providers	0.00		0.23	5.68**	0.45		0.15	46.10***
Consult hours								
Study clinic	4.00	6.95	1.11	4.79*	24.62	11.40	0.20	52.10***
Other providers	0.00		13.30	2.35	9.37		1.65	31.93***
Total cost of ‘special foods’ or supplements								
Cost per phase	27.44	4.21	15.60	7.80***	50.83	4.21	15.60	185.70***

1. Pooling & cleaning datasets
Constructing the dataset: Reconciling income measures

Time period reconciliation:									
Symptom onset	Seeking Care	Diagnosis received	Treatment: Intensive phase		Treatment: Continuation phase				
			Month 1	Month 2	Month 3	Month 4	Month 5	Month 6

Data available:

MERGE (Mudzengi, et al. 2017)
Income estimation: self-reported individual income

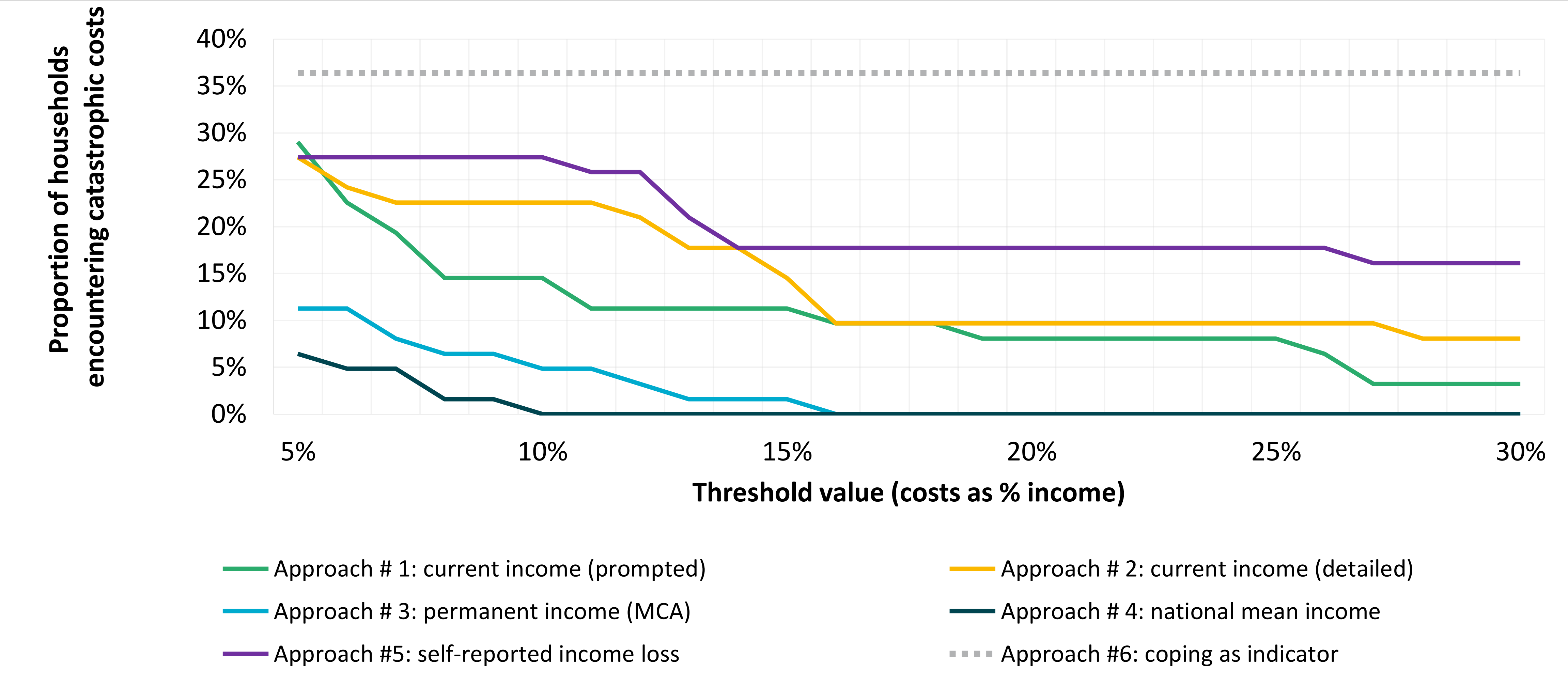
XTEND suspects (Foster et al, 2015)
Income estimation: self-reported individual income (brackets)

XTEND cases (Foster et al, 2015)
Income estimation: self-reported individual income (brackets)

REACH (Chimbindi, et al. 2005)
Income estimation: self-reported household expenditures (brackets)

1. Pooling & cleaning datasets
Constructing the dataset: Reconciling income measures

Measuring income for catastrophic cost estimates: Limitations and policy implications of current approaches (Soc Sci Med 215, 7-15)



1. Pooling & cleaning datasets
Constructing the dataset: Reconciling income measures

- Estimate income through quantile regression analysis linked to National Income Dynamics Study (NIDS) dataset

- Coefficients from regression results applied to predict household income for observations in pooled dataset

- Predictive power of the regression was relatively low – contributes substantial uncertainty in our ultimate estimates

	Quantile Regression (25th quantile; Log)
Constant	4.26*** (0.06)
Urban	0.15*** (0.04)
Female	0.07* (0.03)
Educated ≥ grade 8	0.27*** (0.04)
Married / cohabitating	0.21*** (0.04)
Current TB	-0.28*** (0.04)
Employed	0.33*** (0.03)
Asset quintile (ref Q1)	
Quintile 2	0.20*** (0.04)
Quintile 3	0.48*** (0.05)
Quintile 4	0.73*** (0.04)
Quintile 5	1.37*** (0.05)
Age group (ref age 15-29)	
30-44	-0.09** (0.04)
45 and over	0.10* (0.05)
Province (ref: Eastern Cape)	
Free State	0.04* (0.07)
Gauteng	0.26*** (0.05)
Mpumalanga	0.13* (0.06)
Western Cape	0.26*** (0.05)
KwaZulu-Natal	0.24*** (0.04)

Model description

1. Pooling & cleaning datasets

- Reconciling time periods, provider types, and calculation methods
- Adjusting to constant currency-year (2017 USD)
- Prediction of individual and household income from national surveys (regression)

2. TB-related patient-incurred costs by income group & HIV status (meta-analysis v regression)

- Direct non-medical costs
- Direct medical costs
- Direct food costs
- Total travel and consultation time

2. Estimating costs by income group & HIV status (meta-analysis v regression)

Two approaches to use existing data to parameterize model:

Meta-analysis

Adjusted mean values for each cost category using summary statistics from each dataset, by HIV status and SES quintile

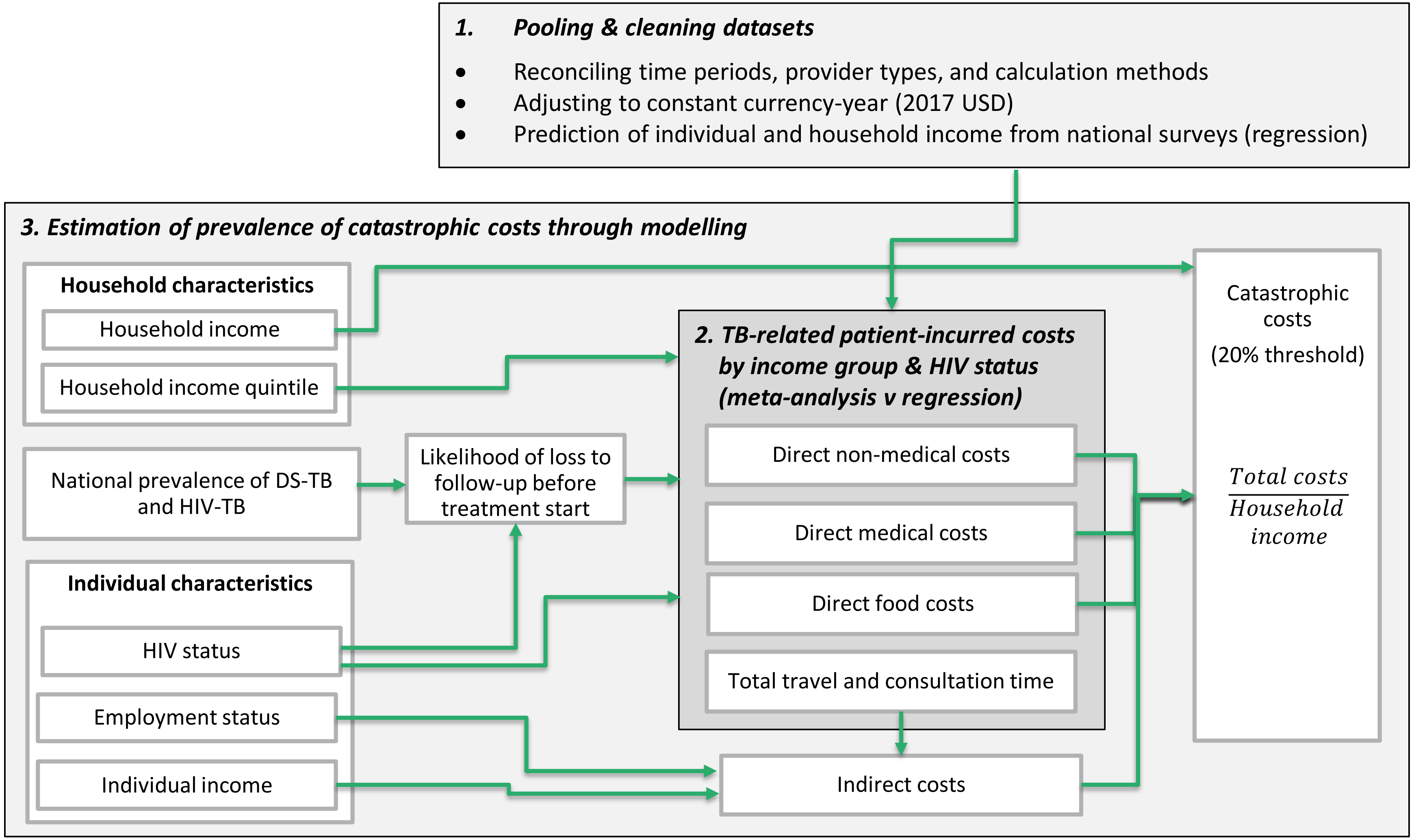
Regression analysis

Generalised linear model with gamma distribution and log link for each cost category, using pooled primary datasets

Independent variables: urbanicity (1 = rural), education level (1 = educated to grade 8 and above), employment status (1 = employed), HIV status (1 = HIV positive), SES quintile (quintiles 1-5).

Marginal estimates by HIV status, SES quintile, employment status, with education/urbanicity held at mean for TB patients in South Africa

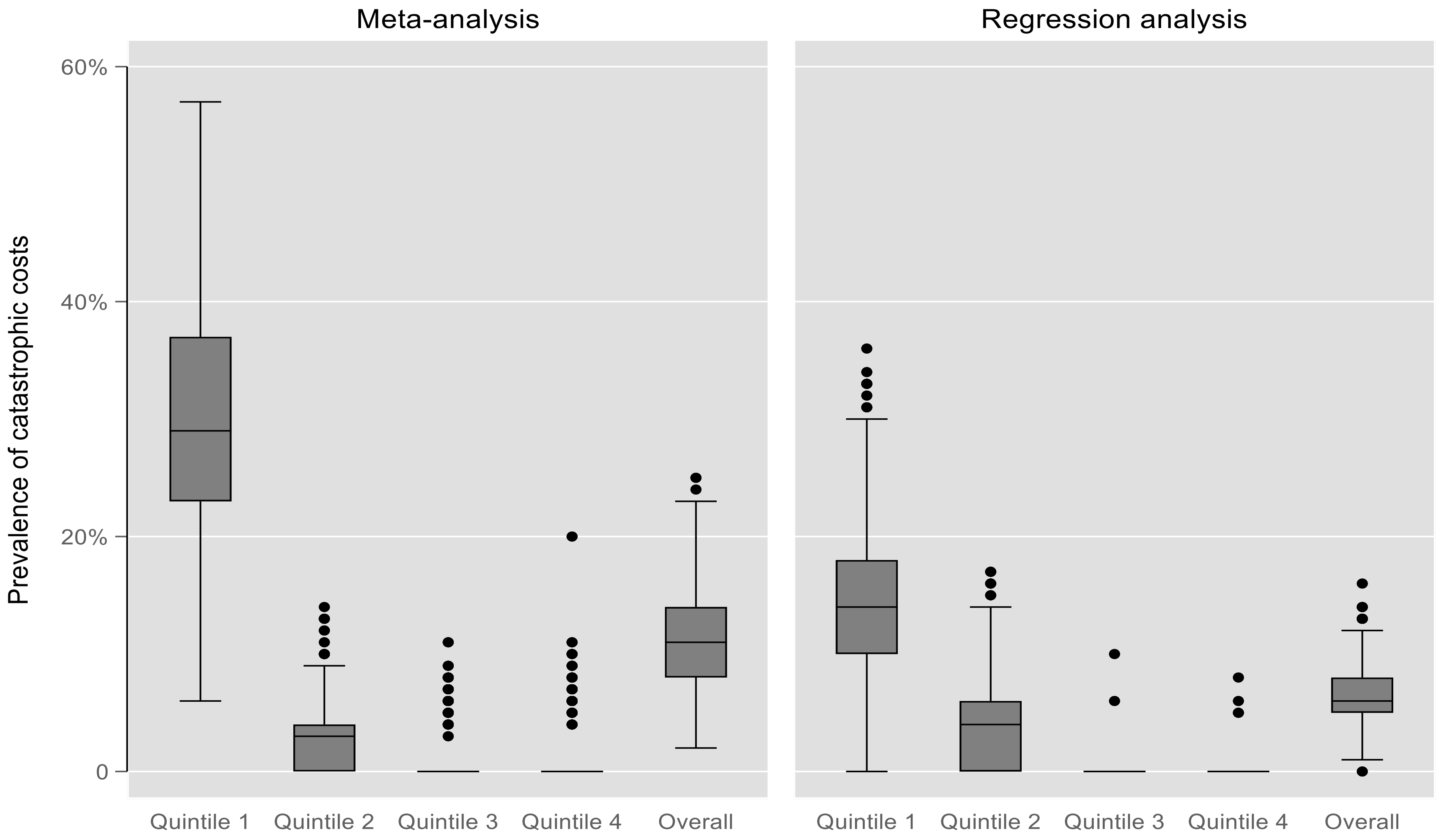
Model description



3. Estimation of prevalence of catastrophic costs through modelling: Model results

	Direct medical costs	Direct non-medical costs	Special foods costs	Travel and consultation time	Total Indirect Costs	Annual Household Income	Prevalence of Catastrophic Costs
Meta-analysis approach							
Quintile 1	$72.81	$20.00	$77.68	33.05	$1.78	$1,310	29%
Quintile 2	$96.09	$63.81	$7.32	170.75	$46.56	$4,149	3%
Quintile 3	$38.66	$54.88	$7.18	69.92	$46.77	$8,389	0%
Quintile 4	$19.30	$26.38	$5.08	62.22	$133.67	$26,188	0%
Overall	$64.72	$40.26	$34.10	82.77	$48.07	$7,636	11%
Regression approach							
Quintile 1	$48.25	$9.08	$24.04	60.1	$2.22	$1,311	14%
Quintile 2	$29.77	$26.31	$26.23	162.73	$74.25	$4,165	4%
Quintile 3	$29.11	$37.25	$18.14	16.81	$11.33	$8,349	0%
Quintile 4	$33.60	$62.89	$21.82	16.68	$32.16	$25,929	0%
Overall	$36.42	$28.36	$23.14	71.84	$31.31	$7,478	6%

Comparing results



Reflections

Cohort model allows for adjustment of demographics and treatment phase

- Uncertainty was slightly reduced in the individual-level analysis

Usefulness of this approach depends on purpose

- year-to-year monitoring vs rough estimation for other policy purposes

“No amount of statistical analysis can compensate” for underlying uncertainty in the data (Graves 2002)

Better data is needed:

- On costs of care across the TB pathway, but especially before receipt of diagnosis
- On individual and household income for people with TB

Thank you!

Any questions?

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