Advancing universal health coverage by incorporating equity and financial protection into economic evaluations of cancer interventions

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JAMA | Special Communication

Recommendations for Conduct, Methodological Practices, and Reporting of Cost-effectiveness Analyses

Second Panel on Cost-Effectiveness in Health and Medicine

Gillian D. Sanders, PhD; Peter J. Neumann, ScD; Anirban Basu, PhD; Dan W. Brock, PhD; David Feeny, PhD; Murray Krahn, MD, MSc; Karen M. Kuntz, ScD; David O. Meltzer, MD, PhD; Douglas K. Owens, MD, MS; Lisa A. Prosser, PhD; Joshua A. Salomon, PhD; Mark J. Sculpher, PhD; Thomas A. Trikalinos, MD; Louise B. Russell, PhD; Joanna E. Siegel, ScD; Theodore G. Ganiats, MD

IMPORTANCE Since publication of the report by the Panel on Cost-Effectiveness in Health and Medicine in 1996, researchers have advanced the methods of cost-effectiveness analysis, and policy makers have experimented with its application. The need to deliver health care efficiently and the importance of using analytic techniques to understand the clinical and economic consequences of strategies to improve health have increased in recent years.

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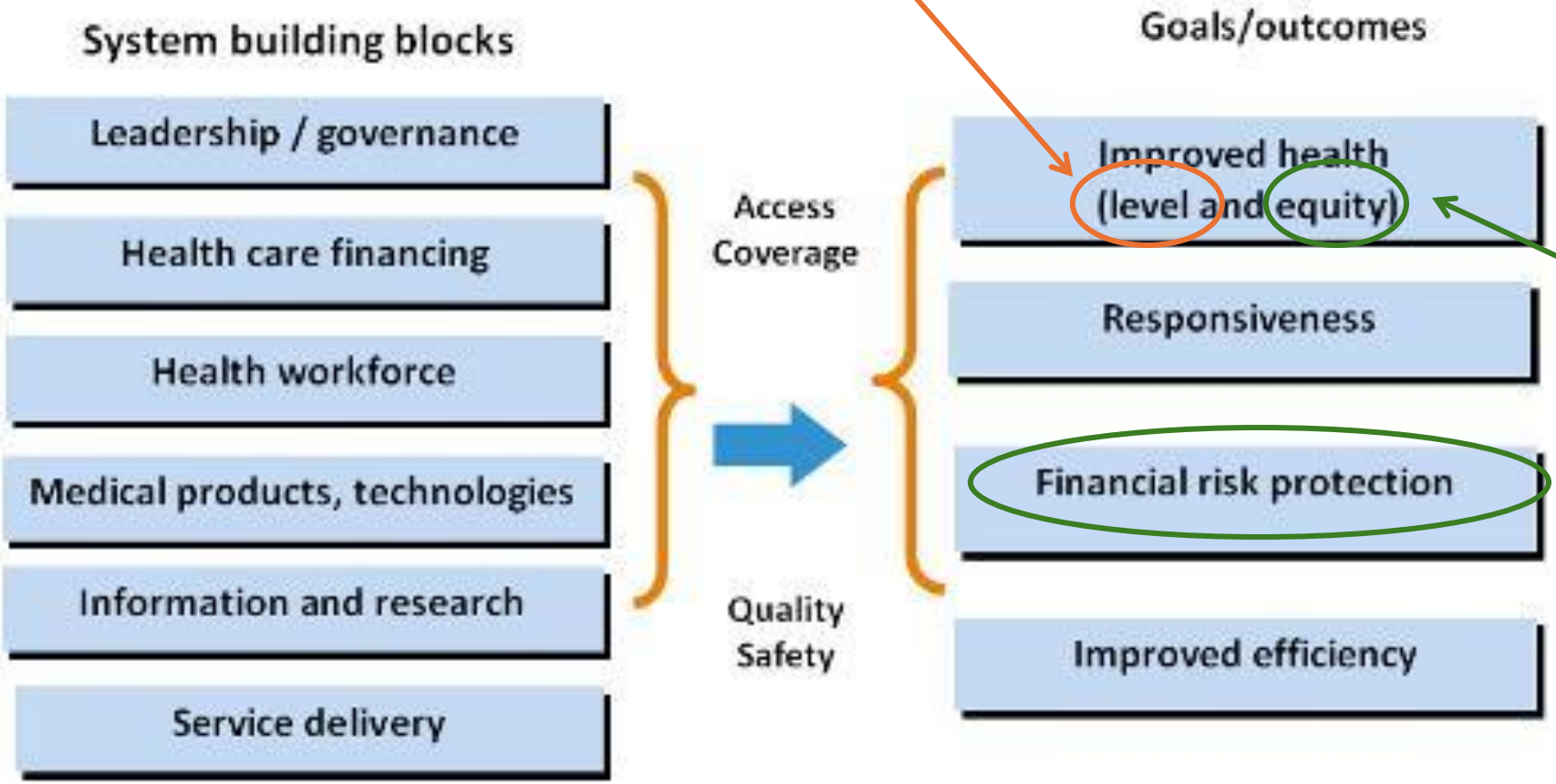
Supplemental content

CME Quiz at jamanetworkcme.com

Sanders G. JAMA, 2016.

Conventional CEA outcome metric



Additional ECEA outcome metrics

WHO, 2010.

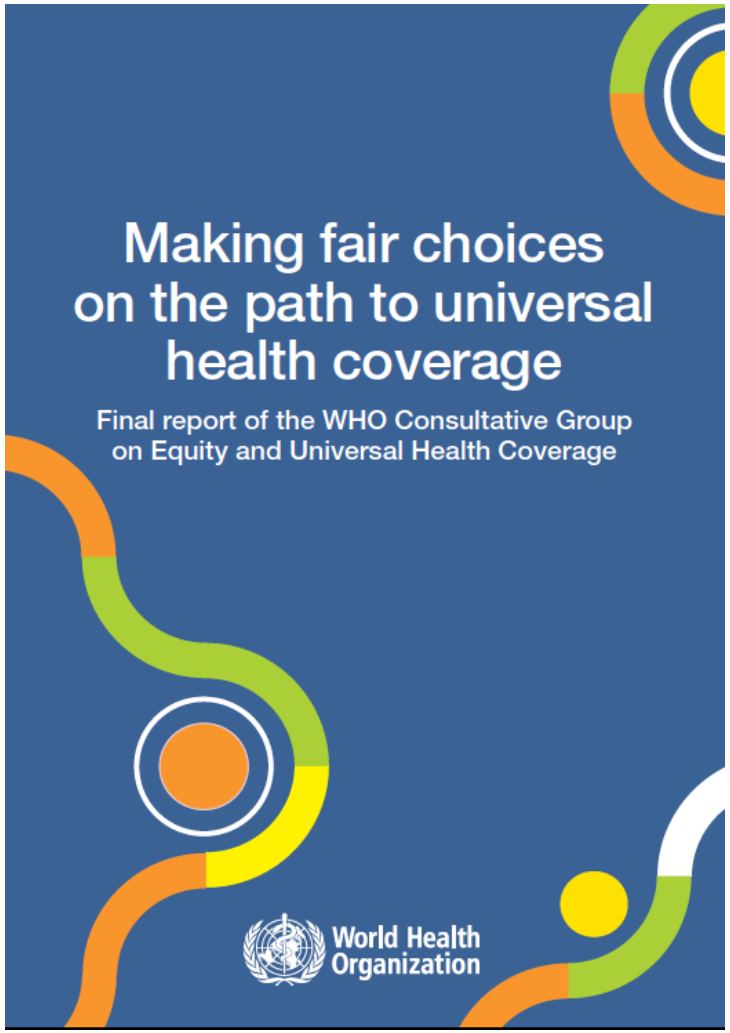
Criteria for designing health benefit packages

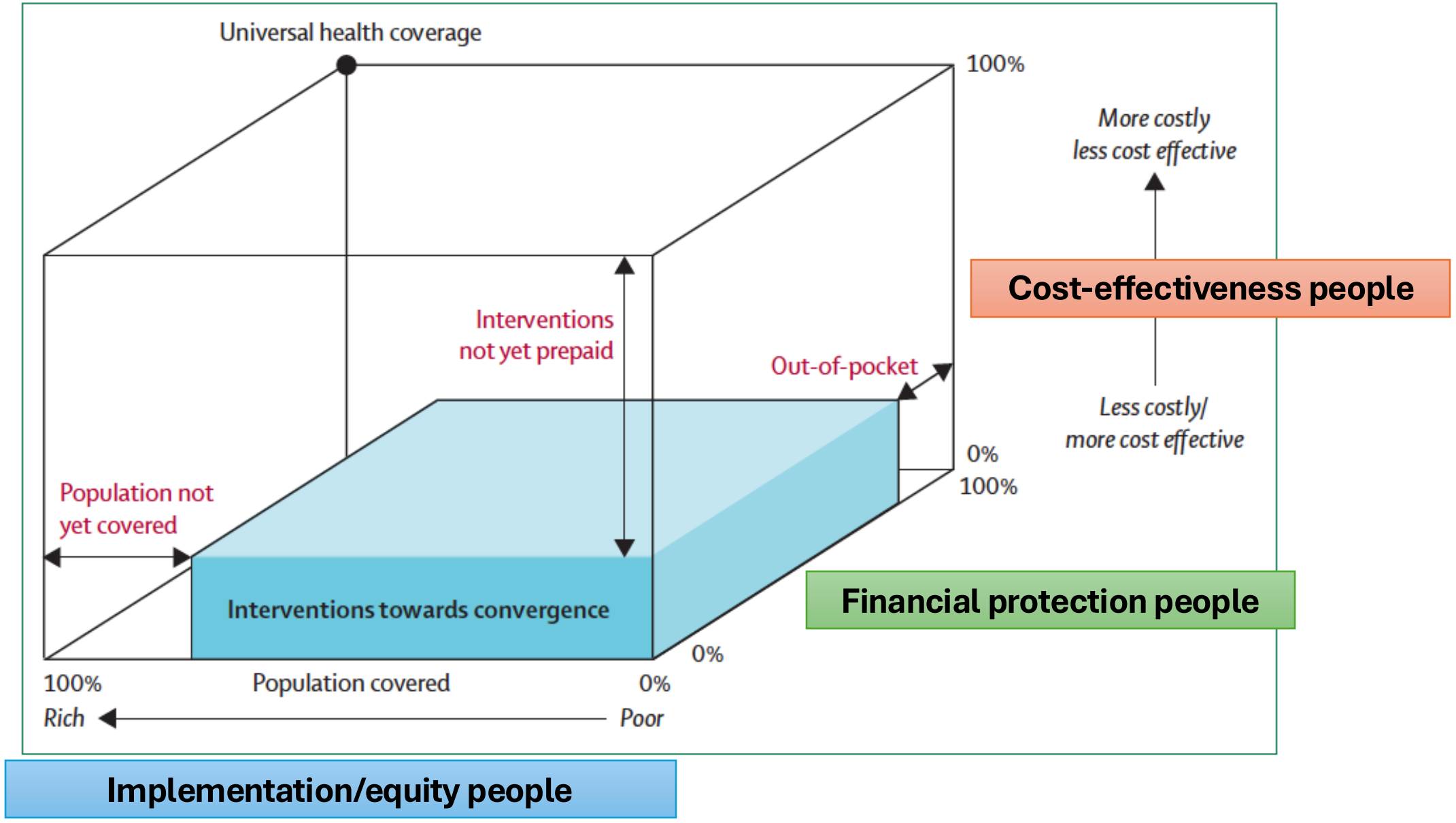
1. Very good value for money
2. Priority to the worst off (equity)
3. Provide substantial financial risk protection

Financing by priority tiers:

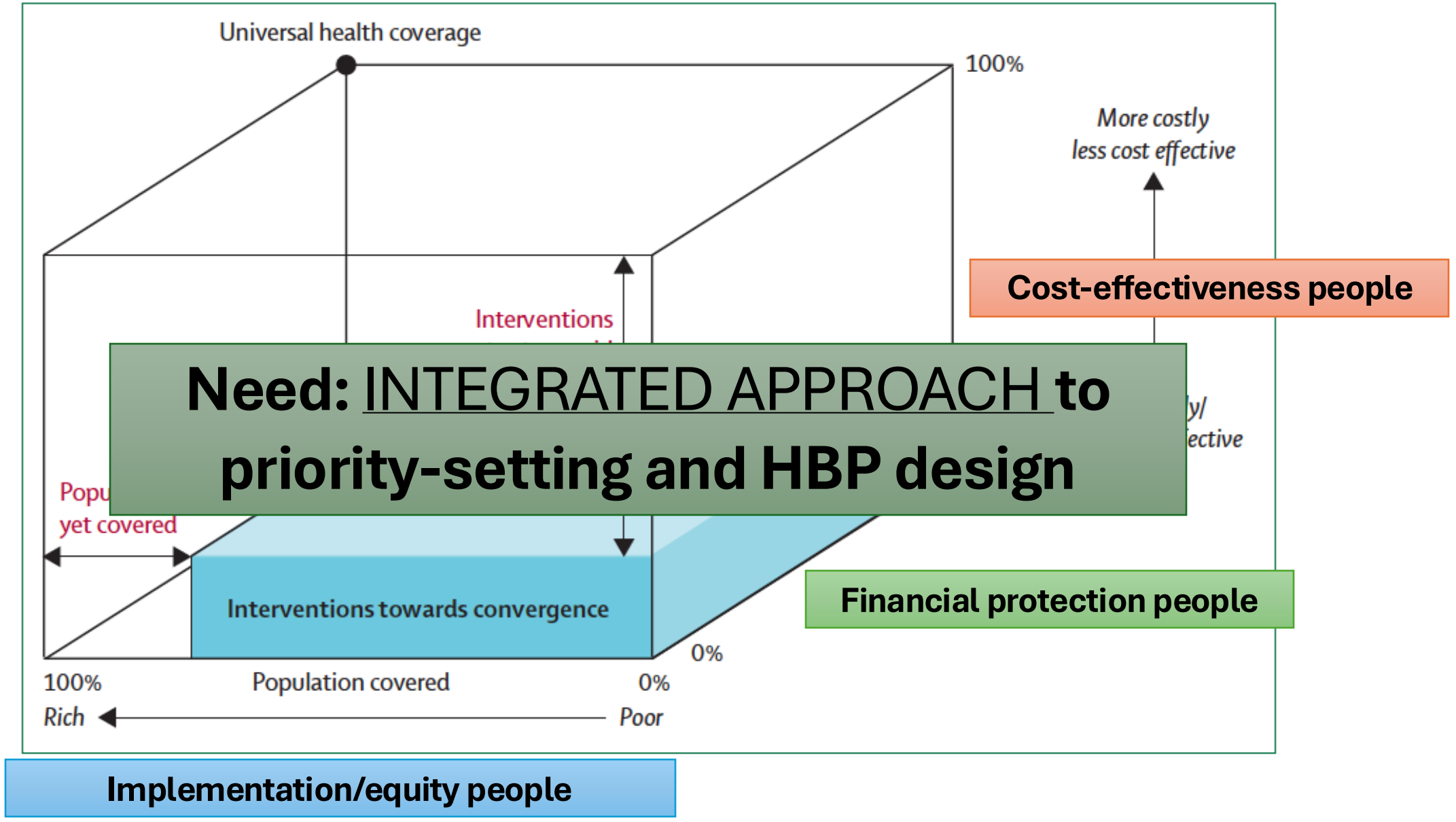
- High: 100% prepaid
- Medium: Cost-sharing
- Low: Cost recovery (= 100% OOP)

WHO, 2014.



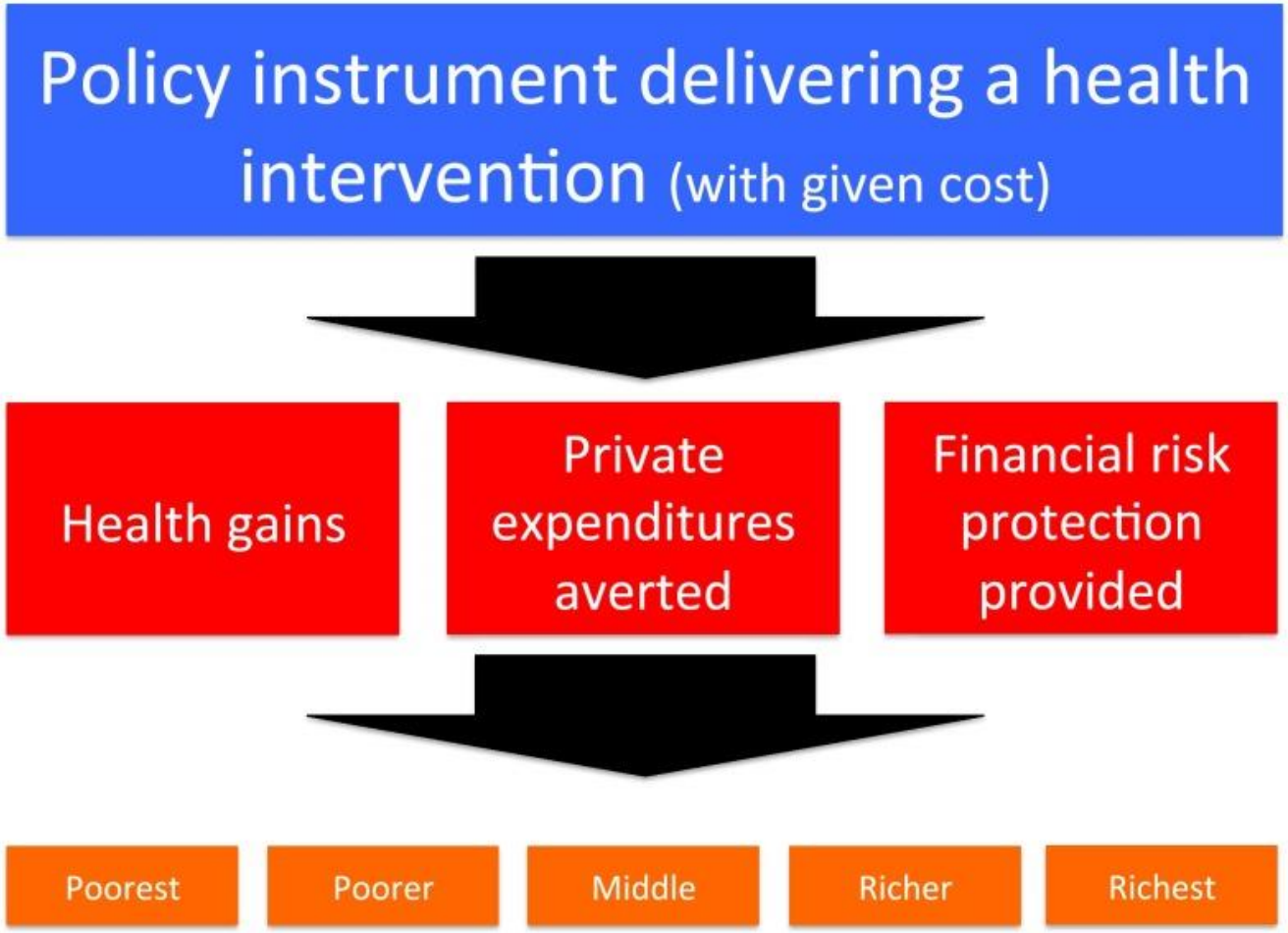


Jamison DT. Lancet, 2013.

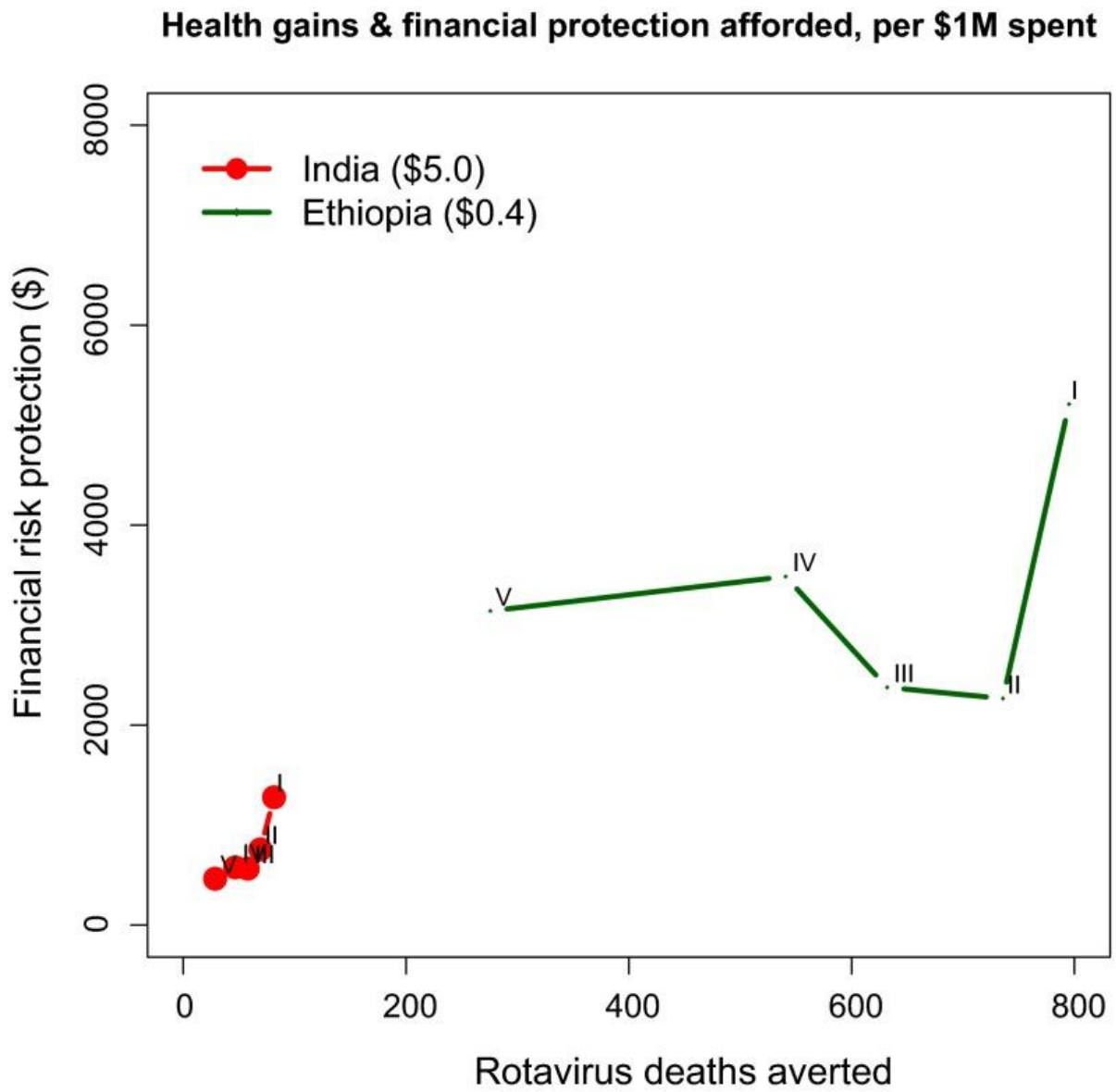


Jamison DT. Lancet, 2013.

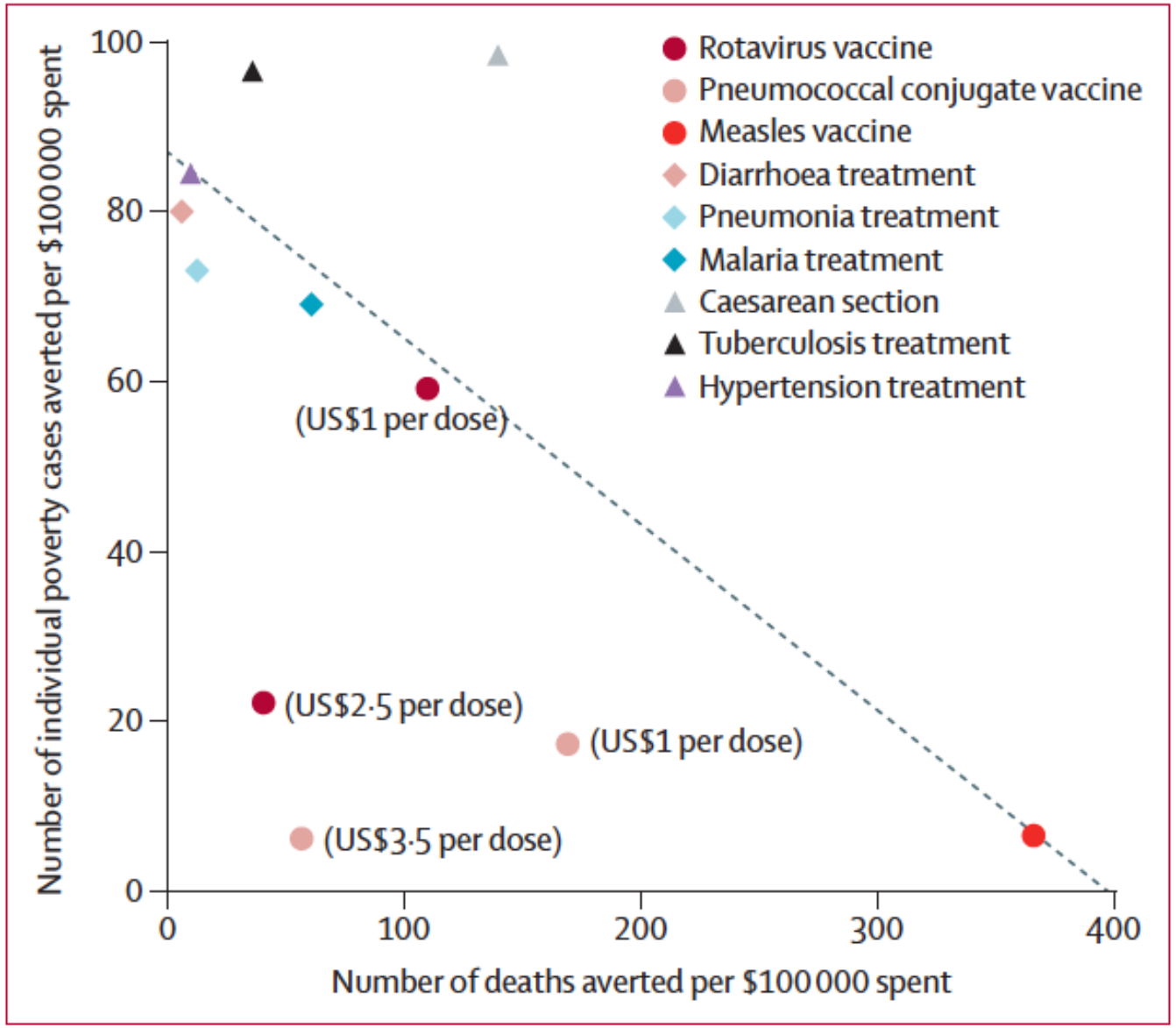
Extended cost-effectiveness analysis



Verguet S. Pharmacoeconomics, 2016


Health gains & financial protection afforded, per $1M spent
India ($5.0)
Ethiopia ($0.4)
Financial risk protection ($)
0
2000
4000
6000
8000
0
200
400
600
800
Rotavirus deaths averted
I
II
III
IV
V

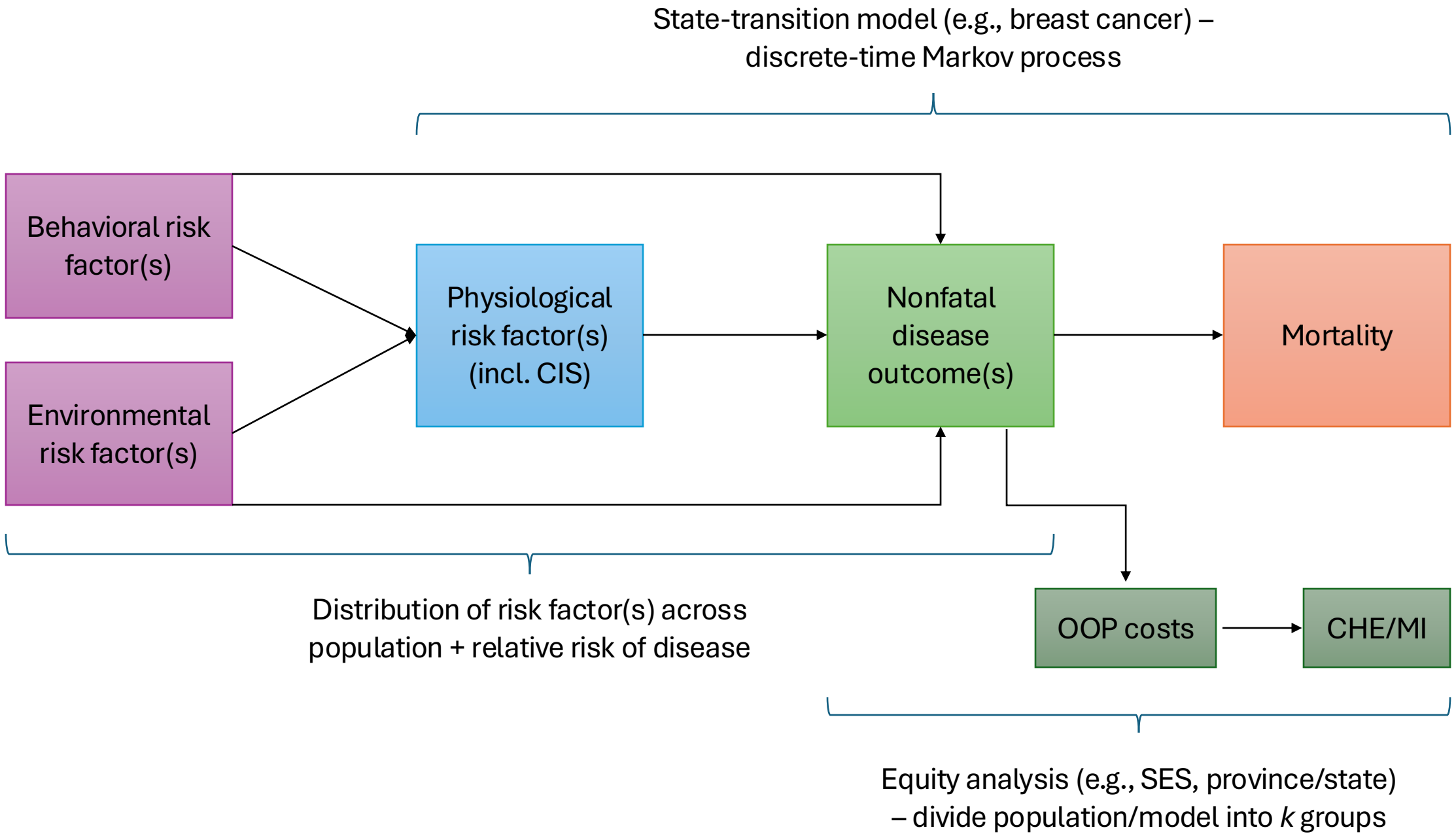
ibid.



Verguet S. Lancet Glob Health, 2015

Application of the method to cancer systems

- Stylized analyses done for Lancet Commission
- Imagine the typical demography, economy, and epidemiology of a low-income African country
- Dynamic population models for top 16 cancers, integrated within demographic model
- Estimate the costs and consequences of basic treatment for each
  - Effects on disease progression: literature and expert opinion
  - Costs: extrapolated from insurance claims data
  - Current coverage and prepayment levels: assumption


State-transition model (e.g., breast cancer) – discrete-time Markov process
Behavioral risk factor(s)
Environmental risk factor(s)
Physiological risk factor(s) (incl. CIS)
Nonfatal disease outcome(s)
Mortality
Distribution of risk factor(s) across population + relative risk of disease
OOP costs
CHE/MI
Equity analysis (e.g., SES, province/state) – divide population/model into *k* groups

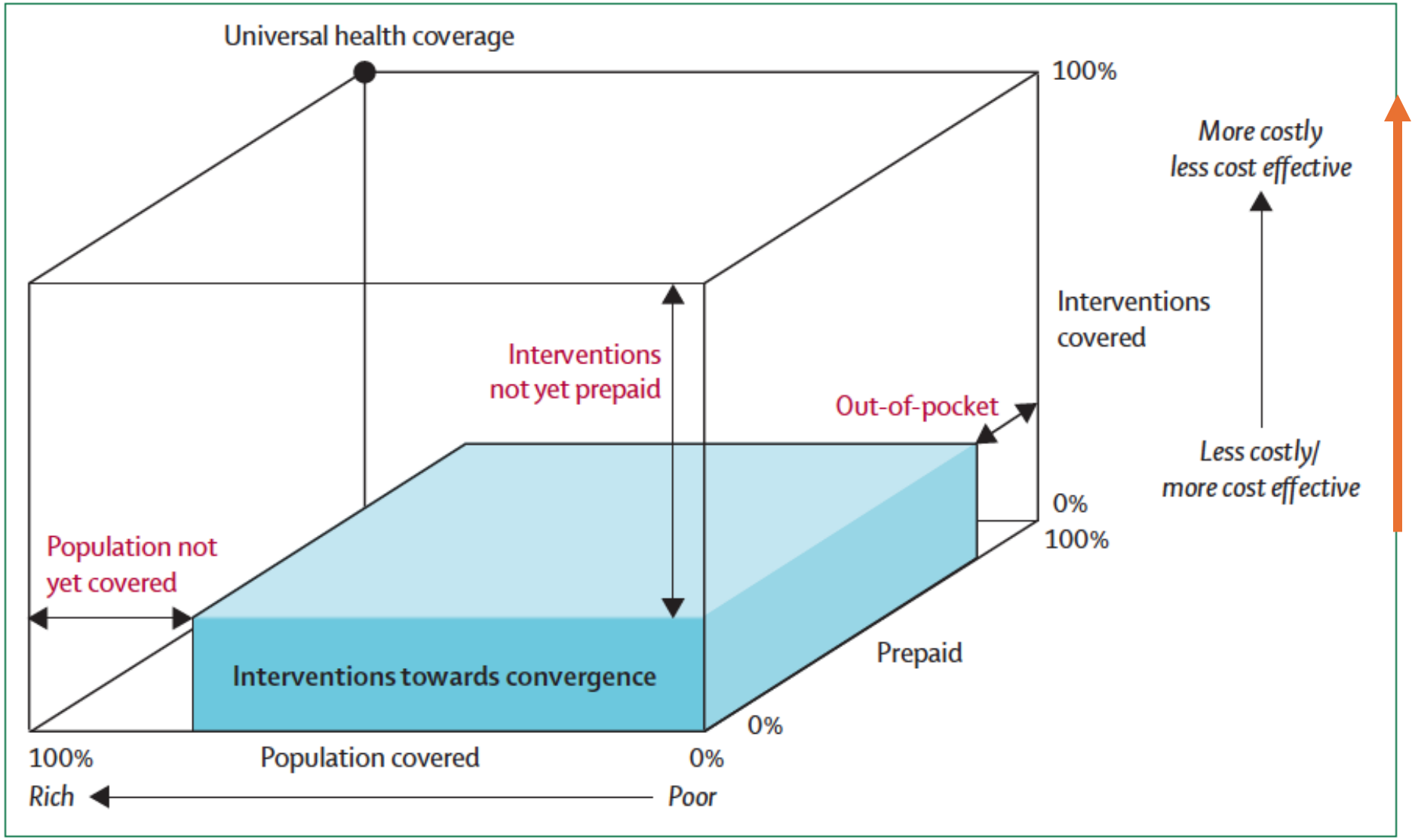
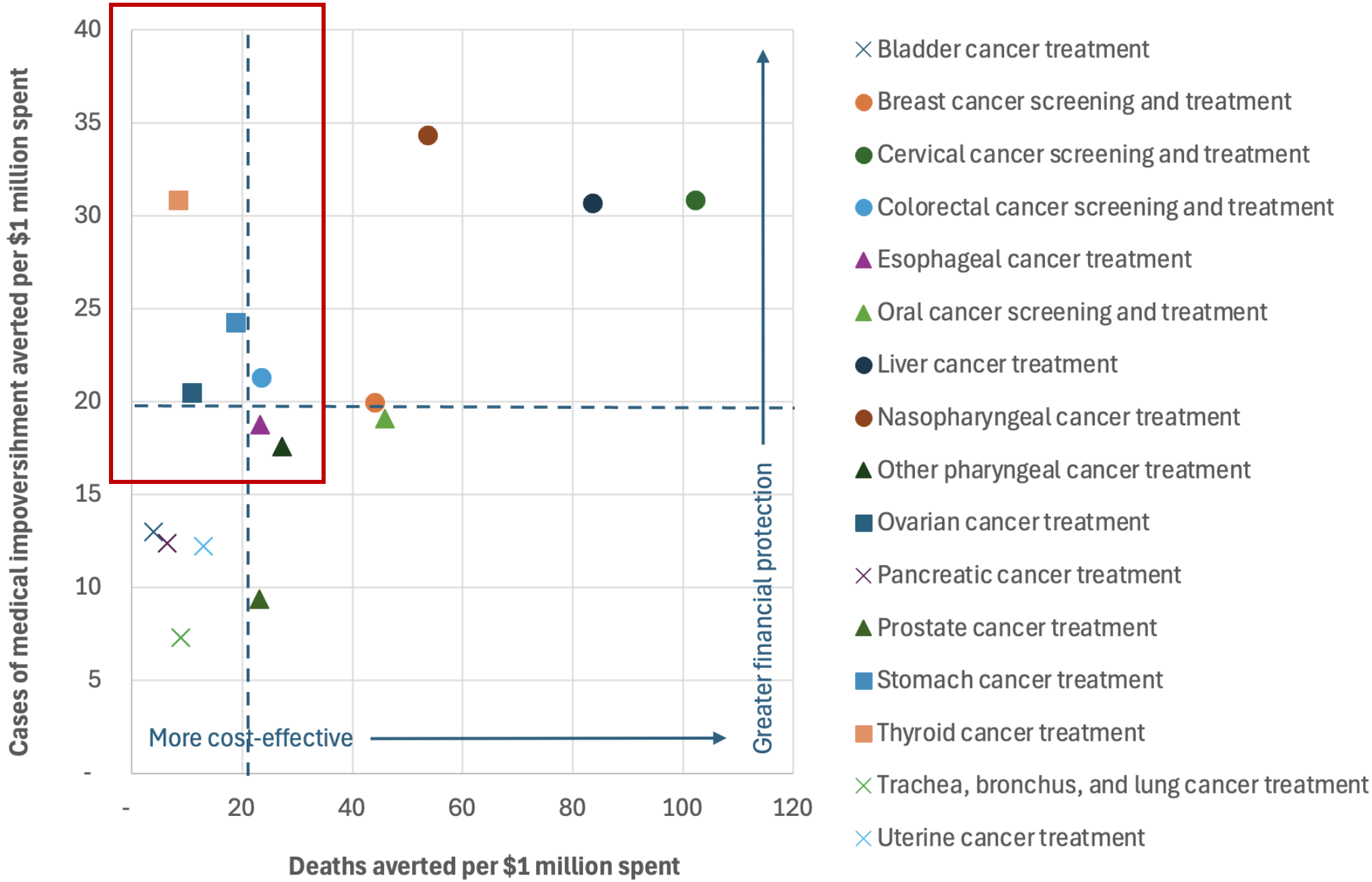
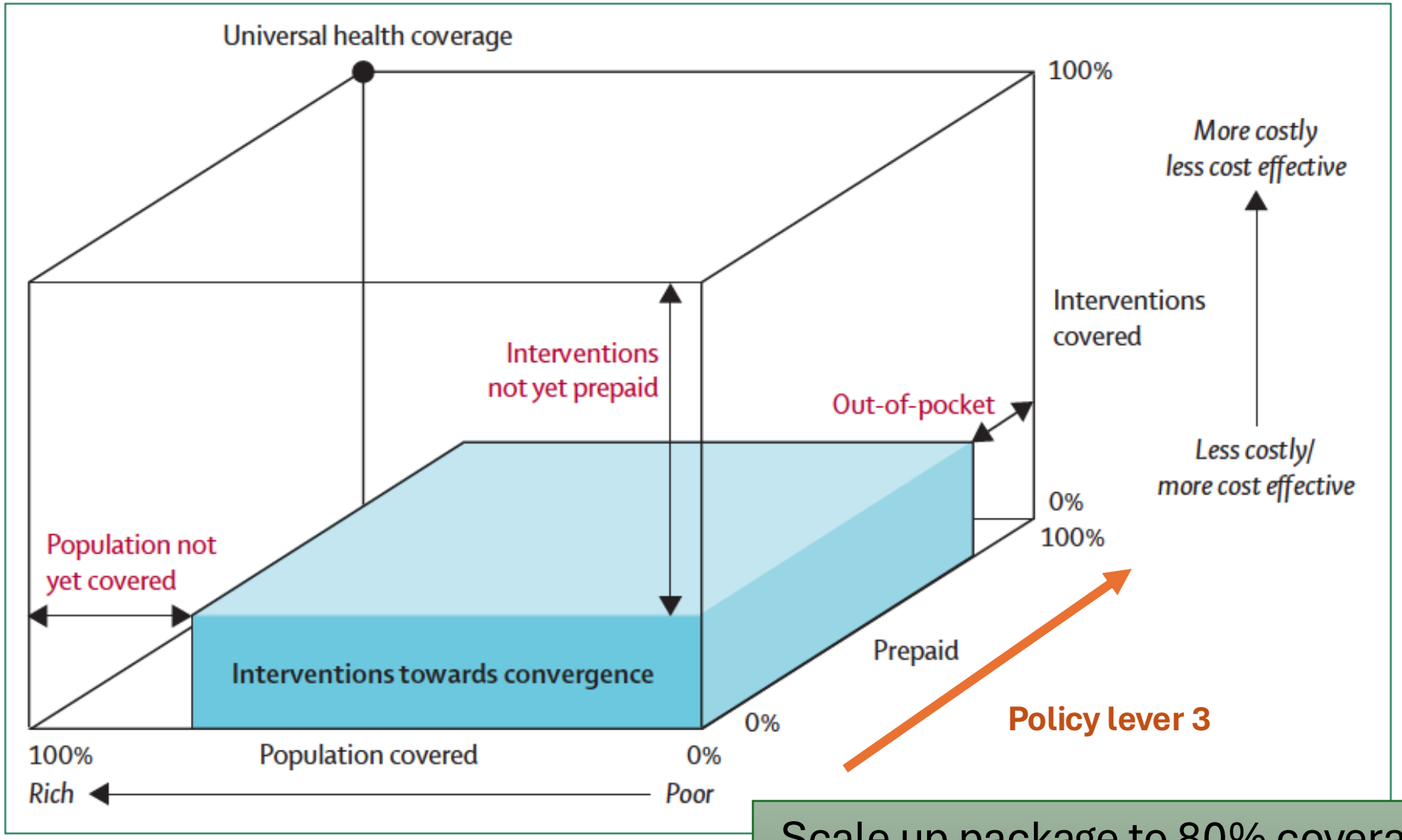


Figure from: Jamison DT. Lancet, 2013.


Cases of medical impoverishment averted per $1 million spent
40
35
30
25
20
15
10
5
-
-
20
40
60
80
100
120
Deaths averted per $1 million spent
More cost-effective
Greater financial protection
Bladder cancer treatment
Breast cancer screening and treatment
Cervical cancer screening and treatment
Colorectal cancer screening and treatment
Esophageal cancer treatment
Oral cancer screening and treatment
Liver cancer treatment
Nasopharyngeal cancer treatment
Other pharyngeal cancer treatment
Ovarian cancer treatment
Pancreatic cancer treatment
Prostate cancer treatment
Stomach cancer treatment
Thyroid cancer treatment
Trachea, bronchus, and lung cancer treatment
Uterine cancer treatment



(Policy lever 1 taken as given)

Policy lever 3

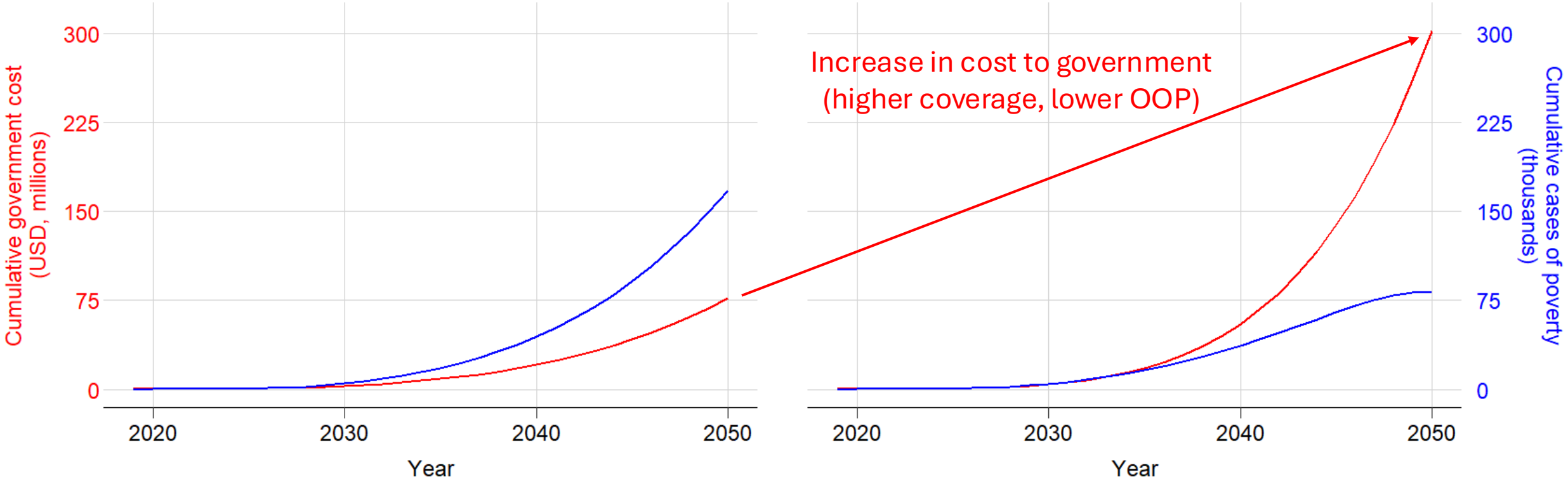
Policy lever 2

Scale up package to 80% coverage and 100% prepayment by 2050

ibid.

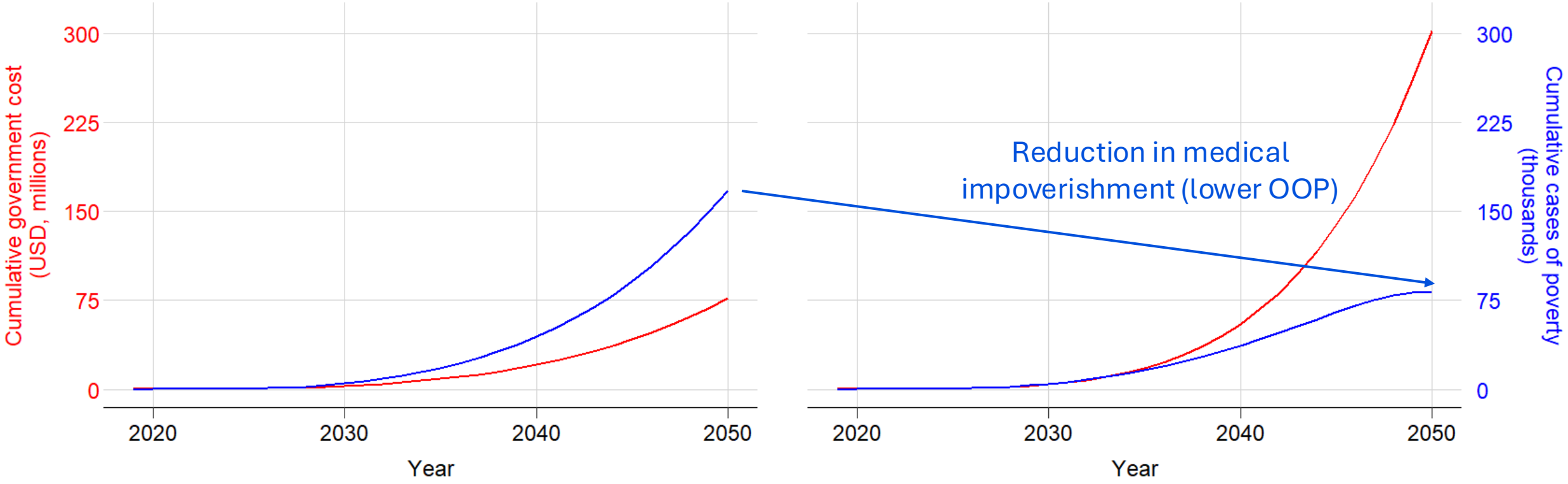
Status quo scenario

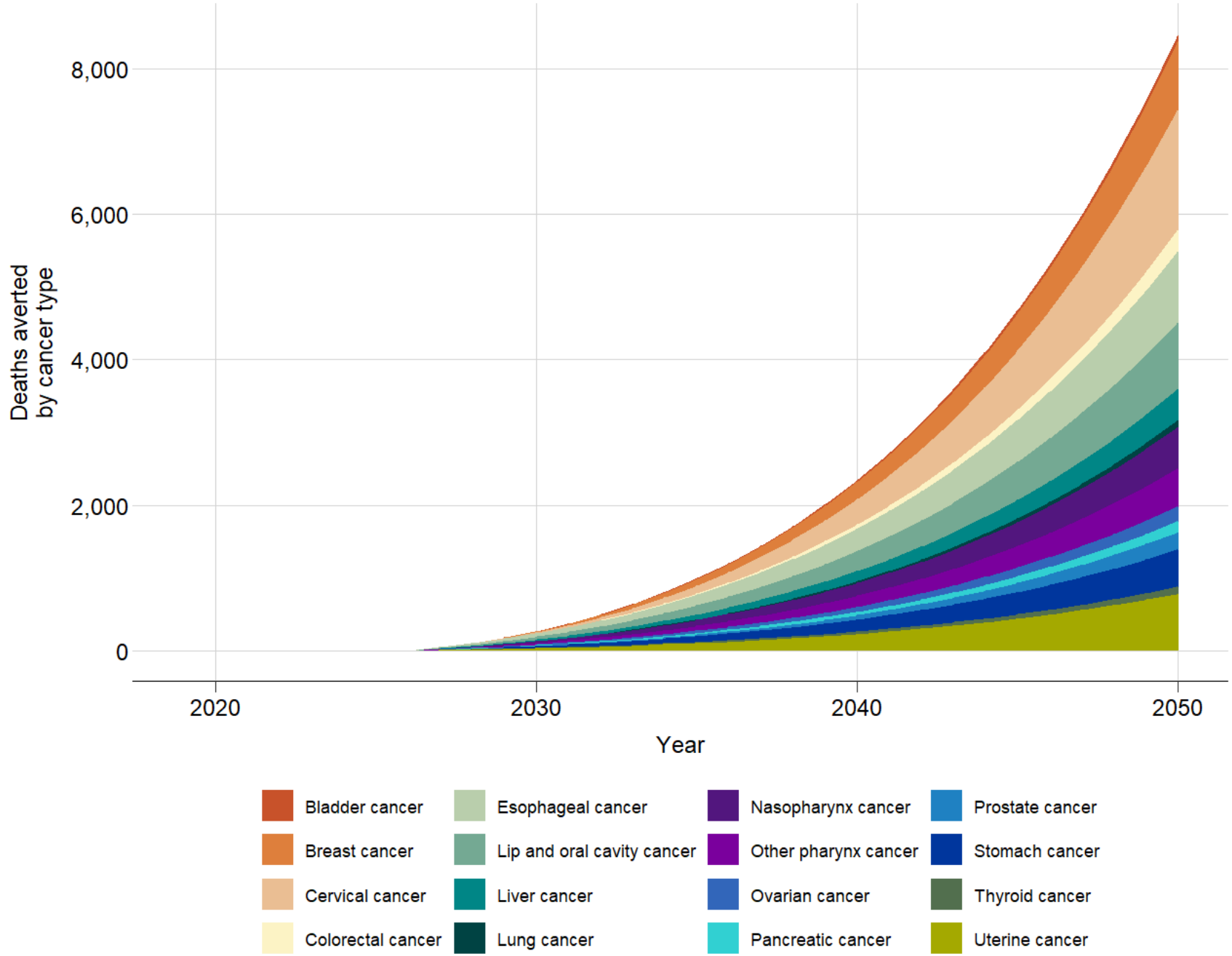
Scale-up scenario



Status quo scenario

Scale-up scenario




8,000
6,000
4,000
2,000
0
Deaths averted by cancer type
2020
2030
2040
2050
Year
Bladder cancer
Breast cancer
Cervical cancer
Colorectal cancer
Esophageal cancer
Lip and oral cavity cancer
Liver cancer
Lung cancer
Nasopharynx cancer
Other pharynx cancer
Ovarian cancer
Pancreatic cancer
Prostate cancer
Stomach cancer
Thyroid cancer
Uterine cancer

Scenarios for breast cancer intervention

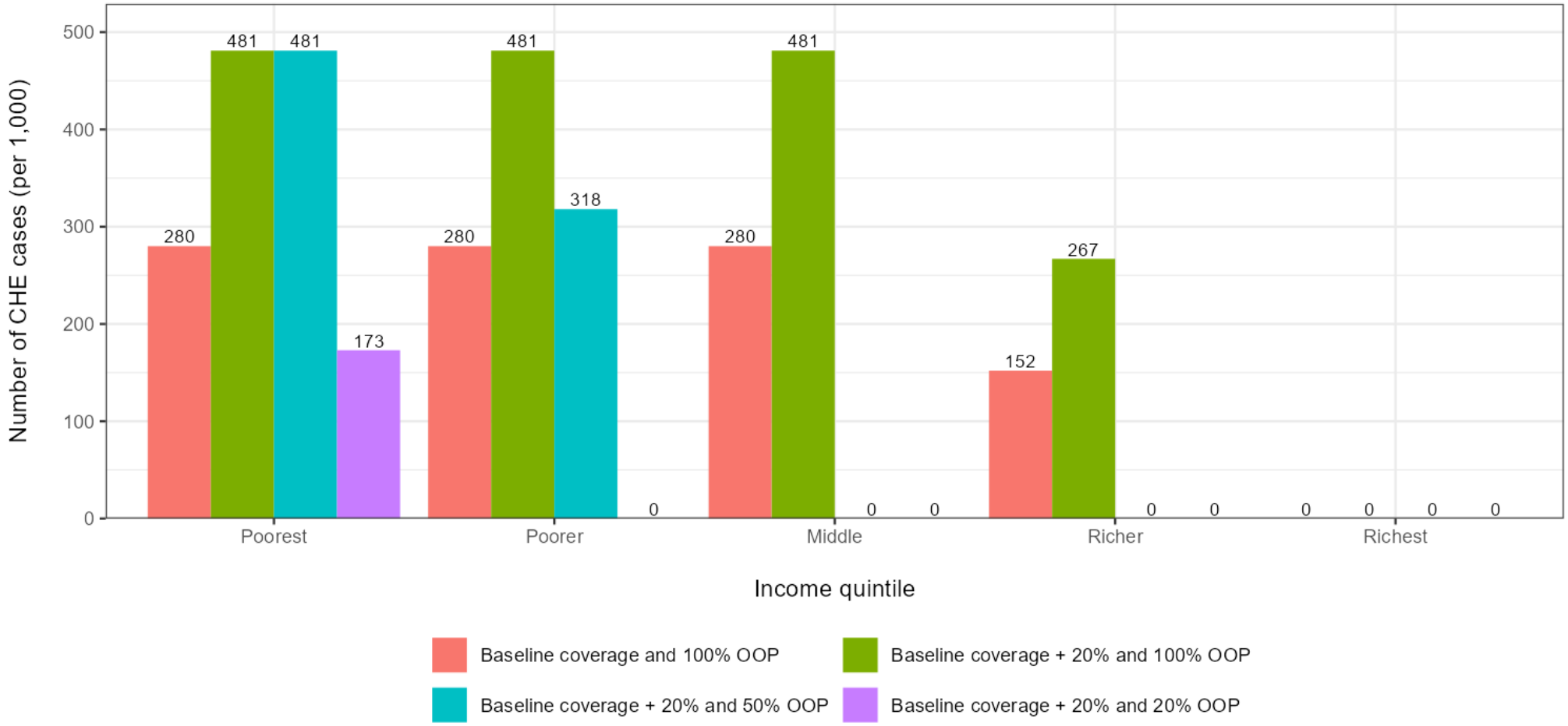
Policy lever 2

Intervention coverage	80%	60%	40%	20%	0%
50%	254,000 28,000	254,000 61,000	254,000 97,000	254,000 139,000	254,000 186,000
40%	199,000 22,000	199,000 48,000	199,000 76,000	199,000 108,000	199,000 145,000
30%	146,000 16,000	146,000 35,000	146,000 56,000	146,000 79,000	146,000 106,000
20%	96,000 10,000	96,000 22,000	96,000 36,000	96,000 51,000	96,000 68,000
10%	47,000 4,000	47,000 11,000	47,000 18,000	47,000 25,000	47,000 33,000

Out-of-pocket proportion

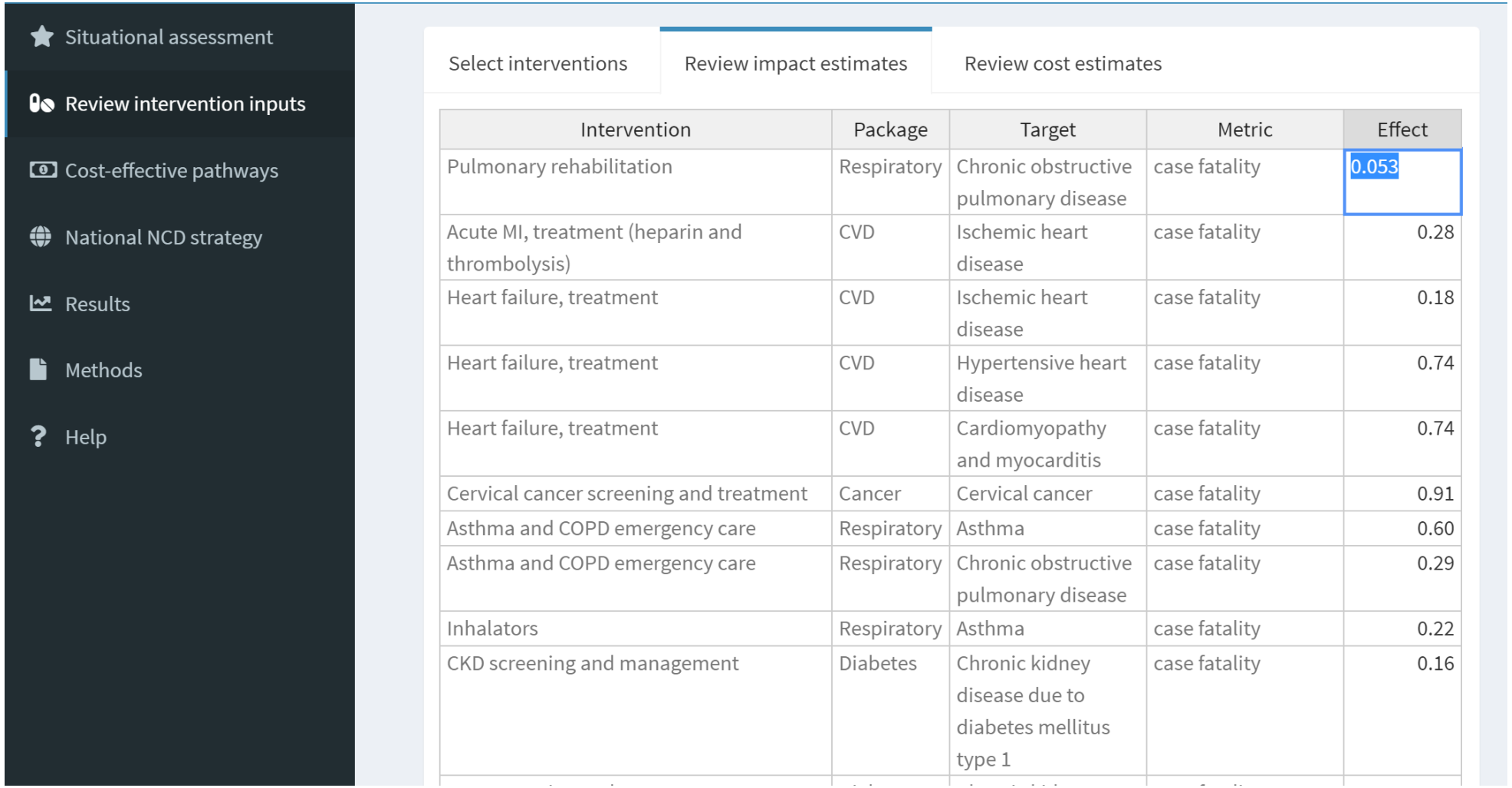
Policy lever 3

Future: incorporating equity into modeling



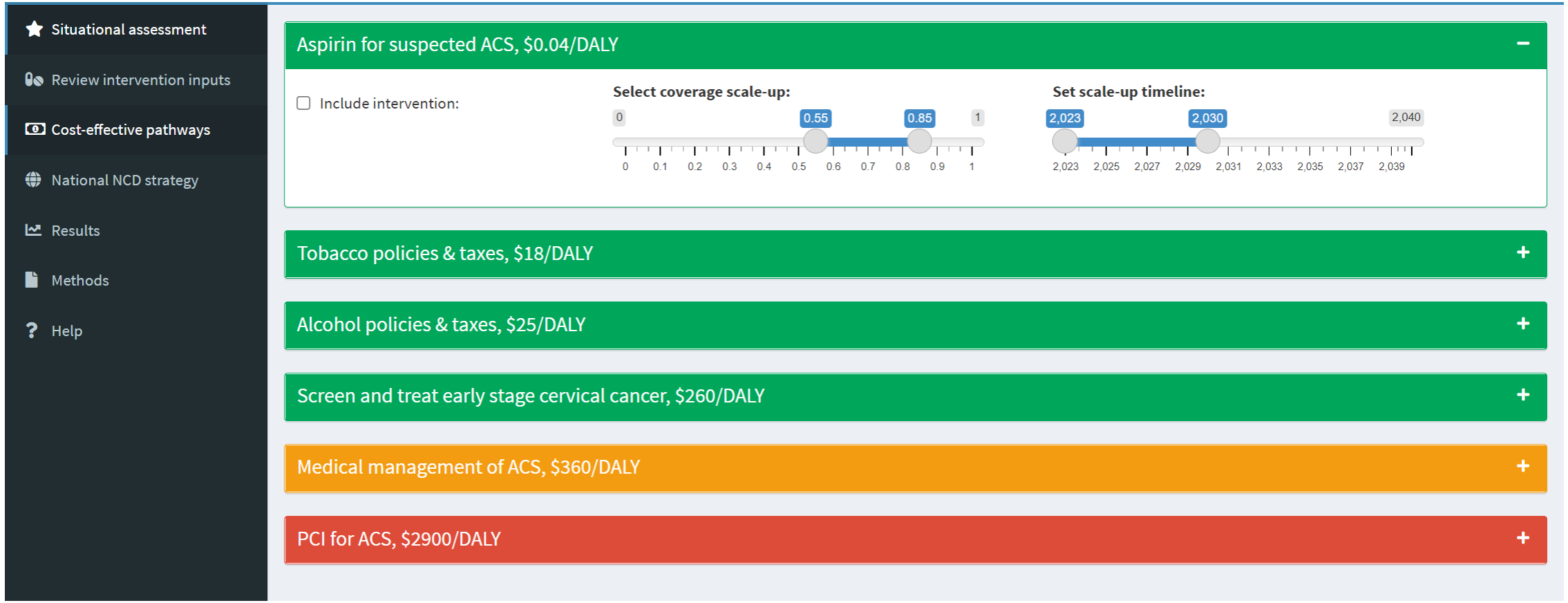
Stylized example; manuscript in preparation.

Future: modeling tool for cancer programs



Intervention	Package	Target	Metric	Effect
Pulmonary rehabilitation	Respiratory	Chronic obstructive pulmonary disease	case fatality	0.053
Acute MI, treatment (heparin and thrombolysis)	CVD	Ischemic heart disease	case fatality	0.28
Heart failure, treatment	CVD	Ischemic heart disease	case fatality	0.18
Heart failure, treatment	CVD	Hypertensive heart disease	case fatality	0.74
Heart failure, treatment	CVD	Cardiomyopathy and myocarditis	case fatality	0.74
Cervical cancer screening and treatment	Cancer	Cervical cancer	case fatality	0.91
Asthma and COPD emergency care	Respiratory	Asthma	case fatality	0.60
Asthma and COPD emergency care	Respiratory	Chronic obstructive pulmonary disease	case fatality	0.29
Inhalators	Respiratory	Asthma	case fatality	0.22
CKD screening and management	Diabetes	Chronic kidney disease due to diabetes mellitus type 1	case fatality	0.16

Future: modeling tool for cancer programs



Future: modeling tool for cancer programs

National NCD strategy

Results

Methods

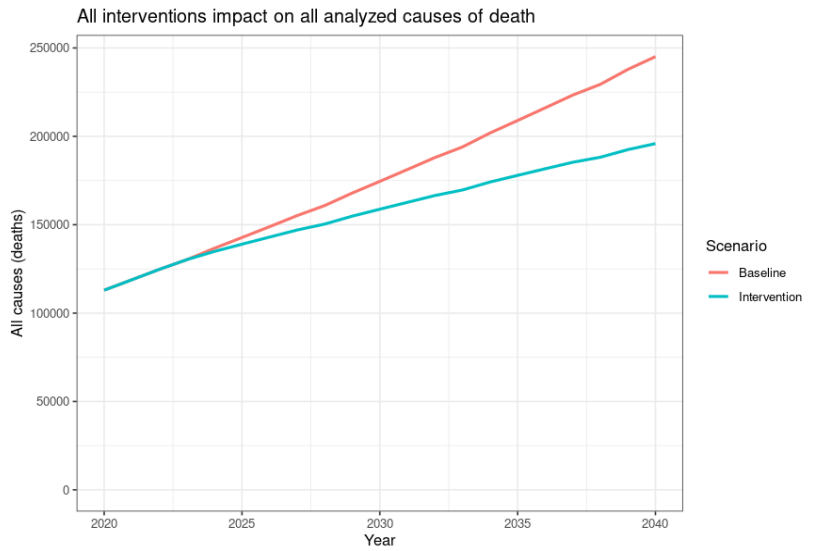
Help

390 thousand
Lives saved

360 thousand
New cases averted

$840
Cost per death averted

Deaths by year



Deaths by cause

cause	Baseline	Intervention	Difference
Asthma	8.1K	7.3K	820
Breast cancer	160K	160K	910
Cardiomyopathy and myocarditis	180K	150K	33000
Cervical cancer	110K	96K	11000
Chronic obstructive pulmonary disease	630K	610K	23000
Colon and rectum cancer	270K	270K	500
Diabetes mellitus type 2	260K	250K	8300
Esophageal cancer	39K	39K	-340
Hypertensive heart disease	210K	180K	31000
Intracerebral hemorrhage	180K	180K	-4
Ischemic heart disease	1.6M	1.3M	270000
Ischemic stroke	310K	300K	12000
Liver cancer	63K	64K	-420
Stomach cancer	260K	260K	-1800
Tracheal, bronchus, and lung cancer	310K	310K	1200

Key messages

Progress on UHC requires careful design of health benefits packages

Extended CEA informs packages by modeling financial protection, equity

Important tradeoffs between health and financial protection for cancer; copayment design

Lancet Commission background work will include tool for doing cancer ECEAs

Thank you!

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