COPENHAGEN CONSENSUS CENTER

BHUTAN ACADEMY

Health: costs, benefits and value for money

Methods, international evidence and Bhutan applications

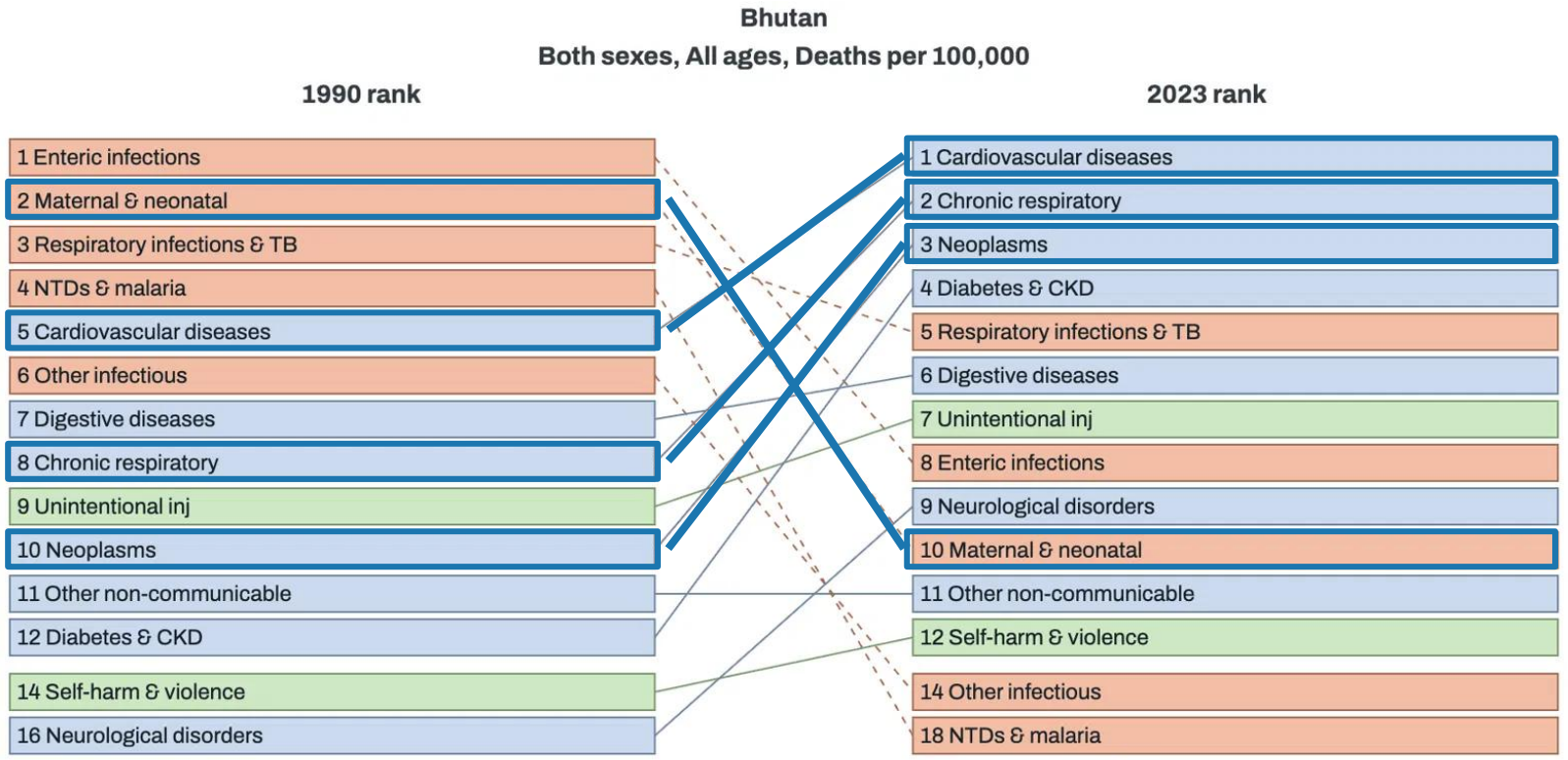
Saleema Razvi, Copenhagen Consensus Center

October 2026

Bhutan’s health profile

Bhutan: causes of death, 1990–2023

Deaths identify mortality; DALYs also include disability (next slide)

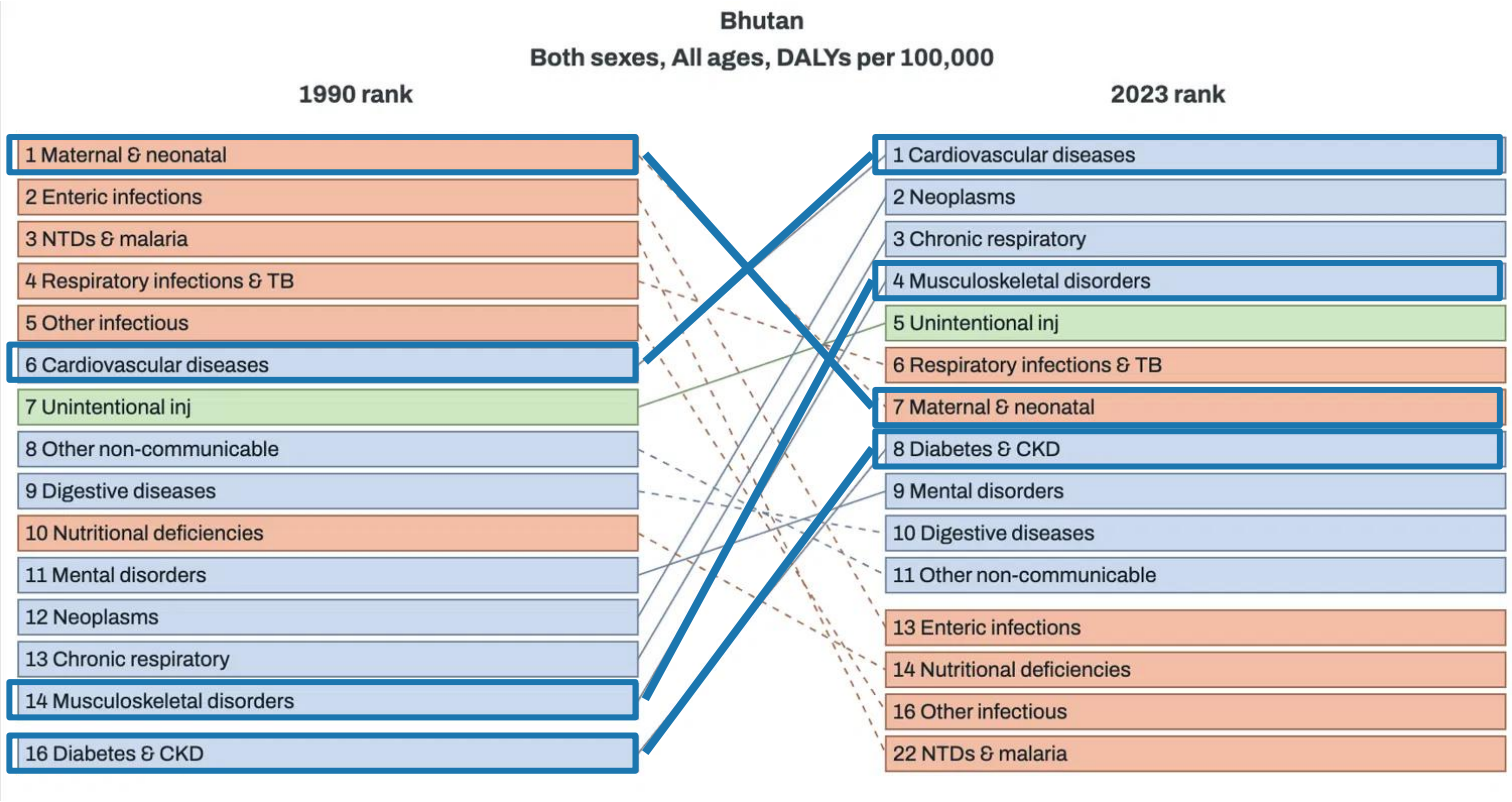


Cardiovascular: 5 → 1 **Cancer: 10 → 3** **Respiratory: 8 → 2** **Maternal/newborn: 2 → 10**

Source: IHME, Global Burden of Disease 2023 — GBD Compare

Bhutan: DALYs, 1990–2023

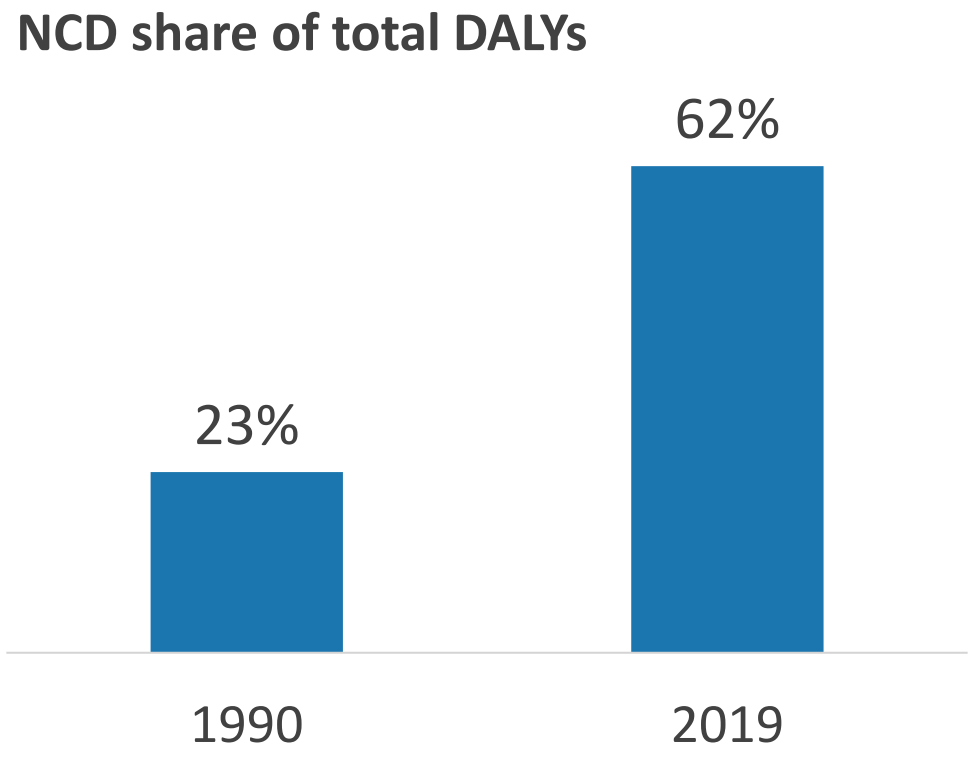
DALY = disability-adjusted life-year: one healthy year lost



Cardiovascular: 6 → 1 **Musculoskeletal: 14 → 4** **Diabetes/CKD: 16 → 8** **Maternal/newborn: 1 → 7**

Source: IHME, Global Burden of Disease 2023 — GBD Compare

A larger NCD burden: where is the best value?



NCDs caused 71% of deaths in 2019

- Burden: where could health improve?
- Cost-effectiveness: cost per DALY averted
- CBA: value of additional benefits / full costs

Source: World Bank (2024), Ageing & NCDs

Source: Tamang, Dahal, Dorji et al. (2022)

Worked health investments

Maternal and newborn health: the problem

295,000

maternal deaths a year
during and just after pregnancy

2.4 million

newborn deaths a year
in the first month of life

- Study: 55 low- and lower-middle-income countries
- Question: which additional package saves most lives per dollar?
  - **Compare expansion with current care, not with no healthcare**

Source: Madise et al. (2023); Best Things First summary

Maternal and newborn health: solution and costs

Basic emergency obstetric and newborn care (BEmONC)
Coverage 68% → 90%, plus access to family planning

Additional resources in the package	Why they matter
Medicines, supplies, staff and facilities	Safe delivery; bleeding, infection and newborn care
Training, supervision and referral	The equipment works only within a functioning service
Access and women's travel/waiting time	Patients must be able to reach and use the service

Annual incremental cost, book scenario	US$ billion
Financial programme costs	2.1
Women's time costs	1.6
Total social costs	3.7

Source: Best Things First / CCC maternal-health case (2023)

Neonatal resuscitation: low unit cost, large effect

Problem: some newborns do not start breathing

Cost input	Worked unit cost
Resuscitator purchase price	$65 per device
Uses assumed for allocation	25 newborn treatments
Equipment cost per treatment	$65 / 25 = $2.60
Equipment + health-worker time	About $5 per newborn treated



Benefit: about 30% fewer eligible asphyxia deaths

Lives saved = eligible deaths × effect × additional coverage

Source: Madise et al. (2023), resuscitation example

Maternal and newborn health: benefits and BCR

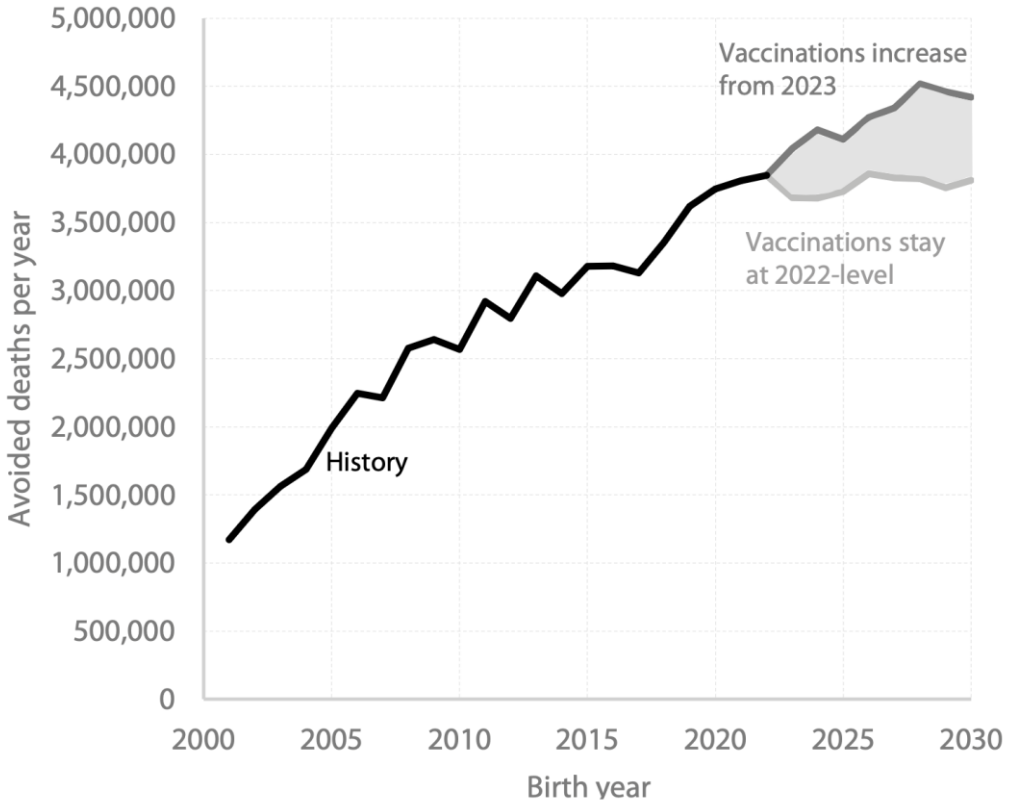
Incremental benefit at full scale	Reported quantity or value
Mothers' lives saved	161,000 a year
Newborn lives saved	More than 1.2 million a year
Health gains + demographic dividend	US$322 billion a year
Full annual social cost	US$3.7 billion

BCR = $322bn benefits / $3.7bn costs ≈ 87

Source-reported international case; valuation is explained after the break

Source: Best Things First / CCC case; linked peer-reviewed study

Vaccination expansion: value the additional gain



- BAU: maintain 2022 coverage
- Expansion: increase coverage from 2023
  - **Additional gain = gap between the paths**
- Later recipients can cost more to reach
  - **Outreach, travel, cold chain, staff time**

Marginal return: additional benefit / additional delivery cost

Source: Patenaude et al. (2023); Best Things First

Vaccinations: average returns and marginal returns

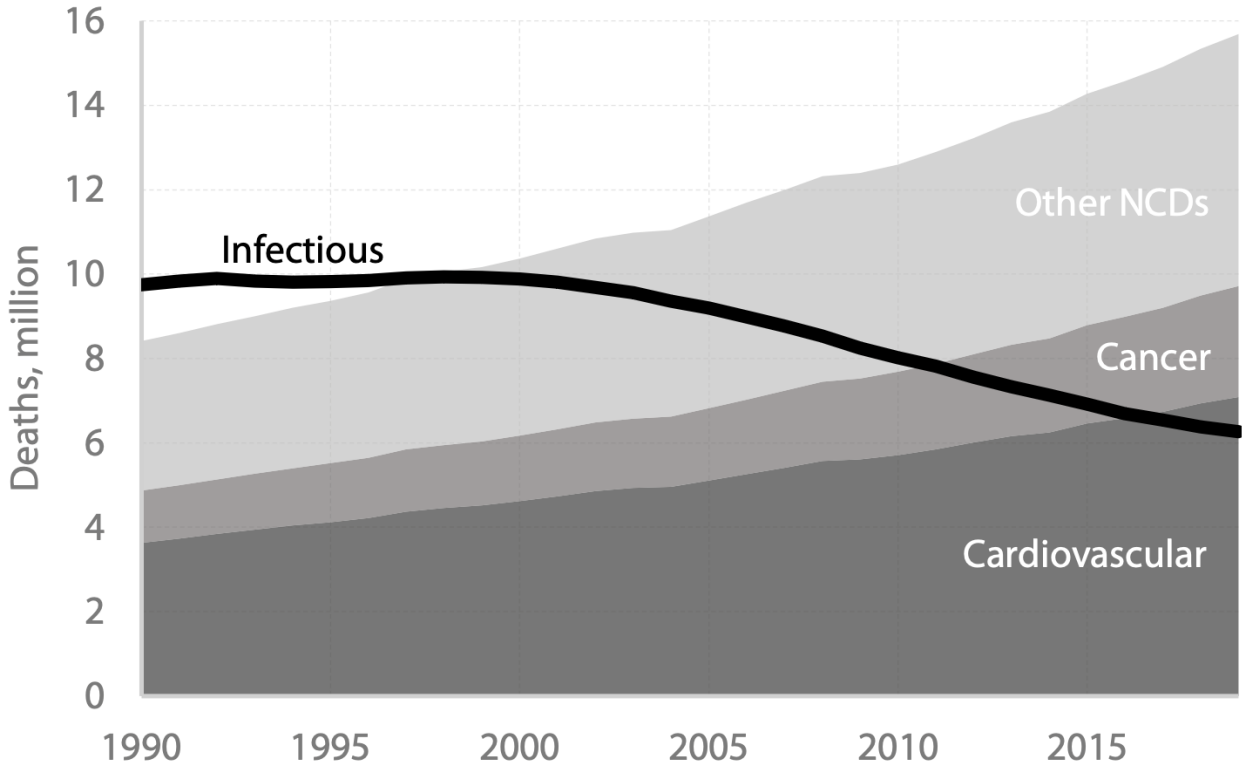
Book scenario: annual US$ billion	Existing programme	Additional scale-up
Benefits	1,070	167
Costs	3.7	1.7
Reported BCR	286	101

Rounded annual totals; reported BCRs use unrounded model values.

- Average return: value of existing provision / its cost
- Marginal return: value of additional coverage / additional cost
- Reaching remote or underserved groups raises delivery costs

Source: Best Things First (2023); Patenaude et al.

Chronic disease: burden does not identify the best buy

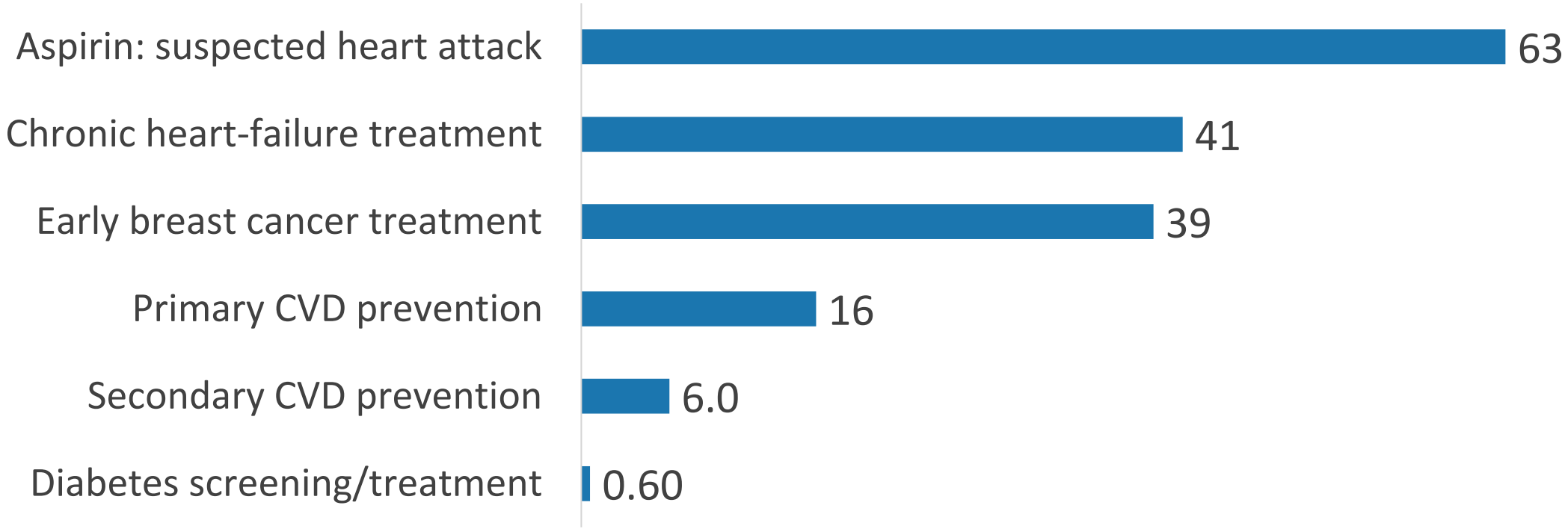


- Which patients are reached?
- What changes versus BAU?
- What does delivery cost?
- How much health is gained?

A large burden can contain both high-return and low-return investments

Source: Best Things First (2023), LICs and lower-middle-income countries

Selected chronic-disease interventions: BCRs



Six selected examples of 24 clinical interventions; not the full ranking

Source: Best Things First (2023), selected clinical results

Chronic disease: calculating costs and health gains

The chronic-disease study and its evidence

- Watkins, Ahmed and Pickersgill (2023): low- and lower-middle-income countries
- 30 interventions: 24 clinical treatments + 6 intersectoral policies
- Disease Control Priorities, third edition (DCP3)
  - **Peer-reviewed syntheses; trials, meta-analyses and costing studies**
- Scale-up model: 2023–2030; measurable additional health gains

Source: Watkins et al. (2023), Journal of Benefit-Cost Analysis

Business-as-usual and the marginal scale-up

Model element	Business-as-usual	Additional investment
Clinical coverage	Hold baseline coverage constant	Increase linearly toward 80% by 2030
Policy coverage	Current taxes/regulations	Policy-specific target
Population and disease risk	Population and risks evolve	Same background trajectory
What counts in the CBA?	Existing provision stays in BAU	Only the additional costs and outcomes

Incremental = investment scenario minus business-as-usual

Source: Watkins et al. (2023), 2023–2030 model

Clinical costs: resources per additional patient

Resource	Costing method in the study
Medicines and traded supplies	Traded-cost component
Staff, facilities and local services	Non-traded cost scaled with country income
Evidence and price year	DCP3 reviews; costs in real 2020 US$
Additional care delivered	People in need × additional coverage

Additional cost = full unit cost × additional patients treated

Bhutan adaptation: add setup, follow-up, tests, travel and patient time

Source: Watkins et al. (2023); DCP3 costing reviews

Taxes and regulations: a different cost boundary

Policy effect	Treatment in the study
Government administration and enforcement	Resource costs
Firm compliance and reformulation	Private resource costs
Forgone consumer welfare	Offset against gross health benefits
Tobacco and alcohol tax receipts	Transfer: payer cost and government receipt

Count government, firm and consumer effects; legislation is not costless

Source: Watkins et al. (2023), intersectoral costing

Benefits: estimate additional deaths and DALYs averted

Input to the impact model	What it supplies
UN projections + WHO mortality	Population, age and baseline deaths
GBD incidence and prevalence	Disease and disability burden
Trials, reviews and NCD Countdown	Intervention-specific effect sizes
Study implementation factor: 0.70	Adjust efficacy for imperfect delivery

Illustration: 20% trial risk reduction × 0.70 = 14%

Additional health gain = BAU outcomes minus investment outcomes

Source: Watkins et al. (2023), population-health model

Selected scale-ups: costs per additional life saved

Selected clinical expansion	Cost, US$ million/year	Additional lives saved/year	US$ per life saved
Aspirin: suspected heart attack	3	2,949	1,017
Chronic heart-failure treatment	551	346,556	1,590
Primary CVD prevention	3,467	931,401	3,722
Secondary CVD prevention	6,864	640,195	10,722

Cost per life saved = additional annual cost / additional lives saved

Calculated from rounded study totals; nonfatal health benefits are additional.

Source: Best Things First (2023), selected model results

DALYs and their monetary value

DALYs: years lost to death and disability

DALY = YLL (years of life lost) + YLD (years lived with disability)

Teaching input	Calculation	Healthy years lost
Illness lasts 10 years; disability weight 0.50	10 years × 0.50	5 YLD
Death at age 30; 50 remaining years in reference life table	1 death × 50 remaining years	50 YLL
Total burden for this assumed history	50 YLL + 5 YLD	55 DALYs

One DALY means one healthy year lost; averting it is a health benefit

Source: IHME GBD; Robinson et al. (2019)

Disability weights: severity and duration

Specified health state	Weight: healthy year lost per year
Mild anaemia	0.004
Controlled asthma	0.015
Mild anxiety disorders	0.030
Metastatic phase of cancer	0.451
Severe multiple sclerosis	0.719

YLD = affected people × duration in years × disability weight

Use the exact health state; adjust overlapping conditions, not a diagnosis label

Source: IHME GBD 2023 disability-weight catalogue

Depression: every input in the DALY calculation

Teaching assumption	Value / calculation
Region population	2,000,000 residents
Depression prevalence	600 cases per 100,000 residents
Cases in the region	2,000,000 × 600 / 100,000 = 12,000 cases
Additional cases with illness burden averted	12,000 cases × assumed 10% = 1,200 cases
Burden averted per case	1 year × disability weight 0.40 = 0.40 DALY

1,200 cases × 0.40 DALY/case = 480 DALYs averted

Source: Illustrative example adapted from the approved CBA toolkit

Value of a statistical life: small risks, added together

Teaching assumption	Value
People paying for a safety improvement	1,000 people
Mortality-risk reduction for each person	1 / 1,000
Willingness to pay per person	$100
Expected deaths avoided across the group	1,000 × (1 / 1,000) = 1 statistical death
Total willingness to pay	$100 × 1,000 people = $100,000

VSL = total willingness to pay / expected deaths avoided = $100,000

Source: Robinson et al. (2019), Reference Case Guidelines

Evidence for willingness to pay for mortality-risk reductions

Research method	Teaching trade-off and calculation
Wage–risk study	Extra pay $2,000/year ÷ extra annual risk 4/10,000 = $5m VSL
Safety-product purchase	$500 willingness to pay ÷ risk reduction 1/10,000 = $5m VSL
Stated-preference survey	$500 stated payment ÷ risk reduction 1/10,000 = $5m VSL

- Wage studies control for other pay determinants
- Safety purchases need evidence of the risk reduction
- Surveys explain small probabilities and test responses

Source: Robinson et al. (2019), valuation evidence

Bhutan VSL for 2026: retain the 2015 transfer inputs

Academy transfer input	Definition and value
US reference VSL / income	160 × US GNI per capita, 2015
2015 Bhutan GNI per capita, PPP	7,520 international dollars
2015 US GNI per capita, PPP	57,900 international dollars
Income elasticity	1.5: response of VSL to income
Exponent for the VSL / income multiple	Elasticity − 1 = 0.5

160 × (Bhutan 7,520 / US 57,900)^0.5 ≈ 57.66

Retain the original source vintage. PPP is not the final CBA currency.

Source: Robinson et al. (2019), Reference Case Guidelines

Bhutan VSL: update growth and income to 2026

Update step	Input and result
Real GNI per person, 2015 → 2024	236,646 / 195,055 constant LCU ≈ 1.213
GDP-growth proxy, 2025 → 2026	$1.08 \times 1.063 / 1.007^2$; population +0.7%/year assumed
Total real per-person growth factor	$1.213 \times 1.08 \times 1.063 / 1.007^2 \approx 1.374$
Updated VSL / income multiple	$57.66 \times \sqrt{1.374} \approx 67.58$
2026 forecast income in ngultrum	US$4,521.3/person × Nu 90/US$ assumed ≈ Nu 407,000
2026 projected Bhutan VSL	67.58 × Nu 407,000 ≈ Nu 27.5 million

2026 approximation: GDP-growth proxy, exchange rate and population assumptions.

Source: World Bank real GNI/person

Source: Bhutan budget FY2026–27, pp. 6 & 14

Bhutan VSLY: a provisional 2026 planning value

Input / convention	Bhutan approximation, 2026
Transferred statistical-life value (VSL)	About Nu 27.5 million
Life expectancy at birth	73.8 years: assumed 2026 projection
Academy VSLY denominator	0.5 × 73.8 = 36.9 years
VSLY = VSL / denominator	Nu 27.5 million / 36.9 ≈ Nu 745,000
Provisional planning value, rounded	Nu 750,000 per DALY averted

Health benefit = summed DALYs averted × Nu 750,000 (2026)

No DALY discounting. Do not add VSL and VSLY for the same health outcome.

Source: Robinson et al. (2019); projected Bhutan inputs

Statistical risk reduction, not a price for a person

- Nu 750,000 is per healthy life-year / DALY averted (VSLY)
  - **The corresponding statistical-life value (VSL) is about Nu 27.5 million**
- VSL adds willingness to pay for many small mortality-risk reductions
  - **It is not a value assigned to an identified person's life**
- An infinite value would imply abandoning ordinary trade-offs
  - **For example: driving at 5 km/h and spending all our time avoiding injury**

Source: Robinson et al. (2019), statistical-risk valuation

Health benefits beyond Health

Air pollution: exposure, disease and health gains

Evidence / appraisal step	What it tells us
China heating-policy boundary study	Sustained exposure contrast, not a randomised trial
Research finding north of boundary	TSP about 55% higher; life expectancy about 5.5 years lower
Local policy → change in exposure	Estimate pollution concentrations where people live
Exposure → deaths and illnesses	Use baseline risk, population and dose-response evidence
Health gain → value	Sum additional YLL/YLD × Nu 750,000/DALY (2026)

Use the local exposure change; do not copy 5.5 years into a Bhutan policy

Source: Chen et al. (2013), PNAS, Huai River study

Air pollution: summed health gains without double counting

Teaching outcome assumption	Summed health gain
10 deaths avoided; 20 healthy years per death	10 deaths × 20 years = 200 YLL
100 nonfatal episodes; 0.1 years; weight 0.05	100 × 0.1 × 0.05 = 0.5 YLD
Total additional health gain	200 YLL + 0.5 YLD = 200.5 DALYs
Base-year value, 2026	Nu 750,000 per DALY; no DALY discounting

200.5 DALYs × Nu 750,000/DALY = Nu 150,375,000

Count each death once. Keep medical savings and full policy costs separate.

Source: Robinson et al. (2019); illustrative Bhutan-valued outcomes

Traffic safety: protection, coverage and the baseline

Evidence or policy step	Meaning for the CBA
Helmet protection among crash-involved riders	About 42% lower death risk; 69% lower head-injury risk
Policy changes helmet wearing and quality	Additional correct use versus existing practice
Local crash exposure and baseline severity	Convert the policy change into avoided outcomes
Costs beyond the helmet	Enforcement, education, rider time and compliance
Other benefits beyond DALYs	Vehicle damage and emergency-service resources avoided

A helmet effect is not the effect of passing a helmet law

Source: Liu et al. (2008), Cochrane helmet review

Traffic safety: deaths plus lasting disability

Teaching outcome	Duration and severity	Health gain
1 premature death avoided	30 healthy years remaining	1 × 30 = 30 YLL
10 nonfatal injuries avoided	2 years each; weight 0.20	10 × 2 × 0.20 = 4 YLD
Total health gain, summed	Fatal and nonfatal groups do not overlap	34 DALYs averted

- 34 DALYs × Nu 750,000/DALY = Nu 25,500,000 (2026)
- Property damage: replacement/repair values, not DALYs
- Emergency care: real resources saved; avoid overlap with other costs

Source: Robinson et al. (2019); illustrative outcome quantities

Policing: crime reduction

Research story	CBA translation
Focused policing at small crime hot spots	Compare extra effort with ordinary policing
65 studies; 78 tests; 27 randomised studies	Review finds a small, significant mean crime reduction
Violent offences and injury severity	Estimate additional fatal/nonfatal harms avoided
Displacement and nearby diffusion	Count outcomes across the affected area
Programme and other costs	Police time, justice resources and effects on residents

Only health-related harms become DALYs; property losses need another measure

Source: Braga et al. (2019), Campbell hot-spots policing review

Violent crime: injury severity and other benefits

Teaching injury group	Cases avoided	Duration × weight	DALYs averted
Minor injuries	50	0.2 years × 0.10	50 × 0.2 × 0.10 = 1
Serious injuries	2	10 years × 0.30	2 × 10 × 0.30 = 6
Total, summed			7

7 DALYs × Nu 750,000/DALY = Nu 5,250,000 (2026)

- Fatal injuries and supported mental-health sequelae require separate inputs
- Property returned to victims: replacement value, not a DALY
- Academy: illicit gains have zero welfare weight
  - **Do not count the same asset again as an avoided property loss**

Source: Robinson et al. (2019); illustrative crime outcomes

Domestic violence: evidence and the health pathway

Case element	What the evidence supports
Intervention	SASA!: community mobilisation and social-norm change
Design and setting	Cluster-randomised trial in 8 communities, Kampala, Uganda
Past-year physical partner violence	Relative risk 0.48; 95% CI 0.16–1.39
Health pathway to estimate	Fewer assaults → fewer injuries and supported mental-health harms
Cost boundary	Staff, training, community activity, survivor time and services

The trial's violence outcome is not itself a fixed number of DALYs

Source: Abramsky et al. (2014), BMC Medicine, SASA! trial

Domestic violence: mental health and overlapping effects

Teaching input	Value and meaning
Depression episodes averted by the additional policy	20 episodes (assumed; not the SASA! estimate)
Duration of each episode	0.5 years of illness averted
Disability weight for this illustration	0.30 (assumed severity, not a named GBD state)
Health gain	20 × 0.5 × 0.30 = 3 DALYs; × Nu 750,000 = Nu 2,250,000 (2026)

- Add physical injury and mental-health effects only with credible links
- Adjust overlapping conditions for the same person and period
- DALYs capture health loss; safety, dignity and justice need separate treatment

Source: Robinson et al. (2019); WHO violence-against-women evidence

Health benefits across sectors: the same CBA method

Example	What to estimate and keep separate
Air pollution	Exposure change → mortality/illness; timing; no duplicate mortality benefit
Traffic accidents	Deaths + lasting injuries; property damage and emergency costs separately
Policing and crime prevention	Violent injuries → health gains; property losses valued using other measures
Domestic violence prevention	Supported injury + mental health; overlap adjustments; wider effects visible

Business-as-usual → additional outcomes → monetary benefits (including summed DALYs x VSLY) → full incremental costs → BCR

Source: Robinson et al. (2019), cross-sector health valuation

LUNCH BREAK

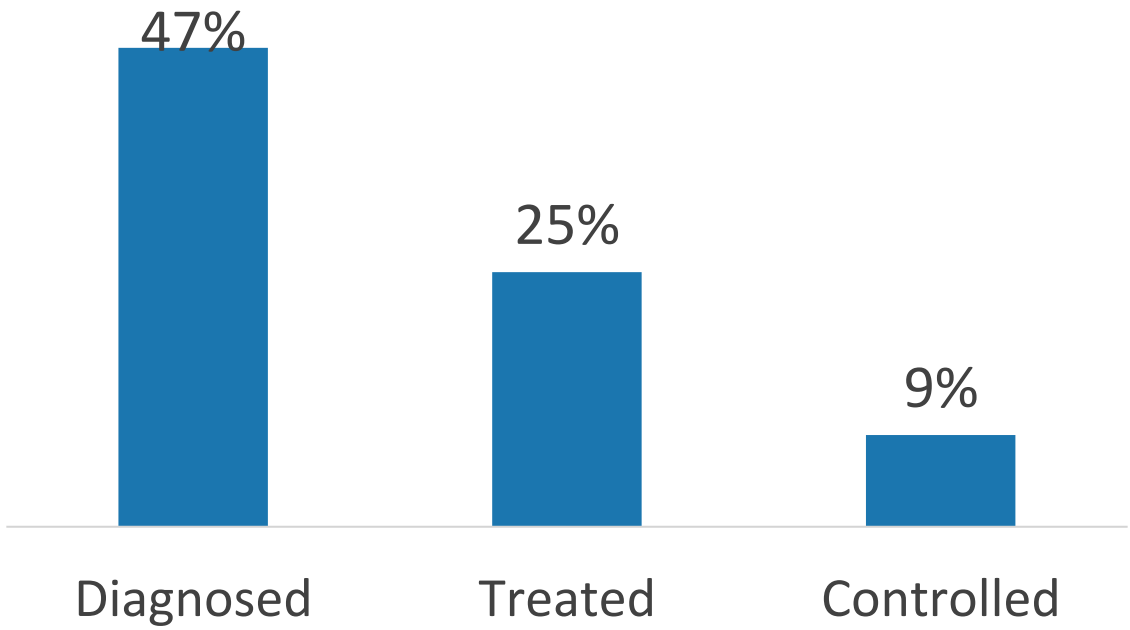
Next: Bhutan case

Cardiovascular care in Bhutan: costs and benefits

Bhutan’s hypertension gap: define the additional service

166,000 people with hypertension

About 151,000 without control



- Adults aged 30–79; all percentages use people with hypertension
- BAU includes existing services; value the extra control from expansion
- Control is an intermediate outcome: estimate strokes, deaths and DALYs

Source: WHO hypertension profile (2025), 2024 estimates

Which cardiovascular service buys the most health?

Service / population	Costs to include	Benefits to estimate
Hypertension / primary prevention	Screening, medicines, visits, tests, patient time	Additional strokes, heart attacks and disability avoided
Secondary prevention after a heart attack	Medicine delivery, refills, follow-up, adherence support	Additional recurrent events and deaths avoided

- Monitoring is useful when it triggers refills, follow-up or treatment
- CBA asks what changes above current care and what that change costs

Source: Watkins et al. (2023); WHO Bhutan implementation story

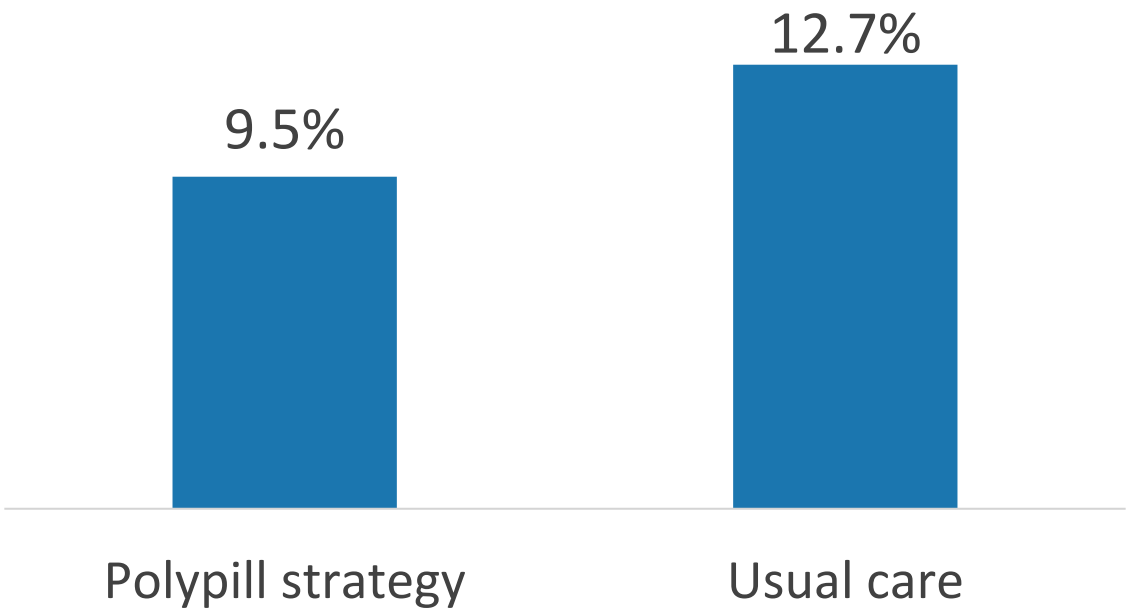
Secondary prevention: problem, service and cost

Case element	Defined intervention
Problem	People after myocardial infarction have recurrence risk
Eligible population	Patients after a heart attack, not all hypertensive adults
Service	Evidence-based medicines and reliable follow-up
Delivery costs	Medicines, staff, visits, tests, refills and patient time
Benefit pathway	Additional adherence → fewer recurrent events → health gains

Compare an additional treatment strategy with the care already provided

Source: Castellano et al. (2022), SECURE trial

SECURE: observed effect, not yet a cost-benefit result



2,499 post-heart-attack patients Randomised; median 3-year follow-up

9.5% vs 12.7% had a primary event Hazard ratio 0.76 (95% CI 0.60–0.96)

- Endpoint includes death, nonfatal heart attack/stroke and revascularisation
- A composite-event effect is not an annual mortality reduction

Source: Castellano et al. (2022), New England Journal of Medicine

Two Bhutan teaching cases: define the marginal change

Case definition	Primary prevention	Secondary prevention
Eligible population	High-risk adults before a heart attack	Patients after a heart attack
Business-as-usual	Existing screening and blood-pressure care	Existing medicines and follow-up
Additional programme	One year of treatment and adherence support	One year of medicines and adherence support
Decision unit	One additional eligible patient-year	One additional eligible patient-year
Evidence status	Illustrative 2026 CBA	Illustrative 2026 CBA

All effect and cost inputs are placeholders, not Bhutan programme estimates

Source: Robinson et al. (2019); clinical inputs are teaching assumptions

Teaching inputs: risk, effect, adherence and survival

Assumption per extra eligible patient-year	Primary	Secondary
Annual BAU mortality risk	1%	12%
Conditional mortality reduction if effectively treated	23%	23%
Additional effective adherence above BAU	62%	62%
Healthy survival per death avoided	10 years	10 years
Base-year VSLY, 2026	Nu 750,000/DALY	Nu 750,000/DALY

Illustrative assumptions: neither column is a measured Bhutan effect

Source: Robinson et al. (2019); clinical inputs are assumptions

From mortality-risk reductions to additional DALYs

Calculation step	Primary prevention	Secondary prevention
Expected deaths avoided per patient-year	0.01 risk × 0.23 effect × 0.62 adherence = 0.001426	0.12 risk × 0.23 effect × 0.62 adherence = 0.017112
Healthy years / DALYs averted	0.001426 deaths × 10 years = 0.01426	0.017112 deaths × 10 years = 0.17112
Expected lives saved per 1,000 additional patient-years	1.426	17.112

- Fractional deaths are expectations, not observed counts
- DALYs are summed without discounting; both cases use the same survival assumption
- Nonfatal benefits are omitted here; add them only with an accepted outcome model

Source: Robinson et al. (2019); illustrative health quantities

Full incremental costs: informed placeholders for teaching

Cost per additional patient-year, Nu (2026)	Primary	Secondary
Medicines: recurring	600	3,000
Staff, visits and refills: recurring	400	800
Tests and monitoring: recurring	300	400
Patient travel and time: private costs	600	600
Setup, training and equipment: allocated once	100	200
Referral and adverse-event care: recurring	200	200
Total incremental social cost	2,200	5,200

All costs occur in 2026. Transfers and future costs/savings assumed zero.

Placeholders only: replace with local resource quantities, prices and time values.

Source: Illustrative cost assumptions; Robinson social-cost boundary

Complete the two CBAs at the 2026 Bhutan VSLY

Per additional eligible patient-year	Primary prevention	Secondary prevention
Additional DALYs averted, summed	0.01426	0.17112
2026 value per DALY	Nu 750,000	Nu 750,000
Value of health benefits	0.01426 × 750,000 = Nu 10,695	0.17112 × 750,000 = Nu 128,340
Full incremental social costs	Nu 2,200	Nu 5,200
BCR = benefits / costs	10,695 / 2,200 ≈ 4.9	128,340 / 5,200 ≈ 25

Same base-year value. No discounting of DALYs. Full assumed costs.

Source: Robinson et al. (2019); all case inputs are illustrative

Which cardiovascular service buys the most health?

Teaching comparison	Primary	Secondary
DALYs per Nu 1,000 spent	0.01426 / 2,200 × 1,000 = 0.0065	0.17112 / 5,200 × 1,000 = 0.0329
Health benefit per Nu 1 spent (BCR)	4.9	25
What explains the difference?	Lower baseline risk; lower cost	Higher baseline risk; greater health gain

- Under these assumptions, secondary prevention buys about five times as much health per ngultrum
- Both cases have positive returns; eligible populations and scale differ
- Replace risk, adherence and all costs before making a Bhutan policy recommendation

Source: Illustrative 2026 Bhutan teaching comparison