The role of burden of disease, cost-effectiveness and technical efficiency in improved strategic decision-making

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Outline

Examine a range of quantitative tools or potential tools that could assist governments in strategic decision-making.

1) Health problems deserving policy attention
2) Benchmarking to determine achievable reductions
3) Health system response capability
4) Picking the right tactical mix
5) Tools
Making sense of complex health patterns

1) Detailed health patterns and trends are extremely complex – diseases, risk factors, age-sex patterns, subnational profiles etc.

2) Annual updates of the Global Burden of Disease makes this detail available in a highly standardized form – increasingly at the subnational level.

3) External heuristics such as the MDGs focused attention on a limited subset of conditions; SDGs provide a much broader viewpoint.

4) Parse patterns into a) the typical demographic and epidemiological changes expected due to changes in socio-demographic status, b) deviations from these expected levels and c) newly emerging or increasing challenges can help simplify understanding a population’s health challenges.
Socio-demographic status

1) Levels of health strongly correlated with GDP per capita, educational attainment and the total fertility rate.

2) For heuristic purposes, useful to collapse these three variables into a single measure: socio-demographic status. – using principal components analysis.

3) Single measure allows for simple visualizations of the expected changes in the burden of disease – far more predictive than GDP per capita alone

4) SDS explains a tremendous amount of variation overtime and across countries for many causes (e.g. diarrhea) but far less for some (e.g. interpersonal violence)
Neonatal disorders age-standardized death rates and SDS, 1980-2015

Strong relationships with SDS – graph is on a log scale

2015 at the same level of SDS is lower than 1980 – blue versus green line

At any level of SDS in any given year, there is considerable variation in SDS
Epidemiological transition: predicted DALY rates for YLLs and YLDs by cause as a function of socio-demographic status
The cancer Years of Life Lost (YLLS) transition in detail
What patterns are unexpected compared to epidemiological transition?
Using GBD to isolate causes where age-standardized rates are increasing
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Achievability

1) Unusually large challenges compared to expected, rising challenges and the expected shifts with the epidemiological transition do not necessarily translate into government action to reduce burden or mitigate trends.

2) Most policy-makers want to know what reduction in the burden of a disease or a risk factor can be achieved?

3) Achievability can be assessed through benchmarking exercises: compared to what other comparators have achieved what reduction is possible.

4) Achievability for diseases can also be assessed through ex ante modeling especially where there are no current good benchmarks or for which a new intervention is available but not used on a population scale.
Benchmarking – 3 strategies

1) Comparing to countries with similar socio-demographic status, what reductions in a disease or risk factor should be possible?

2) Comparing subnational units (first or second administrative levels) within a country with similar socio-demographic status, what reductions in a disease or risk factor should be possible?

3) Comparing to a set of specific selected countries, what is achievable?
Achievable reductions Mexico 2013, SDS benchmarking

Diab + Urog + Hem

- Diabetes, urogenital, blood, and endocrine diseases
  - Value: 0.033
  - Attribution: 0.54

Mental

CVD

Neoplasms

Neuro

Cirrhosis

Digestive

MSK

Chr Resp

Nutr Def

Self-harm & IPV

Unint Inj

Trans Inj

HIV + TB

Neonatal

Diar + LRI + Other

Other groups
Achievable reductions Kenya 2013, SDS benchmarking
Achievable reductions Kenya 2013, SDS benchmarking
Achievable burden benchmarking

1) More standardized tools for this form of benchmarking planned for public release by IHME later this year including SDS and user selected benchmarks.

2) Benchmarking answers the question as to whether progress should be possible but does not provide the answer on the tactics needed in each setting.

3) Because no country at a given level of SDS has achieved a better outcome does not mean it is not possible – eg. Hepatitis C treatment
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Health system response capability – three among many components

1) **Resource levels** – how much is a country investing in its health system compared to what is possible at a given level of GDP per capita – the notion of fiscal space.

2) **Stewardship capacity** – ability of the system to follow the best trajectory for dealing with the epidemiological transition, formulate policies for major national deviations from the epidemiological transition and handle increasing threats depends on their stewardship capability.

3) **Health system efficiency** – given domestic resources and development assistance for health, ability of the system to respond depends critically on system technical efficiency.
Estimating Potential Government Health Expenditure -- using stochastic frontier analysis on child health expenditure
Understanding system efficiency

1) **Provider technical efficiency of producing intermediate outputs** – practical methods available that allow insights into the technical efficiency of intermediate output (with and without quality adjustment) for specific providers.

2) **System efficiency of producing effective coverage** – with expanding efforts to measure coverage and effective coverage that go beyond maternal and child health interventions, this becomes more feasible.

3) **System efficiency of producing health outcomes** – how well does a system overall produce health gain? Statistical challenges of isolating the effect of the health system from other determinants and dealing with time lags remain challenging.
Technical efficiency measurement methods

• **Data Envelopment Analysis (DEA)**
  o Operations research approach
  o Formulated as a non-parametric, piecewise linear program

• **Stochastic Distance Function (SDF)**
  o Econometric approach
  o Assumes parametric production function
  o Splits the error term into inefficiency \( u_i \) and stochastic components \( v_i \)

\[
\begin{align*}
\min \theta_j &= \sum_{i=1}^{I} v_{ij} x_{ij} \\
\text{s.t.} & \quad \sum_{i=1}^{I} v_{ij} x_{ij} - \sum_{r=1}^{R} u_{rj} y_{rj} \geq 0 \\
& \quad u_{r}, v_{i} \geq 0, \quad \forall \ i, r
\end{align*}
\]

\[
-ln y_1 = \beta_1 ln x_1 + \beta_2 ln x_2 + \beta_3 ln \frac{y_2}{y_1} + u_i + v_i
\]
Development of an ensemble method for estimating producer efficiency that is robust to a wide range of production functions and provider behaviours.
ABCE (Access, Bottlenecks, Costs, and Equity)

- A panel dataset of nearly 600 health facilities, representative sample at the national level
- Covering facilities in Kenya, Uganda, Zambia, and Ghana
Application of ensemble efficiency methods to Zambia, Uganda and Kenya: Technical efficiency is low in many facilities
Potential for ART expansion through increased efficiency

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**Kenya**

**Uganda**

**Zambia**

![Graph showing the potential for ART expansion through increased efficiency for Kenya, Uganda, and Zambia.](image-url)
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Picking the right tactics

1) In a system at a given level of technical efficiency and a willingness to invest in addressing a health problem, there are many tactical options.

2) Evidence on intervention efficacy, effectiveness and cost can be a critical input – some health systems have been more successful at using this information for clinical intervention choice e.g. NICE.

3) Divergence between ex ante and ex post assessments of effectiveness and costs in many developing country assessments demonstrates the need for more standardized ex ante modeling and ex post monitoring.
Lessons from HIV prevention and treatment

1) Late 1990s studies on the expected effectiveness of HIV prevention programs and costs argued limited investments in HIV prevention would be transformative while treatment was not cost-effective.

2) After spending more than $25 billion of DAH on HIV prevention, PMTCT has had clear impact but many other prevention programs have not; there is overwhelming evidence of impact of the $25 billion of DAH on HIV treatment.

3) *Ex ante* modeling of intervention cost and consequence needs rigor and standardization to be a robust tool for tactical decision-making in each context.
Impact accounting

1) Monitoring expenditure and estimated health gain through interventions in each country can help identify where *ex post* benefits diverge from *ex ante* assessment of benefits – this divergence can help target managerial and policy intervention.

2) Impact accounting is not a substitute for rigorous *ex post* evaluation but can provide timely information on variation in costs and consequences.
Lives saved scorecard – July 2015 Lancet

1) For child deaths, time series is good enough to estimate how many child lives averted above and beyond what would have been expected by changes in GDP per capita and educational attainment.

2) Changes in expenditure on child health (domestic and DAH) can be compared to changes in child deaths averted yielding country estimates of cost per child death averted.

3) Cost per death averted rises with income and has been increasing overtime.

4) Similar analyses planned for maternal mortality, HIV and malaria.
Detailed health expenditure by programmatic area overtime with GBD outputs opens possibility of impact accounting for many more causes

US expenditure by age, service and cause, 2013
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Healthdata.org

Annual GBD available at
http://vizhub.healthdata.org/gbd-compare/

Global health data exchange provides microdata for random sample health surveys
http://ghdx.healthdata.org/

Code for ensemble efficiency
http://ghdx.healthdata.org/record/efficiency-simulation-health-production-low-middle-income-countries

Achievable burden tools, fiscal space SFA, health expenditure forecasts, health forecasts coming soon…