Assessing country UHC performance relative to spending:

a DEA investigation

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Health systems’ efficiency’ Special Interest Group
Motivation for the analysis

• Growing dissatisfaction with use of health expenditure targets in the health financing dialogue

• Based on a wide range of assumptions e.g. scope of services, extent of scaling up, timeline. Total or public? Evidence base often weak.

• Some value for advocacy, but can have negative effect on direction of country level discussions, action.

• Risks sending message that progress is not possible without significant increases in spending.

• WHO publishes health expenditure data (GHED), and health coverage data (GHO), typically considered separately.

• We analyse variation in performance relative to spending, in 83 low and middle income countries (2012 data)
Numerous targets exist

- **1993**
  - $12-22 per capita

- **2001**
  - Abuja: 15% GGE to health

- **2009**
  - $60 per capita

- **2010**
  - <20% OOP/THE 5%GDP
  - $44-$80 per capita

- **2014**
  - $86 per capita/5% GDP

Health expenditure estimates
Our requirements

• A technique to assess the relationship between the level of public expenditure on health in a country and its performance on agreed UHC tracer indicators.

• A method flexible enough to accommodate one input and multiple outputs simultaneously.

Our decisions

• We used non-parametric DEA; linear programming method which allows us to determine how well an entity, in our case a country, converts an input (health spending) into outputs (performance).

• We assigned the constraint that all outputs be given a weight greater than 0, to ensure all were evaluated, whilst permitting flexibility in the assignment of weights. Without these constraints, poor performance on some indicators may be ignored.

• We used an output-oriented model, which reports the extent to which a unit can be expected to increase its outputs at its given level of inputs.

• We conducted three sensitivity analyses.
Data envelopment analysis:

*in algebraic terms*

In algebraic terms, given \( n \) outputs and \( m \) inputs:

\[
E_0 = \frac{\sum_{i=1}^{m} u_i \cdot y_{i0}}{\sum_{i=1}^{m} v_i \cdot x_{i0}}
\]

where \( y_{i0} \) = quantity of output \( r \) produced by unit \( 0 \);
\( u_r \) = weight attached to output \( r \); \( x_{i0} \) = quantity of input \( i \); \( v_i \) = weight attached to input \( i \). For the models in this paper, the denominator is set equal to 1. \( E_0 \) is an indicator of efficiency where \( 1 \geq E_0 \geq 0 \).

The model in linear programming terms is:

For unit \( 0 \) in a sample of \( n \) units,

Maximize:

\[
h_0 = \sum_{r=1}^{n} u_r \cdot y_{r0}
\]

Subject to:

\[
\sum_{i=1}^{m} v_i \cdot x_{i0} = 1
\]

\[
\sum_{r=1}^{n} u_r \cdot y_{r0} - \sum_{i=1}^{m} v_i \cdot x_{i0} \leq 0
\]

\[
u_r \geq \epsilon, \quad r = 1, \ldots, n
\]

\[
v_i \geq \epsilon, \quad i = 1, \ldots, m
\]

where \( \epsilon \) is an infinitely small constant which restricts the weights to positive values.
Single input: what governments spend

• We use public rather than total health expenditure, given the widespread evidence that private sources (voluntary insurance, OOPs) contribute little to UHC progress at the system level.

• Public spending on health as % GDP gives very little variation across our sample.

• Indicator used: public spending per capita on health (PPP$ for 2012) – from WHO Global Health Expenditure Database.
### Six output measures of UHC performance

<table>
<thead>
<tr>
<th>Measure</th>
<th>Performance</th>
</tr>
</thead>
</table>
| TB treatment (% coverage)                                               | - 64/83 countries achieve 80%  
- Of those achieving, lowest spenders are in region of $8-20 per capita |
| DPT among 1-year-olds (% coverage)                                      | - 65/83 countries achieve 80%  
- Of those achieving, lowest spenders around $8-30 per capita |
| Live births attended by skilled personnel (% cov.)                      | - 43/83 countries achieve 80%  
- Of those achieving, lowest spenders $41-49 per capita, but average is higher = $450 pc |
| Family planning (% coverage)                                            | - 12/83 countries achieve 80%  
- Of those achieving, the lowest spender is $192 per capita |
| Antiretroviral therapy (% cov)                                           | - 0/83 countries achieve 80%  
- Best performers spend little:  
  1<sup>st</sup> = 67% coverage for $41 pc  
  2<sup>nd</sup> = 66% coverage for $92 pc |
| Total public spending (GGHE) as a % total health spending              | >80% in 2/83 countries  
(spending $1642 Cuba & $788 Romania).  
>70% in 11/83 countries |

#### Notes:
- Sample: 83 low and middle income countries (>1.5m pop)  
Source: GHED & GHO for 2012 or nearest
DEA scores

Assesses performance (outputs) relative to inputs in countries with similar levels of public spending per capita on health. Each country is given a score between 0-100%. A score of 100% is given to the “best performer” for a given level of spending. A score of 50%, for example, implies a performance 50% that of best performer.
## Standard deviation of DEA scores by quintile

<table>
<thead>
<tr>
<th>Quintile</th>
<th>Level of public spending on health per capita</th>
<th>Number countries</th>
<th>Std. dev.</th>
<th>Mean DEA score</th>
<th>Min DEA score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>GGHE less than $37.50</td>
<td>17</td>
<td>14.4%</td>
<td>77.0%</td>
<td>45.5%</td>
</tr>
<tr>
<td>2</td>
<td>GGHE between $38.20 and $59.60</td>
<td>17</td>
<td>9.9%</td>
<td>83.0%</td>
<td>59.2%</td>
</tr>
<tr>
<td>3</td>
<td>GGHE between $60.90 and $198.10</td>
<td>16</td>
<td>10.7%</td>
<td>86.8%</td>
<td>57.1%</td>
</tr>
<tr>
<td>4</td>
<td>GGHE between $207.60 and $500.30</td>
<td>17</td>
<td>6.5%</td>
<td>88.1%</td>
<td>79.1%</td>
</tr>
<tr>
<td>5</td>
<td>GGHE higher than $520.50</td>
<td>16</td>
<td>5.6%</td>
<td>87.8%</td>
<td>78.3%</td>
</tr>
</tbody>
</table>
Disaggregated performance by spending quintiles

Service coverage:
- systematic increase in performance with increased public spending
- systematic fall in variation across countries (less poor performers)

Financial protection:
- performance increases in Q4 and Q5. High variation remains
Sensitivity analysis
alternative financial protection proxy (1-OOP/THE)

Initial proxy excludes VHI, external resources flowing outside government channels, and OOPs

Five of six countries remain best performers (Cambodia dropped)
Sensitivity analysis

• **Sensitivity #2**: average values for 2008-2012 to smooth transitory shocks. Best performers remain the same except Rwanda replaced by China

• **Sensitivity #3**: Removal of imputed data (23 countries had at least one value imputed). Remaining sample = 60. Myanmar and Rwanda dropped as best performers.


• **Limitations of the study**
  • financial protection proxy: will re-run model with improved financial protection data (some descriptive preliminary results)
  • Not a 1:1 relationship between inputs and outputs
Not one country in our sample achieves both 80% coverage on each of the five service indicators and >70% public health spending as %THE. On ART coverage, the best performers are some of the lowest spenders. Targets are of limited value.

Observe large variation in UHC performance for the money spent at low levels of public spending. Suggests many countries can improve spending, even at very low levels e.g. <40$ per capita; however, non-health system factors also important.

ABSOLUTE LEVELS OF PUBLIC SPENDING MATTERS
We observe systematic improvement in service coverage as public spending increases, as well as convergence across countries.

Whilst financial protection also improves with public spending (especially >$200), progress remains highly variable across countries, even at public spending >$520 pc. Improving financial protection requires development of risk-sharing institutions and related policies. Private spending?
Updates and possible future work

- SDG indicators to track progress towards UHC within the SDGs have been adopted (listed next slide)
- Comprehensiveness of SDG UHC indicators has improved
  - more countries (and more countries with panel data)
  - Possible to explore countries trajectories and how that relates to public/private levels of spending (methods to be defined)
  - VERY preliminary descriptive analysis using cross-sectional SDG indicators suggests most of the findings still hold (see next slides)

- Data available from http://apps.who.int/gho/portal/uhc-financial-protection-v3.jsp
Disaggregated performance using SDG indicators of UHC by spending quintiles

Service coverage (SDG 381):
- Linear increase in performance with increased public spending up to Q4
- Significant variation observed across countries at all quintiles

Financial protection (SDG 382, 10%):
- No clear pattern observed

Q1 to Q5 denote quintiles of public spending on health per capita, US$(PPP)

- Different sub-sample: N=71, n=15/14
Thank you

www.who.int/health_financing/documents/no-magic-number
SDG UHC indicators – 381 service coverage

- Composite index based on geometric means of 4 dimensions, each one based on geometric means of tracer indicators
- Presented on a 0-100 scale with “high score indicating better performance”
- Limitation: not a measure of population coverage

**Reproductive, maternal, newborn and child health**
1. Family planning (FP)
2. Antenatal care, 4+ visits (ANC)
3. Child immunization (DTP3)
4. Careseeking for suspected pneumonia

\[ RMNCH = (FP \cdot ANC \cdot DTP3 \cdot \text{Pneumonia})^{1/4} \]

**Infectious disease control**
1. TB effective treatment (TB)
2. HIV treatment (ART)
3. Insecticide-treated nets (ITN)
4. At least basic sanitation (WASH)

\[ Infectious = (ART \cdot TB \cdot WASH \cdot ITN)^{1/4} \]

- If high malaria risk
\[ Infectious = (ART \cdot TB \cdot WASH)^{1/4} \]
- If low malaria risk

\[ NCD = (BP \cdot FPG \cdot Tobacco)^{1/4} \]

**Noncommunicable diseases**
1. Normal blood pressure (BP)
2. Mean fasting plasma glucose (FPG)
3. Tobacco non-smoking (Tobacco)

**Service capacity and access**
1. Hospital bed density (Hospital)
2. Health worker density (HWD)
3. IHR core capacity index (IHR)

\[ Capacity = (Hospital \cdot HWD \cdot IHR)^{1/4} \]

**UHC service coverage index**
\[ = (RMNCH \cdot Infectious \cdot NCD \cdot Capacity)^{1/4} \]

Proportion of the population with household out-of-pocket spending on health greater than 10% or 25% of household’s total consumption or income

- Impact measure of financial hardship at population level
- Reflects ethical concern: no one should have to choose between spending on health and spending on other basic goods and services (e.g. food, education)
- Limitations:
  - Insensitive to financial barriers to access (unmet need is not captured)
  - SDG definition tends to be more concentrated among the rich than the poor
Countries are at different stages in service coverage and financial protection as tracked by SDG indicators 381 & 382

125 countries

Sub-sample 71 countries

- N=71 countries
- Latest estimate available for 382
- 381 estimate matched to year of 382 estimate (2008-2015)
- Only 3 good performers in both dimensions
- Only 10 good performers in 381 but poor performance in 382 (large variations)