Estimating future health spending to highlight funding gaps and ensure fiscal sustainability

Joseph Dieleman, PhD
Outline

1. 184 countries by source, 2013 – 2040
   a) Methods
   b) Results

2. An alternative model: US spending by cause through 2040
Outline

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   a) Methods
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2. An alternative model: US spending by cause through 2040
Development assistance for health: past trends, associations, and the future of international financial flows for health

Joseph L Dieleman, Matthew T Schneider, Annie Haakenstad, Lavanya Singh, Nafis Sadat, Maxwell Birger, Tara Templin, Hannah Hamavid, Abigail Chapin, Christopher J L Murray

National spending on health by source for 184 countries between 2013 and 2040

Joseph L Dieleman, Tara Templin, Nafis Sadat, Patrick Reidy, Abby Chapin, Kyle Foreman, Annie Haakenstad, Tim Evans, Christopher J L Murray, Christoph Kurowski
Four models

Total Health Spending

Government Health Spending

Development Assistance for Health

Prepaid Private Spending

Out-of-Pocket Health Spending

Data Sources:

- IHME’s *Financing Global Health 2015* Report
- WHO’s *Global Health Observatory*
Four ensemble models

Universe of variables
- GDP pc
- LDI pc
- Share of pop > 65
- Share of pop < 15
- Lags of health spending variables
- Convergence term
- AR terms (1-3)
- Linear time trend
- Country-specific fixed and random intercepts

Each variable modeled as a share of GDP using differences and levels

Government Health Spending
Development Assistance for Health
Prepaid Private Spending
Out-of-Pocket Health Spending

8,212 forecasts
Model inclusion

8,212 forecasts

417 forecasts pass all three inclusion criteria

- Statistical significance
- Expected relationships
- Empirical growth norms
Using past trends and relationships to estimate health spending, 2013–2040: Low-income countries
Development Assistance for Health

Billions of USD (2015)

Year

Government health spending per person: 2040

IHME | UNIVERSITY of WASHINGTON
Using past trends and relationships to estimate 2040 health spending gaps: *Chatham House benchmarks*

<table>
<thead>
<tr>
<th>Income Level</th>
<th>Number of countries</th>
<th>Benchmark 1: More than $86 per person on total health spending</th>
<th>Benchmark 2: More than $86 per person on government health spending</th>
<th>Benchmark 3: More than 5% of GDP on government health spending</th>
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</thead>
<tbody>
<tr>
<td>High-income</td>
<td>52</td>
<td>52</td>
<td>52</td>
<td>36</td>
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<tr>
<td>Upper-middle-income</td>
<td>52</td>
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<td>52</td>
<td>23</td>
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<td>Low-middle-income</td>
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<td>46</td>
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<td>Low-income</td>
<td>34</td>
<td>28</td>
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</table>
Health Financing Transition by GBD region

Prepaid domestic spending (governmental or prepaid private)

Larger dot reflects more spending per capita

Socio-demographic index: percentile of PCA of LDI per capita, TFR, education, and mean age of population
Outline

1. 184 countries by source, 2013 – 2040
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US Disease Expenditure project

Disaggregate US health spending by:
- Age/sex (38)
- Cause (161)
- Type of care (8)
- Year (18)

DUBE = Diabetes, urogenital, blood, and endocrine diseases
Estimating future US health spending

Credible, policy-relevant, granular health spending estimates need to be:

\[ \text{HE}_{a,s,c,f,y} = \text{population}_{a,s,y} \times \text{prevalence}_{a,s,c,y} \times \text{utilization}_{a,s,c,f,y} \times \text{price}_{a,s,c,f,y} \]

IHME Global Burden of Disease

IHME Disease Expenditure Tracking
Preliminary US estimates: health spending by cause level II; 2013 – 2040

Trillions of 2014 US dollars
Conclusions

- Two disparate estimation strategies provide similar estimates for the future of health expenditure.

- Past trends and relationships suggest that health spending will grow, although spending in low-income countries will remain insufficient.

- Substantial variation across countries suggests high potential for increased investment in health.
Thank you

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Annie Haakenstad
Tim Evans
Christopher Murray
Christoph Kurowski
Bonus slides
Development Assistance for Health

Steps for DAH:
1) Model DAH provided (by source)
2) Aggregated to get total envelope
3) Model share of DAH received for each recipient
4) Model graduation
### Expected relationships

<table>
<thead>
<tr>
<th>Independent Variable</th>
<th>logit GHES/GDP</th>
<th>logit OOP/GDP</th>
<th>logit PPP/GDP</th>
<th>ln DAH/GDP</th>
<th>logit DAH$_d$/ Σ$_d$ DAH$_d$</th>
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<tr>
<td>ln LDI per capita</td>
<td>+</td>
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<tr>
<td>ln GDP per capita</td>
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<td>-</td>
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<td>logit((pop &gt; 65)/pop)</td>
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<td>logit GHES/GDP</td>
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<td>No prior</td>
<td>Not tested</td>
<td>Not tested</td>
<td>Not tested</td>
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<tr>
<td>logit OOP/GDP</td>
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<td>logit DAH/GDP</td>
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<td>Not tested</td>
<td>Not possible</td>
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</table>
Empirical norms as a inclusion criterion

Percent change in GHES/GDP

GHES/GDP
Propagating uncertainty

1. Model uncertainty → ensemble modeling

2. Parameter uncertainty → make draws from variance-covariance matrix

3. Data uncertainty → use random draws from underlying GDP forecasts

4. Fundamental uncertainty → generate country specific distributions of residuals (1995 – 2013) and then draw from that add random draws from those distributions into forecasts