Projection Models of Human Resources in Health
Econometric Approach

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Workshop Health Workforce Planning and Predictive Models

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Outline

1. Defining terms: need, demand, and supply
2. Labor market framework
3. Regression equations to estimate
4. Results
5. Limitations of this approach
6. Adapting the approach to other contexts
Defining Terms

1. **Need** - # of health workers required to attain the objectives of a health system

2. **Demand** - # of health workers that a health system can support in terms of funded positions or economic demand for services

3. **Supply** - # of health workers available in a country
A graphical depiction of need, demand, and supply

Need

- Often estimated based on the minimum number of health workers needed to address priority population health issues

- **Example:** Recent WHO report [2] defined need as the number of health workers needed to achieve the median level of attainment (25%) for a composite index of 12 tracer health indicators.
  - Led to a need estimate of **4.45** doctors/nurses/midwives per 1000 population

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SDG composite index

Table 1 The 12 selected tracer indicators in the SDG composite index threshold and their primary classifications

<table>
<thead>
<tr>
<th>SDG tracer indicator</th>
<th>Classification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Antenatal care</td>
<td>MNCH</td>
</tr>
<tr>
<td>Antiretroviral therapy</td>
<td>ID</td>
</tr>
<tr>
<td>Cataract</td>
<td>NCD</td>
</tr>
<tr>
<td>Diabetes</td>
<td>NCD</td>
</tr>
<tr>
<td>DTP3 immunization</td>
<td>ID</td>
</tr>
<tr>
<td>Family planning</td>
<td>MNCH</td>
</tr>
<tr>
<td>Hypertension</td>
<td>NCD</td>
</tr>
<tr>
<td>Potable water</td>
<td>ID</td>
</tr>
<tr>
<td>Sanitation</td>
<td>ID</td>
</tr>
<tr>
<td>Skilled birth attendance</td>
<td>MNCH</td>
</tr>
<tr>
<td>Tobacco smoking</td>
<td>NCD</td>
</tr>
<tr>
<td>Tuberculosis</td>
<td>ID</td>
</tr>
</tbody>
</table>

Source: [1]
Abbreviations: MNCH Maternal, Newborn, Child Health, ID Infectious Disease, NCD Non-communicable Disease

1. Each country received 1 point for each indicator where the % of the population covered was over 80% (score 0-12)
2. Indicators weighted by global burden of disease (tobacco smoking 12x burden of DTP3 vaccination)
3. Score normalized to be between 0 and 1
   a. Median country had a score of 0.25


Note: SDG = Sustainable Development Goals
Need regression equation

\[
\text{SDG composite} = \beta_0 + \beta_1 \ln (\text{health workers per 1000 population}_i) + \xi_i
\]


Note: SDG = Sustainable Development Goals
Demand

- National income is known as the major predictor of health care spending and hence the demand of health workers (see e.g. [3],[4])


**Demand**

\[
\ln \left( \text{physicians per 1000 population}_{it} \right) = \beta_0 + \beta_1 \ln(\text{GDP per capita}_{it-1}) + \beta_2 \ln(\text{GDP per capita}_{it-4}) + \beta_3 \ln(\text{GDP per capita}_{it-5}) + \beta_4 \ln(\text{OOPPC}_{it-2}) + \beta_5 \ln(Pop65_{it-3}) + \mu_i + \xi_{it}
\]

i=country, t=year

Out of pocket spending per capita

% of population over 65

country fixed effects

Supply

- Supply of health workers is a function of the training capacity in a country and the net migration, deaths, and retirements of health workers.
Supply
WHO separately estimated the growth rate of physician and nurses/midwives density for each country from 1990 to 2013 using the following equations:

Physicians per 1000 population$_t$
$$= \alpha_0 + \alpha_1 \cdot \text{year}_t + \varepsilon_t$$

Nurses/midwives per 1000 population$_t$
$$= \beta_0 + \beta_1 \cdot \text{year}_t + \varepsilon_t$$

Table 5 Estimated and projected global needs-based and demand-based shortages of health workers, by World Bank income group and WHO region, 2013 and 2030 [shortages are positive, surpluses are negative]

<table>
<thead>
<tr>
<th>World Bank Income Group (° of countries)</th>
<th>Needs-based shortages (Need-Supply)</th>
<th>Demand-based shortages (Demand-Supply)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
<td>2030</td>
</tr>
<tr>
<td>Low (29)</td>
<td>4 202 379</td>
<td>5 746 161</td>
</tr>
<tr>
<td>Lower-middle (44)</td>
<td>9 003 163</td>
<td>6 495 262</td>
</tr>
<tr>
<td>Upper-middle (46)</td>
<td>3 658 626</td>
<td>1 746 981</td>
</tr>
<tr>
<td>High (46)</td>
<td>81 361</td>
<td>74 838</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>WHO Region (° of countries)</th>
<th>Needs-based shortages (Need-Supply)</th>
<th>Demand-based shortages (Demand-Supply)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2013</td>
<td>2030</td>
</tr>
<tr>
<td>Africa (43)</td>
<td>4 194 741</td>
<td>6 088 186</td>
</tr>
<tr>
<td>Americas (28)</td>
<td>708 021</td>
<td>503 870</td>
</tr>
<tr>
<td>Eastern Mediterranean (15)</td>
<td>1 569 814</td>
<td>1 508 924</td>
</tr>
<tr>
<td>Europe (50)</td>
<td>78 394</td>
<td>57 749</td>
</tr>
<tr>
<td>South-East Asia (8)</td>
<td>6 661 765</td>
<td>4 547 443</td>
</tr>
<tr>
<td>Western Pacific (21)</td>
<td>3 732 794</td>
<td>1 357 071</td>
</tr>
<tr>
<td>World (165)</td>
<td>16 945 529</td>
<td>14 063 242</td>
</tr>
</tbody>
</table>

Sources: [1, 2]

Notes: Health worker refers to physicians, nurses/midwives, and other health workers. For demand-based shortages, positive totals represent shortages while negative totals represent surpluses. The total needs-based shortages reported in this table are lower than the totals reported by the WHO report because this table computes needs-based shortages for 165 countries (to correspond with the demand estimates) whereas the WHO report computed needs-based shortages for 210 countries.
Limitations of this approach

Demand
- Doesn’t include
  - Increased productivity (technology)
  - Changes in the organization of health care delivery

Supply
- Assumes no change in either entry or exit of workers into the market
  - Recent policy and programmatic changes intended to augment the production of health workers not accounted for (supply underestimated)

Data Availability
- Best data typically on physicians. Data on other health care professionals not as comprehensive.
Adapting the approach to other contexts

- Regions within a country can replace countries as the unit of analysis
  - Data availability the most common hurdle
    - Are health worker data available over time for the regions you are interested in studying?
    - Do you have data on the region’s health spending budget over time?
  - “Need” needs to be defined
    - WHO report was one example, but the priorities of a particular country (region) should go dictate how need is defined
References


