Status of Global Health Disparities

Shahrzad Bazargan-Hejazi, PhD
Professor
College of Medicine
Charles R. Drew University of Medicine and Science
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Overview

• Introduction to Global Burden of Disease (GBD)
  • Rational
  • Key principles
  • Masseurs & Metrics

• Summary of some of the key GBD 2015 results

• Implication for global health and development
GBD 1990: Quantified the health effects of more than 100 diseases and injuries for 8 regions of the world, giving estimates of morbidity and mortality by age, sex, and region
1. In 2000–2002, the GBD1990 study was updated by WHO to include a more extensive analysis.

2. In 2004, the WHO estimates were again updated covering 136 causes of deaths.

3. In 2007, under the direction of Christopher Murray the Institute for Health Metrics and Evaluation (IHME) was founded at the University of Washington with a joint endowment grant from Gates Foundation and State of Washington.

4. GBD Study 2010 was a collaboration between IHME and WHO and Harvard School of Public Health and a community of nearly 500 experts from around the world in epidemiology, statistics, and other disciplines.
   
   • Produced estimates for 291 diseases and injuries, 67 risk factors, 1,160 sequelae, 21 regions, 20 age groups, and 187 countries.
Rational Behind GBD

• Everyone all over the world deserves to live a long life in full health.

• GBD study shows us causes that prevent population from achieving a long life in full health.
  • What causes are getting worse
  • Which ones are improving

• So that the world decision makers and development planners align your resources, talents, and attention with where true needs

• Design the best public policy to improve population health
What is GBD Study?

• It is a systematic and worldwide collaborative scientific effort to measure the comparative magnitude of health loss due to major disease, injuries, and risk factors by age, sex, and country for 1990-2015.

• Key principles:
  1. The cause list is comprehensive for broader global use
  2. Informed estimates better than no estimate
  3. Comparability matters for objective policy dialogue
  4. Measures health loss from various conditions and not welfare loss
GBD 2015 by the Numbers

- 324 diseases and injuries (mutually exclusive causes)
- 2,619 sequelae
- 83 risk factors
- Global
- 7 Super-regions
- 21 regions
- 195 countries
  - 13 sub-national level (U.S. China, Mexico, Brazil, Japan, India, Saudi Arabia)
- 1990-2015
- Results are updated annually
- IHME is funded by Bill and Melinda Gates foundation
- Over 2000 collaborators across the globe
- Published in Major medical journals
GBD Output Metrics for Health

- Traditional metrics
  - Incidence
  - Prevalence
  - Mortality

- Years of life lost (YLLs) due to premature death
- Years lived with disability (YLDs)
- Disability adjusted life years (DALYs) \((\text{DALYs} = \text{YLL} + \text{YLD})\)
- Life expectancy
- Risk factor attribution

- Socio-demographic Index (SDI) to enhance comparability of the data (0-1)
  - Income per capita, average level of educational attainment, and fertility rate
    - High SDIs
    - High Middle SDIs
    - Middle High SDIs
    - Middle SDIs
    - Low SDIs
Not all people are in perfect health their entire lives

**YLDs**: Years lived with disability (not morbidity)

**YLL**: Year of life lost due to premature death

**DALYs**: Years of life lost due to premature mortality plus years live with disability (DALYs = YLL + YLD)
# Data Sources: Cause of Death

<table>
<thead>
<tr>
<th>Source</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vital Registration</td>
<td>Registration of Birth and Death marriages divorces in defined population</td>
</tr>
<tr>
<td>Verbal Autopsy</td>
<td>Assigning cause of death based on signs/symptoms reported by the family</td>
</tr>
<tr>
<td>Surveillance Systems</td>
<td>Monitoring of diseases and mortality of one defined population</td>
</tr>
<tr>
<td>Police Reports</td>
<td>Death registration just for some causes</td>
</tr>
<tr>
<td>Census/Surveys</td>
<td>Recording and counting information about the member of population</td>
</tr>
<tr>
<td>Hospital Records</td>
<td>Reporting of discharge data in hospital</td>
</tr>
<tr>
<td>Burial/Mortuary</td>
<td>Using different cemetery information</td>
</tr>
<tr>
<td>Population Based Cancer Registry</td>
<td>Systematic collection of data about cancer in defined population</td>
</tr>
</tbody>
</table>
“Before you take me away, I just want to update my profile picture.”
Data Sources: Non-fatal

1. Scientific literature
2. Population surveys
3. Hospital & outpatient data
4. Surveillance/ notification
5. Disease registries
6. Others
Hierarchy Example: Where is opioid use?

All causes

1. Non-communicable diseases

2. Mental and substance use disorders

3. Drug use disorders

4. Opioid use
Risk Factor Hierarchy

Group I (behavioral)
- Dietary, Malnutrition, Tobacco, Alcohol & Drugs, Physical Activity

Group II (environmental)
- Air pollution, Occupational, Unsafe water/Sanitation/Handwashing, Other environmental

Group III (metabolic)
- Blood pressure, BMI, Cholesterol, Glomerular filtration, Plasma glucose, Bone mineral
Hierarchy Example: Where is low back pain?

All risk factors

1. Environmental

2. Occupational risks

3. Occupational ergonomic factors

4. Low back pain
1. Data Sources
   - Case notifications
   - Population-at-risk data
   - Seroprevalence data
   - Disease registries
   - Birth registries
   - Active screening
   - Vital registration
   - Surveillance
   - Community surveys
   - National surveys
   - Outpatient hospital data
   - Claims data - outpatient visits
   - Claims data - inpatient visits
   - Inpatient hospital data
   - Cohort follow-up studies

2. Data Adjustment
   - Adjustment for underreporting
   - CSIR or GDecon
   - Age-sex-splittting
   - Add study-level covariates
   - Pre DisMod bias correction
   - Adjustment for multiple outpatient visits per prevalent/incident case based on claims data
   - Adjustment for primary code to all code based on claims data

3. DisMod-MR 2.1 Estimation
   - Nonfatal Database: prevalence, incidence, excess mortality rate, RSR, SMR, duration, remission, severity proportions & intermediary modelling variables
   - Determine most severe nature of injury category in any individual
   - Apply cause-nature of injury matrices with regression models
   - Generate case-nature of injury matrices with regression models
   - Determine most severe nature of injury category in any individual
   - Apply cause-nature of injury matrices
   - Probability of long-term disability
   - Long-term incidence by E-code
   - Short-term incidence by cause-nature & in/outpatient
   - Short-term incidence by cause-nature and in/outpatient
   - Meta-analysis
   - DISMOD 2.1
   - Metaregression analysis by severity level
   - Map SF 12 to GBD disability weights
   - SEQUELAE mapped to health states

4. Injury Custom Modeling
   - Adjusted input data
   - Surveys with diagnostic info & SF-12
   - Opportunistic survey on HME to 81 SF-12 for lay descriptions
   - Lay descriptions for 235 health states
   - GBD collaborator advice
   - House hold surveys
   - Analysis of paired comparisons & population health equivalence responses
   - Open access web-based survey

4a. Disease Custom Modeling (Details Fig 1B)
   - HIV/AIDS and TB
   - Malaria
   - Seroprevalence to incidence models
   - Case fatality proportion and cause of death rate models
   - Neonatal disorders
   - Cancer
   - Incidence and prevalence from custom models

5. Etiology/Impairment Estimation
   - Proportion of disease/impairment sequelae or etiologies
   - Scale to 100%
   - Severe proportion of disease/impairment sequelae or etiologies
   - Apply etiology-specific proportion to disease/impairment morbidity estimates
   - Scale impairment prevalence by etiology (and severity) to envelope
   - Prevalence & incidence of impairment envelope (by severity)

6. Severity Distribution
   - Regression to estimate disability weight by cause in survey respondents controlling for comorbidity
   - Scale to 100%
   - Meta-analysis of proportion by severity level
   - Discount analysis by severity level
   - YLD by sequela

7. Disability Weights
   - Disability weights for 235 health states
   - Disability adjusted life years (DALYs)
   - YLD for each disease & injury by age, sex, region & sex

GBD Model and Data Flow Chart

Colors of Nonfatal Estimation
- Raw data source
- Data adjustment
- Risk
- Disability weight
- Disease/Impairment
- Disease custom modeling
- Final burden estimate
- Nonfatal Estimation Process
- Input data
- Database
- Process
- Results
Who Uses GBD for Decision Making?
Key finding of GBD 2015 at the Global Level

• Leading causes of deaths (1990 vs. 2015)
• Leading causes for premature deaths (YLLs) (1990 vs. 2015)
• Leading causes for disabilities (YLDs) (1990 vs. 2015)
• Leading causes for disease burden (DALYs) (1990 vs. 2015)
• Leading risk factors
• Summary for global health and development

• All the estimates, charts and figures come from the GBD database and visualization tools, which are available for public access on the IHME website.
Global
Both sexes, Age-standardized, YLLs per 100,000

1990 rank
1. Lower respiratory infect
2. Ischemic heart disease
3. Diarrheal diseases
4. Neonatal preterm birth
5. Hemorrhagic stroke
6. COPD
7. Tuberculosis
8. Neonatal encephalopathy
9. Malaria
10. Measles
11. Ischemic stroke
12. Lung cancer
13. Drowning
14. Self-harm
15. Protein-energy malnutrition
16. Pedestrian road inj
17. Stomach cancer
18. Congenital heart
19. Other neonatal
20. Diabetes
21. Motor vehicle road inj
22. Neonatal sepsis
26. Alzheimer disease
40. HIV/AIDS other

2015 rank
1. Ischemic heart disease
2. Lower respiratory infect
3. Hemorrhagic stroke
4. Neonatal preterm birth
5. Diarrheal diseases
6. Neonatal encephalopathy
7. COPD
8. Malaria
9. HIV/AIDS other
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20. Other neonatal
22. Stomach cancer
23. Protein-energy malnutrition
25. Drowning
63. Measles

Communicable, maternal, neonatal, and nutritional diseases
Non-communicable diseases
Injuries
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<th>2015 rank</th>
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Under 41.2
41.2 to 45.7
45.7 to 51.2
51.2 to 61.3
61.3 to 65.5
Over 65.5

Figure 1. Map of HAQ Index values, by decile, in 2015 (B)
Status of Global Health in 2015

$35-$50

Central African Republic

$2.90

Burundi

Russia

~ 65 Countries in the world fall below this threshold
Who are the players in the global health?

Total for 2014: $36.0 billion
Where Does the Donor Money Go?

- Policy of the donors
  - Donors set priorities based on:
    - Measureable outcomes
    - Show progress
    - Quick fix
    - Country infrastructure (poor countries get very little)
  - Only 6% - 10% of the donors money goes to poor countries
  - Fund communicable diseases vs. NCD ($ 12 vs. $ 4)
  - Poor people in poor countries pay more out of their pockets than rich people in rich countries (over 50%)
What is the message for those who are concerned about the health of population?

1. Demographic transition is shifting burden from children to adults
2. Disease transition is changing the composition of disease very rapidly in most parts of the world from communicable to NCD
3. Disability transition in progressively shifting the burden of disease away from premature mortality to chronic disability
4. Risk transition is shifting the burden of disease from poverty to those of lifestyle risks
5. The leading burden/health problems in Sub-Saharan Africa remain those related to MDG Goals 4, 5, 6.
6. Yet the biggest improvement in health in the past 25 yr has occurred in lower SDIs
7. Health is personal and social good that is distributed unequally
8. Equal access to health continues to be the greatest health related problem for the world
What is the message for those who are concerned about the health of population?

9. HIV/TB/Malaria each equally important in terms of premature death.

10. There is an urgent need to promote policies and programs aimed at:
   • Avoiding premature death of adults
   • Reducing chronic disability from mental health and musculoskeletal conditions
17 Goals
169 Targets
230 Indicators

Sustainable Development Goals (SDGs):
2030

The United Nation's Sustainable Development Goals in the Common Core

Herculean task to assess countries SDG achievements
Measureable, Attainable, Relevant, Time bound, Communicate.
This is my story and I am sticking to it.

Any questions?
Who are the players in the global health?

- Multilateral and International Organization.
  - Global Fund; UN agencies WHO, GAVI
- Bilateral Organizations.
  - U.S, UK, USAID
- Private Sectors
  - Biotech, pharmaceutical, diagnostics, foundations, Gates Foundations
- Academics; Research Institutions
  - Carnegie, Rockefeller; Think Tanks ie. Rand Cooperation
- Civil Society
  - NGOs, CBOs
- Individuals and Families