Status of Global Health Disparities

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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
Episodes of illness and injury

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)

Life expectancy= 83
## 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 (Civil registry)</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
**GBD Cause Hierarchy**

**Group I**
- (communicable, maternal, neonatal, and nutritional)
  - Diarrhea/LR/other
  - HIV+TB
  - Maternal
  - Neonatal
  - Nutritional deficiencies
  - Other group I

**Group II**
- (non-communicable diseases)
  - Cardiovascular
  - Cancer
  - Mental disorders
  - Neurological
  - Chronic respiratory
  - Digestive
  - Diabetes/urogenital/blood/endocrine
  - Other NCD

**Group III**
- (injuries)
  - Unintentional
  - Transport
  - Self-harm & IPV
  - Forces of nature/war/legal intervention


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
- Expansion factors for case notifications
- Population-at-risk data
- Seroprevalence data
- Disease registries
- Birth registries
- Active screening
- Intervention coverage
- 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
- Computed excess mortality prior to estimate mortality and prevalence
- CSIR from GoConnect

### 4a. Disease Custom Modeling (Details Fig 1B)
- Disease registries
- Active screening
- Disease surveillance
- Case notification proportion and cause of death rate models
- Cancer

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

### 3. DisMod-MR 2.1 Estimation
- DisMod-MR 2.1
- Proportion by sequence
- Prevalence of sequela
- Proportion by sequence
- Prevalence & incidence by disease

### 6. Severity Distribution
- Surveys with diagnostic info & SF-12
- Opportunistic surveys on HMEs to SF-12 for lay descriptions
- Map SF-12 to GBD disability weights
- Meta-analysis: proportion by severity level
- Disability analysis proportion by severity level

### 7. Disability Weights
- Disability weights for GBD health states
- Household surveys
- Lay descriptions for 235 health states
- GBD collaborator advice

### 8. Comorbidity
- Comorbidity correction (CDMOS)
- YLDs for each disease & cause by age, sex, region, cause

### GBD Model and Data Flow Chart
- Input data
- Database
- Process
- Results
- Nonfatal Estimation Process

### Colors of Nonfatal Estimation
- Nonfatal data
- Disability weighting
- Disease/Impairment
- Study/Population
- Country
- Initial individual

### Map 235 health states
- CoMorbidity
- Nonfatal data
- Disability weighting
- Disease/Impairment
- Study/Population
- Country
- Initial individual
GBD Organizational Structures

- IHME
- GBD Collaborators
- Core Analytic Team
- Independent Advisory Committee
- GBD Scientific Council
- GBD Management Team
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.
<table>
<thead>
<tr>
<th>1990 Rank</th>
<th>2015 Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low back pain</td>
<td>Low back pain</td>
</tr>
<tr>
<td>Iron-deficiency anemia</td>
<td>Iron-deficiency anemia</td>
</tr>
<tr>
<td>Major depression</td>
<td>Major depression</td>
</tr>
<tr>
<td>Other hearing loss</td>
<td>Other hearing loss</td>
</tr>
<tr>
<td>Neck pain</td>
<td>Neck pain</td>
</tr>
<tr>
<td>Migraine</td>
<td>Migraine</td>
</tr>
<tr>
<td>Other musculoskeletal</td>
<td>Other musculoskeletal</td>
</tr>
<tr>
<td>Diabetes</td>
<td>Diabetes</td>
</tr>
<tr>
<td>Anxiety disorders</td>
<td>Anxiety disorders</td>
</tr>
<tr>
<td>Asthma</td>
<td>Asthma</td>
</tr>
<tr>
<td>Falls</td>
<td>Falls</td>
</tr>
<tr>
<td>Refraction &amp; accomodation</td>
<td>Refraction &amp; accomodation</td>
</tr>
<tr>
<td>COPD</td>
<td>COPD</td>
</tr>
<tr>
<td>Schizophrenia</td>
<td>Schizophrenia</td>
</tr>
<tr>
<td>Osteoarthritis</td>
<td>Osteoarthritis</td>
</tr>
<tr>
<td>Dysthymia</td>
<td>Dysthymia</td>
</tr>
<tr>
<td>Other mental &amp; substance</td>
<td>Other mental &amp; substance</td>
</tr>
<tr>
<td>Other unintentional</td>
<td>Other unintentional</td>
</tr>
<tr>
<td>Medication headache</td>
<td>Medication headache</td>
</tr>
<tr>
<td>Bipolar disorder</td>
<td>Bipolar disorder</td>
</tr>
<tr>
<td>Alzheimer disease</td>
<td>Alzheimer disease</td>
</tr>
<tr>
<td>Edentulism</td>
<td>Edentulism</td>
</tr>
<tr>
<td>Dermatitis</td>
<td>Dermatitis</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>Ischemic heart disease</td>
</tr>
<tr>
<td>Alzheimer disease</td>
<td>Alzheimer disease</td>
</tr>
<tr>
<td>Other unintentional</td>
<td>Other unintentional</td>
</tr>
</tbody>
</table>

Diseases: Communicable, maternal, neonatal, and nutritional diseases, Non-communicable diseases, Injuries.
<table>
<thead>
<tr>
<th>1990 Rank</th>
<th>2015 Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Lower respiratory infect</td>
<td>1. Ischemic heart disease</td>
</tr>
<tr>
<td>2. Ischemic heart disease</td>
<td>2. Lower respiratory infect</td>
</tr>
<tr>
<td>3. Diarrheal diseases</td>
<td>3. Hemorrhagic stroke</td>
</tr>
<tr>
<td>5. COPD</td>
<td>5. Diarrheal diseases</td>
</tr>
<tr>
<td>6. Hemorrhagic stroke</td>
<td>6. COPD</td>
</tr>
<tr>
<td>7. Tuberculosis</td>
<td>7. Diabetes</td>
</tr>
<tr>
<td>9. Malaria</td>
<td>9. Low back pain</td>
</tr>
<tr>
<td>10. Ischemic stroke</td>
<td>10. Malaria</td>
</tr>
<tr>
<td>11. Measles</td>
<td>11. HIV/AIDS other</td>
</tr>
<tr>
<td>12. Low back pain</td>
<td>12. Ischemic stroke</td>
</tr>
<tr>
<td>15. Lung cancer</td>
<td>15. Other hearing loss</td>
</tr>
<tr>
<td>16. Asthma</td>
<td>16. Tuberculosis</td>
</tr>
<tr>
<td>17. Drowning</td>
<td>17. Lung cancer</td>
</tr>
<tr>
<td>19. Protein-energy malnutrition</td>
<td>19. Other musculoskeletal</td>
</tr>
<tr>
<td>20. Major depression</td>
<td>20. Self-harm</td>
</tr>
<tr>
<td>21. Other hearing loss</td>
<td>25. Asthma</td>
</tr>
<tr>
<td>23. Neck pain</td>
<td>31. Protein-energy malnutrition</td>
</tr>
<tr>
<td>31. Other musculoskeletal</td>
<td>37. Drowning</td>
</tr>
<tr>
<td>51. HIV/AIDS other</td>
<td>95. Measles</td>
</tr>
</tbody>
</table>
Figure 1. Map of HAQ Index values, by decile, in 2015 (B)
Status of Global Health in 2015

~ 65 Countries in the world fall below this threshold

$35-$50

$2.90

Burundi

$6103
Who are the players in the global health?
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
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**