Global Burden of Blindness and Vision Impairment

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Global Burden of Disease Study
preparing the systematic review for GBD 2010

The Vision Loss Expert Group’s extension of the review to 2012
the findings: prevalence of vision loss by cause
global → Europe → UK

GBD 2010: The Lancet reports
Disability weights
DALYs and YLDs & Vision Loss

OUTPUTS/ DATA SHARING
Investing in Vision, Reference Indicators, etc

The Global Vision Database and future research (GBD2013 !)
Global Burden of Disease
GBD study

Vision Loss Expert Group (coordination of 79 members): WHO collaboration (Serge Resnikoff)

First comprehensive systematic review of all blindness/vision impairment data published since 1980: 2.9 million vision examinations from 243 studies

GBD Study- principle all-disease resource for governments/NGOs- DALYs
<table>
<thead>
<tr>
<th>GBD</th>
<th>WHO Vision Group</th>
</tr>
</thead>
<tbody>
<tr>
<td>National/subnational/local</td>
<td>“country-representative”</td>
</tr>
<tr>
<td>≥ 60% (95% are &gt;70%)</td>
<td>Response rate accepted</td>
</tr>
<tr>
<td>Yes</td>
<td>Gender breakdown for 0-49 yrs</td>
</tr>
<tr>
<td>Borrowing strength from neighboring countries, using covariates, and over time</td>
<td>Handling country-years that lack data</td>
</tr>
<tr>
<td>&lt;6/12</td>
<td>Regional estimates by imputing estimates for countries lacking data using economic groupings</td>
</tr>
<tr>
<td>more complex model</td>
<td>Lowest limit of VI</td>
</tr>
<tr>
<td>Planned open access to sources &amp; modeling process</td>
<td>Temporal trends based on most recent sources vs older sources</td>
</tr>
<tr>
<td>Access</td>
<td>Not all sources referenced are entered in model</td>
</tr>
</tbody>
</table>
Methods: Step 1 (of 5)

Accessed all published data (and some unpublished) data from population-based studies of VI and blindness from 1980 to 2012.

MEDLINE, EMBASE, WHOLIS: 14,908 abstracts $\rightarrow$ 1,334 articles reviewed
Supplemented by MICRODATA from PI contact: eg. Blue Mts, Rotterdam, Pakistan, RAAB, RACSS studies

Data of 259 data sources extracted into database, disaggregated by age & sex, coverage, cause, pres/BCVA: 6500 datapoints.
Step 2: Conversion to core definitions of VA

Data sources report a variation of Visual Acuity thresholds
Few studies reported mild VI (<6/12 to 6/18) or severe VI (<6/60 to 3/60)
Most reported blindness and ‘low vision’ (<6/18 to 3/60)

High correlation between prevalence of mild, moderate, severe VI and Low

<table>
<thead>
<tr>
<th>Conversion to blind (&lt;3/60)</th>
<th>Conversion to low vision (&lt;6/18 and ≥3/60)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Value</td>
<td>Standard error</td>
</tr>
<tr>
<td>from &lt;6/60</td>
<td>-1.062</td>
</tr>
<tr>
<td>from ≤6/60</td>
<td>-1.213</td>
</tr>
<tr>
<td>from &lt;6/18</td>
<td>-0.521</td>
</tr>
<tr>
<td>from &lt;6/12</td>
<td>-1.280</td>
</tr>
</tbody>
</table>

Blind (<3/60)  
Low Vision (<6/18 to 3/60)
Step 3: Conversion to age-specific data

Studies that reported **age-specific** data were used to fit 2 universal age patterns for:

- **Blind**
- **Low Vision**

Age patterns then fitted to data from studies which was only available by **wide age group** to calculate **prevalence by 5-year age intervals**.

Ensured that the age-specific prevalence values summed to the reported wide age range prevalence, when weighted by the country’s population.
Step 4: Analysis of VI prevalence by country, year, age & sex

2 hierarchical logistic regressions to estimate VI prevalence over time for age group, sex, and country.

Relative weight: is informed by availability & consistency of data from these sources.

Data from other countries in: same region vs data from:

Sao Paulo Eye Study 2004
Sao Paulo East Zone 2002
Campinas (rapid) 2003
Botucatu Eye Study

Relative weight vs data from:

Data from other countries in: same region vs other regions.
Step 4: Analysis of VI prevalence by country, year, age & sex

2 hierarchical logistic regressions to estimate VI prevalence over time by:
- age group
- sex
- country

Blind

Low Vision

Cambodia Eye Survey 1996 - all ages - subnational
RACSS 2002 - 50-99 yrs - Battambang subnational
RAAB 2007 - 50-99 - national

Relative Weight vs data from:
- Data from other countries in: same region
- other regions

Relative weight: is informed by availability & consistency of data from these sources
Cambodia: blindness
Hierarchical linear trends modelled over time for 4 world regions, allowing for:

- region-specific trends in prevalence of visual impairment
- gender-specific trends in prevalence of visual impairment
- age-specific (3-piece linear spline with knots at ages 40 and age 70)

Fitted a fixed effect for data recording presenting visual impairment

3 country-specific covariates evaluated:
- GDP per capita
- Mean years of adult education
- Access to health care

2 study-specific covariates: a fixed offset for studies carried out in urban areas, and a fixed offset for studies carried out in rural areas.

Step 5: Predict the prevalence of severe, moderate, and mild visual impairment for each country, year, age, and sex.
Results: Data availability

Data sources identified

[Map showing data availability across the world with color coding: No data, 1, 2, 3-5, 6 or more]
Global Burden: Blind

Age-stand. Prev. vs. Number blind
Regional burden of BLIND age-standardised prevalence (all ages)

- Asia
- High Income, East & Central Europe
- Latin America & Caribbean
- N Africa & M East
- Sub-Saharan Africa

1990 | 2000 | 2010
---|---|---
0.0% | 0.5% | 1.0% | 1.5% | 2.0% | 2.5%
More women are blind and visually impaired - Ratio F:M
Table 4. Global Trends in Numbers of People Blind or Visually Impaired between 1990 and 2010 and the Change Attributable to Population Growth, Population Ageing, and Change in Age-Specific Prevalence of Blindness or Visual Impairment

<table>
<thead>
<tr>
<th></th>
<th>Blind</th>
<th>Moderate and Severe Vision Impairment</th>
</tr>
</thead>
<tbody>
<tr>
<td>No. of persons in 1990 (millions)</td>
<td>31.8</td>
<td>172.0</td>
</tr>
<tr>
<td>No. expected with 2010 population, 1990 population age structure, and 1990 prevalence (millions)</td>
<td>41.4</td>
<td>223.9</td>
</tr>
<tr>
<td>No. expected with 2010 population, 2010 population age structure, and 1990 prevalence (millions)</td>
<td>50.9</td>
<td>268.0</td>
</tr>
<tr>
<td>No. of persons in 2010 (millions)</td>
<td>32.4</td>
<td>191.0</td>
</tr>
<tr>
<td>Percentage change from 1990 because of population growth</td>
<td>30%</td>
<td>30%</td>
</tr>
<tr>
<td>Percentage change from 1990 because of population ageing</td>
<td>30%</td>
<td>26%</td>
</tr>
<tr>
<td>Percentage change from 1990 because of change in age-specific prevalence</td>
<td>-58%</td>
<td>-45%</td>
</tr>
<tr>
<td>Percentage change from 1990 to 2010</td>
<td>2%</td>
<td>11%</td>
</tr>
</tbody>
</table>

Graphs showing trends in numbers of people blind or visually impaired by age and region.
Global Burden of Disease
GBD study

Principal findings reported in Lancet 2012 Special Issue
Co-authored by VERU
Royal Society launch
Department of Health UK think-tank: UK findings fast-tracked

Rise in DALY burden between 1990 and 2010:

- Age-related Macular Degeneration: 160%
- Glaucoma: 113%
- Cataract: 12%
The Global Burden of Disease Project

- Global Burden of Disease (GBD) study aims to measure impact of ~200 causes of mortality and morbidity in terms of losses in population health
- GBD quantifies magnitude of different health problems in units of disability-adjusted life years (DALYs), which capture...
  - Lost years of life due to premature mortality (YLL)
  - Loss of healthy years due to living with non-fatal outcomes (YLD)
The Disability Adjusted Life Year (DALY)

One DALY can be thought of as one lost year of "healthy" life. The sum...can be thought of as a measurement of the gap between current health status and...ideal health...

\[ \text{DALY} = \text{YLL} + \text{YLD} \]

Life years lost to death

Life years lost to disability

http://www.who.int/healthinfo/global_burden_disease/metrics_daly/en/
Life Years Lost to Disability

\[ \text{YLD} = I \times \text{DW} \times L \]

- Incident cases of disease
- Disability weight
- Years lived with condition
Assigning Disability Weights 1996 vs. 2010

<table>
<thead>
<tr>
<th>1996</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Set by expert panels</td>
<td>• Base upon responses of community members</td>
</tr>
<tr>
<td>• 22 conditions weighted using the PTO</td>
<td>• All ~230 sequelae estimates</td>
</tr>
<tr>
<td>• Rest (&gt; 200) set using a VAS</td>
<td></td>
</tr>
</tbody>
</table>
Study components

- Population-based surveys in 5 primary sites
  - Face-to-face interviews in Tanzania, Bangladesh, Indonesia, Peru
  - Telephone interview in random sample of US households
  - N = 2,500 per site
- Open-access Internet survey
  - Currently live, in English and Spanish (Mandarin coming soon).

http://www.gbdsurvey.org
Welcome
Thank you for participating in this survey. Your answers will provide crucial information that will greatly enhance the latest Global Burden of Disease study, which aims to measure the impact of different diseases, injuries, and risk factors on people’s health worldwide. This research updates a groundbreaking study first published in 1993 that changed the way researchers and health experts around the world thought about global health priorities.

Who is healthier...
The survey will ask you to imagine different health outcomes and compare them to each other. For example: "Imagine two different people – the first person is completely blind, and the second person is completely deaf. Who is healthier overall?"

This information will help researchers understand how people think about different types of health problems. Your participation in this study is completely voluntary, and your responses will be anonymous. By participating in the study, you will contribute to an important effort to improve the understanding of global health problems.

This study is being led by the Institute for Health Metrics and Evaluation at the University of Washington in conjunction with Harvard University, Johns Hopkins University, the University of Queensland, and the World Health Organization.

The survey takes around 15 to 20 minutes to complete. We encourage you to share this survey link with others to help us collect a broad range of opinions.

Thank you again for taking part in this survey.
Measurement methods

- Basis for all survey assessments are brief *lay descriptions* of sequelae highlighting major functional consequences and symptoms.

- Primary mode of eliciting responses is simple *paired comparison*:
  - Respondents hear (or read) two descriptions of hypothetical people with selected lay descriptions.
  - Respondents indicate *which person is healthier*. 
Imagine having 10 years left to live, and living those ten years with the following health problems:

Constant pain and stiffness in the back and in legs, which makes it difficult to sit, stand, run and jump. With these problems, you would avoid bending, twisting and lifting things; would feel some loss of enjoyment in life, and would sleep poorly

Or

Completely blind in both eyes
Results: comparison of household and web surveys

- Web respondents comprise non-random, highly educated, self-selected sample
- But, response probabilities are virtually indistinguishable from those in household surveys
# Fall in Disability Weight for Blindness

<table>
<thead>
<tr>
<th></th>
<th>1990</th>
<th>GBD 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blindness</td>
<td>0.6</td>
<td>0.2</td>
</tr>
<tr>
<td>VI (sev/mod/mild)</td>
<td>0.19 / 0.03 / 0.004</td>
<td></td>
</tr>
<tr>
<td>Acute Low back pain</td>
<td>0.06</td>
<td>0.27</td>
</tr>
</tbody>
</table>

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## Methodological note

Disability weights in the Global Burden of Disease 2010: Unclear meaning and overstatement of international agreement

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\(^a\) The Norwegian Institute of Public Health, Norway
\(^b\) The University of Oslo, Norway

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**Disability weights for vision disorders in Global Burden of Disease study.**

Taylor HR, Jonas JB, Keeffe J, Leasher J, Naidoo K, Pesudovs K, Resnikoff S.

**Comment in**

Global Prevalence of Vision Impairment and Blindness
Magnitude and Temporal Trends, 1990—2010

Gretchen A. Stevens, DSc, Richard A. White, PhD, Seth R. Flagman, BA, Holly Price, BSc, PhD, Jos B. Jonas, MD, Jill Kefee, PhD, Janet Leasher, OD, MPH, Kevyn Naidoo, OD, PhD, Konrad Pescoulous, PhD, Serge Resnikoff, MD, PhD, Hugh Taylor, AC, MD, on behalf of the Vision Loss Expert Group

UK health performance: findings of the Global Burden of Disease Study 2010


Summary
Background The UK has had universal free health care and public health programmes for more than six decades. Several policy initiatives and structural reforms of the health system have been undertaken. Health expenditure has increased substantially since 1990, albeit from relatively low levels compared with other countries. We used data from

Published Online March 5, 2013 http://dx.doi.org/10.1016/
DATA SHARING

Health Economics


Human capital investment (World Economic Forum)

Global Indicators Project: Monitoring progress in elimination of avoidable blindness
Global Vision Database
updates & maintenance

Aditi Das & Alex Silvester: GBD Fellows

Visualisation Project

Dissemination: Governments, NGO’s, professional societies, public. Policy decisions, resource allocation.

Brien Holden Vision Institute
grant 2013-2018
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Vision & Eye Research Unit (Shahina Pardhan, Holly Price, Aditi Das, Alexander Silvester, John Somner)

Co-members of Vision Loss Expert Group

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