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Department of Health
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TO: ALL UNDERSECRETARIES, ASSISTANT SECRETARIES,
CONCERNED DOH BUREAUS, SERVICES, AND UNITS

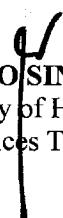
SUBJECT: Interim Guidelines on the Estimation of Burden of Disease in the Philippines

In compliance to Section 32 of the Implementing Rules and Regulations (IRR) of the Universal Health Care Act (RA 11223), the Department of Health (DOH), through the Epidemiology Bureau, shall “publish annual provincial Burden of Disease (BOD) estimates using internationally validated estimation methods and biennially using actual public and private sector data from electronic records and disease registries, to support Local Government Units in tracking the progress of health outcomes.” The IRR further stated that the DOH, in consultation with relevant stakeholders, shall issue guidelines that specify procedures for BOD estimation.

The **Interim Guidelines on the Estimation of Burden of Disease in the Philippines** is hereby issued to provide guidance on the procedures for BOD estimation in the country. These criteria shall be used in the interim while DOH prepares corresponding policies and systems and while awaiting the establishment of the Philippine BOD Consortium to manage national BOD-related activities.

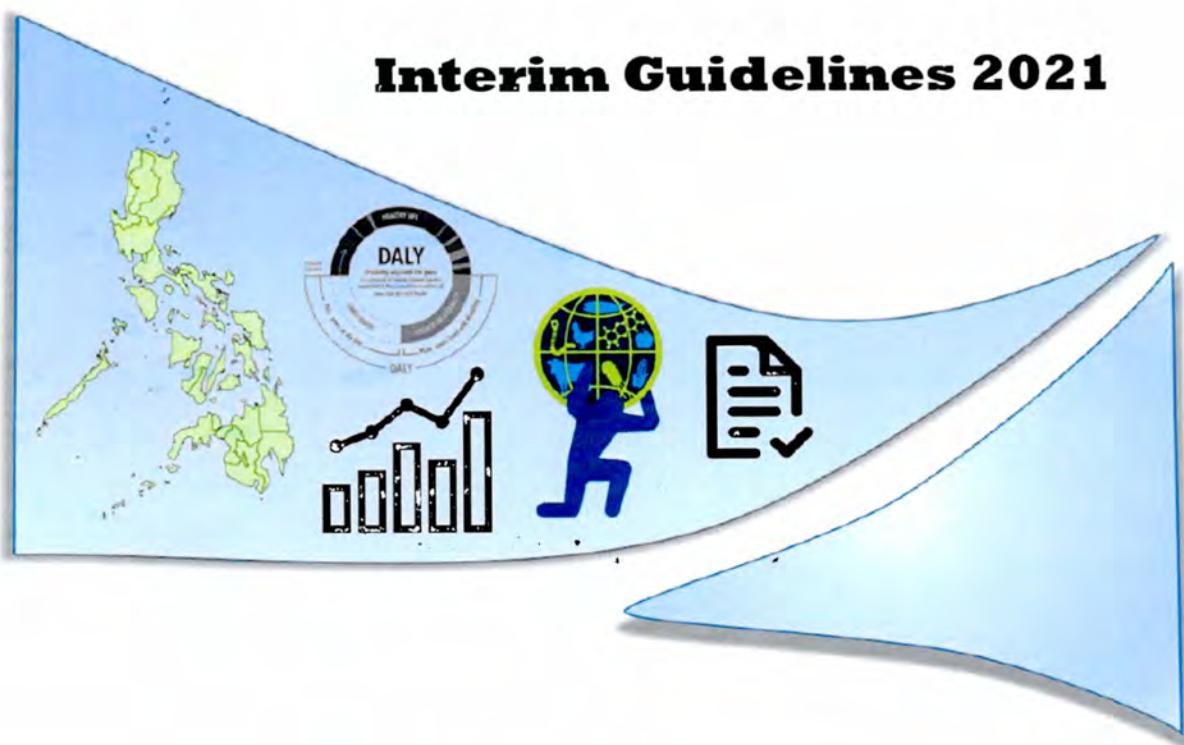
Attached is the document for ready reference. Dissemination of the information to all concerned is requested.

By Authority of the Secretary of Health:


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Estimation of Burden of Disease in the Philippines

Interim Guidelines 2021



**Surveys, Monitoring and Evaluation Division
Epidemiology Bureau**

**Department of Health
Philippines**



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ACKNOWLEDGEMENTS

In preparing this guidelines, we drew heavily from articles and tools found in the Institute for Health Metrics and Evaluation websites (www.healthdata.org, <http://ghdx.healthdata.org>) and *The Lancet 2020*, which has the supplementary appendix to the Methods to “Global Burden of 369 diseases and injuries in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease 2019.” The paper is freely available to the public at www.thelancet.com/gbd. Chapter 8 draws from the National Burden of Disease Studies: A Practical Guide Edition 2.0 by the World Health Organization. Various National Burden of Disease Studies and teaching materials were also reviewed. We also thank the Health Policy Development and Planning Bureau, particularly Dr. Socorro Santos, who contributed substantially to the development of this document.

The Institute for Health Metrics and Evaluation is greatly acknowledged for without them, the Estimation of the Burden of Disease in the Philippines would be challenging.

Purpose of the Guidelines

This document provides general guidance on Philippine Burden of Disease (BOD) Estimation. It is intended for use:

- As a general reference for Philippine Burden of Disease activities
- To outline the process in producing burden of disease estimates using internationally validated estimation methods
- To define the roles and functions of DOH and other institutions involved
- To guide DOH offices and concerned stakeholders in the processes and procedures undertaken to produce burden of disease estimates
- As a resource for training, monitoring, supervision and evaluation of Philippine Burden of Disease activities

Who should use this Document?

The guidelines are designed to be used primarily by the Epidemiology Bureau (EB). The EB is the lead body on matters related to BOD and subnational estimates. It will be responsible in publishing annually the national and subnational burden of disease estimates.

How the Document was Developed

This document was developed based on guidelines provided by Institute for Health Metrics and Evaluation, where the Global Burden of Disease Study is centered. The World Health Organization Practical Guide on National Burden of Disease was also referred to. Consultation with different staff from the Epidemiology Bureau, Health Policy Development and Planning Bureau, and Disease Prevention and Control Bureau was also done.

Scope and Limitations

The document provides an overview of the processes and results tool of the Global Burden of Disease Study. It also highlights the engagement between the Department of Health and Institute for Health Metrics and Evaluation, as the lead in the Global Burden of Disease Study. It does not include the detailed tables, estimation processes and comprehensive description of analytical steps per disease and injury.

LIST OF ABBREVIATIONS

BOD	Burden of Disease
CODEm	Cause of Death Ensemble Model
CodViz	Cause of Death Visualization
DALY	Disability Adjusted Life Year
DOH	Department of Health
EpiViz	Epi Visualization
FNRI	Food and Nutrition Research Institute
GBD	Global Burden of Disease
GHDx	Global Health Data Exchange
HALE	Healthy Life Expectancy
IHME	Institute for Health Metrics and Evaluation
LGU	Local Government Unit
MMR	Maternal Mortality Ratio
MortViz	Mortality Visualization
PhilHealth	Philippine Health Insurance Corporation
PSA	Philippine Statistics Authority
PUF	Public Use Format
SEV	Summary Exposure Value
SMPH	Summary Measures of Population Health
TMREL	Theoretical Minimum Risk Exposure Level
YLD	Years Lived with Disability
YLL	Years of Life Lost

DEFINITION OF TERMS

Burden of Disease – a concept to describe death and loss of health due to diseases, injuries and risk factors.

Cause List – hierarchical list of all risk factors measured in GBD.

DALY – years of healthy life lost to premature death and disability.

Disability – refers to all non-fatal health loss (short or long term) caused by disease or injury.

Disability Weight – weights ranging from zero (perfect health) to one (death) reflecting the severity of a health state or sequela.

Dismod-MR – a Bayesian meta-regression tool that produces internally consistent estimates of incidence, prevalence, remission and mortality risk for many non-fatal health outcomes and risk in GBD.

Duration – a measure of how long a person is ill.

Frequency – a measure of how often a person is in ill health.

HALE - the number of years of total life that a person at a given age can expect to live in good health, taking into account mortality and disability.

Health Expectancies – population indicators that estimate the average time (in years) that a person could expect to live in a defined state of health.

Health Gaps – measure the difference between actual population and a specified norm or goal.

Incidence – number of people who are newly diagnosed with a condition in a given time period.

Life Expectancy – the average number of years that a person of a certain age is expected to live if current mortality rates continue to apply into the future.

Mortality envelope – total number of deaths (from all causes combined) in a given age/sex/location/year.

Prevalence – number of people with a condition at a certain time. In GBD, prevalence refers to point prevalence.

Relative Risk – the ratio of the rate or probability of an event occurring in an exposed group to the rate or probability of the event occurring in a comparison, non-exposed group.

Risk Factor – potentially modifiable causes of disease and injury.

Standard Life Expectancy – the standard of longevity set in the GBD against which YLL are estimated.

Sequela – consequences of a disease. Sequelae of a disease or injury in GBD are mutually exclusive and their prevalence sum to the total disease or injury prevalence.

Subnational – refers to all provinces of the Philippines and the National Capital Region.

YLD – estimated as the prevalence of all conditions that are a departure from full health, adjusted for severity by the disability weights.

YLL – years of life lost due to premature mortality. Estimated as the number of deaths at each age multiplied by the standard life expectancy at the age of birth.

1. INTRODUCTION

1.1 SUMMARY MEASURES OF POPULATION HEALTH

Summary measures of population health (SMPH) combine information on mortality and non-fatal health outcomes to represent the health of a particular population in a single numerical index.¹ Traditionally, mortality statistics have been the solid basis of population health measures. As preventive and curative health care became more effective at modifying disease patterns, morbidity became an indispensable population health indicator, especially in low-mortality populations.²

The simplest and most widely used method for producing health statistics is to aggregate data on individuals in order to generate statistics. This approach becomes unmanageable when a lot of data is being monitored and we want to make comparisons over time, across population groups, or before and after health interventions. The SMPH allow us to summarize these numbers in a comprehensive and consistent manner.

Classification of Summary Measures of Population Health

Health Expectancies are population indicators that estimate the average time (in years) that a person could expect to live in a defined state of health. It is measured in units (expected years of life) that are meaningful to and within the common experience of non-technical audiences. Examples include disability-free life expectancy, active life expectancy and disability-adjusted life expectancy. These extend the concept of life expectancy to refer to expectations of various health states, not just of life.

Health Gaps measure the difference between actual population and a specified norm or goal. The principle characteristic defining a health gap measure is the population norm (age). Time-based health gaps offer the possibility of using a common metric for population health and for outcomes of interest in randomized control trials, in cohort studies and in health service administrative datasets. A common metric is the key to linking economic evaluations of interventions, monitoring of health system outcomes, and the overall health burden of diseases, injuries and health determinants in the population.

One fundamental goal in constructing summary measures is to identify the relative magnitude of different health problems including diseases, injuries and risk factors. There are two dominant traditions in widespread use for causal attribution: categorical attribution and counterfactual analysis.

¹ Field MJ, Gold MR, editors. Summarizing population health: directions for the development and application of population metrics. Washington (DC): National Academy Press; 1998.

² Van der Maas P. How summary measures of population are affecting health agendas. Bulletin of the World Health Organization; 2003 81 (5).

In *categorical attribution*, an event such as death is attributed to a single cause according to a defined set of rules. Such rules inevitably involve grey areas and degrees of unpredictability in dealing with multi-causality and comorbidity.

In *counterfactual analysis*, the contribution of disease, injury or risk factor is estimated by comparing the current and future levels of a summary measure with the levels that would be expected under some alternative hypothetical scenario.

Health gap measures use categorical attribution to attribute the fatal and non-fatal burden of diseases and injuries to an exhaustive and mutually exclusive set of disease and injury categories. They generally use counterfactual analysis to attribute the burden of disease to health determinants and risk factors.

Health expectancy measures do not naturally lend themselves to disaggregation by categorically defined causes. Instead, counterfactual methods, such as disease elimination, are required to quantify the contribution of disease causes to overall health expectancy measure and for dealing with risk factors.

1.2 BURDEN OF DISEASE (BOD)

Burden of Disease is a concept to describe death and loss of health due to diseases, injuries and risk factors. It is estimated by adding together the number of years of life a person loses as a consequence of dying early because of a disease (Years of Life Lost) and the number of years of life a person lives with disability caused by a disease (Years of Life lived with Disability). It gives a single figure estimate called the Disability Adjusted Life Year (DALY). One DALY represents the loss of one year of life lived in full health.

Looking at burden of disease using DALYs can reveal unexpected results about a population's health. For example, the Global Burden of Disease 2004 suggests that neuropsychiatric conditions are the most important causes of disability in all regions of the world, accounting for around 33% of all years lived with disability among adults aged 15 years and over, but only 2.2% of deaths.³ Therefore, while psychiatric disorders are not traditionally regarded as having a major impact on the health of populations, this picture is completely altered when the burden of disease is estimated using DALYs.

Why is it important to estimate burden of disease?

Scientific evidence is key to improving global public health. Health policies should be based on accurate and meaningful health information. Poorly informed policy-making can be one of the reasons why attempts to improve public health fail, jeopardizing the attainment of health-related goals. However, it is extremely difficult to directly translate health data into policy for a number of reasons:

³ http://www.who.int/healthinfo/global_burden_disease/GBD_report_2004update_part3.pdf

- Health data from routine statistics or epidemiological studies may be fragmented, concentrated on fatal health outcomes or only be partially available
- Studies which investigate particular conditions may overestimate mortality, largely because several coexisting diseases may contribute to and compete for the cause of death
- Traditional statistics often do not permit direct comparisons of the cost-effectiveness of different health treatments

Estimating the burden of disease helps overcome some of these problems.

2. PHILIPPINE BURDEN OF DISEASE

2.1 POLICY/GUIDELINES IN SUPPORT OF PHILIPPINE BOD

The Republic Act No. 11223, an act instituting Universal Health Care for all Filipinos, prescribing reforms in the health care system, and appropriating funds thereof, was approved in 2019. Under Section 32.b Monitoring and Evaluation – The Department of Health (DOH) shall publish annual provincial burden of disease estimates using internationally validated estimation methods and biennially using actual public and private sector data from electronic records and disease registries, to support Local Government Units (LGUs) in tracking progress of health outcomes.

The Implementing Rules and Regulations further stated that the DOH, in consultation with relevant stakeholders, shall issue guidelines that specify procedures for BOD estimation. For this purpose, BOD estimates shall refer to quantitative health information concerning distribution of and health loss attributable to diseases, injuries and risk factors.

Furthermore, the DOH, in coordination with Philippine Health Insurance Corporation (PhilHealth), academic and research organizations, and development partners, shall:

- Produce annual BOD estimates through a systematic and transparent manner;
- Build institutional and sectoral capacity for BOD research and analysis;
- Promote the use of BOD estimates for policy and planning at national and local levels; and,
- Inform the improvement of existing disease-specific information systems

All BOD estimates must be accessible in public use format (PUF) and accessible by the general public, in accordance to Republic Act 10173 (Data Privacy Act) and existing laws.

2.2 OBJECTIVES

The results of the Philippine BOD estimates aim to inform the general public on the state of health of the country and help guide health care administrators and policymakers toward the informed formulation and implementation of national and local health policies. The generated national and subnational reports will be utilized for decision making and priority setting. The findings will be communicated to decision makers and/or if applicable, use the findings when drafting health policies or designing programs.

Furthermore, the DOH presents the need for subnational BOD estimates for the following:

- Performance accountability and good governance as drivers of Universal Health Care
- The DOHs role as sectoral manager and regulator
- Anticipated province-level integration
- Strong monitoring and evaluation of local health system performance
- More reliable local data
- Better capacity for planning and allocation for both national and local government

2.3 FRAMEWORK

The findings from the Global Burden of Diseases (GBD), Injuries, and Risk Factors Study, led by the Institute for Health Metrics and Evaluation (IHME), will be adopted by the DOH to extrapolate the country's national and subnational estimates.

WHY PARTNER WITH IHME?

The DOH has no consolidated estimation framework to estimate BOD from local data. There were benefits in closer collaboration with IHME due to their computational expertise and worldwide data (public and private sources, administrative, survey data) from which to borrow strength. As a health research center, IHME may also contribute to improve the quality of our data sources and build local capacity for BOD research.

In 2017, the DOH began coordination with IHME. A Memorandum of Understanding was signed by both parties to improve estimates of the BOD, injuries and risk factors for the Philippines using methods consistent with the overall Global Burden of Disease enterprise centered at IHME. Through close scientific collaboration, both parties entered the agreement to facilitate research in the GBD and related areas such as local burden of disease, forecasting, intervention analyses, and assessments of resource availability and use. The two institutions will collaborate to share data, knowledge, expertise, and results.

RESPONSIBILITIES OF DOH AND IHME

The DOH and IHME designated individuals to serve as the main point of contact for the activities related to the engagement. Depending on the need, individuals involved may identify and assess data, comment on methods, critique results, write publications, create presentations, participate in training exercises, share insights with decision makers, and convey findings to others at conferences or meetings. Depending on the activity, additional specific project protocols may exist that govern participation in these activities.

Data

The DOH will provide IHME available data for use in the GBD and related analyses such as but not limited to local burden of disease, forecasting, intervention analyses, and assessments of resource availability and use in order to expand the quantitative evidence available to decision makers. In each case, no personally identifiable information will be conveyed with the data. Appropriate metadata will be provided with each datasets including any code books; provenance information such as institution that collected the data originally; and descriptive information such as the years, geography, age-sex groups, and specific geo-location data pertaining to the dataset.

Relevant data may include but are not limited to:

- All-cause mortality data by age, sex, and year
- Population, fertility, and migration data by age, sex, and year
- Causes of death data by age, sex, and year
- Incidence and prevalence of diseases, injuries, or risk factors by age, sex, and year
- Sociodemographic indicators such as educational attainment and income by age, sex, and year
- Other datasets used as covariates for linked analyses such as data on human capital stock, health facilities, interventions, expenditure, urbanicity, ethnicity, and related indicators

IHME will be allowed to share data with its staff, subcontractors, and formal collaborators on specific projects subject to the protocols for those specified projects. In some cases, IHME may have to sign additional data use agreements with the original data provider.

IHME will make available to DOH all results and intermediate data that are produced as part of the activities undertaken. Wherever possible, IHME will also provide access to the input data used in the analyses. Where separate data use agreements take precedence, IHME will provide DOH the appropriate metadata and any instructions available on how to gain access to the input data itself. In all cases, appropriate data and project protocols will be followed by both parties.

Data Security

All electronic data provided to IHME are stored on secure server protected by a firewall that does not allow outside access. Metadata for all data used will be catalogued in the Global Health Data Exchange and linked to appropriate data points and citation lists in tools and presentation of results. Unless otherwise noted, viewers of the results will also be provided access to an electronic copy of the input data itself. Potentially individually identifiable data will never be released, in any form, outside of IHME.

Results

IHME and DOH will together review and critique results of the analyses undertaken. The results made available for review and critique will follow appropriate project-specified protocols where such protocols exist. Individuals associated with DOH may be required to sign on as formal collaborators to a specific project in order to review results prior to their public release. Specific results expected include but are not limited to incidence, prevalence, deaths, years of life lost (YLLs), years lived with disability (YLDs), disability-adjusted life years (DALYs), and risk factors related to the 81 provinces and the National Capital Region of the Philippines.

GLOBAL BURDEN OF DISEASE COLLABORATORS

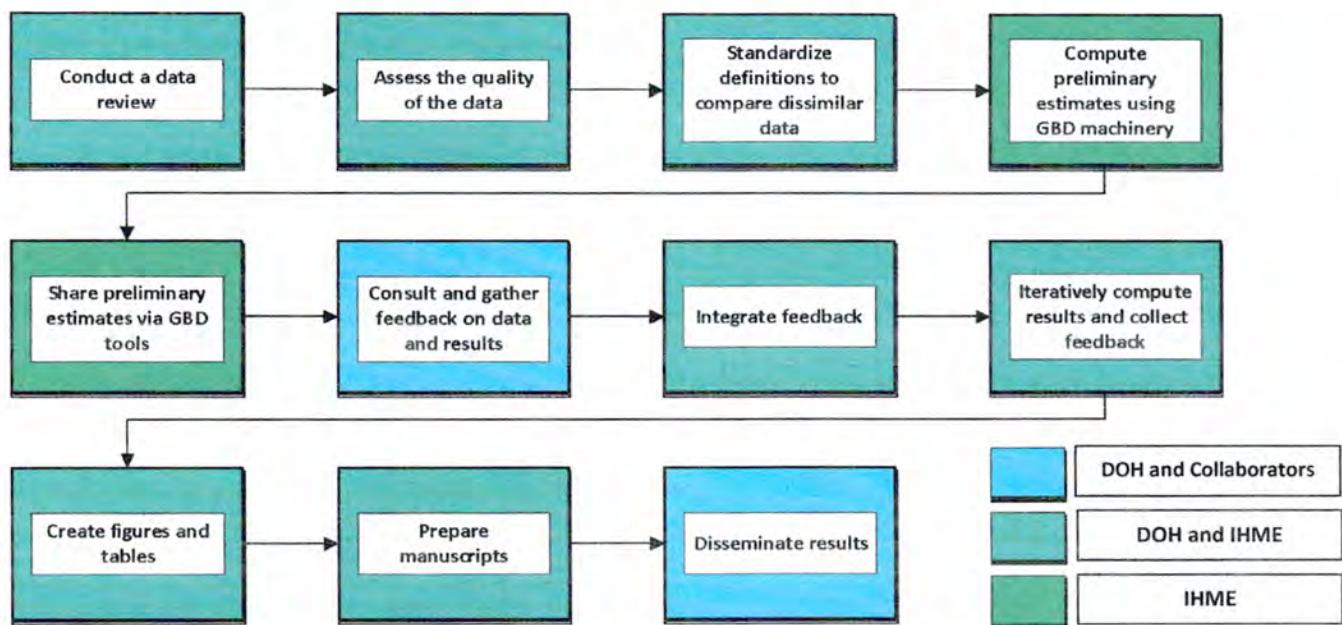
Collaborators share their knowledge and skills, provide access to new data sources, contribute to refining models, and help in the critiquing and dissemination of results and other deliverables. In the Philippines, there are GBD collaborators from various institutions such as the Food and Nutrition Research Institute (FNRI) and PhilHealth, who may contribute to the GBD study. Locally, they will also be tasked with providing feedback on the quality of data being submitted and disseminating the results within their respective institutions to promote their use.

PROCESS OF COLLABORATION OF DOH, IHME, AND PARTNERS

The data from DOH and other sources will both be reviewed and assessed by DOH and IHME. Data gaps will be identified and definitions will be standardized. Further inclusion of new sources will be validated.

Analysis of data using unique and custom-specific metrics will be done by IHME. These metrics are continuously reviewed for improvement and as needed. Preliminary results from the analysis will be shared to DOH and collaborators via GBD tools for critiquing and feedback. Necessary revisions will be done prior to the creation of figures and tables, and manuscript as needed. The findings will then be disseminated by DOH and local collaborators (*Figure 1*).

Figure 1. Process Flow and Roles of DOH, IHME and Partners



PHILIPPINE BURDEN OF DISEASE CONSORTIUM

Identified local GBD collaborators and representatives nominated by institutions involved in BOD, which includes data patrons and the academe, will be part of the Philippine Burden of Disease Consortium. The consortium is tasked to carry out the following:

- Liaise with IHME for year-on-year improvement of province-level estimates through continued supply of data inputs and evaluation of data sources
- Identify and manage data sharing agreements with all Philippine institutions owning health data relevant to burden of disease, including, but not limited to, the PhilHealth, FNRI, and the Philippine Statistics Authority (PSA)
- Lead the routine, systematic validation of the burden of disease estimates through comparisons with locally produced data and known epidemiological patterns via an in-house technical unit or a contracted expert reference group
- Facilitate the training of statisticians, epidemiologists, regional and local counterparts and researchers in burden of disease tools, methods, and results
- Lead the translation of burden of disease estimates from both IHME and in-house units into policy actions and timely public health research
- Develop and implement a long-term plan for the establishment of a Philippine burden of disease unit

3. GLOBAL BURDEN OF DISEASE STUDY

The Global Burden of Disease (GBD) study is the most comprehensive worldwide observational epidemiological study. It is an international collaboration, consisting of over 3,600 collaborators in more than 140 countries and territories. The study offers a powerful resource to understand the changing health challenges facing people across the world in the 21st century.

Examining trends from 1990 to the present, the GBD study that is produced annually includes data on mortality and morbidity in 204 countries and territories, 369 diseases and injuries, and 87 risk factors. By tracking progress within and between countries, it provides an important tool to inform clinicians, researchers, and policy makers, promote accountability and improve lives worldwide.

3.1 INSTITUTE FOR HEALTH METRICS AND EVALUATION

The Institute for Health Metrics and Evaluation (IHME) is an independent global health research center at the University of Washington, Seattle, USA. The IHME provides rigorous and comparable measurement of the world's most important health problems and evaluates strategies used to address them. IHME makes this information freely available so that policymakers have the evidence they need to make informed decisions about how to allocate resources to best improve population health.

3.2 GEOGRAPHIC LOCATIONS OF THE ANALYSIS

The estimates for 204 countries and territories are grouped into 21 regions and seven super-regions. The seven super-regions are central Europe, eastern Europe, and central Asia; high income; Latin America and the Caribbean; north Africa and the Middle East; south Asia; southeast Asia, east Asia, and Oceania; and sub-Saharan Africa. In GBD 2019, nine countries and territories (Cook Islands, Monaco, San Marino, Nauru, Niue, Palau, Saint Kitts and Nevis, Tokelau, and Tuvalu) were added, such that the GBD location hierarchy now includes all WHO member states. This round, GBD includes subnational analyses for several new countries and continues to analyze at subnational levels countries that were added in previous cycles. Subnational estimation in GBD 2019 includes five new countries (Italy, Nigeria, Pakistan, the Philippines, and Poland) and 16 countries previously estimated at subnational levels (Brazil, China, Ethiopia, India, Indonesia, Iran, Japan, Kenya, Mexico, New Zealand, Norway, Russia, South Africa, Sweden, the UK, and the USA). All analyses are at the first level of administrative organization within each country except for New Zealand (by Māori ethnicity), Sweden (by Stockholm and non-Stockholm), the UK (by local government authorities), and the Philippines (by provinces). All subnational estimates for these countries were incorporated into model development and evaluation as part of GBD 2017.

The locations are defined as standard locations and non-standard locations. Standard GBD locations are defined as the set of all sub nationals belonging to countries where data quality is high and with populations over 200 million, in addition to all other countries. Standard locations include the sub nationals for China, India, the USA, and Brazil, but not Indonesia; data for China, India, the USA, and Brazil are also included at the country level. All other countries with subnational estimates are defined as non-standard locations.

3.3 TIME PERIOD OF THE ANALYSIS

The numbers and rates of incidence, prevalence, years lived with disability (YLDs) and disability-adjusted life years (DALYs) are estimated from 1990 to present date. The deaths and years of life lost (YLLs) are estimated from 1980 to the present date.

3.4 GBD CAUSE LIST

The GBD cause and sequelae list (*Annex A*) is organized hierarchically to accommodate different purposes and needs of various users. The first two levels aggregate causes into general groupings. At Level 1 there are three cause groups: communicable, maternal, neonatal, and nutritional diseases (Group 1 diseases); non-communicable diseases (Group 2); and injuries (Group 3). These Level 1 aggregates are subdivided at Level 2 of the hierarchy into 22 cause groupings (eg, neonatal disorders, neurological disorders, and transport injuries). The disaggregation into Levels 3 and 4 contains the finest level of detail for causes captured in GBD 2019. The greatest detail available for some causes, such as anxiety disorders or rheumatoid arthritis, is at Level 3 of the hierarchy, while other specific causes are at Level 4 of the hierarchy with an aggregate category at Level 3 (for example, depressive disorders at Level 3, which encompasses major depressive disorders and dysthymia at Level 4). Sequelae of diseases and injuries are organized at Levels 5 and 6 of the hierarchy. In GBD, sequelae are defined as distinct, mutually exclusive categories of health consequences that can be directly attributed to a cause. For example, both neuropathy and blindness due to diabetic retinopathy are sequelae of diabetes; stroke and ischaemic heart disease are not, as these consequences cannot be categorically ascribed to diabetes in an individual despite good evidence for increased risk of these outcomes. The finest detail for all sequelae estimated in GBD is at Level 6 and is aggregated into summary sequelae categories (Level 5) for causes with large numbers of sequelae. Examples include the grouping of the infectious disease episodes and long-term sequelae of meningitis.

The GBD cause list continues to evolve to reflect the policy relevance, and public health and medical care importance of the causes of major losses of health. The cause and sequelae list expand based on input from the Scientific Council and GBD collaborator network. For GBD 2019, the causes of death cause list has increased to 286 causes, from the 282 causes in GBD 2017. The non-fatal cause list has expanded from 354 causes in GBD 2017 to 364 causes in GBD 2019. The total number of fatal and nonfatal causes combined for GBD 2019 is 369.

3.5 GBD RESULTS OVERVIEW

The GBD results can be found in research publications, current data visualizations, and the GBD Results Tools, which allows users to select, view, and download GBD results data.

4. HOW HEALTH IS MEASURED IN GBD

To understand how to bridge the gap between existing and ideal health outcomes, the GBD study relies on several unique and custom-designed metrics. These tools empower collaborators and policymakers to compare conditions, illnesses, and injuries that were previously incomparable in order to work toward better global health outcomes.

4.1 DISABILITY-ADJUSTED LIFE YEARS (DALYs)

The DALY is the foundational metric of GBD methodology, and measuring DALYs makes fatal and nonfatal health outcomes universally comparable. One DALY equals one lost year of healthy life. The great appeal of the DALY as a metric of health loss is that it can be applied to health outcomes as diverse as traffic accidents and diabetes. Using DALYs as its main metric enables the GBD to make comparisons of health loss due to injuries and illnesses across all countries and over time.

DALYs are calculated as the sum of Years of Life Lost (YLLs) and Years Lived with Disability (YLDs), such that:

$$\text{DALYs} = \text{YLLs} + \text{YLDs}$$

DALYs measure the gap between existing and ideal health conditions. In other words, a person or population who lived in full health to the maximum possible life expectancy would experience zero DALYs.

As the sum of YLLs and YLDs, DALYs account for both mortality (death) and morbidity (illness/injury):

- YLLs mark the difference between age at death and life expectancy
- YLDs capture health loss by taking into account both the severity and duration of a nonfatal condition

DALYs are, thus, a composite measure of health lost. Measuring averted DALYs is also, conversely, a highly effective way to gauge the success (or potential success) of a public health policy or intervention.

4.2 YEARS OF LIFE LOST (YLLs)

YLLs, or Years of Life Lost, account for the mortality aspect of DALYs. Each death contributes a number of YLLs that reflects how many more years that individual would have lived under ideal circumstances. In other words, a death of a young child contributes many more YLLs than a death of an elderly person.

Premature Death: any death that occurs before the standard life expectancy, the number of years an individual could expect to live in the best health conditions witnessed globally today.

Standard Life Expectancy: the number of years an individual of a given age in any country can expect to live. It is determined by the current lowest death rates at each age observed globally. The GBD uses the same standard life expectancy because it values every life equally, meaning that a death at age 5 in Somalia contributes the same number of YLLs as a death at age 5 in Finland.

YLLs are the difference between standard life expectancy and the age at death. The YLLs for a child who dies at the age of five currently equals 83 years. What this means is that a child who is age 5 today can, ideally, expect to live another 83 years.

4.3 YEARS LIVED WITH DISABILITY (YLDs)

YLDs, or Years Lived with Disability, account for the morbidity aspect of DALYs by measuring years of life affected by durations of illness and/or injury. YLDs account for all periods of ill health.

4.4 HEALTHY LIFE EXPECTANCY (HALE)

HALE is the number of years of total life that a person at a given age can expect to live in good health, taking into account mortality and disability. HALE is calculated adjusting life expectancy for type and duration of illness.

5. GLOBAL BURDEN OF DISEASE PROCESS OVERVIEW

5.1 GBD DATA SOURCES

I. Surveys

- a. **Household Surveys:** Provide information on health-related behaviors used to examine a broad range of indicators from child mortality to tobacco smoking or the prevalence of asthma
- b. **Verbal Autopsies:** Interview-based surveys of relatives of deceased to help determine cause of death in populations without a complete vital registration system

II. Government and Other Sources

- a. **Disease Registries:** Centralized databases storing information on patients with a specific disease that provide data for incidence, prevalence, mortality or complications
- b. **Demographic Surveillance Systems:** Provide demographic data on births, migrations, pregnancies, and deaths (including cause of death) and other health characteristics in well-defined populations
- c. **Censuses and Population Registries:** Provide demographic, economic, and social data on every member of a population and are an important source for population denominators. Typically conducted once every 10 years
- d. **Vital Statistics:** Offer a continuous collection of data on 'vital' events of every member of the population, including causes of death, live births, and deaths
- e. **Sample Registries:** Similar to vital statistics but for a sample of the population
- f. **Police Records:** Provide data related to injuries and homicides, which may contribute to estimates of deaths
- g. **Health Insurance Claims:** Data on all inpatient and outpatient episodes/encounters. An important source for disease incidence or prevalence for morbidity models

III. Clinical Informatics

- a. **Disease Notification Data:** Data on (mostly) infectious disease for which there is a legal obligation to report any case
- b. **Health Services Encounter Data:** Includes data on hospital inpatient episodes, emergency department visits, or visits to a specialist or general practitioner. An important source for incidence or prevalence of diseases for which medical attention is sought

IV. Scientific Literature

- a. **Published Scientific Literature:** Peer-reviewed articles and papers contain health-related data reporting on data collected through any of the data collection mechanisms

5.2 MEASURING MORTALITY

I. Processing Data

The GBD study handles huge quantities of data. Researchers and collaborators have access to a large and well-established technological infrastructure that allows them to collect, sort, model, and interpret the data gathered.

II. Estimating Child and Adult Mortality

In countries without vital registration systems, most of the data that exist are either about children under the age of five or adults ages 15–59. Using the best data available for those age groups, GBD researchers estimate child mortality first, then adult mortality. Next, they use statistical models to fill in the gaps (ages 5–14 and 60+) in order to arrive at mortality estimates.

III. Developing Life Tables

Using a model life table system, GBD researchers generate **life tables**, which show age-specific death rates. The inputs into the model life table system are **mortality between ages 0–4** and **mortality for ages 15–59** for men and women separately. Based on these inputs, using all available mortality data, the model life table system produces a complete set of age- and sex-specific mortality rates for each country and year. (For a sense of scale, GBD 2016 relied on 38,460 data sources to create life tables.) These life tables can be further processed to include mortality shocks, such as armed conflicts, natural disasters, or epidemics like HIV.

IV. Creating Mortality Envelopes

From the life tables, the GBD develops **mortality envelopes**: the total number of deaths in a given year, age, and sex group. For example, researchers might determine the total number of deaths among men aged 50–54 in China in 1990 and deaths among Chinese men aged 54–59 in the same year. These estimates are then aggregated across all twenty-three GBD age groups to derive the total number of deaths for men in China in 1990. These totals, or mortality envelopes, allow researchers to assign a cause to each death. At that stage, the GBD works to ensure that the sum of deaths from each cause adds up to the estimated total number of deaths. These data are aggregated to account for mortality throughout countries, regions, and even the entire globe.

V. Estimating Life Expectancy

The **life table** shows at each age how many more years a person in a given country can expect to live. At birth, the value shown is known as life expectancy at birth, or in other words, the number of years an individual born in that country today can expect to live. Using all life tables from around the world, the GBD can also determine the **standard life expectancy**—the number of years that a person at any given age can expect to live. As a global standard for health, the GBD Study uses 87.9 as the standard life expectancy at birth for all countries and both sexes. This figure is based on the lowest age- and sex-specific observed death rates globally in 2017.

5.3 CAUSE OF DEATH

Developing comprehensive accounts of how many people die in each country every year, makes it possible to ask what they're dying from. Since its inception, the GBD study has captured age-and sex-specific data about more than 300 diseases and injuries in 195 countries. Knowing what kills people helps policymakers design targeted and effective health plans.

I. Compiling Cause of Death Data

By compiling every available data source, the GBD creates the most complete, accurate, and unbiased picture of global mortality rates and causes. When dealing with cause-specific mortality data, it's important to always remember: The sum of cause-specific deaths must equal the sum of deaths from all causes. That may sound obvious, but due to overlapping conditions and misunderstandings, the data will often suggest that the sum of cause-specific deaths is greater than the sum of deaths from all causes. GBD researchers are careful to correct for this tendency.

II. Processing the Data

The data processing steps that occur between data collection and modeling are critical. At this stage, researchers examine all data sources and patterns and identify all the ways in which data need to be adjusted in order to be comparable and valid.

Processing all the COD data is a complex endeavor since much of the data are incomplete or flawed:

- Frequently age and sex are not reported
- The assigned cause-of-death may be incorrect or impossible (e.g., children dying from Alzheimer's or women dying from prostate cancer)
- Multiple coding systems exist that use different codes and definitions for the same cause of death

III. Cause of Death Ensemble Model (CODEm)

The GBD Study uses CODEm to combine all plausible relationships between potential causes of death and related factors to produce the best estimates of how many people die from each cause. The steps of the modeling process are:

1. Identify all covariates that have a biological, etiological, or socioeconomic link to a given cause of death.
2. Determine the expected direction of the covariate relationship as positive, negative, or either.
3. Classify each covariate by the strength of its relationship to the disease/condition.
4. Test all possible combinations of covariates, and retain the combinations that produce statistically significant results that fit with the criteria set.
5. Rank all models based on how well they perform in-sample and out-of-sample.
6. Create an ensemble model to represent the weighted averages of the best individual models.
7. Pick the best model based on performance. The best model might be the ensemble model or an individual model.

Each model undergoes regular and rigorous validity testing to make sure that final results align with the original data.

5.4 MEASURING ILL HEALTH

Measuring health loss to nonfatal conditions is an even more challenging and nuanced task than measuring deaths, due to the scarcity and complexity of ill health data as well as the lack of standard case definitions in published studies. Nonfatal health outcomes from diseases and injuries are crucial considerations in promoting and monitoring individual and population health.

I. Combating Statistical Challenges

Models of nonfatal conditions are more statistically challenging than models of deaths. This is because data on nonfatal conditions tend to be highly varied. The reasons for this include:

- Different researchers use different study methods, definitions, and age categories
- There is a large amount of regional diversity regarding causes of illness and injury
- Many published studies focus on non-representative populations
- There are many geographic areas for which little to no data are available
- Different data sources about the same topics don't always agree

In spite of these challenges, the GBD study is committed to reconciling data and studying global health loss.

II. Capturing Frequency, Duration, and Disability Weight

The GBD uses all available data (weighted according to reliability) to evaluate and process the following aspects of ill health.

Frequency is a measure of how often a person is in ill health. This measure entails prevalence (a measure of existing cases) and incidence (a measure of new cases).

Duration is a measure of how long a person is ill. This concept goes hand-in-hand with remission, which is a period of good health between intervals of illness.

Disability weights measure how debilitating a period of ill health is. We use disability weights on a scale from 0.0 (perfect health) to 1.0 (death) to approximate the health loss associated with different illnesses and injuries.

III. Dismod-MR

Dismod-MR is a Bayesian metaregression tool that GBD researchers use to model data for nonfatal health outcomes. It produces estimates based on weighted averages of many data points (meta), and it factors in known associations between multiple variables (regression). As new and better data related to ill health become available, researchers use this tool to update estimates of nonfatal disease burden.

5.5 UNDERSTANDING RISK FACTORS

The GBD's goal in studying risk factors is to determine the extent to which disease burden can be linked to particular risk factors. Understanding the connections between risk factors and health burden empowers individuals and policymakers to change unhealthy behaviors and set effective health policy agendas.

I. Risk Factor Hierarchy

The GBD Study organizes all measured risks into three overarching categories, known as Level 1 risk factors:

Behavioral: These are risks that come from life choices and include dietary choices; physical activity; sexual activity; and the use of tobacco, drugs, or alcohol.

Environmental/ Occupational: These risks are present in the world and may or may not be under an individual's control. Environmental risks include air pollution, unsafe water, sanitation levels, and handwashing. Occupational risks include exposure to several harmful substances like carcinogens or secondhand smoke.

Metabolic: These risks relate to the body's ability to break down, process, and integrate substances like food and water so that it can live, move, and heal. Metabolic risk factors include blood pressure, BMI, cholesterol, and bone mineral density.

Below these Level 1 risk factors are other subdivided tiers.

II. Exposure Levels

The GBD Study uses measurable exposure levels—encountered risks like smoking or unsafe water—and compares them to an ideal level for burden attribution. Ideal levels of exposure are theoretical levels that help determine how much the burden of disease would be reduced if a risk factor were removed from the world.

The GBD uses the theoretical minimum risk exposure level (TMREL) to indicate the lowest imaginable healthy level of exposure. For example, since it's possible to imagine a world in which no one smokes, the TMREL for smoking is zero.

III. What do risk factors have to do with disease burden?

Examining risk factors allows the GBD to pose two important questions about disease burden:

How much would burden of disease be reduced in a country or the world if a particular risk factor were removed? For example, how much lower would the burden of disease be in China if no one there suffered from high blood pressure?

It's also important to ask how risk factors affect the burden of any single disease.

How much lower would the burden of a disease be if all risk factors that contribute to it were modified? For example, studying ischemic heart disease reveals that 93% of all burden can be explained by risk factors such as blood pressure, smoking, and obesity. Bringing these risk factors down to the theoretical minimum would mean 93% less suffering and early death due to ischemic heart disease worldwide.

5.6 MEASURING RISK FACTORS

I. Risk-Outcome Pairs

When there is sufficient evidence that a risk factor causes a specific outcome, the two become a risk-outcome pair. Using evidence-rating criteria based on the World Cancer Research Fund grades of convincing or probable evidence, the GBD determines which risk-outcome pairs to include in the study each year. GBD revises and updates the evidence-rating criteria annually to make sure that risk-outcome pairs are up to date, objective, consistent, and transparent.

II. Exposure Estimate

The exposure estimate involves determining the prevalence of the risk factor. For instance, in studies of smoking as a risk factor, the exposure estimate would be the number of people who smoke.

III. Relative Risk Estimate

The relative risk estimate is a calculation of how much more likely individuals are to get a given disease because of a particular risk factor. For example, researchers might ask how much more likely it is that a person will get diarrhea if they don't practice proper handwashing.

Relative risk estimates are measured on an exponential, unbound scale. A relative risk of 1 means that someone who is exposed to the risk factor is just as likely to get the disease as someone who isn't exposed to the risk factor. Any score higher than 1 indicates exponentially larger chances of getting the disease as a result of exposure to the risk factor.

IV. Theoretical Minimum Risk Exposure Level

GBD researchers determine the ideal level of exposure that a population could have to this risk factor. Remember, the TMREL varies according to the risk factor being investigated. For instance, for unsafe sanitation, the TMREL is a population where every individual uses a flush toilet. Additionally, the TMREL doesn't have to exist anywhere in the real world—it's simply the most ideal, healthy level imaginable.

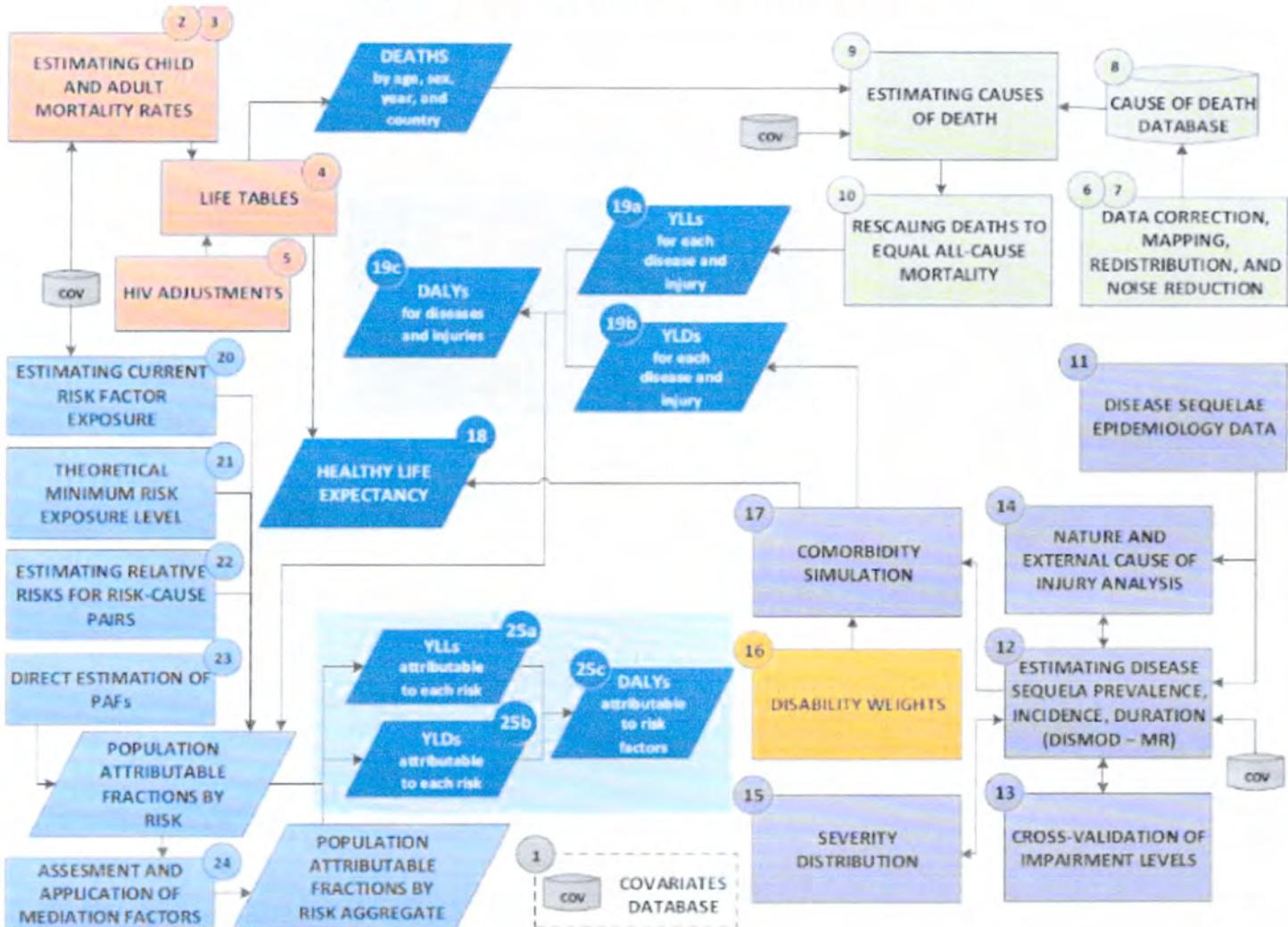
V. Total Deaths or DALYs

Researchers pull the number of cause-specific deaths or DALYs for all diseases included in the risk-outcome pairs. A proportion of this number of cause-specific deaths (or DALYs) will be attributable to this risk factor.

VI. Attributable Deaths or DALYs

The final output in risk factor analysis is the number of deaths or DALYs that can be directly attributed to a given risk factor.

Figure 2. GBD Data and Model Flow Chart



6. GBD DATA AND TOOLS

IHME maintains six online GBD query tools and data visualizations. These are the GBD Results Tool, GBD Compare, Mortality Visualization (MortViz), Causes of Death Visualization (CoDViz), Epi Visualization, (EpiViz), and GBD Data Input Sources Tool. An overview of the indicators and outputs can be seen in *Annex B*. With these, users can query, view, and download, in CSV format, information and data of the following types:

- **Data input sources:** These are lists of the raw data sources used to produce estimates for different components of the study, and relevant metadata about them
- **Model input data:** These are data points adjusted to meet GBD's format and quality requirements
- **Estimates:** These are final GBD results: the point estimates and 95% uncertainty intervals, where appropriate, for study indicators

While most GBD results are distributed through the tools listed above, certain results are published and made available for download as prepackaged files in the Global Health Data Exchange (GHDx), IHME's health and health-related data catalogue. Covariate data used in GBD and certain items of frequently requested documentation (disability weights, GBD cause-ICD code maps, relative risks, and more) are always available through GHDx records. Code used to produce GBD estimates is also hosted in the GHDx.

6.1 GBD RESULTS TOOL

The GBD Results Tool (*Figure 3*) allows the user to query and download in a CSV file the indicators from the most recently published annual GBD. Users can select a specific subset of results according to different dimensions including indicator, cause, risk, location, age, and year. The GBD Results Tool is found here: <http://ghdx.healthdata.org/gbd-results-tool>.

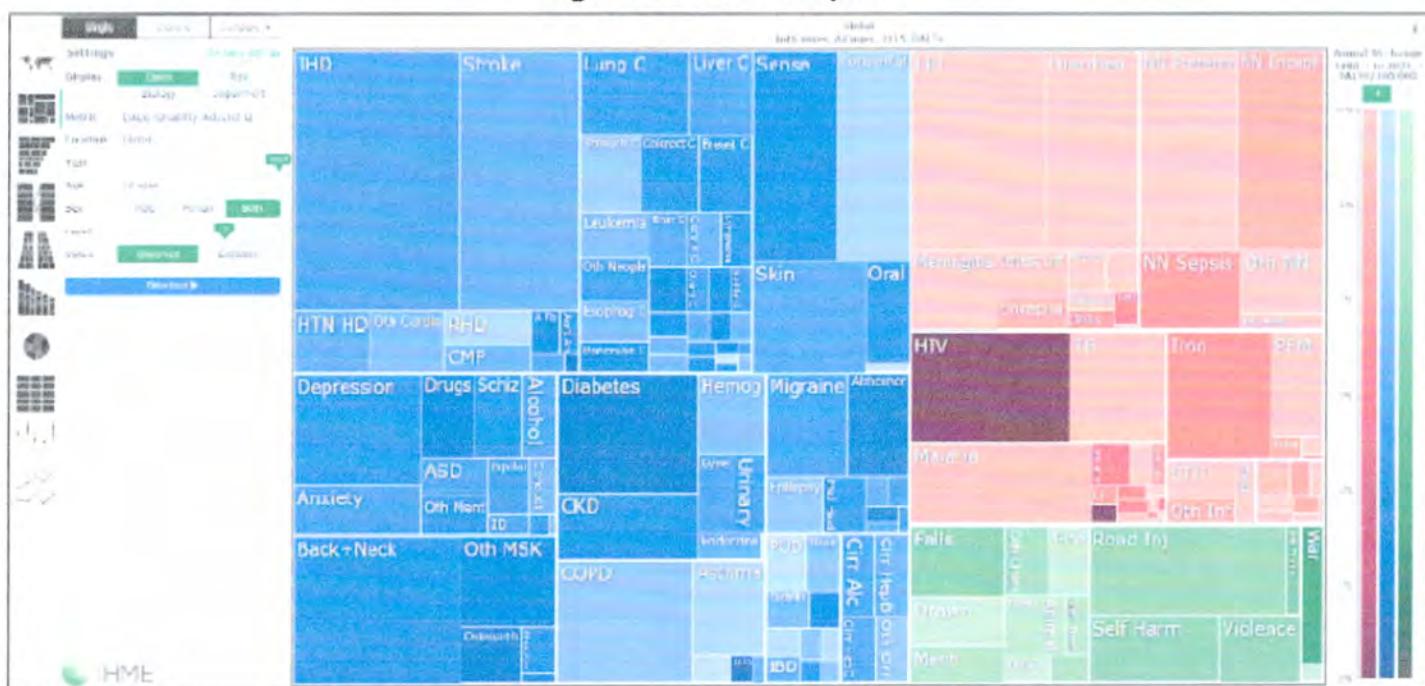
Figure 3. Results Tool



6.2 GBD COMPARE

GBD Compare (Figure 4) is the GBD's most comprehensive visualization, displaying data from the widest range of GBD components. Users can use maps, plots, treemaps, arrow diagrams, and a dozen other charts to compare patterns and trends in causes and risks over time, to explore the health profile within a country by age and sex; to compare countries with one another; or to explore regional or global trends. Users can drill from a global view into country views including subnational details for some countries; can examine how disease patterns have changed over time; and can explore which causes of death and disability are increasing and which are decreasing. GBD Compare is found here: <http://www.healthdata.org/data-visualization/gbd-compare>.

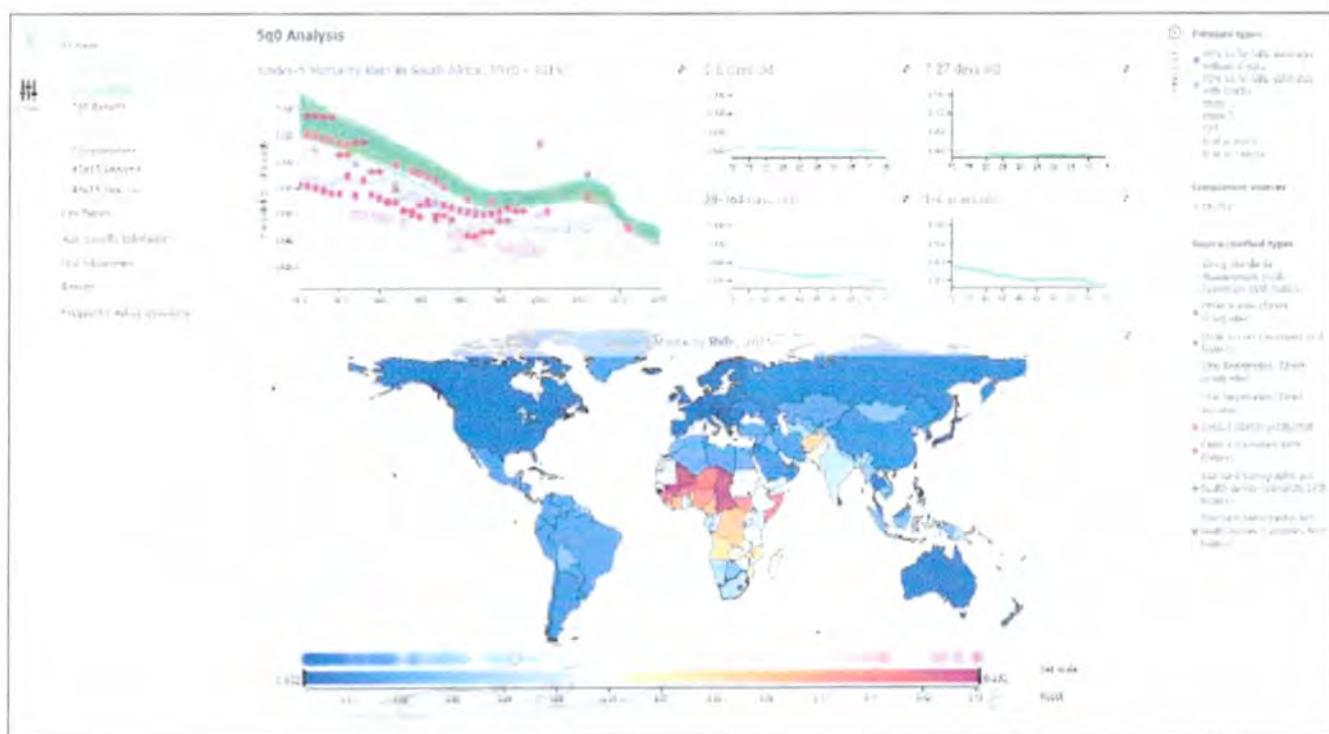
Figure 4. GBD Compare



6.3 MORTALITY VISUALIZATION (MortViz)

The Mortality Visualization (*Figure 5*) allows users to view data and indicators of all-cause mortality. Users are able to follow each analytic step from the beginning of the data preparation to the final results and each transformation along the way. The visualization provides views of both child mortality (defined as the probability of dying between birth and age 5) and adult mortality (defined as the probability of dying between age 15 and 60) for each of the locations for which indicators are produced for the annual global GBD enterprise. MortViz is found here: <http://www.healthdata.org/data-visualization/mortality-visualization>.

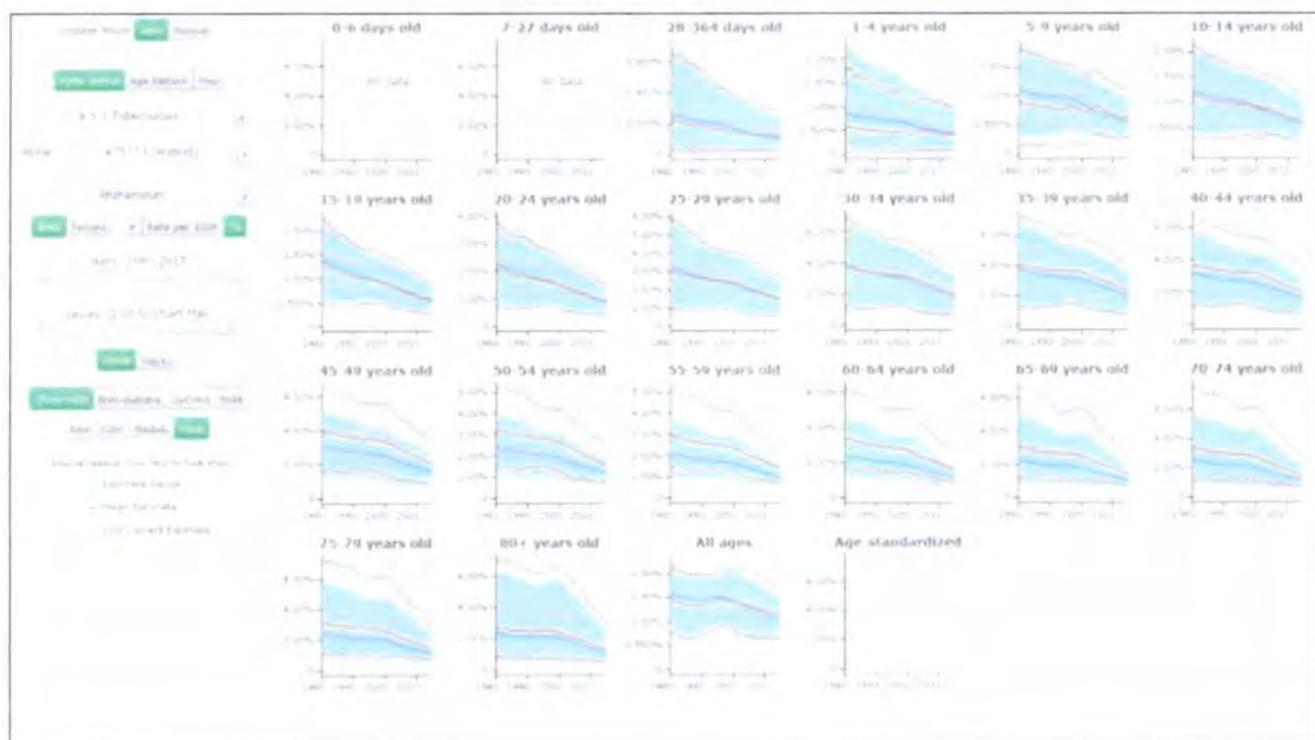
Figure 5. MortViz



6.4 CAUSE OF DEATH VISUALIZATION (CodViz)

The Causes of Death (*Figure 6*) allows users to view data and estimates of death by cause, age, sex, and location over time. Deaths are represented as rates, cause fractions (i.e., the proportion of total deaths due to a cause), and numbers. Users have the ability to see the transformations of the input data to correct for different biases and to see the effects of garbage code redistribution. They also have access to the model parameters that were used to generate results for a given cause. CodViz is found here: <http://www.healthdata.org/data-visualization/causes-death-cod-visualization>.

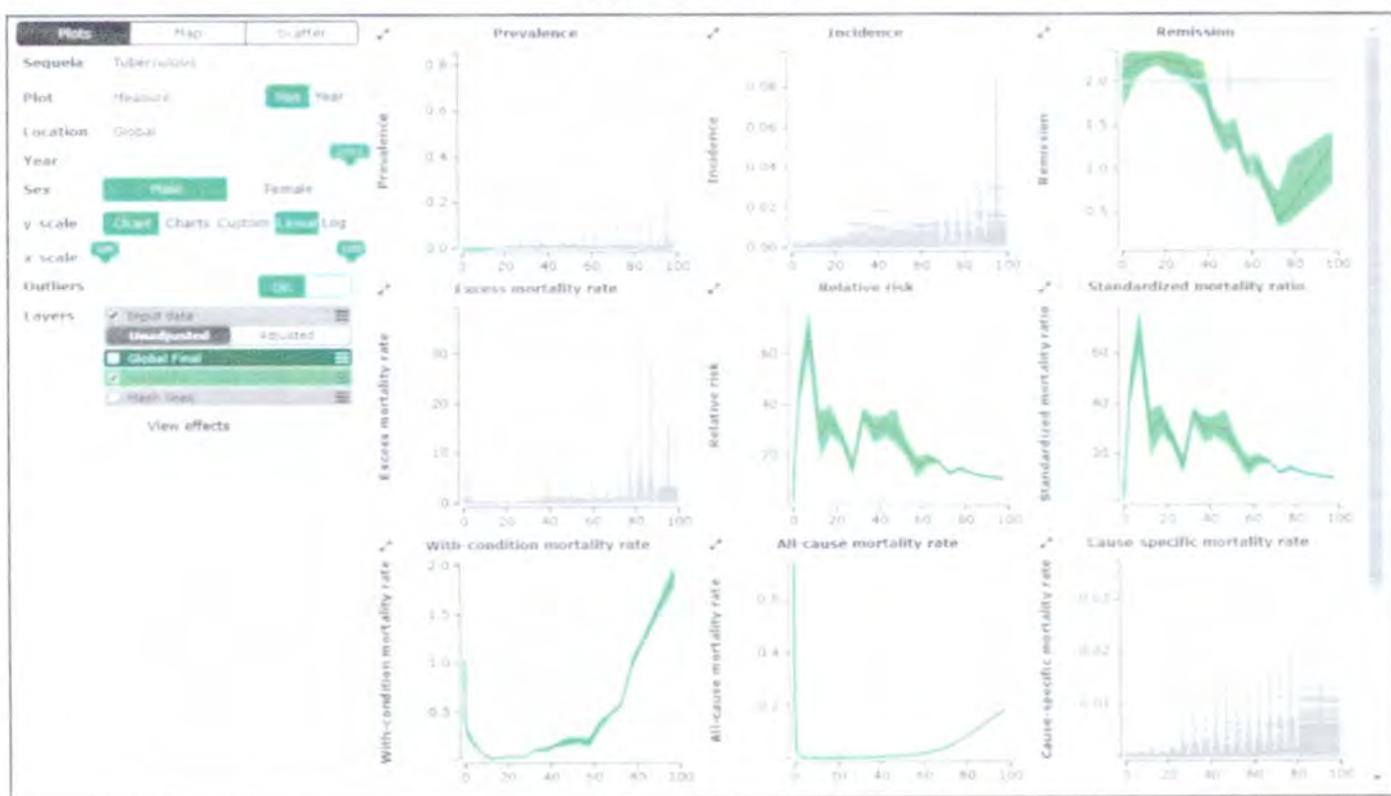
Figure 6. CodViz



6.5 EPI VISUALIZATION (EpiViz)

The Epi Visualization (*Figure 7*) allows users to view data from the nonfatal health outcomes component of the GBD. It allows users to see the input data, data corrections, model settings and results of prevalence, incidence, remission, excess mortality and cause-specific mortality rates for each of the diseases and risk factors that have been analyzed in the GBD. EpiViz is found here: <http://www.healthdata.org/data-visualization/epi-viz>.

Figure 7. EpiViz



6.6 DATA INPUT SOURCES TOOL

The Data Input Sources Tool (*Figure 8*) allows users to view citations for sources of data by cause, location, and year for the most recently published set of annual results. For example, users can search for all sources associated with a particular cause and location and retrieve a set of citations used by GBD to produce those indicators.

The tool's CSV export function also provides the complete set of dimensions and metadata associated with that source. The Data Input Sources Tool is found here: <http://ghdx.healthdata.org/gbd-2019/data-input-sources>.

Figure 8. GBD Data Input Source Tool

The screenshot shows the 'Global Burden of Disease Study 2015 (GBD 2015) Data Input Sources Tool' interface. At the top, there is a navigation bar with links for 'Home', 'About', 'Contact', and 'Help'. Below the navigation bar, there is a search bar and a 'Download' button. The main content area has a heading 'Global Burden of Disease Study 2015 (GBD 2015) Data Input Sources Tool'. It includes a brief description of the tool, a note about the CSV file, and a link to the 'Data Catalog'. On the right side, there is a sidebar with sections for 'Components', 'Locations', 'Causes', 'Risk', 'Impairments', and 'Covariates', each with dropdown menus. At the bottom, there is a 'Search' button.

6.7 GLOBAL HEALTH DATA EXCHANGE (GHDx)

The Global Health Data Exchange (*Figure 9*) is a catalogue of data sources related to health. It includes citations for all sources used in the most recent version of the annually published GBD. (It also includes sources that are not included in or relevant to the GBD, but are health-related and may be of use to other research.) Users can perform searches based upon keyword, location, data type, and year. Full citation information is provided for all sources. Wherever possible, links are provided to the data contained in each source. Where data holders prohibit direct access to the data and require further registration or request, links are provided to the relevant instructions. The GHDx is found here: <http://ghdx.healthdata.org/>.

Figure 9. GHDx

The screenshot shows the homepage of the Global Health Data Exchange (GHDx). At the top, there is a navigation bar with links for Countries, Series and Systems, Organizations, Keywords, GHDx Data, About the GHDx, and Help. Below the navigation bar, the main content area has a title "Global Health Data Exchange" and a sub-section "Global Health Data Exchange". It features a search bar with placeholder text "Search data" and a dropdown menu showing "Malaria". To the right of the search bar, there are several data series listed: "Lumonda National Malaria Mortality 2015", "United States National Survey on Drug Use and Health 2014", "Indonesia Family Life Survey First 2012", "Bogotanah Population and Housing Census 2013 - 2015", "Assessment Survey of Mortality, Anemia, and Nutrition 2013-2015", and "Afghanistan Demographic and Health Survey 2014". At the bottom left, there is a logo for the Institute for Health Metrics and Evaluation (IHME) and contact information: 230 University Avenue, Suite 400, Seattle, WA 98164, USA; Tel: +1.206.897.3800; Fax: +1.206.897.3899. A copyright notice from 2017 is also present. On the right side, there is a "Contact Us" button.

6.8 CODE

Starting with the 2015 study, GBD publishes its analytic code in concordance with the GATHER guidelines. Code is found here: <http://ghdx.healthdata.org/gbd-2019/code>.

7. PHILIPPINE BURDEN OF DISEASE REPORTS

The disease causes, risks, impairments, and injuries by nature from the GBD study that are available for the Philippines and its corresponding level of analysis will be included in the national and subnational reports. The following measures may be used:

- Deaths
- Years of life lost (YLLs)
- Years lived with disability (YLDs)
- Disability-adjusted life years (DALYs)
- Prevalence
- Incidence
- Life expectancy
- Healthy life expectancy (HALE)
- Maternal mortality ratio (MMR)
- Summary exposure value (SEV)

The results may be presented in different views to highlight the following:

- **Changes in Cause or Risk Composition:** the prominence of individual causes or risks within the country
- **Disease Burden due to Risk Factors:** how much of the burden of each disease can be attributed to risk factors. Cause-specific burden numbers, rates and composition may be compared
- **Changes Over Time:** how causes or risks changed over time to visualize both the progress made and challenges that remain
- **Population Variation:** tracking changes related to sex, age and location across time
- **Socio-demographic Variation:** how the risk affects different groups and locations

8. PRESENTATION AND DISSEMINATION OF RESULTS

If you fail to interest policy makers and the community in the results of your study, your endeavors will remain 'academic' (in the negative sense of the word meaning ignored by those who matter) and largely a wasted exercise even if the quality of the study is very high. The opposite, doing a poor study that attracts a lot of attention of policy makers, the media and or community groups may lead to short term fame and influence but is likely to have an even worse outcome in the end: not only failed but also denounced.

8.1 TARGET AUDIENCE

At the start of the report, there should already be a plan or strategy for dissemination of results. From the way objectives are stated, it should already become clear who the audience is and what content will be provided to them. The following are set of objectives as an example:

- 1) To provide internally consistent estimates of the burden of fatal and non-fatal health events (in numbers of deaths, incident and prevalent cases and DALYs) for the 100 most important conditions in country
- 2) To describe differentials in the burden of disease between x number of small areas/regions, rural and urban areas, between socio-economic strata and between ethnic groups in country
- 3) To describe the burden of disease attributable to 10 major risk factors of disease in country
- 4) To project the burden of disease 20 years into the future in country
- 5) To construct detailed disease models that describe the natural history of the 50 most important conditions that can be used as a basis for cost-effectiveness analyses
- 6) To provide policy makers, planners and the community with an understanding of the size of health problems and the distribution of health problems in country

From these objectives, target audiences for different elements of the results are apparent. Table 1 gives examples of the areas of interest to different stakeholders.

Table 1: Stakeholders Interests in BOD Results

Stake holders	Areas of interest
Policy makers	
Those involved in resource allocation	Health inequalities as a guide to funding formulas by region or sub-population
	The size of health problems: to identify 'neglected' areas which in turn may lead to an analysis of intervention options and/or research priorities
	The results of cost-effectiveness analyses that you may plan as a follow-up
Public health managers	Risk factor analyses, infectious diseases
Hospital managers	Number of prevalent and incident cases as a guide to potential demand for services
Planners	Projections of disease burden
	Number of incident/prevalent cases
Clinicians	A population health perspective to the health problems they deal with on a doctor to patient basis
Media	Striking differentials in health
	Projections
	Risk factor analyses
Community	'Neglected' health problems
	Striking differentials in health
	Projections
	Risk factor analyses
Disease advocacy groups	Estimates of size of the burden for the health problem of their interest
Academics	Methods, innovations, particular findings

8.2 METHODS OF DISSEMINATION

Every study produces a large amount of results. Some stakeholders will be interested in a few summary findings while others will want to scrutinize and make use of very detailed descriptions of the methods and results. This means a number of dissemination strategies should be planned to satisfy the information demands of target audiences.

The main aim of doing a BOD study is to inform and influence policy and planning and to involve the community in thinking about health problems. Many of the stakeholders will not have the time or inclination to examine worksheets and long tables of results. Identify the best way to get target audiences interested and choose appropriate methods of dissemination which may include one or more of the following:

- Printed Publication

Most studies will produce a written report. The main body of such a report typically will contain 3–8 pages of executive summary, up to 5 pages of background and justification and objectives, a methods section of 20–60 pages, 20–60 pages of results, and up to 20 pages of discussion and recommendations. This can be followed by tables of summary results and appendices with e.g. list of diseases with ICD-codes, the disability weights and examples of one or two of your worksheets. The whole report should probably not exceed 200–300 pages.

- Summary Report

Many people interested in the study will not be able to or want to read a full report. They may be referred to the executive summary of the report but it may be better to produce a small summary booklet of 30–40 pages. The style of such a booklet can be ‘looser’ than that of the full report or a paper in a scientific journal. Short sentences with clear simple language, separate text boxes to highlight an issue or explain a concept and lots of graphic images are strategies for a booklet that is accessible to a wide audience.

- Presentations

Most of the mortality analyses can be highlighted first to show interesting results to kindle interest for the study. On completion of the study, it is likely that a collection of different presentations depending on the audience you were talking to is available. It is helpful to organize visual aids in such a way that for each new request for a presentation, it is easy to pull together a set of slides, overheads or PowerPoint slides relevant to the occasion. Give the slides a similar look (same background color/design, similar font, similar headings and preferably a logo for the study or the organization you work for).

8.3 PRESENTATION OF RESULTS

It is not so easy to decide on which of the many results of the study will be presented and how best to present results. It often helps to use a variety or a combination of methods:

- a good description of the most important points in text
- a graph
- a table

Develop a certain common look to the tables and graphs. This will help the audience recognize that the different components of the study hang together. Give each table and figure a self-explanatory heading that—using few words—describes the contents of the table or figure to a reader who may not take the time to read your text. Use the same fonts throughout for headings, legends and labels.

Avoid putting too many things in one table or one graph. In principle, each table or graph should have one main message. If there are more messages on the same topic, it is best to create a second graph or table. Also, avoid presenting a graph and a table with the same information. If there is a need to add a table to a graph, just use the table or add value labels to the graph. The text accompanying the tables and graphs in the main body of a report should not repeat what is shown already but should direct the reader to the important message(s) of the table or graph.

In the report, a separate graph for men and women or for other comparisons of health status between sub-populations may be presented. When doing this in a set of graphs, make sure that:

- the measure shown is comparable (e.g. age standardized, a rate rather than absolute numbers)
- the categories of comparison are clearly shown on (usually) the X-axis
- the scale of the measurement (usually the Y-axis) is the same; for instance, if you are comparing DALY rates by age group between one ethnic group and another in two graphs, the Y-axis should run to the same number even if the DALY rates in one of the ethnic groups are much lower.
- start the scale of the Y-axis at 0, or if you have good reasons not to do so indicate this clearly

The choice of type of graph (pie chart, line graph, area graph, 2-D or 3-D, etc.) depends on what you want to show. Again, you will find it helpful to look at how others have done this but you may want to venture in some creative designs that you think best conveys your message.

8.4 DEALING WITH CRITICISM

Summary measures of population health such as the DALY include a number of social value choices (discounting, age weights, disability weights, valuing deaths by the years of life lost) that can stir up heated and sometimes emotional debates. Some of this is a useful way of exploring common ground and trying to reach a consensus that most interested parties in the health sector accept. Some of the more emotional arguments are often based on incomplete understanding of the methods. It is important for the success of the study to be prepared to respond to criticism and to take away misunderstandings.

A good way of pre-empting criticism is demonstrating that you have gone through a process of consultation with prominent health experts about the results.

The most common criticism concerns:

- Confusion about the term disability. In many health systems, disability has become a term reserved for chronic disabling health states —often linked to eligibility to receive government support. Disability advocacy groups endeavor to take away the stigma and discrimination of disability in society. This leads to statements such as: "Persons with a disability can be healthy". In the broad sense in which disability is used in the burden of disease terminology, any departure from full health is counted.
- Equating a disability weight to a value judgment on a person with a disability. This is probably the most emotional criticism of DALYs. If the opportunity is there for discussion, it helps to explain that burden of disease assessments and cost-effectiveness analyses that use DALYs intend to reflect a societal willingness to prevent, cure or treat a health problem and not a judgement on the value of individuals with or without varying degrees of illness and disability. In fact, if a person with a disability (such as deafness) considers him/herself completely healthy this does not mean that society would not want to prevent others from becoming deaf. Thus, identifying the disability as a departure from full health indicates a willingness to invest resources in the prevention and or treatment of persons in that health state.
- Disputes by disease advocacy groups about the estimates for a particular condition. It is not for nothing that decoupling advocacy from epidemiology is an important principle of burden of disease studies. The estimates of the prevalence of a condition are often considerably smaller than those put out by disease experts or advocacy groups. To an extent, this is a consequence of more liberal inclusion criteria while in a BOD study you endeavor to avoid double counting. There is often also an element of exaggeration or choosing the highest estimates to influence policy makers to provide more resources. In these debates it often helps to show your criteria of inclusion and exclusion, and to

provide information on the data sources and data transformations that led to your estimates.

- Unease about the uncertainty of burden of disease estimates. Statisticians and a lot of epidemiologists are averse to uncertainty and may challenge the grounds that there is so much uncertainty in estimates that you cannot possibly present them, let alone base decisions on them. Again, giving full transparency of what was done is an important first step in reply. Another helpful line of argument is to say that it may be better to produce uncertain results rather than ignoring a health problem if available data sources are poor. Moreover, in the absence of evidence about the size and distribution of health problems policy decisions are being made. Therefore, the extent to which decision-making can be informed by the results should not be compared with an ideal of complete knowledge of every disease but against making decisions in the absence of this information.

ANNEXES

Annex A: GBD Cause List

Level 1	Level 2	Level 3	Level 4
Communicable, Maternal, Neonatal, Nutritional Diseases	HIV/AIDS and Sexually Transmitted Infections	HIV/AIDS	HIV/AIDS-drug-susceptible tuberculosis HIV/AIDS-multidrug-resistant TB without extensive drug resistance HIV/AIDS-extensively drug-resistant tuberculosis HIV/AIDS resulting in other diseases
		Sexually Transmitted Infections excluding HIV	Syphilis Chlamydia infection Gonococcal infection Trichomoniasis Genital herpes Other sexually transmitted infections
		Tuberculosis	Latent TB infection Drug-susceptible TB Multi-drug resistant TB
		Lower respiratory infections	
		Upper respiratory infections	
		Otitis media	
	Enteric Infections	Diarrheal diseases	
		Typhoid and paratyphoid	Typhoid fever Paratyphoid fever
		Invasive non-typhoidal Salmonella	
		Other intestinal infectious diseases	
Neglected Tropical Diseases and Malaria	Malaria		
	Chagas disease		
	Leishmaniasis		Visceral leishmaniasis
			Cutaneous and mucocutaneous leishmaniasis
	African trypanosomiasis		
	Schistosomiasis		
	Cysticercosis		
	Cystic echinococcosis		
	Lymphatic filariasis		
	Onchocerciasis		
	Trachoma		
	Dengue		
	Yellow fever		
	Rabies		
	Intestinal nematode infection		Ascariasis
			Trichuriasis
			Hookworm disease
	Food-borne trematodiases		
	Leprosy		
	Ebola virus disease		
	Zika virus disease		
	Guinea worm disease		
	Other neglected tropical diseases		

	Other Infectious Diseases	Meningitis	
		Encephalitis	
		Diphtheria	
		Whooping cough	
		Tetanus	
		Measles	
		Varicella and herpes zoster	
		Acute hepatitis	Acute hepatitis A
			Acute hepatitis B
			Acute hepatitis C
			Acute hepatitis D
			Acute hepatitis E
		Other unspecified infectious diseases	
	Maternal and Neonatal Disorders	Maternal Disorders	Maternal hemorrhage Maternal sepsis and other maternal infections Maternal hypertensive disorders Maternal obstructed labor and uterine rupture Maternal abortion and miscarriage Ectopic pregnancy Indirect maternal deaths Late maternal deaths Maternal deaths aggravated by HIV/AIDS Other maternal disorders
		Neonatal Disorders	Neonatal preterm birth Neonatal encephalopathy due to birth asphyxia and trauma Neonatal sepsis and other neonatal infections Haemolytic disease and other neonatal jaundice Other neonatal disorders
	Nutritional Deficiencies	Protein-energy malnutrition Iodine deficiency Vitamin A deficiency Dietary iron deficiency Other nutritional deficiencies	
Non-communicable diseases	Neoplasms	Lip and oral cavity cancer Nasopharynx cancer Other pharynx cancer Oesophageal cancer Stomach cancer Colon and rectum cancer Liver cancer Gallbladder and biliary tract cancer Pancreatic cancer	Liver cancer due to hepatitis B Liver cancer due to hepatitis C Liver cancer due to alcohol use Liver cancer due to NASH Liver cancer due to other causes

	Larynx cancer	
	Tracheal, bronchus, and lung cancer	
	Malignant skin melanoma	
	Non-melanoma skin cancer	Non-melanoma skin cancer (squamous-cell carcinoma)
		Non-melanoma skin cancer (basal-cell carcinoma)
	Breast cancer	
	Cervical cancer	
	Uterine cancer	
	Ovarian cancer	
	Prostate cancer	
	Testicular cancer	
	Kidney cancer	
	Bladder cancer	
	Brain and central nervous system cancer	
	Thyroid cancer	
	Mesothelioma	
	Hodgkin lymphoma	
	Non-hodgkin lymphoma	
	Multiple myeloma	
	Leukemia	Acute lymphoid leukemia Chronic lymphoid leukemia Acute myeloid leukemia Chronic myeloid leukemia Other leukemia
	Other malignant neoplasms	
	Other neoplasms	Myelodysplastic, myeloproliferative, and other haematopoietic neoplasms Benign and in situ intestinal neoplasms Benign and in situ cervical and uterine neoplasms Other benign and in situ neoplasms
Cardiovascular diseases	Rheumatic heart disease	
	Ischaemic heart disease	
	Stroke	Ischaemic stroke Intracerebral hemorrhage Subarachnoid hemorrhage
	Hypertensive heart disease	
	Non-rheumatic valvular heart disease	Non-rheumatic calcific aortic valvular heart disease Non-rheumatic degenerative mitral valvular heart disease Other non-rheumatic valvular heart disease
	Cardiomyopathy and myocarditis	Myocarditis Alcoholic cardiomyopathy Other cardiomyopathy
	Aortic fibrillation and flutter	
	Aortic aneurysm	
	Peripheral artery disease	

		Endocarditis	
		Other cardiovascular and circulatory diseases	
Chronic respiratory diseases		Chronic obstructive pulmonary disease	
		Pneumoconiosis	Silicosis Asbestosis Coal workers pneumoconiosis Other pneumoconiosis
		Asthma	
		Interstitial lung disease and pulmonary sarcoidosis	
		Other chronic respiratory diseases	
		Cirrhosis and other chronic liver diseases	Cirrhosis and other chronic liver diseases due to hepatitis B Cirrhosis and other chronic liver diseases due to hepatitis C Cirrhosis and other chronic liver diseases due to alcohol use Cirrhosis and other chronic liver diseases due to NAFLD Cirrhosis and other chronic liver diseases due to other causes
Digestive diseases		Upper digestive system disorders	Peptic ulcer disease Gastritis and duodenitis Gastro-esophageal reflux disease
		Appendicitis	
		Paralytic ileus and intestinal obstruction	
		Inguinal, femoral, and abdominal hernia	
		Inflammatory bowel disease	
		Vascular intestinal disorders	
		Gallbladder and biliary diseases	
		Pancreatitis	
		Other digestive diseases	
		Alzheimer's disease and other dementias	
Neurological Disorders		Parkinson's disease	
		Idiopathic epilepsy	
		Multiple sclerosis	
		Motor neuron disease	
		Headache disorders	Migraine Tension-type headache
		Other neurologic disorders	
		Schizophrenia	
Mental Disorders		Depressive disorders	Major depressive disorder Dysthymia
		Bipolar disorder	
		Anxiety disorder	
		Eating disorder	Anorexia nervosa Bulimia nervosa
		Autism spectrum disorders	
		Attention deficit/hyperactive disorder	
		Conduct disorder	

		Idiopathic developmental intellectual disability	
		Other mental disorders	
Substance use disorder	Alcohol use disorder		
	Drug use disorder	Opioid use disorders Cocaine use disorders Amphetamine use disorders Cannabis use disorders Other drug use disorders	
Diabetes and Kidney Diseases	Diabetes mellitus	Diabetes mellitus type 1 Diabetes mellitus type 2	
	Chronic kidney disease	Chronic kidney disease due to diabetes mellitus type 1 Chronic kidney disease due to diabetes mellitus type 2 Chronic kidney disease due to hypertension Chronic kidney disease due to glomerulonephritis Chronic kidney disease due to other and unspecified causes	
	Acute glomerulonephritis		
Skin and Subcutaneous Diseases	Dermatitis	Atopic dermatitis Contact dermatitis Seborrhoeic dermatitis	
	Psoriasis		
	Bacterial skin diseases	Cellulitis Pyoderma	
	Scabies		
	Fungal skin disorders		
	Viral skin disorders		
	Acne vulgaris		
	Alopecia aerata		
	Pruritus		
	Urticaria		
	Decubitus ulcer		
	Other skin and subcutaneous diseases		
Sense Organ Diseases	Blindness and vision loss	Glaucoma Cataract Age-related macular degeneration Refraction disorders Near vision loss Other vision loss	
	Age-related and other hearing loss		
	Other sense organ diseases		
Musculoskeletal Disorders	Rheumatoid arthritis		
	Osteoarthritis	Osteoarthritis hip Osteoarthritis knee Osteoarthritis hand Osteoarthritis other	
	Low back pain		
	Neck pain		

		Gout	
		Other musculoskeletal disorders	
	Other Non-communicable Diseases	Congenital birth defects	<p>Neural tube defects</p> <p>Congenital heart anomalies</p> <p>Orofacial clefts</p> <p>Down syndrome</p> <p>Turner syndrome</p> <p>Klinefelter syndrome</p> <p>Other chromosomal abnormalities</p> <p>Congenital musculoskeletal and limb anomalies</p> <p>Urogenital congenital anomalies</p> <p>Digestive congenital anomalies</p> <p>Other congenital birth defects</p>
		Urinary diseases and male infertility	<p>Urinary tract infection and interstitial nephritis</p> <p>Urolithiasis</p> <p>Benign prostatic hyperplasia</p> <p>Male infertility</p> <p>Other urinary diseases</p>
		Gynaecological diseases	<p>Uterine fibroids</p> <p>Polycystic ovarian syndrome</p> <p>Female infertility</p> <p>Endometriosis</p> <p>Genital prolapse</p> <p>Premenstrual syndrome</p> <p>Other gynecological diseases</p>
		Haemoglobinopathies and hemolytic anemias	<p>Thelassaemias</p> <p>Thelassaemias trait</p> <p>Sickle cell disorders</p> <p>Sickle cell trait</p> <p>G6PD deficiency</p> <p>G6PD trait</p> <p>Other Haemoglobinopathies and hemolytic anemias</p>
		Endocrine, metabolic, blood, and immune disorders	
		Oral disorders	<p>Caries of deciduous teeth</p> <p>Caries of permanent teeth</p> <p>Periodontal diseases</p> <p>Edentulism and severe tooth loss</p> <p>Other oral disorders</p>
		Sudden infant death syndrome	
Injuries	Transport Injuries	Road injuries	<p>Pedestrian road injuries</p> <p>Cyclist road injuries</p> <p>Motorcyclist road injuries</p> <p>Motor vehicle road injuries</p> <p>Other road injuries</p>
		Other transport injuries	
	Unintentional injuries	Falls	
		Drowning	
		Fire, heat, and hot substances	

	Poisonings	Poisoning by carbon monoxide Poisoning by other means
	Exposure to mechanical forces	Unintentional firearm injuries Other exposure to mechanical forces
	Adverse effects of medical treatment	
	Animal contact	Venomous animal contact Non-venomous animal contact
	Foreign body	Pulmonary aspiration and foreign body in airway Foreign body in eyes Foreign body in other body part
	Environmental heat and cold exposure	
	Exposure to forces of nature	
	Other unintentional injuries	
Self-harm and interpersonal violence	Self-harm	Self-harm by firearm Self-harm by other specified means
	Interpersonal violence	Physical violence by firearm Physical violence by sharp object Sexual violence Physical violence by other means
	Conflict and terrorism	
	Police conflict and executions	

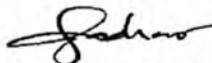
ANNEX B: GBD Tool Outputs and Indicators Overview

GBD 2017 Tool		GBD Results						GBD Data Input Sources
	Tool	Compare	MortViz	CoDViz	EpiViz	GHDx		
GBD Component	Mortality	X	X	X			X	X
	Population						X	X
	Fertility						X	X
	Migration						X	
	Causes of death	X	X		X		X	X
	Nonfatal health Outcomes	X	X			X	X	X
	Risk factors	X	X				X	X
	Covariates						X	X
	Estimates	X	X	X	X	X	X	
Output	Model input data			X	X	X		
	Data input sources							X
Dimension	Age group	X	X	X	X	X	X	X
	Cause	X	X		X	X	X	X
	Impairment	X	X			X		X
	Injuries by nature	X	X					X
	Location	X	X	X	X	X	X	X
	Risk	X	X			X	X	X
	Sex	X	X	X	X	X	X	X
	Year	X	X	X	X	X	X	X
Measure / Indicator	Deaths	X	X	X	X			
	Disability-adjusted life years (DALYs)		X					
	Years lived with disability (YLDs)	X	X					
	Years of life lost (YLLs)	X	X					
	Prevalence	X	X			X		
	Incidence	X	X			X		
	Maternal mortality ratio (MMR)		X					
	Probability of death		X	X			X	
	Life expectancy	X	X	X			X	
	Health-adjusted life expectancy (HALE)	X	X				X	
	Summary exposure value (SEV)	X	X					
	Life expectancy decomposition		X					
	Expected value (life expectancy, deaths, YLLs, YLDs, DALYs)		X					

Measure / Indicator	GBD Results Tool	GBD Tool	Compare	Mortality	CaDViz	EpiVis	GHDX	GBD Data Input Sources
Covariates							X	
Population							X	
Fertility							X	
Universal healthcare (UHC) effective coverage index							X	
Life expectancy (without fatal discontinuities or HIV)				X			X	
Life expectancy (without fatal discontinuities, with HIV)				X			X	
Probability of death (without fatal discontinuities or HIV)				X			X	
Probability of death (without fatal discontinuities, with HIV)				X			X	
Remission						X		
Excess mortality rate						X		
Standardized mortality ratio						X		
With-condition mortality rate						X		
All-cause mortality rate			X			X		
Cause-specific mortality rate					X	X		
Other cause mortality rate						X		
Proportion						X		
Continuous measure						X		

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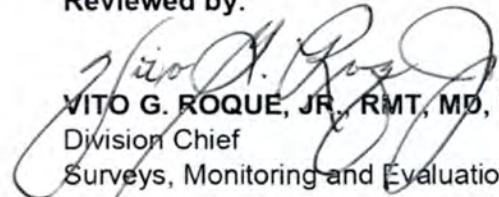


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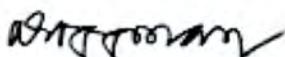


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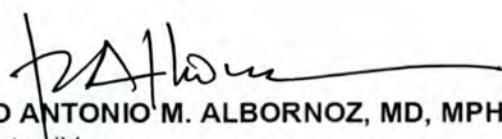


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