

Burden of Disease Studies; harnessing sparse epidemiological data for evidence-informed policy making

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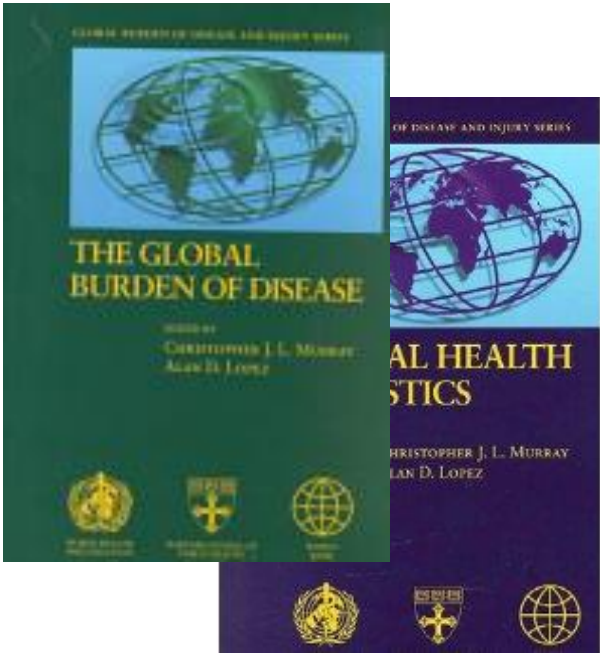
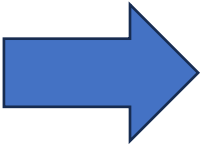
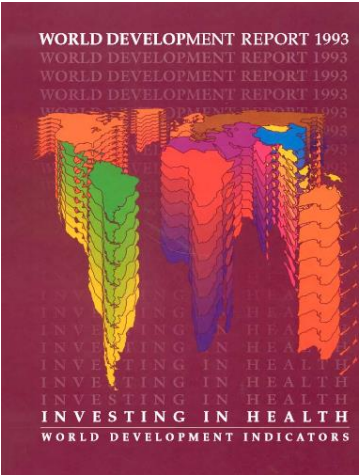
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Burden of disease study

- Quantification of health loss to describe comparative magnitudes of diseases and injuries, and attributable burden to risk factors in a population
- Difference with general term of “disease burden”?
 - Any quantification of disease magnitude or severity at personal or population level
 - Not necessarily comparable

Global Burden of Disease (GBD) project



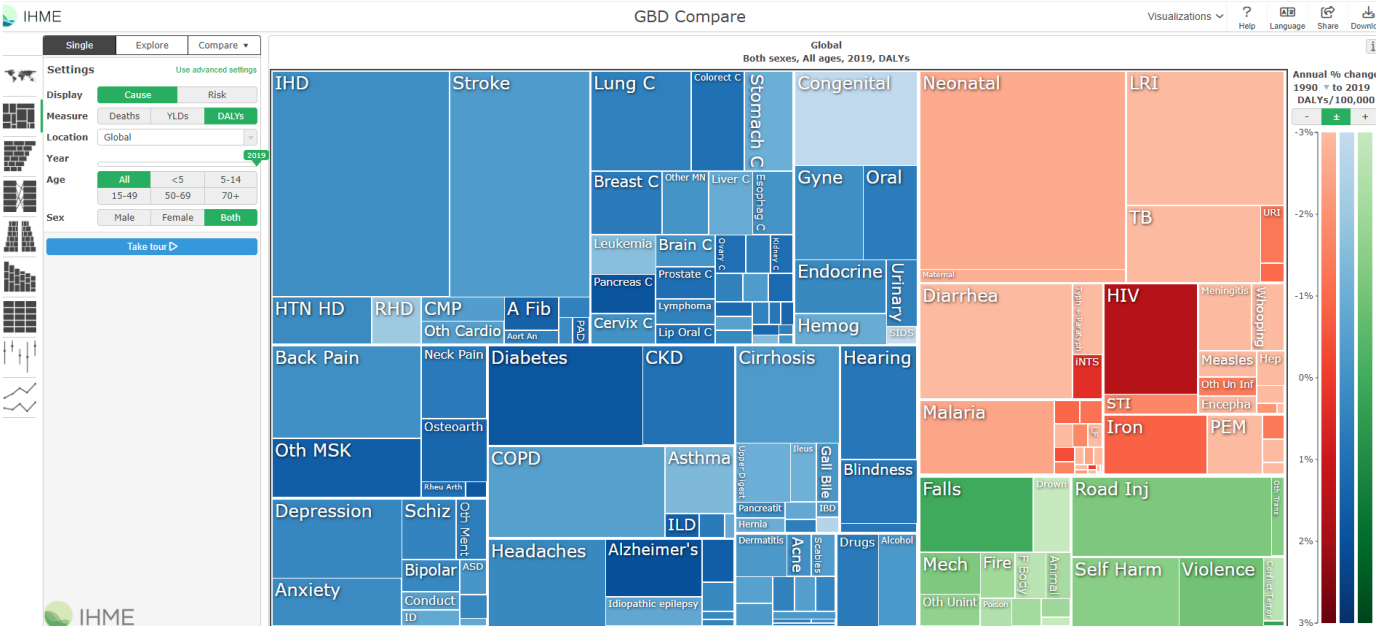
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The Global Burden of Disease Study 2017



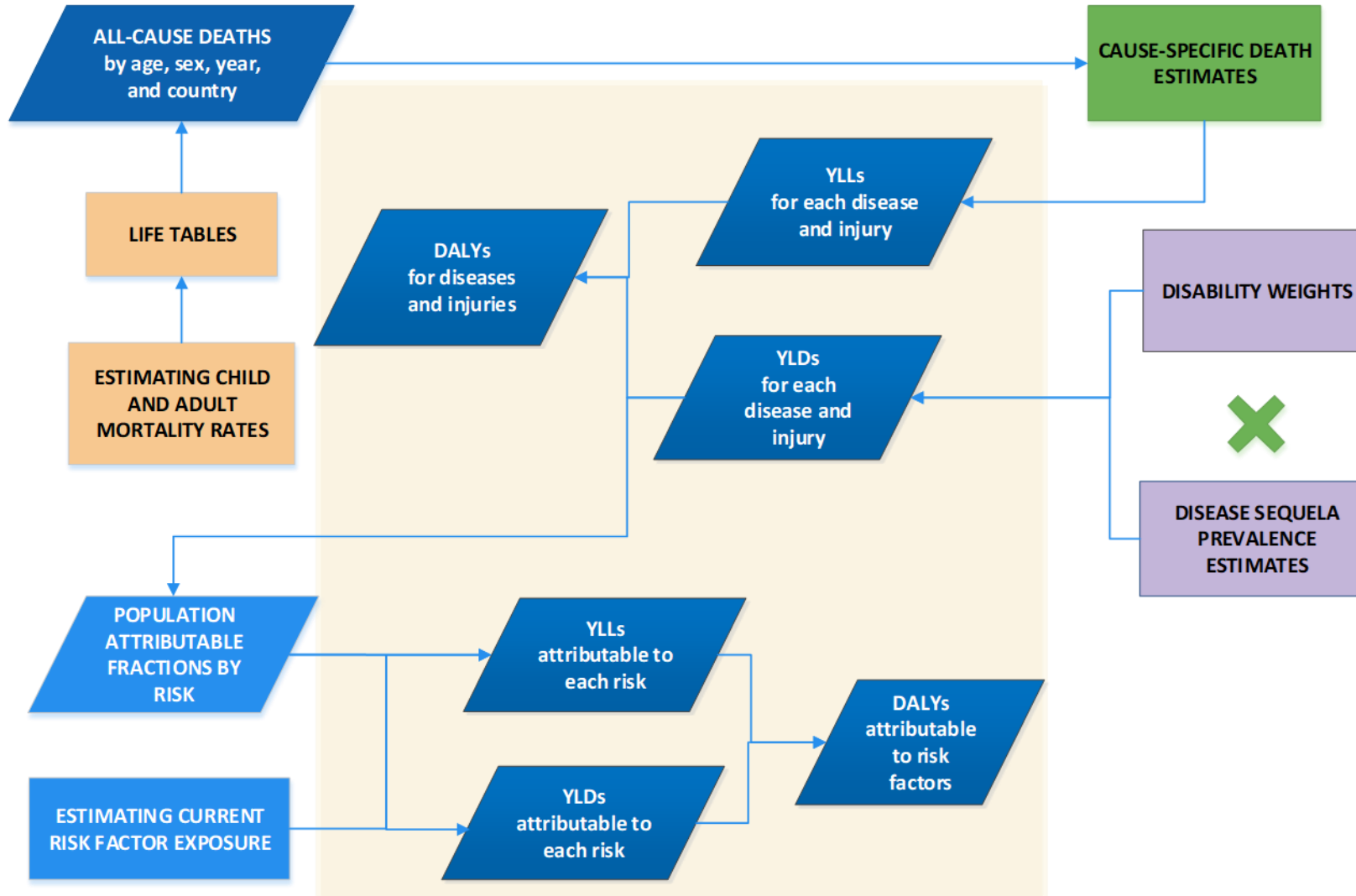
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den of Disease Study 2019

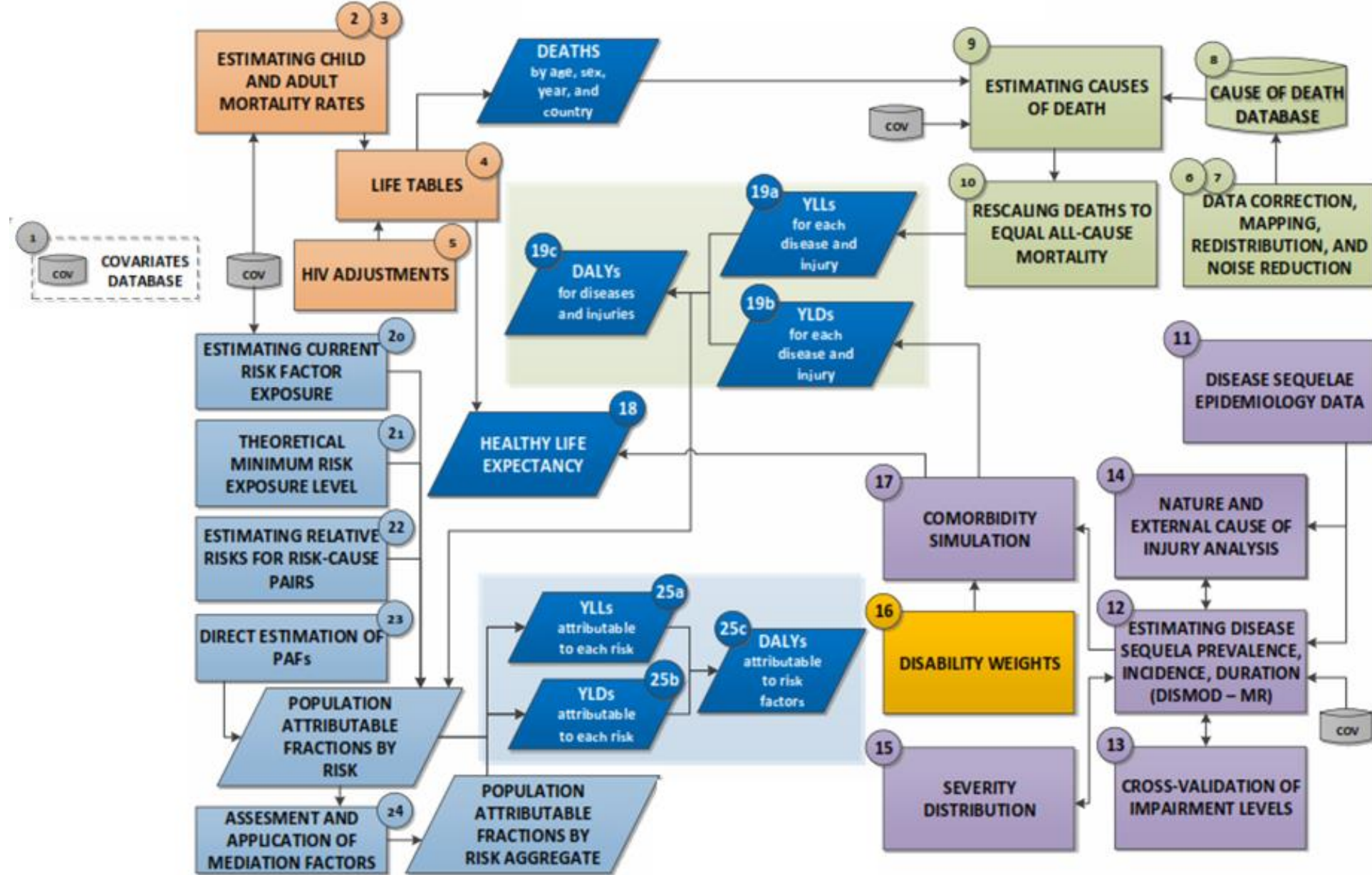




Simplified GBD flow chart



GBD data and model flow chart (more details)



Direct outputs of GBD

- All-cause mortality, Life expectancy and Probability of Death
- Prevalence, Incidence and Mortality for each disease
- All-cause and cause-specific Years of Life Lost (YLL), Years Lived with Disability (YLD) and Disability-Adjusted Life Years (DALYs)
- Health-Adjusted Life Expectancy (HALE)
- Attributable death, YLL, YLD and DALYs to each risk factor
- Specific indicators: Neonatal Mortality Rate, Infant Mortality Rate, Under 5 Mortality Rate, Maternal Mortality Ratio

Other products of GBD

- Population estimates
- Sociodemographic Index (SDI)
- Fertility estimates
- Summary Exposure Values (SEV) of risk factors and Population Attributable Fractions (PAF) for risk-outcome pairs
- Universal Health Coverage (UHC) index
- Health-related Sustainable Development Goals (SDG) indicators

Critiques regarding GBD estimates

- Main concerns
 - Epidemiological measures where/when there is:
 - Poor-quality data
 - Inconsistent data
 - No data
 - Difference between different GBD rounds
 - Analytic process
 - Sources of data
 - Choice of measures and nominal values

The experience with CLINICAL evidence

- Hierarchy of evidence
- Quality of evidence
- Level of evidence
- Strength of recommendations

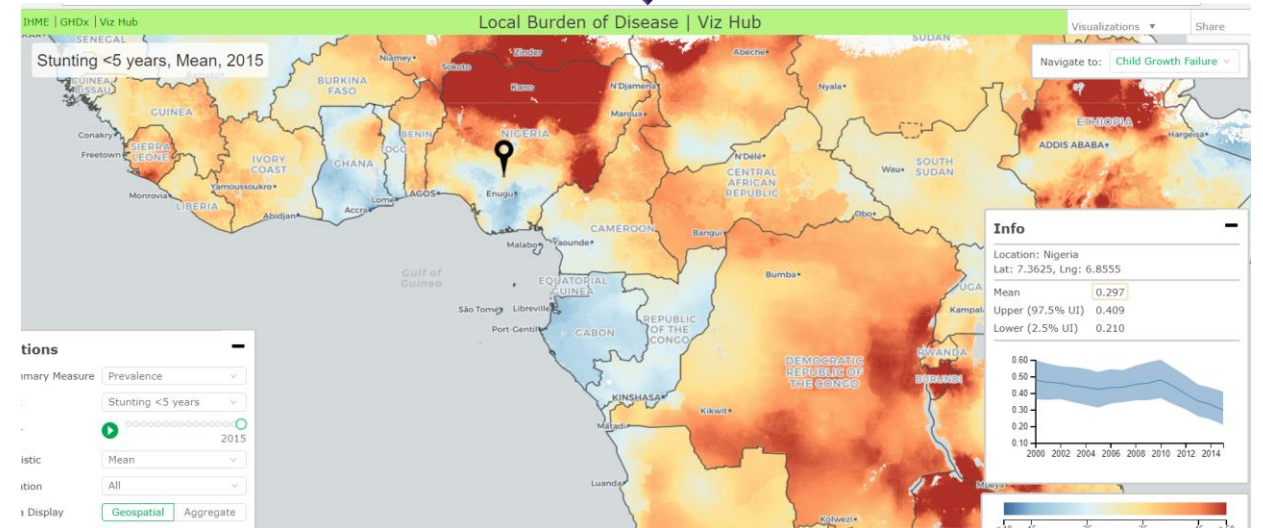
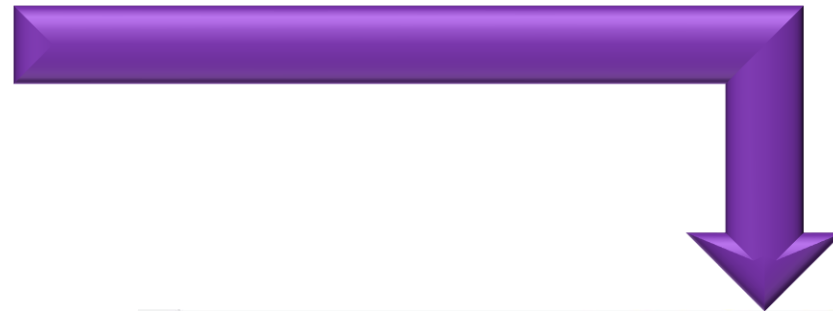
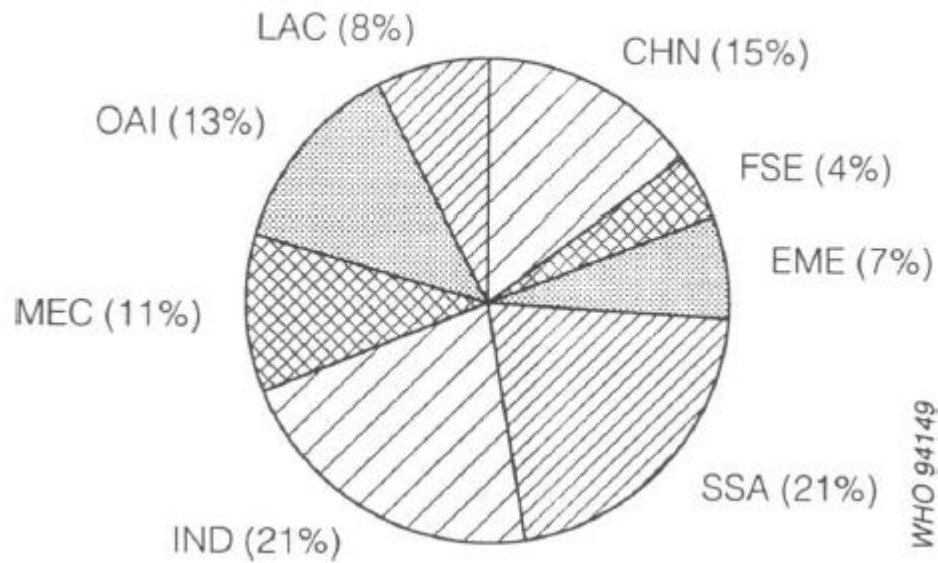
Best available evidence for decision-making

GBD methodological improvements over the time

- Coverage of geographical locations
- Coverage of diseases and risk factors
- Different analytical approaches
- Updated tools for modeling
- Increasing number of input data
- Changes in normative values

From *GLOBAL and REGIONAL* to *NATIONAL, SUBNATIONAL and LOCAL*

Fig. 2. Total DALYs, by region, as a percentage of global DALYs.



More DISEASES and RISK FACTRS are covered

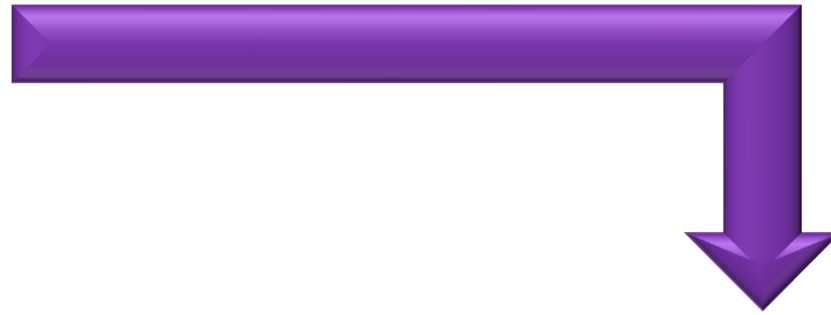
From 107 diseases and 10
risk factors in GBD 1990



To 371 diseases/ injuries,
3,499 sequelae and 87
risk factors in 2021

More advanced ANALYTIC approaches

Simple generic
model (excel-based)



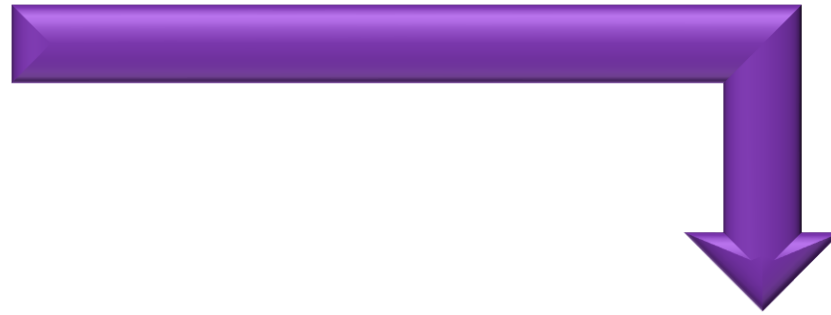
More advanced generic model
(Bayesian Meta-regression)

+

Custom models

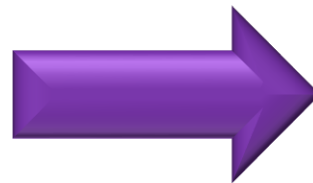
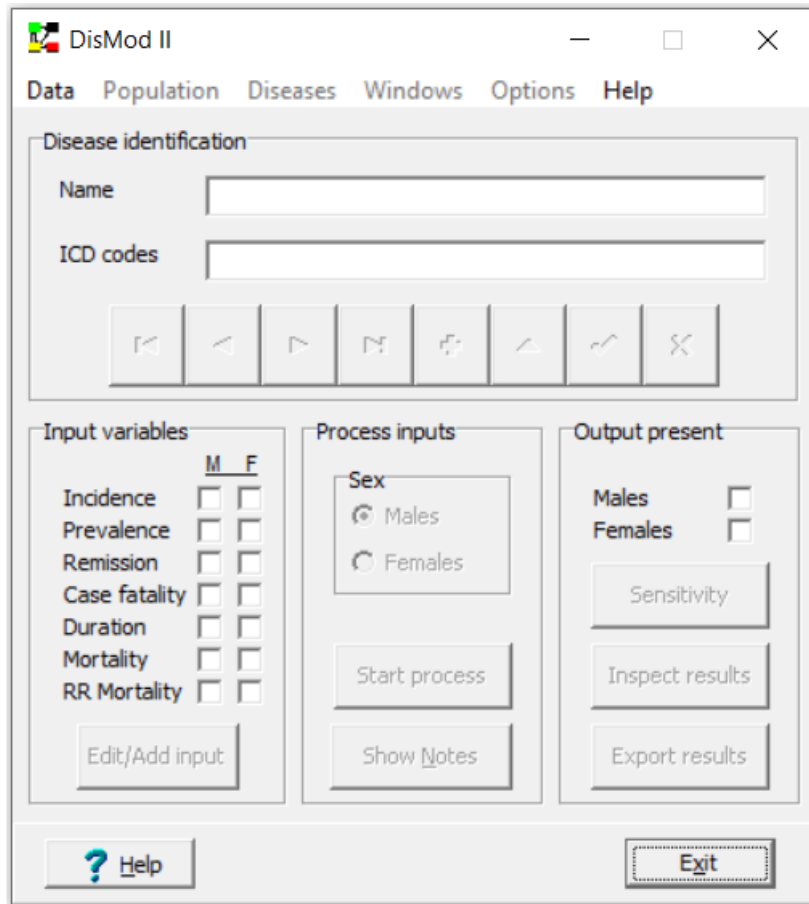
More prominent role of COVARIATES in analysis

No or simple use of
study-level covariates



Common use of study-level
and location-level covariates

Change in analytical approaches



- DisMod MR, a Bayesian meta-regression tool
- Causes of Death Ensemble model (CODEm)
- Spatiotemporal Gaussian Process Regression (ST-GPR)

Bayesian meta-regression approach

- Priors:
 - Global/ super-region/ Region for national levels
 - Experts' priors
 - Input local data
- Covariates
 - Study-level
 - Location-level

Bayesian meta-regression approach

Plots Map Scatter

Model Diabetes mellitus

Plot Measure Age Year

Location Iran (Islamic Republic of)

Year 2010

Sex Male Female

y-scale Chart Charts Custom Lin Log

Min 0 Max 0.8

x-scale Birth 100

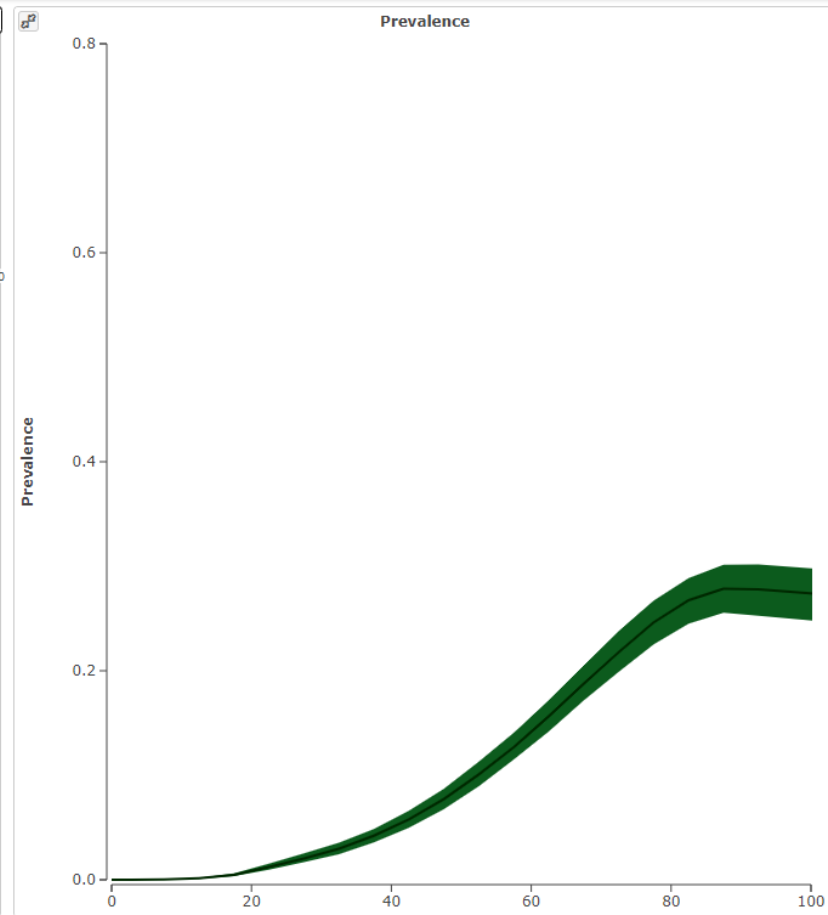
Outliers On

Uncertainty On

Layers

- ☐ Country Fit
- ☐ Country Prior
- ☐ Region Final
- ☐ Region Fit
- ☐ Region Prior
- ☐ Super Region Final
- ☐ Super Region Fit
- ☐ Super Region Prior
- ☒ Global Final
- ☐ Global Fit

View effects



Global final

Plots Map Scatter

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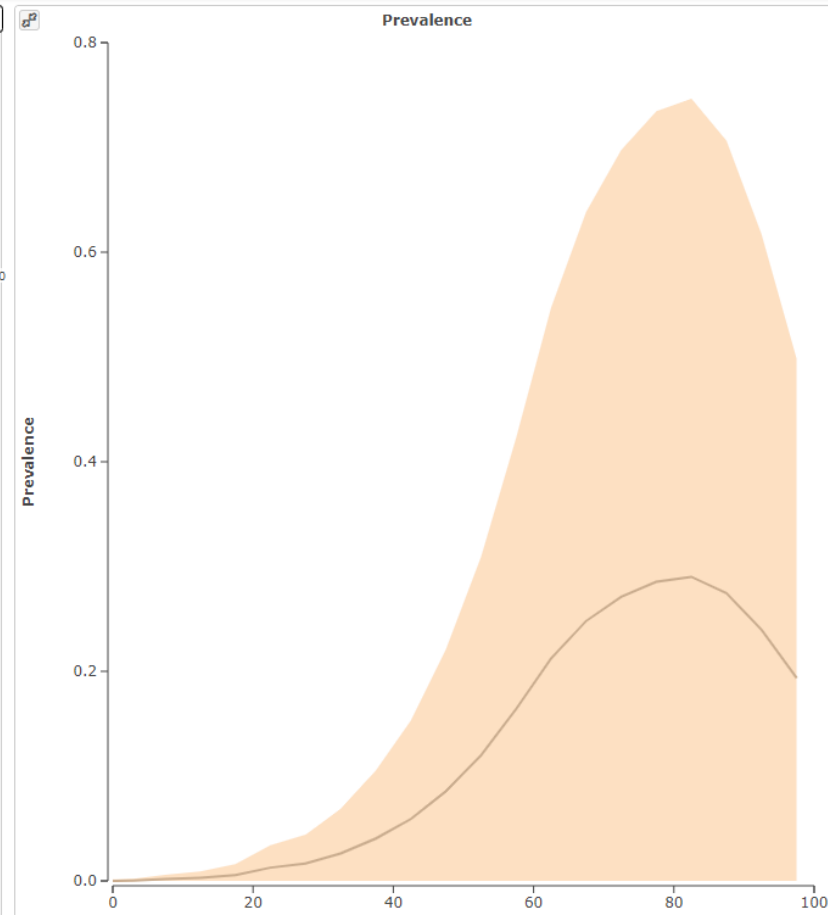
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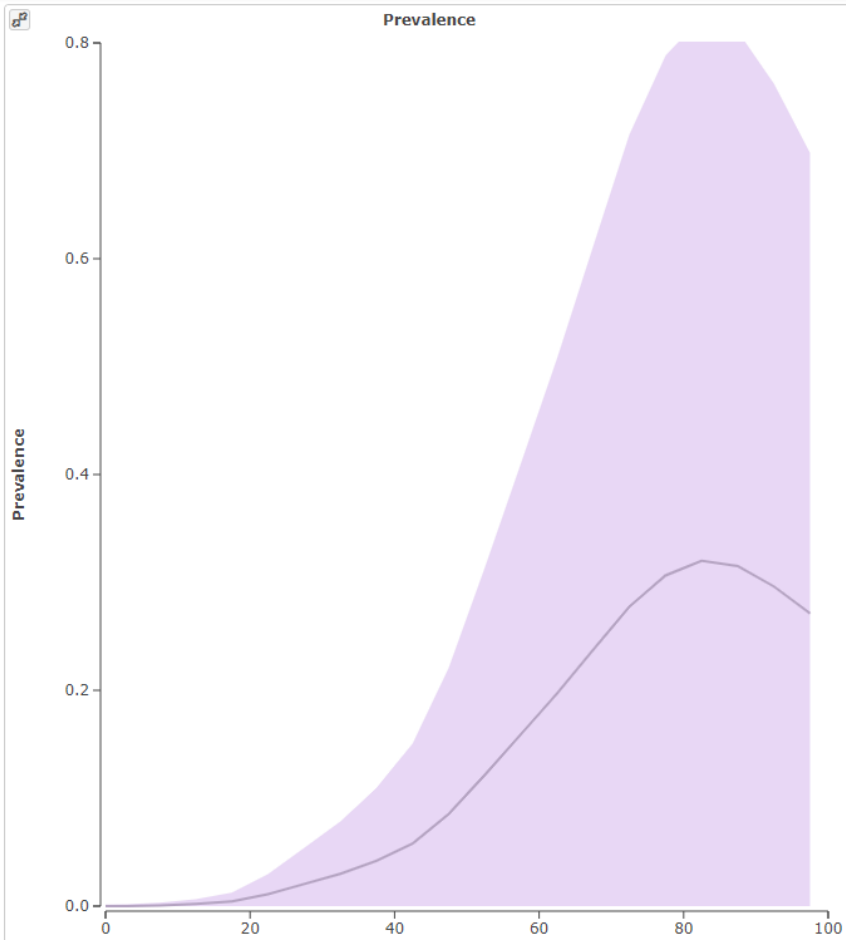
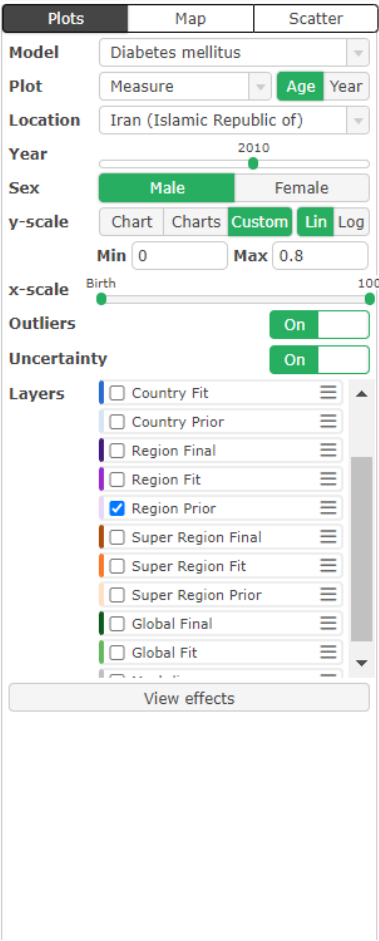
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View effects

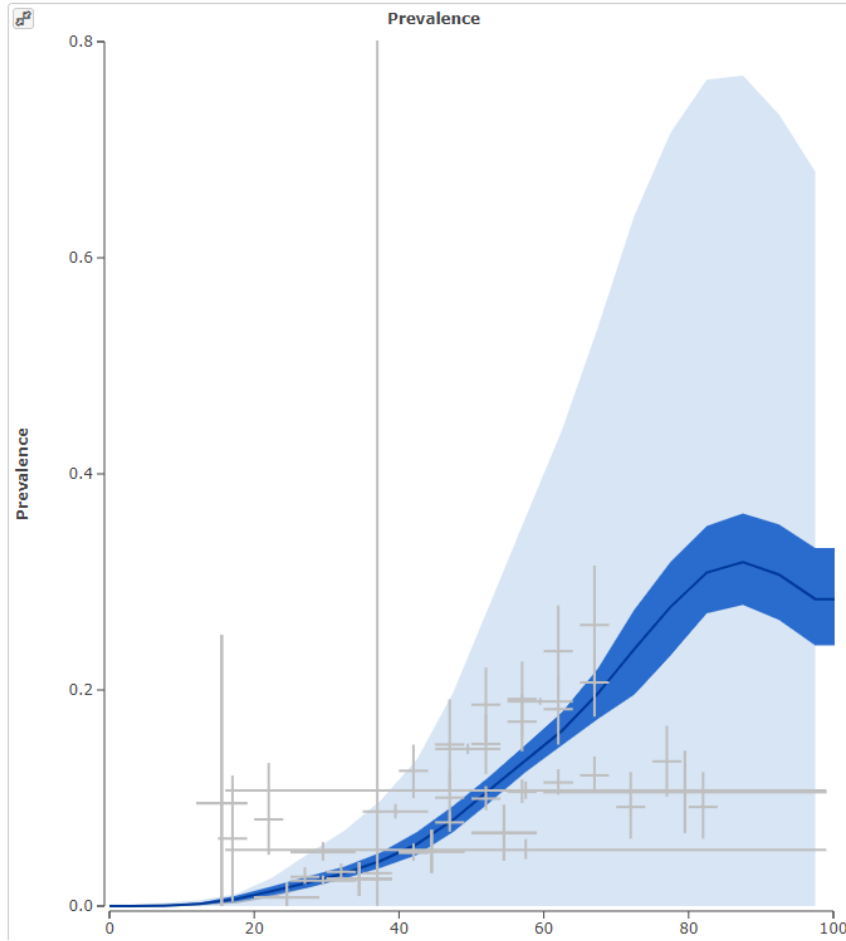
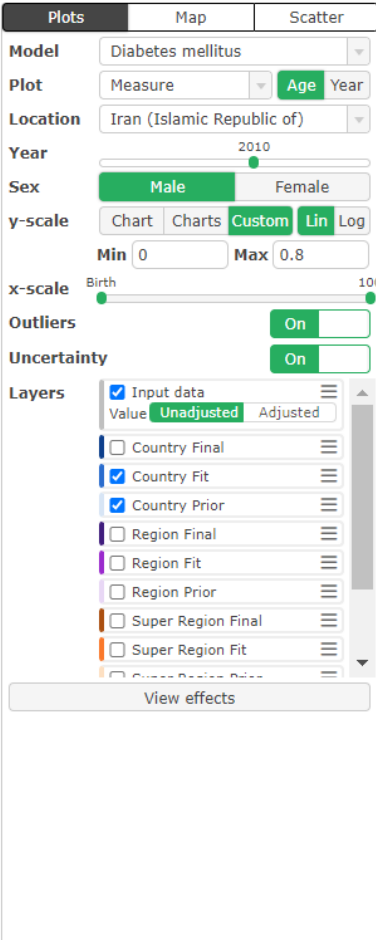


Super-region prior

Bayesian meta-regression approach



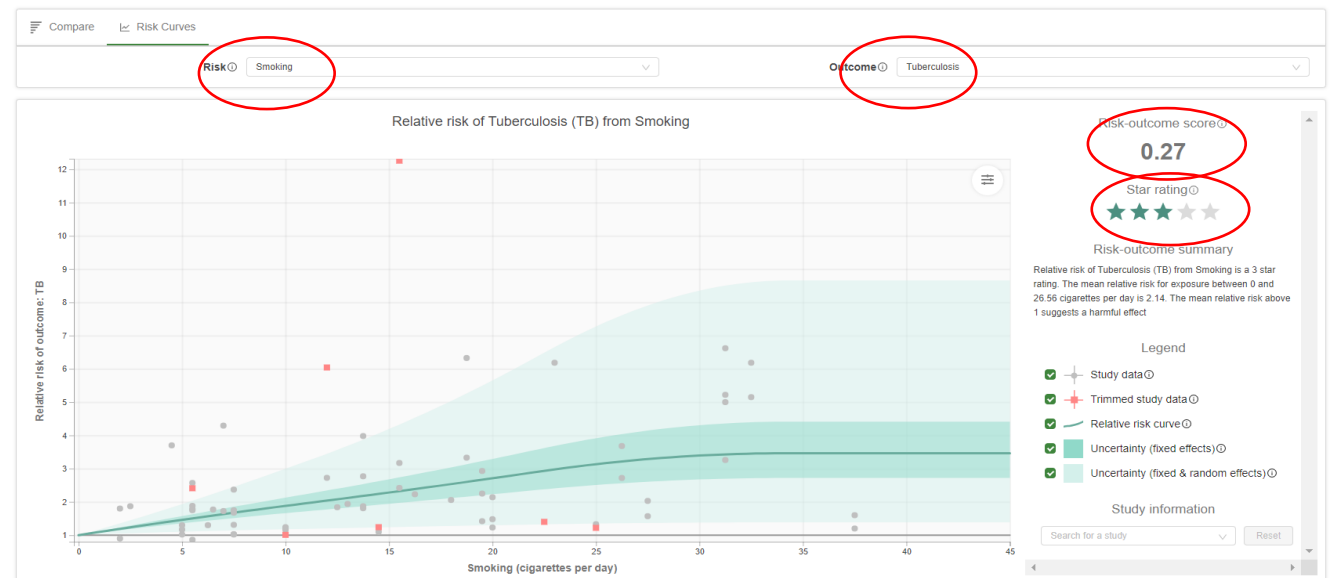
Region prior



Country prior/ Country final/ Local input data

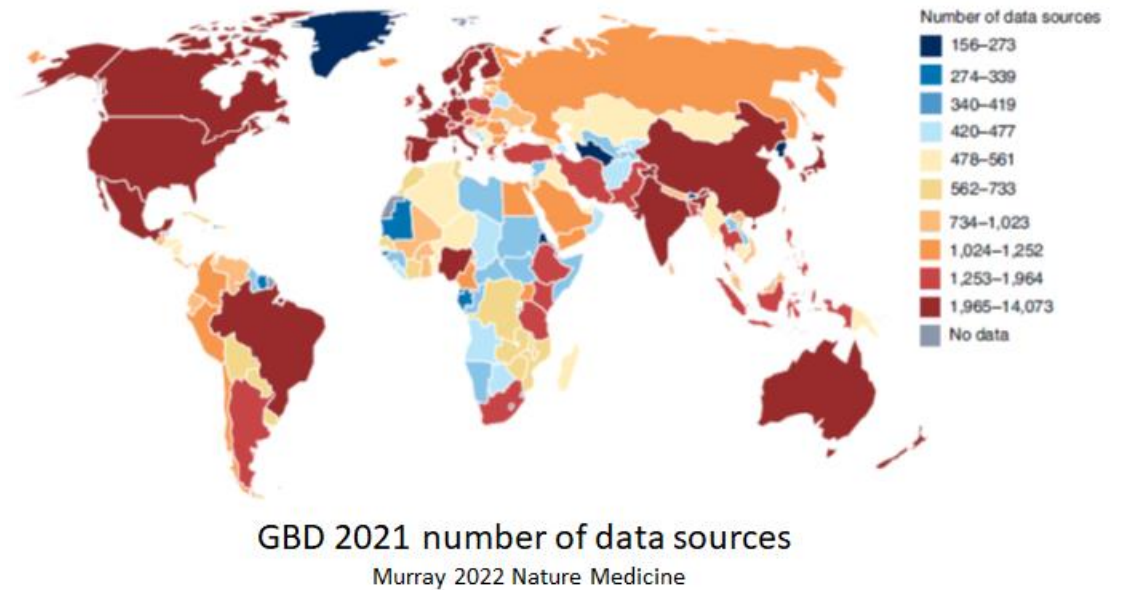
Relative risk estimates

- Strength of risk-outcome relationship
 - Five-star rating
 - Risk-outcome score
 - Burden of proof; <https://vizhub.healthdata.org/burden-of-proof/>



Differences between different GBD rounds

- Main reasons
 - Different sources of data that feed models
 - Access to more data through bilateral or multilateral agreements, individual level data
 - More sensitive electronic searches
 - Advanced computational approaches
 - GBD collaborators' role on improvement of data and methods



Conclusion

- Burden of diseases/injuries and risk factors
 - Using the best available data to inform policies
 - Transparency in methods and reporting uncertainties
- Solutions for locations with sparse and poor-quality data
 - Systematic collection and analysis of data
 - Adjustment of input data
 - Bayesian meta-regression (and alternative statistical approaches)

THANKS for your attention!