IHME

Global burden of disease study : Past, present, and future

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UNIVERSITY of WASHINGTON

Institute for Health Metrics and Evaluation

Outline

1) **Study goals**
2) GBD study overview
3) Key results from GBD 2013
4) Some debates
5) GBD 2015 main innovations
6) New analytical directions

Global Burden of Disease Study Goals

1. Provide valid, reliable, timely and local assessments of the state of health and trends of all populations in the world at national or subnational level.
2. Communicate effectively these results to the scientific community, health decision-makers, the media, and the public.

Global Burden of Disease Study Goals

To achieve these goals, we need to

1. Identify, access and analyze the world's data on health
2. Use the best methods and where needed innovate the methods used to synthesize and analyze health data
3. Create a vibrant global collaboration to tap into expertise relevant to the GBD around the world.

Outline

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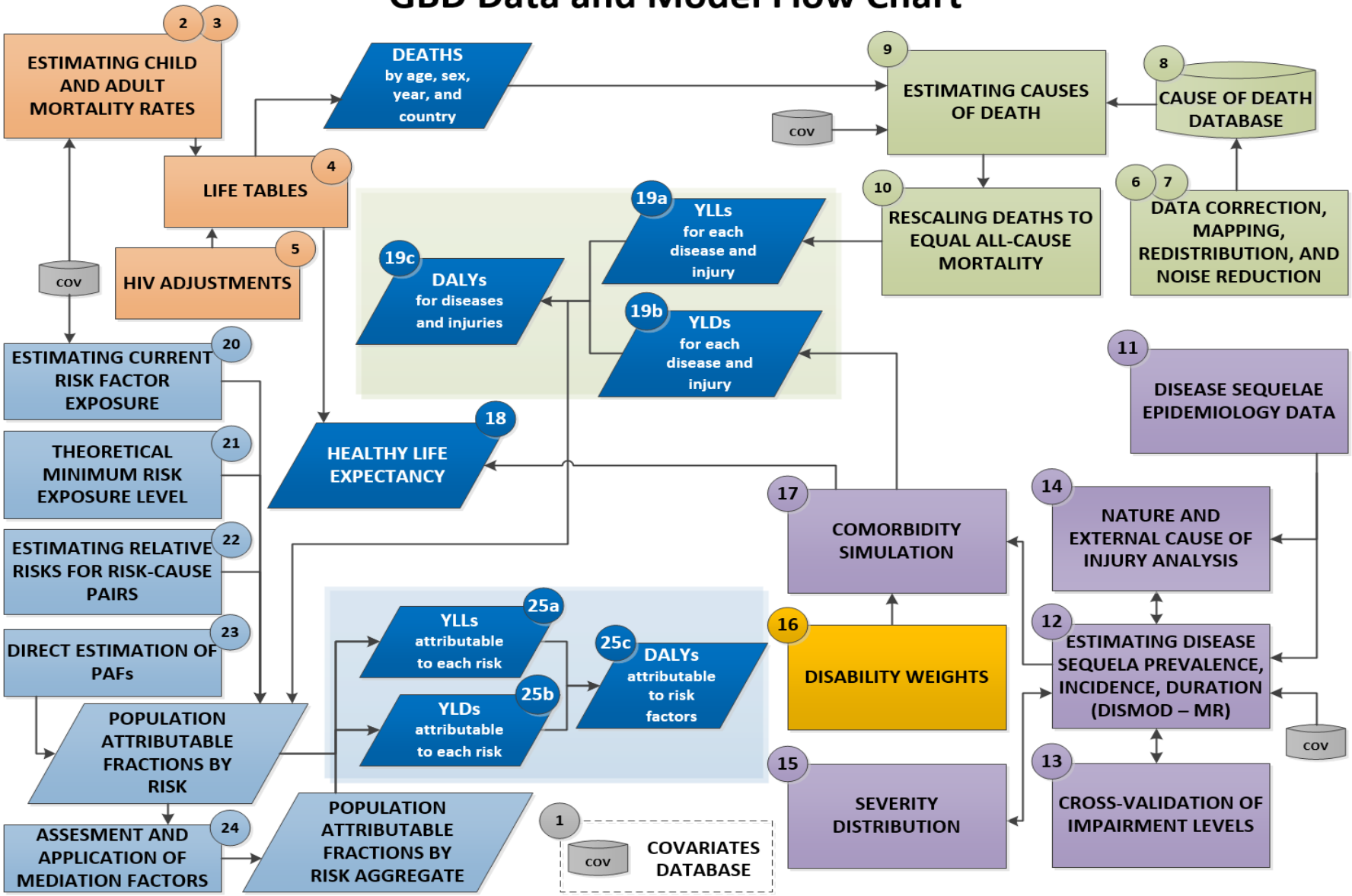
2) **GBD study overview**
3) Key results from GBD 2013
4) Some debates
5) GBD 2015 main innovations
6) New analytical directions

Global Burden of Disease

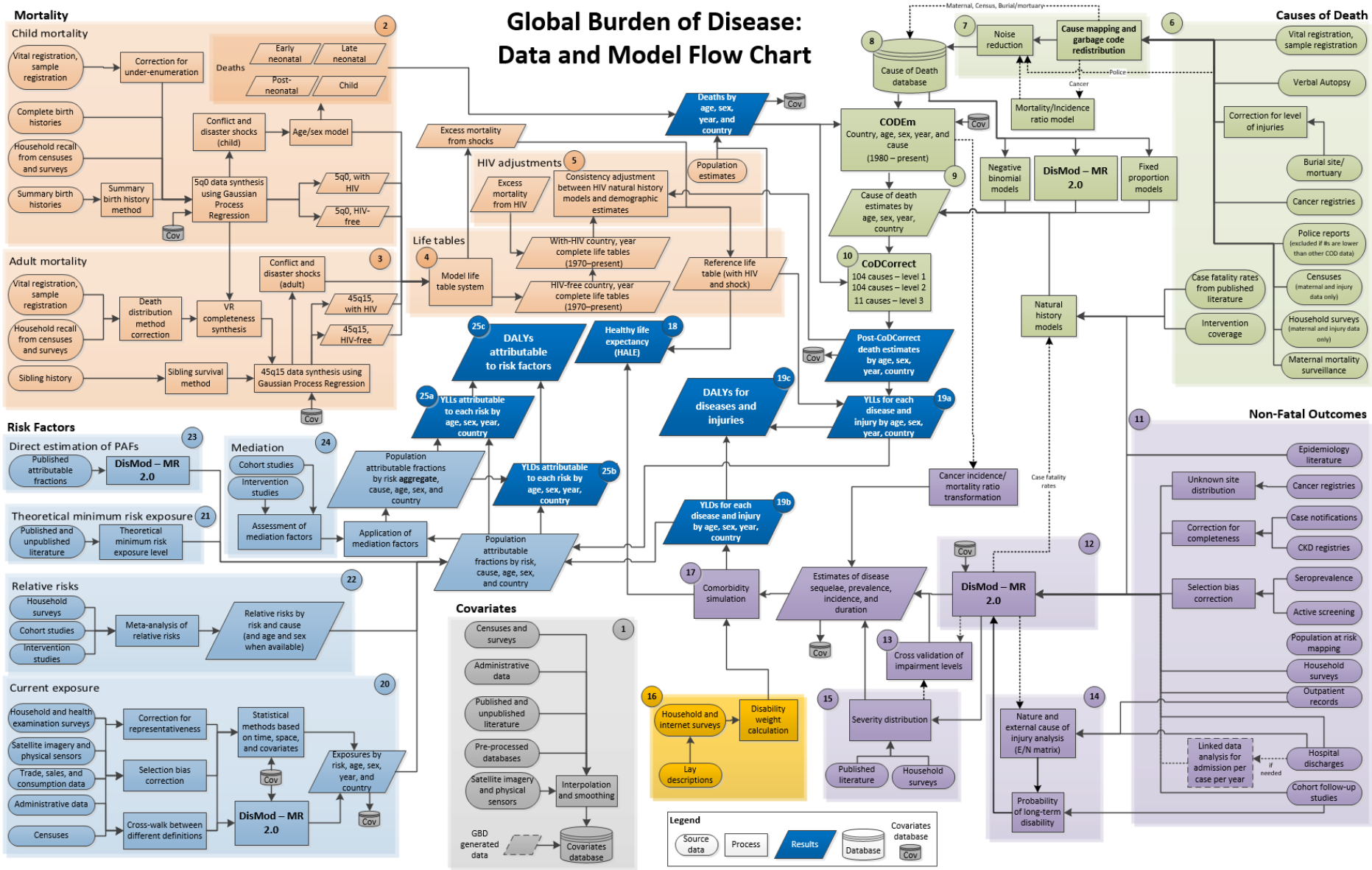
1. A ***systematic, scientific*** effort to quantify the ***comparative*** magnitude of ***health loss*** from all major diseases, injuries, and risk factors by age, sex, and population and over time.
2. 195 countries and territories from 1990 to present. Sub-national assessments for some countries (e.g. **China, Mexico, UK**, US, Brazil, Japan, India, Saudi Arabia, Kenya, South Africa)
3. 306 diseases and injuries, 2,337 sequelae, 79 risk factors or clusters of risk factors.
4. Updated annually; release planned for September each year.
5. Findings published in major medical journals (*Science*, *The Lancet, JAMA, New England Journal of Medicine, PLOS Medicine*), policy reports, and online data visualizations.

A global study with a global network of investigators: 1,656 investigators, 119 countries

GBD Data and Model Flow Chart



Global Burden of Disease: Data and Model Flow Chart



Multiple metrics for health

1. **Traditional metrics:** Disease and injury prevalence and incidence, death numbers and rates.
2. **Years of life lost** due to premature mortality (YLLs) – count the number of years lost at each age compared to a reference life expectancy of 86 at birth.
3. **Years lived with disability** (YLDs) for a cause in an age-sex group equals the prevalence of the condition times the disability weight for that condition.
4. **Disability-adjusted life years (DALYs)** are the sum of YLLs and YLDs and are an overall metric of the burden of disease.
5. **Healthy life expectancy (HALE)** is a positive summary measure counting the expected years of life in full health.

Some core GBD methods

1. Cause of death garbage code analysis – redistribution of causes that cannot be underlying cause of death.
2. Cause of death ensemble modeling (CODEm)
3. Bayesian meta-regression of available incidence, prevalence, cause-specific mortality data using DisMod-MR 2.0.
4. Comorbidity microsimulation to estimate co-occurrence of multiple sequelae.
5. Joint risk factor analysis

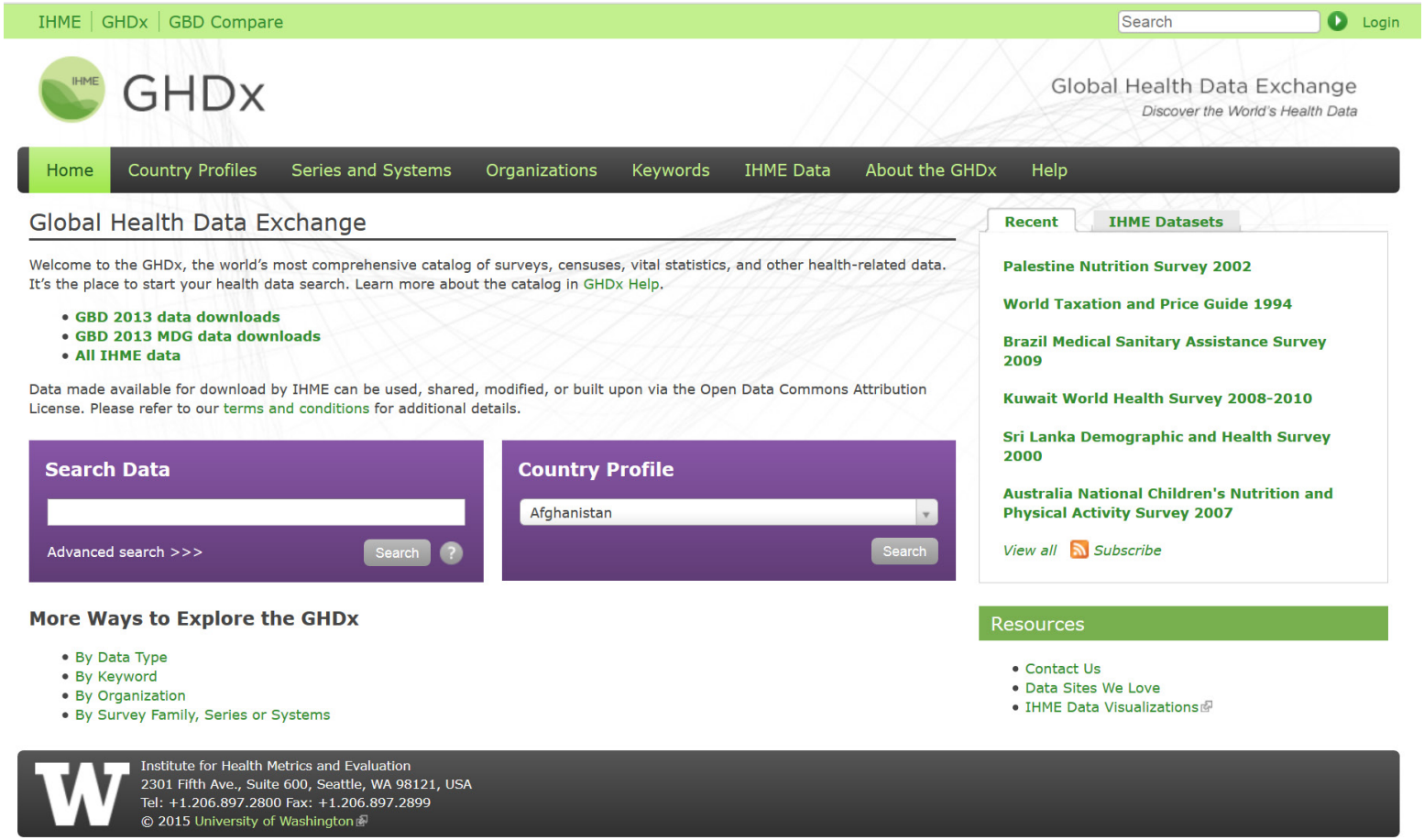
Risk hierarchy

Behavioral
Child and maternal malnutrition
Suboptimal breastfeeding
Childhood undernutrition
Iron deficiency
Vitamin A deficiency
Zinc deficiency
Tobacco smoke
Smoking
Second-hand smoke
Alcohol and drug use
Alcohol use
Drug use
Dietary risks
Diet low in fruits
Diet low in vegetables
Diet low in whole grains
Diet low in nuts and seeds
Diet low in milk
Diet high in red meat
Diet high in processed meat
Diet high in sugar-sweetened beverages
Diet low in fiber
Diet suboptimal in calcium
Diet low in seafood omega-3 fatty acids
Diet low in polyunsaturated fatty acids
Diet high in trans fatty acids
Diet high in sodium
Low physical activity
Sexual abuse and violence
Childhood sexual abuse
Intimate partner violence
Unsafe sex

Environmental/Occupational
Unsafe water, sanitation and handwashing
Unsafe water source
Unsafe sanitation
No handwashing with soap
Air pollution
Ambient particulate matter pollution
Household air pollution from solid fuels
Ambient ozone pollution
Other environmental risks
Residential radon
Lead exposure
Occupational risks
Occupational carcinogens
Occupational asthmagens
Occupational particulate matter, gases, and fumes
Occupational noise
Occupational injuries
Occupational ergonomic factors

Metabolic
High fasting plasma glucose
High total cholesterol
High blood pressure
High body-mass index
Low bone mineral density
Low glomerular filtration rate

On-line catalog with metadata on 50,000+ GBD sources



Some GBD 2013 publications

Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

*Global Burden of Disease Study 2013 Collaborators**

Summary

Background with disabil Disease Stu 188 countri

Methods Es with some i additions tc reviews, use severity spli cause and ir

Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

*GBD 2013 Risk Factors Collaborators**

Global, regional, and national age–sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

GBD 2013 Mortality and Caus

Summary

Background Up-to-date essential for the formati 2013 (GBD 2013) we esti whether there is epidem

Methods We estimated ag accuracy applied to an u death as in the GBD 2010 an updated verbal autops Turkey, and Russia. We strategies across the 240 sufficient information. prevalence studies. For p approach. We computed all pairs of countries (Gin

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ollaborators listed at the end

Global, regional, and national disability-adjusted life years (DALYs) for 306 diseases and injuries and healthy life expectancy (HALE) for 188 countries, 1990–2013: quantifying the epidemiological transition

*GBD 2013 DALYs and HALE Collaborators**

Summary

Background The Global Burden of Disease Study 2013 (GBD 2013) aims to bring together all available epidemiological data using a coherent measurement framework, standardised estimation methods, and transparent data sources to enable comparisons of health loss over time and across causes, age–sex groups, and countries. The GBD can be used to generate summary measures such as disability-adjusted life-years (DALYs) and healthy life expectancy (HALE) that make possible comparative assessments of broad epidemiological patterns across countries and time. These summary measures can also be used to quantify the component of variation in epidemiology that is related to sociodemographic development.

Methods We used the published GBD 2013 data for age-specific mortality, years of life lost due to premature mortality (YLLs), and years lived with disability (YLDs) to calculate DALYs and HALE for 1990, 1995, 2000, 2005, 2010, and 2013 for 188 countries. We calculated HALE using the Sullivan method; 95% uncertainty intervals (UIs) represent uncertainty in age-specific death rates and YLDs per person for each country, age, sex, and year. We estimated DALYs for 306 causes for each country as the sum of YLLs and YLDs; 95% UIs represent uncertainty in YLL and YLD rates. We quantified patterns of the epidemiological transition with a composite indicator of sociodemographic status, which we constructed from income per person, average years of schooling after age 15 years, and the total fertility rate and mean age of the population. We applied hierarchical regression to DALY rates by cause across countries to decompose variance related to the sociodemographic status variable, country, and time.

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*Collaborators listed at the end of the Article

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Clinical Review & Education

Special Communication

The Global Burden of Cancer 2013

Global Burden of Disease Cancer Collaboration

IMPORTANCE Cancer is among the leading causes of de cancer burden in individual countries and regions are n control strategies.

OBJECTIVE To estimate mortality, incidence, years lived lost (YLLs), and disability-adjusted life-years (DALYs) fo from 1990 to 2013.

EVIDENCE REVIEW The general methodology of the Glo study was used. Cancer registries were the source for c mortality incidence (MI) ratios. Sources for cause of dea system data, verbal autopsy studies, and other sources.

Global Burden of Cardiovascular Disease

Estimates of Global and Regional Premature Cardiovascular Mortality in 2025

Gregory A. Roth, MD, MPH; Grant Nguyen, BA; Mohammad H. Forouzanfar, MD, PhD; Ali H. Mokdad, PhD; Mohsen Naghavi, MD, PhD; Christopher J.L. Murray, MD, DPhil

Background—United Nations member states have agreed to reduce premature cardiovascular disease (CVD) mortality 25% ended. We produced estimates to show how selected risk ions and countries.
ative risk data from the Global Burden of Disease, Risk lity for 188 countries up to the year 2025. We disaggregated table and unattributable to hypertension, tobacco smoking, opulation-attributable fraction. Risk factors were projected scenarios were then constructed reflecting CVD premature he year 2025, adjusting for joint effects of risk factors. We risk factor trends continue. Premature CVD deaths would ieved as a result of a 26% reduction for men and a 23% eath. Globally, decreasing the prevalence of hypertension on in tobacco smoking for men and obesity for women, but factor targets on CVD mortality varied widely by region

The NEW ENGLAND JOURNAL of MEDICINE

REVIEW ARTICLE

GLOBAL HEALTH

Measuring the Global Burden of Disease

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DOI: 10.1056/NEJMra1201534

IT IS DIFFICULT TO DELIVER EFFECTIVE without knowing their diagnoses; likew is necessary to understand the key chal health and how these challenges are changi comprehensive and internally consistent s den of diseases, injuries, and risk factors. T World Health Organization launched the G 1991.[1] Although assessments of selected d lected populations are published each yea human immunodeficiency virus [HIV] epi ments of the state of health in the world ha Study for 1990, 1999–2002, and 2004,[1–10] that consistent methods are applied to crit each condition, make this information com from countries with incomplete data, and use of standardized metrics.

The most recent assessment of the glo (GBD 2010), which provides results for 1 investigators collaborated to report summa logic regions in December 2012.[11–18] Regi child mortality, and geographic contiguity number of major limitations of previous a en the statistical methods used for estima burden was broadened to cover 291 diseas of these causes (e.g., diabetic retinopathy, to diabetes, and chronic kidney disease separately. The mortality and burden attri risk factors were also assessed.

GBD 2010, which provides critical info was based on data from 187 countries for includes a complete reassessment of the b estimation for 2005 and 2010 based on t facilitated meaningful comparisons of tren tions was also estimated according to the ye from global and regional data have been

The internal validity of the results is an For example, demographic data on all-caus try, age, and sex were combined with dat that the sum of the number of deaths due number of deaths from all causes. Simila

Research

Original Investigation

Global Burden of Skin Disease as Reflected in *Cochrane Database of Systematic Reviews*

Charlie Karimkhani, BA; Lindsay N. Boyers, BA; Laura Prescott, MA; Vivian Welch, PhD; Finola M. Delamere, PhD; Mona Nasser, DDS, MSc; Amrapali Zaveri, MSc; Roderick J. Hay, DM, FRCP; Theo Vos, PhD; Christopher J. L. Murray, MD, DPhil; David J. Margolis, MD, PhD; John Hilton, MSc, MPhil; Harriet MacLehose, PhD, MA; Hywel C. Williams, DSc, FRCP; Robert P. Dellavalle, MD, PhD, MSPH

IMPORTANCE Research prioritization should be guided by impact of disease.

OBJECTIVE To determine whether systematic reviews and protocol topics in *Cochrane Database of Systematic Reviews* (CDSR) reflect disease burden, measured by disability-adjusted life years (DALYs) from the Global Burden of Disease (GBD) 2010 project.

DESIGN, SETTING, AND PARTICIPANTS Two investigators independently assessed 15 skin conditions in the CDSR for systematic review and protocol representation from November 1, 2013, to December 6, 2013. The 15 skin diseases were matched to their respective DALYs from GBD 2010. An official publication report of all reviews and protocols published by the Cochrane Skin Group (CSG) was also obtained to ensure that no titles were missed. There were no study participants other than the researchers, who worked with databases evaluating CDSR and GBD 2010 skin condition disability data.

MAIN OUTCOMES AND MEASURES Relationship of CDSR topic coverage (systematic reviews and protocols) with percentage of total 2010 DALYs, 2010 DALY rank, and DALY percentage change from 1990 to 2010 for 15 skin conditions.

RESULTS All 15 skin conditions were represented by at least 1 systematic review in CDSR; 69% of systematic reviews and 67% of protocols by the CSG covered the 15 skin conditions. Comparing the number of reviews/protocols and disability, dermatitis, melanoma, nonmelanoma skin cancer, viral skin diseases, and fungal skin diseases were well matched. Decubitus ulcer, psoriasis, and leprosy demonstrated review/protocol overrepresentation when matched with corresponding DALYs. In comparison, acne vulgaris, bacterial skin diseases, urticaria, pruritus, scabies, cellulitis, and alopecia areata were underrepresented in CDSR when matched with corresponding DALYs.

CONCLUSIONS AND RELEVANCE Degree of representation in CDSR is partly correlated with DALY metrics. The number of published reviews/protocols was well matched with disability metrics for 5 of the 15 studied skin diseases, while 3 skin diseases were overrepresented, and 7 were underrepresented. Our results provide high-quality and transparent data to inform future prioritization decisions.

Supplemental content at jamadermatology.com

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JAMA Dermatol. 2014;150(9):945-951. doi:10.1001/jamadermatol.2014.709
Published online May 7, 2014.

Benchmarking using the GBD: example of United Kingdom

1) Based on demand from Jeremy Hunt, Secretary of State for Health, GBD 2010 used to benchmark the UK with western Europe.

2) Public Health England – GBD collaboration to study sub-national BoD. Findings released September 2015.


Articles

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

Articles

Changes in health in England, with analysis by English regions and areas of deprivation, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013

Significantly lower than mean
Indistinguishable from mean
Significantly higher than mean

	Ischaemic heart disease	Lung cancer	Cerebrovascular disease	COPD	Alzheimer's disease	Lower respiratory infections	Colon and rectum cancers	Breast cancer	Self-harm	Pancreatic cancer	Other cardiovascular	Prostate cancer	Oesophageal cancer	Congenital anomalies	Other neoplasms	Road injury	Preterm birth complications	Cirrhosis hepatitis C	Non-Hodgkin lymphoma	Stomach cancer	Brain cancer	Aortic aneurysm	Ovarian cancer	Leukaemia	Drug use disorders
East of England, deprivation level 5	771	395	355	190	237	247	257	279	182	142	105	127	97·8	177	128	156	194	45·8	101	69	119	80·6	89·4	104	59·6
South East England, deprivation level 5	719	376	396	207	270	287	267	284	194	140	106	122	99·4	177	129	178	148	57·1	107	65·3	133	74·4	90·4	107	56·7
South West England, deprivation level 5	782	389	395	186	257	257	277	280	215	141	111	123	114	178	124	197	155	53	127	78·1	130	75·4	90·2	112	72
West Midlands, deprivation level 5	852	394	394	213	243	272	281	300	190	128	98	118	99	224	144	240	187	66·5	86·3	75·7	144	78·1	87·7	108	60·4
North East England, deprivation level 5	882	454	421	199	196	277	252	289	150	135	103	124	103	269	153	193	168	73·5	101	99·8	130	69·5	81·9	115	72·1
Yorkshire and the Humber, deprivation level 5	919	437	492	228	239	289	275	291	190	136	107	128	117	331	161	219	179	87	106	77	130	73·1	89·2	123	64·5
East England, deprivation level 4	793	363	335	200	228	248	263	307	205	140	99·1	135	114	264	160	237	177	76·7	103	89·1	158	72·1	100	117	75·4
South East England, deprivation level 4	851	459	412	263	265	283	286	297	225	149	137	128	125	181	147	220	167	69·5	106	74·8	140	54·2	102	110	78·1
North West England, deprivation level 5	887	435	465	221	238	319	272	286	204	128	122	124	138	224	168	203	194	75·1	107	81·3	129	78·5	95·4	99·2	77·4
Greater London, deprivation level 5	831	405	394	212	299	340	252	278	195	143	106	126	96	184	163	163	126	57·3	114	75·8	132	67·6	95·5	143	77·5
East of England, deprivation level 4	922	460	430	234	301	298	275	301	181	138	121	141	108	250	134	232	188	55·9	108	74·8	132	90·3	97·9	101	77·8
South West England, deprivation level 4	859	438	452	234	294	292	290	303	246	144	129	127	128	198	130	257	214	73·5	114	79·5	134	73	106	108	77·5
Greater London, deprivation level 4	926	473	435	244	285	352	270	305	154	149	127	122	110	204	128	193	174	76·5	116	83·5	140	80·1	96·6	114	87·5
North East England, deprivation level 4	958	527	480	260	258	306	277	280	194	148	127	120	107	232	170	191	162	88·3	99·2	113	129	89·3	122·7	84·2	113
East Midlands, deprivation level 4	988	472	450	277	253	318	294	304	203	144	129	129	138	260	144	235	196	79·4	112	91·5	122	76·8	112	110	83·6
Yorkshire and the Humber, deprivation level 4	1050	540	495	287	255	319	295	298	212	138	122	120	107	269	165	232	199	87·6	104	102	138	81·9	95·7	106	108
North West England, deprivation level 4	1043	514	525	296	236	351	284	294	233	139	139	119	149	277	128	191	167	87	110	101	129	83·7	95·1	112	80
West Midlands, deprivation level 4	968	451	546	268	289	338	309	299	212	146	137	130	142	286	152	244	204	104	107	94·7	121	86·6	103	116	87·8
Greater London, deprivation level 3	1060	531	446	314	311	385	268	291	239	150	131	117	131	220	144	244	222	104	122	94·3	132	96·2	89·3	112	115
South East England, deprivation level 3	982	566	469	332	301	326	295	316	243	165	151	121	144	251	133	175	209	106	116	84·6	127	95·9	107	109	104
South West England, deprivation level 3	1060	592	473	291	273	398	302	305	302	152	139	133	139	264	160	221	248	102	129	91·6	133	96	107	115	122
East of England, deprivation level 3	1060	557	465	300	311	326	313	298	278	162	150	137	129	254	142	232	241	89·4	105	98·2	126	98·6	125	112	118
England	1122	623	497	367	289	343	305	295	254	154	143	127	138	254	147	193	251	122	113	99·7	135	89·7	100	112	140
North East England, deprivation level 3	1260	742	488	362	266	339	317	280	327	194	140	113	135	274	136	141	187	132	105	118	117	92·9	119	103	90·8
East Midlands, deprivation level 3	1158	604	531	353	313	372	306	309	240	161	144	127	151	260	158	274	207	105	122	106	118	91·2	106	117	103
Greater London, deprivation level 2	1189	689	467	434	331	367	279	279	255	152	156	124	117	236	146	193	255	150	120	101	116	91·1	93·5	119	134
Yorkshire and the Humber, deprivation level 3	1230	629	569	371	281	353	318	305	272	147	141	123	128	266	169	237	262	94·2	109	117	154	81·4	94·7	140	138
West Midlands, deprivation level 3	1127	591	566	342	323	359	311	294	248	148	141	131	147	292	173	244	275	115	107	110	133	83·2	116	127	134
South West England, deprivation level 2	1165	665	507	392	294	322	331	297	288	162	165	131	162	222	140	207	249	142	113	89·5	140	99	97·3	133	214
South East England, deprivation level 2	1159	725	465	452	300	340	328	286	256	175	175	127	158	249	155	188	257	149	118	100	122	106	103	154	204
North East England, deprivation level 3	1189	643	579	361	286	330	335	281	266	156	150	128	152	280	163	200	223	131	108	108	144	91·8	103	138	211
East of England, deprivation level 2	1279	712	500	412	294	367	346	331	303	158	158	128	154	235	157	201	327	122	114	104	114	113	109	106	174
Greater London, deprivation level 1	1377	812	525	553	366	377	305	361	240	173	182	130	133	267	147	220	295	188	119	118	106	102	76·4	105	180
West Midlands, deprivation level 2	1334	748	597	481	293	406	353	305	275	157	146	134	159	317	175	224	357	156	139	125	108	84·9	117	121	129
East Midlands, deprivation level 2	1368	781	560	474	332	387	349	298	261	162	158	126	157	274	162	200	360	155	118	125	121	96·9	116	125	139
Yorkshire and the Humber, deprivation level 2	1433	874	589	526	303	407	304	287	290	162	161	134	162	359	163	264	267	134	117	129	120	98·2	113	137	184
North West England, deprivation level 3	1427	982	677	548	311	392	336	315	328	178	159	140	150	387	189	276	306	167	134	137	129	120	110	121	181
North West England, deprivation level 2	1520	850	647	569	364	439	335	313	330	166	174	128	191	253	158	224	327	188	120	124	108	112	103	105	202
South East England, deprivation level 1	1440	961	516	623	286	362	332	291	362	179	196	127	183	242	140	190	241	234	126	91·4	111	139	128	105	214
East of England, deprivation level 1	1658	918	521	527	296	384	321	306	402	197	193	133	184	334	145	192	286	201	145	115	114	125	101	106	301
West Midlands, deprivation level 1	1634	917	610	663	305	415	355	307	375	179	164	118	193	408	148	193	418	232	117	150	109	91	107	103	171
East Midlands, deprivation level 1	1651	961	600	644	346	429	358	307	304	185	211	132	199	307	168	229	366	231	126	131	125	115	102	102	230
South West England, deprivation level 1	1681	961	583	618	309	392	386	303	438	198	205	141	193	279	142	227	294	245	128	138	130	107	99·3	124	407
Yorkshire and the Humber, deprivation level 1	1854	1171	638	761	333	473	375	299	346	185	189	122	160	358	150	220	335	204	129	156	133	103	99·4	115	280
North East England, deprivation level 1	1818	1118	723	753	372	443	403	304	399	198	187	131	166	226	141	194	227	278	112	170	119	139	139	114	315
North West England, deprivation level 1	1888	1264	696	822	340	500	390	312	377	181	204	128	206	331	161	199	342	324	115	154	124	111	111	112	314

Figure 3: Age-standardised rates of years of life lost (YLLs) for England relative to the deprivation levels in the nine English regions for both sexes combined in 2013
To facilitate comparison, England is shown in bold. Lung cancer=lung, bronchus, and trachea cancer. COPD=chronic obstructive pulmonary disease. Alzheimer's disease=Alzheimer's disease and other dementias. Other cardiovascular=other cardiovascular and circulatory diseases. Cirrhosis hepatitis C=cirrhosis of the liver secondary to hepatitis C. Brain cancer=brain and central nervous system cancer.

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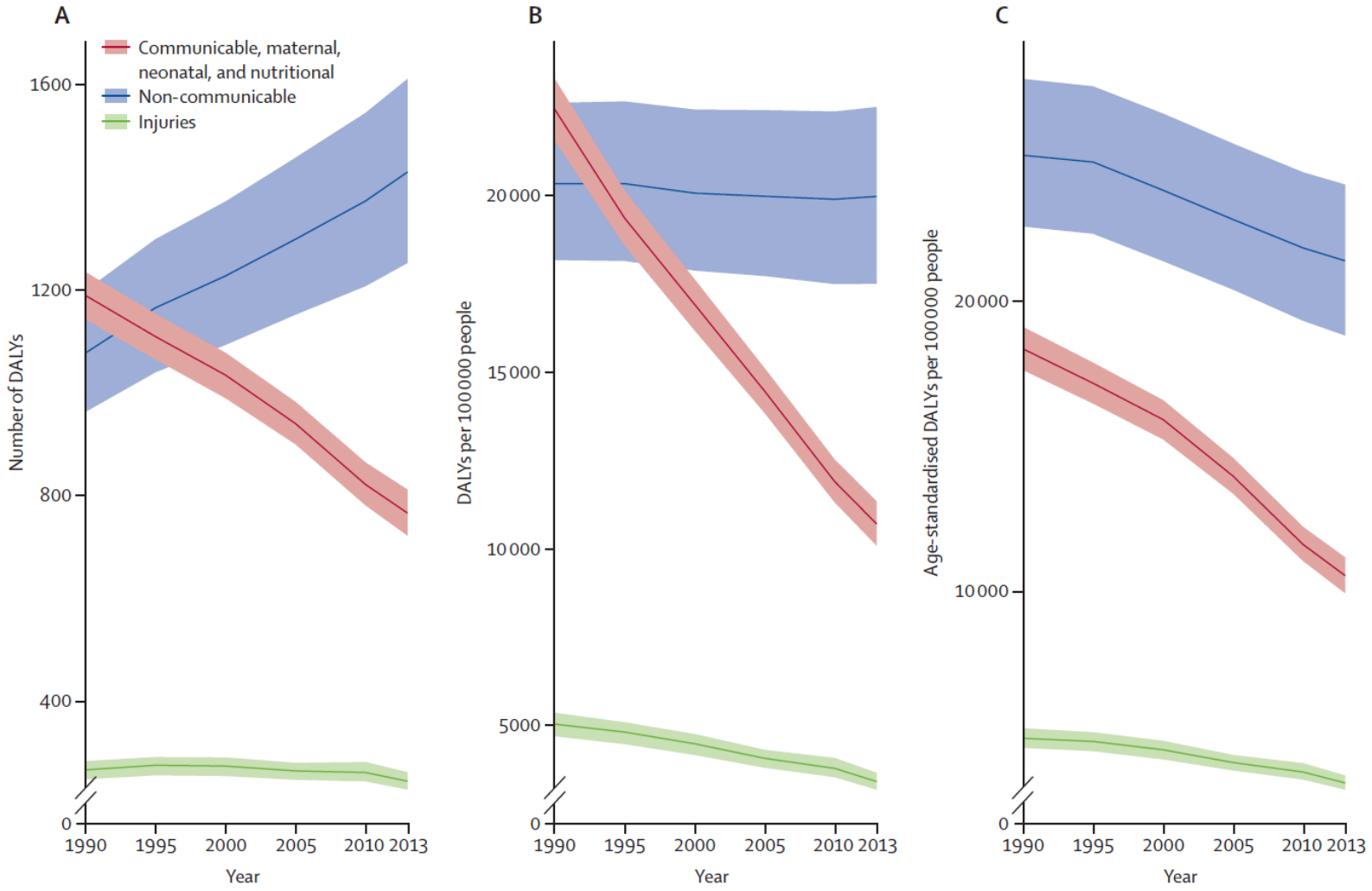
Total DALYs, crude DALY rates, and age-standardised DALY rates from 1990 to 2013



Data viz

www.healthdata.org

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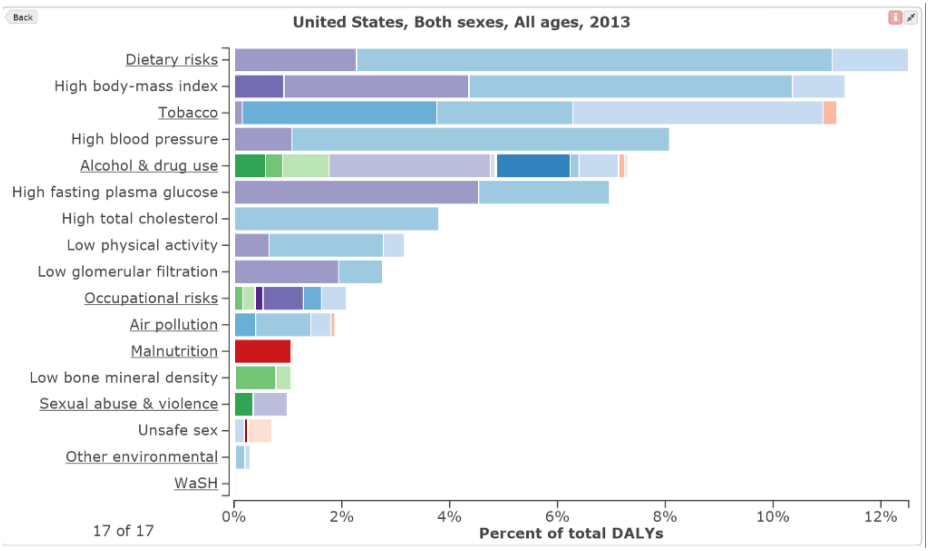
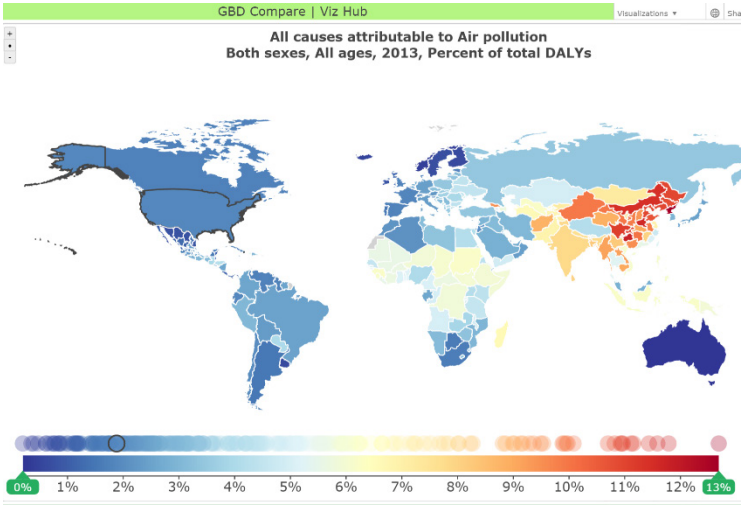
Are diet effects over-estimated?

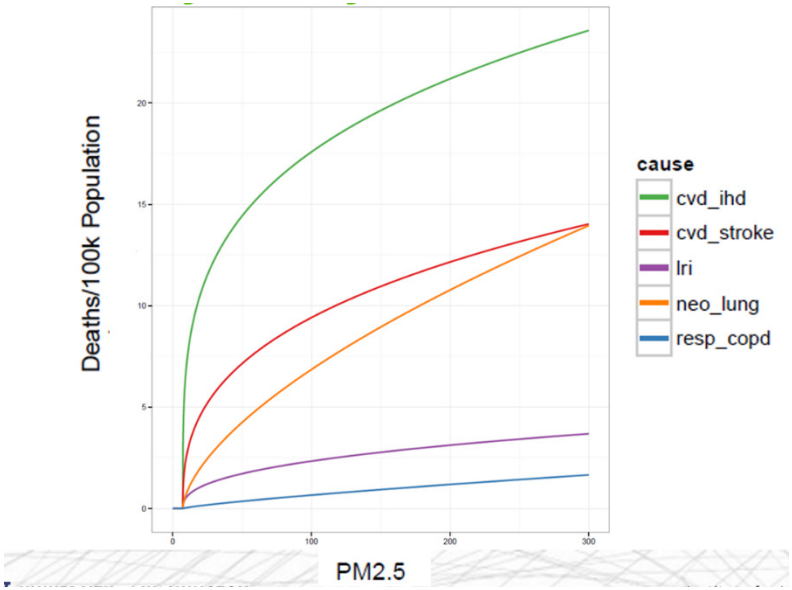
1) Diet components and joint effects based on meta-analyses of cohort studies and randomized trials (mortality and intermediate outcomes).
2) Huge potential health gains through diet modification but substantial controversy about magnitude of the effects in the clinical community.
3) More systematic capture of all cohort studies and internal validation of combined diet effects on mortality should be undertaken



Integrated exposure response curve (IER)

1) Relative risk curve as a function of PM2.5 constructed from pooling data from ambient air pollution, indoor air pollution, second-hand smoke and tobacco studies for CVD and chronic respiratory outcomes.
2) Ambient air pollution studies show excess risk at low levels PM 2.5 leading to a concave risk curve.
3) Policy implication is that health gains from reducing high levels of PM2.5 to moderate is quite small but gains from moderate to low are large.



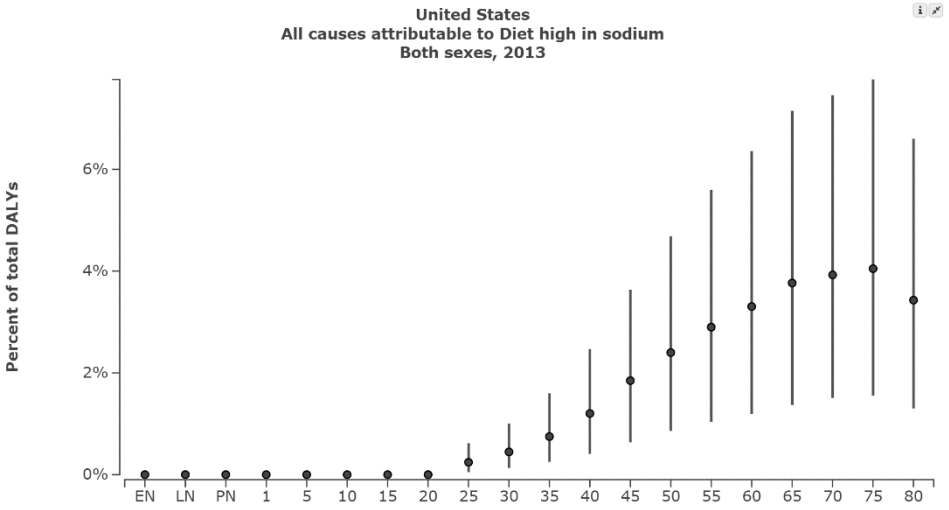


Systolic blood pressure

1) GBD 2013 relative risks based on meta-analysis of pooled cohort and trial data show excess risk for SBP>110-115 mm Hg.
2) JNC8 argued that benefits unclear below SBP 150.
3) SPRINT results confirm magnitude of SBP results quantified in the GBD.
4) HOPE-3 questions benefits in those without disease and SBP below 130

Salt and mortality: implications of PURE

1) GBD 2013 considerable debate within collaboration on the theoretical minimum risk level (TMREL) for salt – level below which there is no further benefit.
2) IOM review and then PURE findings led to widening uncertainty interval for TMREL from 1gm Na/day to 5gm Na/day.



Outline

1) **Study goals**
2) **GBD study overview**
3) **Key results from GBD 2013**
4) **Some debates**
5) **GBD 2015 main innovations**
6) New analytical directions

GBD 2015

1. **New subnational analyses:** India, South Africa, United States, Sweden, Saudi Arabia, Brazil, Japan, Kenya.
2. Added selected territories with high quality data: American Samoa, Puerto Rico, Marshall Islands, Bermuda, Greenland
3. **Enhanced analysis of epidemiological transition**: major emphasis in the analysis of estimating the average pattern of age, sex, and cause-specific burden as a function of socio-demographic status.
4. HIV estimation and all-cause mortality estimation linked at the draw level – ensemble model to estimate HIV using both demographic data sources and EPP-Spectrum natural history model

GBD 2015

5) New causes including Ebola, division of leukemias into ALL, CLL, AML, CML, motor neuron disease
6) GATHER guidelines compliance
7) DisMod-MR 2.1 added estimation for subnational units in analytical cascade
8) Explicit risk-outcome evidence matrix
9) Summary exposure estimation – risk weighted prevalence for each risk factor on a 0 to 1 scale
10) Improvements to GBD Compare

Outline

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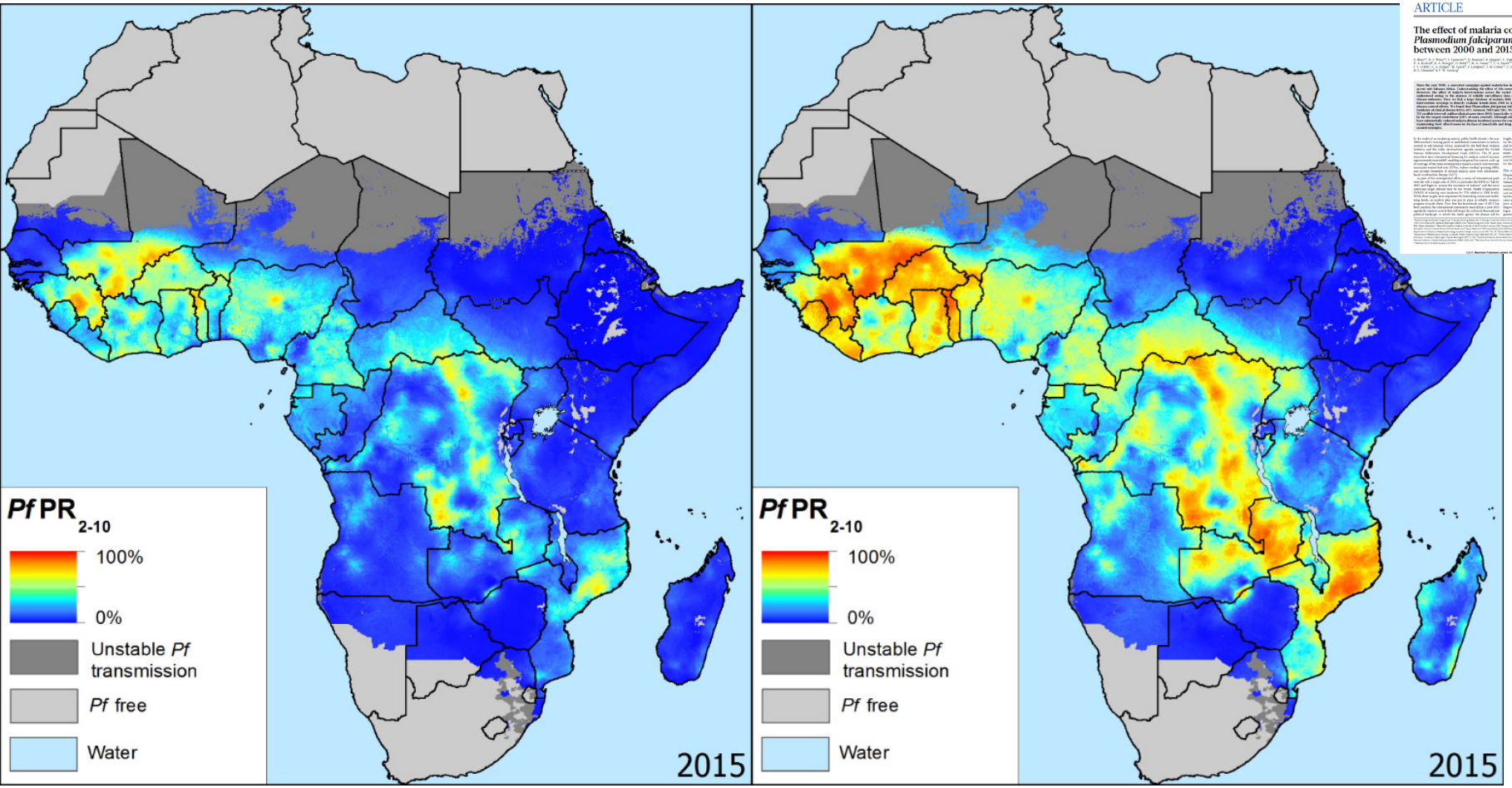
Major extensions to the GBD

1) Next annual update to 2016 to be released in September 2017.
2) Mapping the burden of disease at the pixel level – beginning with malaria, HIV, tuberculosis, diarrhea and lower respiratory infections will estimate burden at the 5 X 5 km square level.
3) Forecasting platform – creating a burden of disease forecasting platform to create short, medium and long-range forecasts for the GBD. Platform will also allow for exploration of alternative scenarios.
4) Extending risk factors to social determinants and intervention coverage

Fine-grained mapping of disease outcomes and impact of interventions: Malaria Atlas Project



nature International weekly journal of science

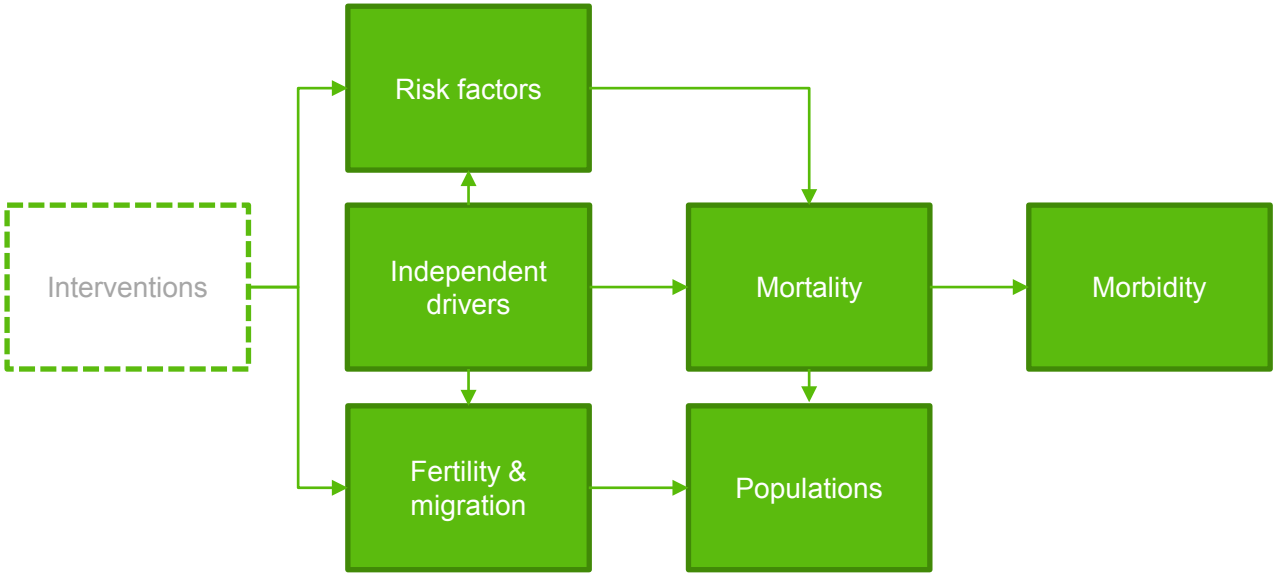
ARTICLE

The effect of malaria control on *Plasmodium falciparum* in Africa between 2000 and 2015

Two distinct goals for health futures platform

1) Generate and regularly update past trends and relationships scenario (PTRS) for mortality, morbidity and population from now to 25 years in the future by age, sex, cause and GBD geographies (over 500 now)
2) Create a comprehensive framework to assess alternative scenarios of interest to relevant stakeholders with different trajectories for independent drivers

Scenarios framework



Distal risks and interventions

1) Expansion of GBD Comparative Risk Assessment to encompass distal risks such as income per capita, poverty, education, electrification….
2) Expansion to include the absence of certain well characterized interventions e.g. rotavirus vaccine.