

Global Burden of Disease 2013 overview and future directions

Christopher J.L. Murray December 8, 2015

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Global Burden of Disease

- 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.
- 188 countries from 1990 to present. Sub-national assessments for some countries (e.g. China, Mexico, UK, US, Brazil, Japan, India, Saudi Arabia)
- 3) 306 diseases and injuries, 2,337 sequelae, 79 risk factors or clusters of risk factors.
- 4) Updated annually; release planned for May each year.
- 5) Findings published in major medical and science journals (*The Lancet, JAMA, New England Journal of Medicine, Science, Nautre, PLOS Medicine*), policy reports, and online data visualizations.

GBD: standardized solution to global health measurement challenges

Challenges:

- 1. Inconsistent coding and case definitions
- 2. No data
- 3. Conflicting data
- 4. Sampling and non-sampling measurement error
- 5. Excluded groups

GBD solutions:

- Quality review of all sources and corrections for garbage coding
- 2. Cross-walking different case definitions, diagnostic technologies, recall periods, etc., using statistical methods
- 3. Statistical methods to deal with missing data, inconsistent data, excluded groups and measurement error



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GBD: a global study with a global collaborative network of investigators



1,414 collaborators from 115 countries



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.
- **Disability-adjusted life years (DALYs)** are the sum of YLLs 4. and YLDs and are an overall metric of the burden of disease.
- **Healthy life expectancy (HALE)** is a positive summary 5. measure counting the expected years of life in full health.



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

Global, regional, and national comparative risk assessment with disabil Disease Stu of 79 behavioural, environmental and occupational, and 188 countrie metabolic risks or clusters of risks in 188 countries, Methods Es with some i 1990-2013: a systematic analysis for the Global Burden of additions to **Disease Study 2013** reviews, use severity spli GBD 2013 Risk Factors Collaborators* cause and ir

Global, regional, and national age-sex specific all-cause and \mathcal{Q}^{\dagger} cause-specific mortality for 240 causes of death, 1990-2013: a systematic analysis for the Global Burden of Disease Study 2013

ptember 11, 2015 tp://dx.doi.org/10.1016/ 140-6736(15)00128-2 e Online/Comment tp://dx.doi.org/10.1016 140-6736(15)00129-4 ollaborators listed at the end

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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 up death as in the GBD 2010 an updated verbal autopsy Turkey, and Russia, We strategies across the 240 c sufficient information. 1 prevalence studies. For p approach. We computed (all pairs of countries (Gin

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 Published Online 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.

August 27, 2015 a//dx.ckii.org/10.1016 50140-6736(15)61340-X See Online/Comment http://dx.doi.org/10.1016 50140, 6736/15/61476.3 collaborators listed at the end

Methods We used the published GBD 2013 data for age-specific mortality, years of life lost due to premature mortality of the Article (YLLs), and years lived with disability (YLDs) to calculate DALYs and HALE for 1990, 1995, 2000, 2005, 2010, and 2013 Correspondence to for 188 countries. We calculated HALE using the Sullivan method; 95% uncertainty intervals (UIs) represent Prof Christopher J L Morray. Institute for Health Metrics and uncertainty in age-specific death rates and YLDs per person for each country, age, sex, and year. We estimated DALYs Evaluation, 2301 5th Avenue for 306 causes for each country as the sum of YLLs and YLDs; 95% UIs represent uncertainty in YLL and YLD rates. Suite 600, Scattle, WA 98171 We quantified patterns of the epidemiological transition with a composite indicator of sociodemographic status, USA which we constructed from income per person, average years of schooling after age 15 years, and the total fertility rate dimension 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

Clinical Review & Education

Special Communication

The Global Burden of Cancer 2013

Global Burden of Disease Cancer Collaboration

MPORTANCE 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 live 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 comortality incidence (MI) ratios. Sources for cause of deal system data, verbal autopsy studies, and other sources

> THE NEW ENGLAND TOURNAL OF MEDICINE REVIEW ARTICLE

> > GLOBAL HEALTH

Measuring the Global Burden of Disease

Christopher J.L. Murray, M.D., D.Phill, and Alan D. Lopez, Ph.D

Background-United Nations member states have agreed to reduce premature cardiovascular disease (CVD) mortality 25% ended. We produced estimates to show how selected rish jons 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 the year 2025, adjusting for joint effects of risk factors. We t risk factor trends continue. Premature CVD deaths would neved as a result of a 26% reduction for mon and a 23% leath. Globally, decreasing the prevalence of hypertension on in tobacco smoking for men and obesity for women, but c factor targets on CVD montality varied widely by region

From the Institute for Health Metrics and Svaluation, University of Washington, Seattle (C.J.L.M.), and the University of Melbourne, School of Population and Golul Hwath, Carbon, VIC, Australia (A.D.L.), Address report requests to Dr. Marray at the institute for Health Metrics and Evaluation, 2301 Fifth Ave., Suite 600. Seattle, WA 91121, or st climptuse.edu N Paul 1 Mark 2012 1 Market LAS Caputalit do 2013 Massokustic Melliud Salacy

1991.1 Although assessments of selected d lected populations are published each year human immunodeficiency virus [HIV] epic ments of the state of health in the world ha Study for 2990, 1999–2002, and 2004.3>>> that consistent methods are applied to crit each condition, make this information com from countries with incomplete data, and r use of standardized metrics.

T IS DIFFICULT TO DELIVER EFFECTIVE

without knowing their diagnoses; likew is necessary to understand the key cha

health and how these challenges are changing

comprehensive and internally consistent a

den of diseases, injuries, and risk factors. T

World Health Organization launched the G

The most recent assessment of the glob (GBD 2010), which provides results for 1 investigators collaborated to report summar logic regions in December 2012,11-18 Regi child mortality, and geographic contiguity number of major limitations of previous an on 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 busden attril

risk factors were also assessed. GBD 2010, which provides critical infor was based on data from 187 countries for includes a complete reassessment of the br estimation for 2005 and 2010 based on th facilitated meaningful comparisons of tren tions was also estimated according to the year from global and regional data have been p The internal validity of the results is an For example, demographic data on all-caus try, age, and sex were combined with data that the sum of the number of deaths due number of deaths from all causes. Simila

W BHOLLI WED BOOK HELM OND AND The New England Journal of Medicin Develoaded from nepr.org at UNIVERSITY OF WASHINGTON on November 4, 2015. F Copyright © 2013 Massachusets Medical Society, Al

Global Burden of Skin Disease as Reflected in Cochrane Database of Systematic Reviews ne Karinkhani, BA, Lindsay N, Boyen, BA, Laura Prescott, MA, Vinian Welch, PHZ: Finda M. D. a Nasee, DOS, MIG: Amogali Zaves, MS: Poderick J. Hug, DM, FRD: Theo:Ves, PRD: stopher J. L. Murray, MD, DPhil, David J. Margolis, MD, PHD: John Hilton, MS: MPMI for MacLinkow, PHD, MA: Hywel C. Williams, DS: (TRO); TROM Y Database, ND, PHD, MSPH

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

INPORTANCE Research minetization should be guided by impact of disease

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

conditions in the CDSR for systematic review and protocol episeration from Nevember 2013, to December 6, 2013. The IS 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.

ship of CDSR topic coverage (s and protocols) with percentage of total 2010 DALYs, 2010 DALY rank, and DALY percentage charge from 1990 to 2010 for 15 skin conditions

RESULTS All 15 skin conditions were represented by at least 1 systematic review in CDSI 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, onmelanoma skin cancer, viral skin diseases, and fungal skin diseases were well matched Decubitus ulcer, psoriasis, and leprosy den en matched with corresponding DALI's. In comparison, acre vulgaris, bacterial skin esses, urticaria, pruntus, scabies, cellulitis, and alopecia areata were underrepresen CDSR when matched with corresponding DALYs.

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

Conversionst 2014 American Medical Assoc

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

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Institute for Health Metrics and Evaluation 2301 Fifth Ave., Suite 600, Seattle, WA 98121, USA Tel: +1.206.897.2800 Fax: +1.206.897.2899 © 2015 University of Washington #			

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Benchmarking using the GBD: United Kingdom and England analyses

- 1) UK benchmarking analyses 2013.
- Public Health England GBD collaboration to study sub-national BoD. Findings released September 2015.
- Future iterations of the England analysis planned for local health authorities.

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ours 3. Age standardised rates of years of life lost (TLL) for England relative to the depination levels in the nine English registers for behaviors. The Data State of the State of the Internet of States and the depination levels in the nine English registers of both States. Alzheimer's disease and other mental. Other advisors/line-both advisors/line-bo





China collaboration

- Policy dialogue with 200 participants hosted by China Medical Board, Peking Union Medical College, China CDC, and IHME in Beijing in April 2013 led to commitment to monitor sub-national burden.
- China Centers for Disease Control, China Maternal and Child Surveillance System, China Cancer Registration System collaborating with IHME on producing provincial and county burden of disease analyses.

-BASED POLICY DIALOO he Global Burden of Dise i负担与健康政策研讨



Rapid health transition in China, 1990–2010: findings from 🏾 🇨 🏷

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Under-5 mortality in 2851 Chir		@ to D			
a subnational assessment of ac	5 .5				
Yanging Wang", Xiaohong Li", Mingang Zhou", Shushong Luo", Juan Lian Dhumhun He, Chuyun Kang, Shiwe Liu, Li Dai, Austin F. Scharmacher, Maya Lumanya Singh, Magana Caggeholt, Mangavet Luid, Yahang Li, Q'Li, Kiu De Deahi Mu, Jua Zhuti, Christopher J.: Mianayit , Hiadong Wang.	u S Fraser, Timothy M Walack, Amanda Pain, Carly E Levitz,			0 causes in China during ational analysis for the Global	
Summary			Disease Study 2013		
Background In the past two decades, the under-5 mortality regards to the Millennium Development Goal (MDG) 4 at t estimate under-5 mortality rates in mainland China for the	he subnational level has not been quantified. We aimed to	Published Critica October 26, 2015 Resp.//dx.doc.org/10.3056/ 50140-8/26(15)00554-1 Fax.fuller.	Wang", Jun Zhu", Wanging Chen", Linhang Wi Feng Tan, Ryon M Barber, Matthew M Coates,	ang, Shiwei Liu, Yichong Li, Lijun Wang, Yunning Liu, Peng Yin, Daniel Dicker, Maya Fester, Dege Ganzillez-Medine, Hannah Hamavid	
Methods We estimated the under-5 mortality rate for 31 prov from censuses, surveys, surveillance sites, and disease sur 2851 counties in China from 1996 to 2012 with the reported of Maternal and Child Health. We used a small area mortality of	veillance points. We estimated under-5 mortality rates for hild mortality numbers from the Annual Report System on stimation model, spatiotemporal smoothing, and Gaussian	See Online Convent Imp. (do. do. org/10.300/ 50140-67(9)(15)00555-3 "Joint companying atthem 1)oint companying atthem		Michael & Phillips, Jun She, Then Hos, Xia Wan, Golin Xu, Lijing L Yan, Yawi, Yu Wang, Christopher J L Mueny F, Ganghwan Yang F,	
progress at the county level with what was expected on the basis of income and educational attainment using an econometric model. We computed Gini coefficients to study the inequality of under-5 mortality rates across counties.		National Office for Maternal and Child Health Sannellance of Osna, Department of Peolatrice, West China Second University Respited, Schwan	is is known about this transition at th	miological and demographic transition during the past e subnational level. Timely and accurate assessment of the priority setting at the local level in China.	Published Online October 26, 2015 http://dx.doi.org/10.1016/ 501.00-6736(25)00551-6
Finding 1a 2012, the lowest provincial level unders' metality rate in China was about free per 1000 breichink, lower than in Canada, New Zhania, and the USA. The highest provincial level unders' monthly rate in China was higher than that of Banghodes. 2P provinces achieved a decrease in unders' monthly rates twice as fast as the MDG 4 target rate only two protocols will not achieved MDG 4/9 2013. Mbound post one contribut is China have unders' monthly rates similar to those in the most developed nations in 2012, some have similar rates those rencorded in Bachkine issue and China Done. Theorem will not achieved monthly configuration of the control of the Bachkine and China Done. Theorem will not achieved the Bachkine and China Done. Theorem will not achieved the control of the Bachkine and China Done. The Done is wide different has been developed nations in 2012, some have similar rates those rencorded in Bachkine issue and Channeson . Deschwide differences the intercounted Gachkine and Done done and Gardenson . Deschwide differences and the developed nations in 2012, some have similar rates the those rencorded in Bachkine intercounted achieves the difference on the control difference has been developed nations in 2012, some have similar rates the difference has been difference has been developed nations in 2012, some have similar rates the difference has been developed nations in 2012, some have similar rates the difference has been difference has been developed nations in 2012, some have similar rates the difference has been din thas been difference has been difference has been		tanismity, Chengda, Sichean, China (hui'Y Mang, Yini') Liong, Cile, Libai, QLI, Ching, Yilo, Cong, Lib, Zian, Xia, Fod Dilai, Pod / Zian, Sian, Fod Dilai, Pod / Zian, Institute For Insult: Microica and Scalastion. University of	he methods of the Global Bunden of Disease Study 2013 (GBD 2013), we kave systematically demographic and epidemiological data sources for China at the provincial level. We developed e county-level surveillance data to inform provincial level analysis, and we used leval data to age code redistribution precedures for China. We assessed levels of and trends in all-cause such, and years of life lost (YLL) in all 33 province-level administrative using in mailund China.		See Overal Connect Integral Macdes ang 20,0000 Set at 60 (ECC)00053 it "Contributed operally "(Set a connected operally National Contex for Oceanic
maternal education and the economic boom have contrib counties in China had rates of decline in under-5 mortality under-5 mortality rates have been recorded not only in the	rates significantly faster than expected. Fast reduction in Han population, the dominant ethnic majority in China,	Washington, Seattle, WR, USA (C.A.Ladal), W.M.Coston, A.C.Schurtscher, M.S.Franz, T.W.Wolod, A.Part, C.E.Loviti,		1 1990 and 2013. stantial strides to improve life expectancy at birth between prosince to 14-2 years in Tibet. Improvements in female life	and Noncommunicable Disea Control and Provention (Prof M Zhou PhD, Prof L Wang MD, S Lav PhD,
annual reductions in under 5 mortally rates faster than the MDG-3 target at 4 eW. Interpretation: The reduction and under 5 mortally rates in Colma at the countries, and county level is an interpretation the reduction of under 5 mortality rates faster than a 55% (bulke MDG-4 spect) are possible. successful counties should prove valuable for China to internally offens for those with unacceptably high under 5 mortality rates.		L Singh, Wi Coggoshall, Willing, Prof. C (L, Warray, H Wang), National Contex for Worth	those in male life expectancy in all pr	rovinces except Shanghai, Macao, and Hong Kong. We saw scy at birth and probability of death at ages 0–14, 15–49, and	Y LI MPH, Y Lie MSc], National Institute of Occupational Health and Paison Control
		Defect Surveillance of China, West China Second University Hospital, Schwart Drivensby, Cherephi, Schwart, China Chi, Ford J Zha), Key Laboratory of Birth Defects and Related Diseases of Warner and Chidane (Schwart University),	eterogeneity is also present in cause causes of YLLs changed substantially, mplications as the leading causes (Macao) had ischaemic heart disease at ischaemic heart disease, and one h	of a finite and producting to testing a give test, 17-12, and of death straticities bayes uses and potonices. From In 1990, 16 of 33 provinces had lower respiratory infections of YLLs. 15 provinces had cerebrowscular disease and a by 2013, 27 provinces had cerebrowscular disease as the and lung cancer (Hong Kong). Road injuries have become a the most common one-communicable diseases, including	(Frof FTac NE), Chibese Cardo for Disease Control and Provention, Brijling, China (Frof Likay, Frin Frid) (Liu MD, Prof SY's PAD, Prof Y Mang HD), Prof Y Liang HD), forditions for health Martins and Evolution
Funding National "Twelfth Five-Year" Plan for Science and Technology Support, National Health and Family Planning. Commission of The People's Republic of China, Program for Changjiang Scholars and Innovative Research Team in University, the National Institute on Aging, and the Bill & Mellind Gates Foundation.		Ministry of Education, Chengda, Sichuary, Chima X UI; Nutional Center for Disease and Noncommunicable Disease	ase, stroke, chronic obstructive pul ore to YLLs in 2013 compared with 15	Imonary disease, and cancers (liver, stomach, and lung),	Pool M Zhou, Hittory PhD, FM Barber ID, M Khang PhD, E M Barber ID, M M Caster BA, D Octor BB, M Franc BA, D Constitut-Heading BA, Hitaropool BA, Prod Totas PhD.
Introduction China has made tremendous strides in reducing under-5 mortality rates in the past decades. ¹⁴ It achieved the	education and empowerment, reductions in fertility rates, and health policies such as antenatal care, in- facility birth, and immunisation." Analysis of causes of	Control and Prevention, Chivese Center for Disease Control and Prevention, Beijing, Chive (Pryl W Zhou, Perf 1996, State Victo Office	ith system by epidemiological and	demographic change differ between groups of Chinese mented to tackle the diverse challenges faced by local	Prof II Naglant (Hz), Prof II Naglant (Hz), Prof C J L Martay D/Hz), Oniversity of Washington, Southle, Wit, USA, Matienal
Millennium Development Goal 4 (MDG 4) target of a two thirds reduction in the under-5 mortality rate 7 years in and pneumonia deaths in particular. ²⁵⁶ China's		to haliosi discontant (MAHandi Sottikon of Hon, Sotosi et Abia wash, halion turnerih mahh kunan Kunan turneti kunan			Office of MO1 Serveillance of
The under-5 mortality rate in 2013 reached 13-0 per 1000 livebirths (12-0-13-8) in China, a 78% reduction	disease among children has been identified as an example to be emulated by other low-income and middle-income countries. China has made hoge progress in reducing child monthly during a period of damatic economic growth, with Cross Domestic Product (CDP) per person increasing 668% from 1990 to 2013. Economic	General present insent General present insent (Prof S. Lau, Y. Gak, C. Kang, H. Uj, and Department of Child, Aduktowant and Werench Houths, School of Public Health, Policing University Health Sciences Center, Beijing, China (Prof S. Lau, Y. Gai, C. Kang)	China experienced rapid economic ne per capita increasing from RMB' and life expectancy at birth ars. ¹ Under 5 death rates dropped 1 in 1990 to 13 per thousand in 2013 e second fustest annualised rate of	increased policy attention on the challenges of health inequalities." Concerns have been raised that health inequalities are rising. ¹ Levels and trends of mortality separated by cause are a crucial strating point to understand health inequalities across provinces. To our knowledge, there have not been any systematic studies of provincial causes of death in	Prof X Jun WDy, Institute of Rask Medical Sciences (X Was PhD), Okraes Academ of Medical Sciences, Beijing Chine, School of Public Health Prof 7 Soc PhD, Discontan
www.ihelancet.com Published online October 36, 2015 http://dx.doi.org/20.1	016/50140-6738(15)00554-1	ι.	us.' Rapid reductions in mortality ciated with a progressive shift in	China. ³⁴ Since the 1970s, there has been extensive analyses of variation between provinces, and even	and Health Statistics, Schools Public Health, Central South
		diseases, increas	remous diseases to non-communicable sing the demand for affordable access es. Rising income inequality has also	counties, for cancer death rates. ⁴⁴ Various causes of heart disease, mickle, and injuries have been studied for selected provinces. ⁴⁴⁴ More comprehensive cause of	University, Charapha, China (Prof & Hu 1901), Tanjin Conto Ster Disease Control and

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Total DALYs, crude DALY rates, and agestandardised DALY rates from 1990 to 2013



Global DALYs by cause 1990



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Global DALYs by cause 2013



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Co-morbidity population pyramids for highincome countries







www.healthdata.org



GBD new directions: fine spatial resolution

1) To guide priority setting, program targeting and evaluation of local programs pushing estimation to finer grained levels using small area statistical methods.

Age-standardized liver cancer death rate for US counties 2013, both sexes combined





GBD new directions: future health scenarios 2015-2040

- What will happen to the burden of disease in each country in the next generation if past trends and relationships continue? And what will be the evolution of health expenditure?
- 2) Alternative scenarios where policy change can influence the evolution of key drivers of health

Mexico YLLs in 2040 in the past trends and relationships scenario

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GBD new directions: social, cultural and economic, absence of intervention risk factors

- To date, the comparative risk assessment component of GBD quantifies a set of key behavioural, environmental, occupational and metabolic risk factors based on criteria of convincing or probably causal evidence.
- 2) In coming years, we plan to expand the set of risk factors quantified in two key directions: upstream to social, cultural and economic risks and to characterize the absence of proven interventions as risks.
- Implication is that the evidence criteria used for including social, economic and cultural risks will need to be modified based on the type of evidence that is available.



GBD new directions: achievable reductions in burden at different levels of socio-demographic status

1) Use the national and sub-national GBD results to answer the question: what reductions in burden for each disease are achievable given the observed variation across populations at the same level of income, education and fertility?

2) Achievable burden can help focus attention on where the greatest potential for improvement in a state or country is possible. It is a formalized form of benchmarking.



Achievable reductions in CVD in US counties at different levels of income – blue lines connect observed to possible