Saving Society, Sydney, NSW, Australia (R Franklin PhD); James Cook University, Townsville, QLD, Australia (K Watt PhD, R Franklin PhD); Howard University College of Medicine, Washington, DC, USA (Prof R F Gillum MD); Addiction Info Switzerland, Lausanne, Switzerland (Prof G Gmel PhD); Department of Epidemiology and Biostatistics (M C Nevitt PhD), University of California, San Francisco, San Francisco, CA, USA (Prof R Gosselin MD, M Lipnick MD, A-C Meyer MD, C Robinson BS); College of Medicine, SUNY Downstate Medicle Center, Brooklyn, NY, USA (J Groeger MPH), National Center for Injury Prevention and Control (D A Sleet PhD), Centers for Disease Control and Prevention, Atlanta, GA, USA (S T Wiersma MD); Université de Lorraine, Nancy, France (Prof F Guillemin MD); University of Bristol, Bristol, UK (Prof D Gunnell DSc); New York University, New York City, NY (Prof H Hagan PhD, Prof G D Thurston ScD); Brandeis University, Waltham, MA, USA (Y A Halasa DDS, S Shahraz MD, Prof D S Shepard PhD, E A Undurraga PhD); Parc Sanitari Sant Joan de Déu, CIBERSAM, Universitat de Barcelona, Sant Boi de Llobregat, Spain (J M Haro MD); Karolinska University Hospital, Stockholm, Sweden (R Havmoeller); The Queen Elizabeth Hospital, Adelaide, SA, Australia (C Hill MBBS); Université de Franche-Comté, Besançon, France (Prof B Hoen MD); Centre Hospitalier Régional Universitaire de Besançon, Besançon, France (Prof B Hoen); National Institute on Deafness and Other Communication Disorders (H Hoffman MA), National Institute of Diabetes and Digestive and Kidney Diseases, National Institutes of Health, Bethesda, MD, USA (R G Nelson MD); National School of Tropical Medicine, Baylor College of Medicine, Houston, TX, USA (Prof P J Hotez MD); University of Port Harcourt, Port Harcourt, Nigeria (S E Ibeanusi MBBS); George Mason University, Fairfax, VA, USA (K H Jacobsen PhD); Department of Ophthalmology, Medical Faculty Mannheim, Ruprecht Karls University,

exceptions. The variation in prevalence across disorders extended by more than a factor of 100 000. A weak relation exists when the more common sequelae are milder than the less common sequelae (correlation coefficient −0·37). The lack of a strong association between prevalence and severity plus the substantial number of highly prevalent, but mild, disorders draws attention to why consideration of prevalence of disorders alone is insufficient in quantifying burden of disease. To understand which causes contribute the greatest burden, we need to take into account both prevalence and severity of the health states. The disability weights collected from the general public provide the mechanism by which the highly diverse set of sequelae can be compared by adjusting for severity.[30]

In 2010, there were a total of 777 million YLDs globally, implying an average health loss of 0·11 years per person. By sex, the YLD rate was 10 819 per 100 000 male individuals and 11 755 per 100 000 female individuals, with female individuals accounting for 51·6% of all YLDs globally. Disaggregated into three broad cause groups, 15·3% of YLDs in 2010 were due to communicable, maternal, neonatal, and nutritional disorders, 78·6% to non-communicable diseases, and 6·1% to injuries. The heavy preponderance of YLDs from non-communicable diseases is substantially different from the distribution of years of life lost because of premature mortality (YLLs; 42·8%).[68]

We detected a characteristic pattern of the prevalence of disease adjusted for severity by age and sex at the global level in 2010 (figure 2). This figure provides an analysis using the 21 mutually exclusive and collectively exhaustive cause categories at the second level in the GBD cause list for male and female individuals. In children younger than 5 years, leading causes of YLDs included neonatal disorders, nutritional deficiencies, diarrhoea, lower respiratory infections, other infectious diseases, and neglected tropical diseases and malaria. Beginning at age 10 years and extending to age 65 years, mental and behavioural disorders were a major cause, contributing as much as 36% at age 20–29 years. Nearly as important but with an older age distribution, the other dominant cause was musculoskeletal disorders. The third most important factor in adults was other non-communicable diseases, which includes congenital anomalies, skin diseases, sense organ disorders, and oral disorders (figure 2). Diabetes, urogenital, blood, and endocrine diseases made a progressively larger contribution with age. Neurological disorders (Alzheimer's disease and Parkinson's disease in particular) started to make a major contribution in individuals aged 80 years or older. Chronic respiratory disorders made a substantial contribution in individuals aged 10 years and older, whereas cardiovascular diseases seemed progressively more important at older ages. The long-term cumulative disability from unintentional injuries is also an important factor. This age-sex pattern of the leading causes was very different from the pattern for mortality by cause, which was dominated by causes such as cancers, cardiovascular diseases, HIV and tuberculosis, diarrhoea, pneumonia, and other infectious diseases.[68]

The GBD 2010 includes the assessment of 1160 sequelae, of which 600 are 40 different nature of injury sequelae (such as hip fracture or traumatic brain injury) for each of the 25 external causes of injury (such as falls or road injury). For simplicity of presentation, table 2 shows YLD estimates for all non-fatal health outcomes and some select groupings of sequelae. For example, we estimated YLDs for mild, moderate, and severe anaemia from a variety of causes but the table shows YLDs from all three forms of anaemia. For injuries we show only the YLDs by external cause without giving details for each nature of injury. Furthermore, we show results for both sexes combined for summary age groups (table 2) and the full age and sex detail for 2010 and 1990 (appendix pp 37–270). A substantial number of causes contribute to the overall YLDs at the global level (appendix pp 37–270). The leading causes were low back pain, which contributed 10·7% of total YLDs, and major depressive disorder, which contributed 8·1% of total YLDs. Within the broad category of

	All causes	Communicable, maternal, neonatal, and nutritional disorders	Non-communicable diseases	Injuries
1990 YLDs (thousands)	583 393	113 925	435 400	34 068
YLDs expected with 2010 population, 1990 population age structure, and 1990 YLD rates (thousands)	759 024	158 213	557 726	43 084
YLDs expected with 2010 population, 2010 population age structure, and 1990 YLD rates (thousands)	822 452	150 982	621 220	50 250
2010 YLDs (thousands)	777 401	119 164	611 076	47 162
Percentage change from 1990 due to population growth	30·1%	38·9%	28·1%	26·5%
Percentage change from 1990 due to population ageing	10·9%	−6·3%	14·6%	21·0%
Percentage change from 1990 due to change in YLD rates	−7·7%	−27·9%	−2·3%	−9·1%
Percentage change from 1990 to 2010	33·3%	4·6%	40·3%	38·4%

YLD=years lived with disability.

Table 3: **Decomposition analysis of the change of global years lived with disability (thousands) by level 1 causes from 1990 to 2010 into total population growth, population ageing, and changes in age-specific, sex-specific, and cause-specific years lived with disability rates**

communicable, maternal, neonatal, and nutritional disorders, the most important causes of YLDs included iron-deficiency anaemia, which accounted for 5·5% of all YLDs. Other causes within this group that caused 4 million or more YLDs included tuberculosis, HIV, diarrhoeal diseases, otitis media, malaria, intestinal nematodes, and neonatal disorders. Several neglected tropical diseases caused between 1 million and 4 million YLDs, including schistosomiasis, lymphatic filariasis, and food-borne trematodiases. Although major contributors to YLLs, the entire list of cancers caused a total of 4·5 million YLDs. Cardiovascular and circulatory diseases accounted for 2·8% of all YLDs with ischaemic heart disease and stroke accounting for 60% of the total for the cardiovascular category and the rest distributed across a wide range of causes. Chronic respiratory diseases accounted for 6·3% of global YLDs with the largest contributor being COPD (29·4 million YLDs) followed by asthma with 13·8 million YLDs. YLD rates for COPD have risen since 1990 whereas asthma rates have decreased marginally in this period. Neurological disorders accounted for another 42·9 million YLDs—migraine accounted for more than half of these YLDs.

Mental and behavioural disorders accounted for 22·7% of all YLDs. YLDs for the category as a whole have increased by 37% from 1990 to 2010 from 129 million to 177 million and rates have also increased slightly by 5% over the two decades (from 2440 per 100 000 people to 2564 per 100 000 people). Within this category, six disorders or clusters of disorders accounted for more than 10 million YLDs each. The largest category was depressive disorders: major depressive disorder caused 63 million YLDs and dysthymia caused 11 million YLDs—together accounting for 9·6% of all YLDs. Schizophrenia, alcohol use disorders, drug use disorders, and bipolar disorder accounted for 12·9–16·4 million YLDs. Anxiety disorders were also a major global cause, contributing 3·5% of all YLDs. Another important category of diseases causing YLDs was diabetes, urogenital, blood, and endocrine diseases, which accounted for 56·9 million YLDs. Major causes included diabetes mellitus (20·8 million YLDs), benign prostatic hyperplasia (6·8 million YLDs), gynaecological disorders (10·0 million YLDs), and haemoglobinopathies and haemolytic anaemias (10·2 million YLDs). Together, musculoskeletal disorders caused 21·3% of all YLDs. The main contributors were low back pain (83·1 million YLDs), neck pain (33·6 million YLDs), osteoarthritis (17·1 million YLDs), and the other musculoskeletal category (28·2 million YLDs). Osteoarthritis of the knee accounted for 83% of the total osteoarthritis burden. We included the assessment of 13 separate skin diseases. Collectively they caused 33·7 million YLDs, with the largest cause being eczema followed by acne vulgaris. Many of the skin diseases have low disability weights but because of very high prevalences, they still accounted for a substantial number of YLDs. Oral disorders combined caused 15·0 million YLDs, with about equal shares caused by dental caries, periodontal disease, and edentulism. Injuries collectively caused 6·1% of global YLDs. Falls accounted for 41% of the total YLDs caused by injuries. The other major contributors were road injuries, causing 13·5 million YLDs.

Between 1990 and 2010, the total number of YLDs increased by 194 million—a 33·3% increase. We have decomposed this change into three components (table 3): growth in total population, ageing of the global population, and changes in the YLD rates. We have decomposed change both for YLDs from all causes and also for the three broad cause groups. For YLDs from all causes, population growth alone led to a 30·1% increase in YLDs and population ageing led to a further 10·9% increase in YLDs. Reductions in age-sex specific prevalence rates would have reduced YLDs by 7·7%, leading to an overall increase of about a third. Examination of change by the three broad groups shows distinct patterns. Age-specific and sex-specific YLD rates for communicable, maternal, neonatal, and nutritional disorders have decreased, and alone would have led to a 27·9% decrease in YLDs. Overall, YLDs from this cluster of causes increased, slightly, by 4·6% because of population growth, which increased more in the regions with the highest YLDs from these causes. For non-communicable diseases, the overall increase has been 40·3%, but this increase was driven by both population growth and population ageing, with very small decreases in prevalence rates. For injuries we saw a similar pattern, except that the decrease in age-sex specific rates would have caused a 9·1% decline.

For all causes of YLDs combined, the small decrease expected because of changes in age-specific and sex-specific YLDs per person of 7·7% shown in table 3 can also be seen in figure 3, which shows age-specific YLDs per person in 1990 and 2010 for both sexes. Values in figure 3 can be interpreted as the fraction of health lost to short-term and long-term disabling sequelae in each age group. As expected, the YLDs per person rose with age; YLDs per person aged 5 years were 5·4%, rising to

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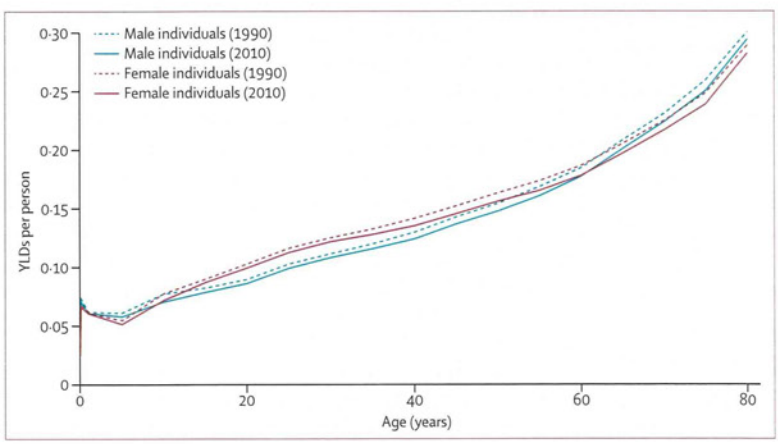

Figure 3: **Global years lived with disability (YLDs) per person in 1990 and 2010 for all ages, by sex**

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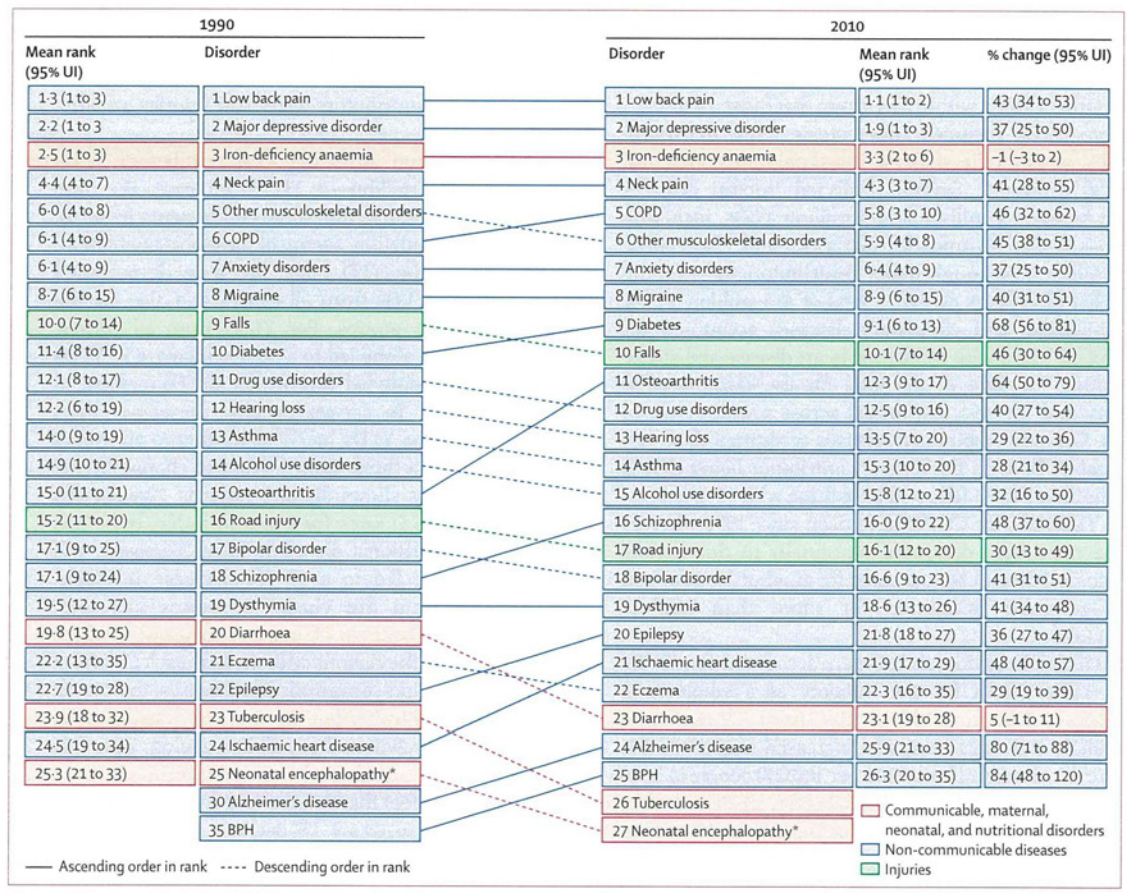

Figure 4: **Global years lived with disability (YLDs) ranks with 95% uncertainty intervals (UI) for the 25 most common causes in 1990 and 2010**
COPD=chronic obstructive pulmonary disease. BPH=benign prostatic hyperplasia. *Includes birth asphyxia/trauma. An interactive version of this figure is available online at http://healthmetricsandevaluation.org/gbd/visualizations/regional.

28·6% (28·2% for women; 29·4% for men) for individuals aged 80 years. Female YLDs per person were higher than male YLDs for individuals aged 10–60 years at the global level; the difference is highest for individuals aged 30 years, when YLDs per woman were 1·4 percentage points higher than YLDs per man. The decrease in overall YLDs per person over the 20 year period (between 1990 and 2010) was much smaller than the approximate 20% decrease in mortality.[68]

Faster rates of increase in YLDs for non-communicable diseases led to their share of total YLDs increasing from 74·6% in 1990 to 78·6% in 2010. Causes are ordered by their mean rank across 1000 draws. The order based on the mean rank across draws is not the same as the order based on the mean value of YLDs. The 25 most common causes in 1990 and 2010 are shown in figure 4. Non-communicable diseases were the most common cause of YLDs (figure 4); 21 of the 25 leading causes are from non-communicable diseases, up from 19 of the 25 most common in 1990. The four leading causes in 2010 were also the four leading causes in 1990: low back pain, major depressive disorder, iron-deficiency anaemia, and neck pain. COPD increased from sixth to fifth, and anxiety and migraine retained the same ranking as in 1990 (figure 4). Other notable changes over the time period include the drop in the ranking of asthma, although the number of YLDs it caused increased by 28%. Road injury YLDs also increased but to a lesser extent than the increase in many of the non-communicable diseases, meaning that it also dropped in the rank list. We detected larger decreases in the rank of diarrhoea and tuberculosis than the other 25 most common causes in 1990.

The appendix (pp 280–88) shows YLDs per person by age and sex for the 21 GBD regions in 2010 and 1990. In general, in almost all age groups, the lowest YLDs per person were in the high-income Asia Pacific and east Asia regions. Western Europe and Australasia had the next lowest levels of YLDs per person, with rates of YLDs typically 10–15% lower than in high-income North America for most age groups. We estimate that the highest levels of YLDs per person were in the Caribbean, Oceania, and sub-Saharan Africa, particularly in the age groups affected by HIV in southern sub-Saharan Africa. The ratio of YLDs per person, comparing regions with the highest

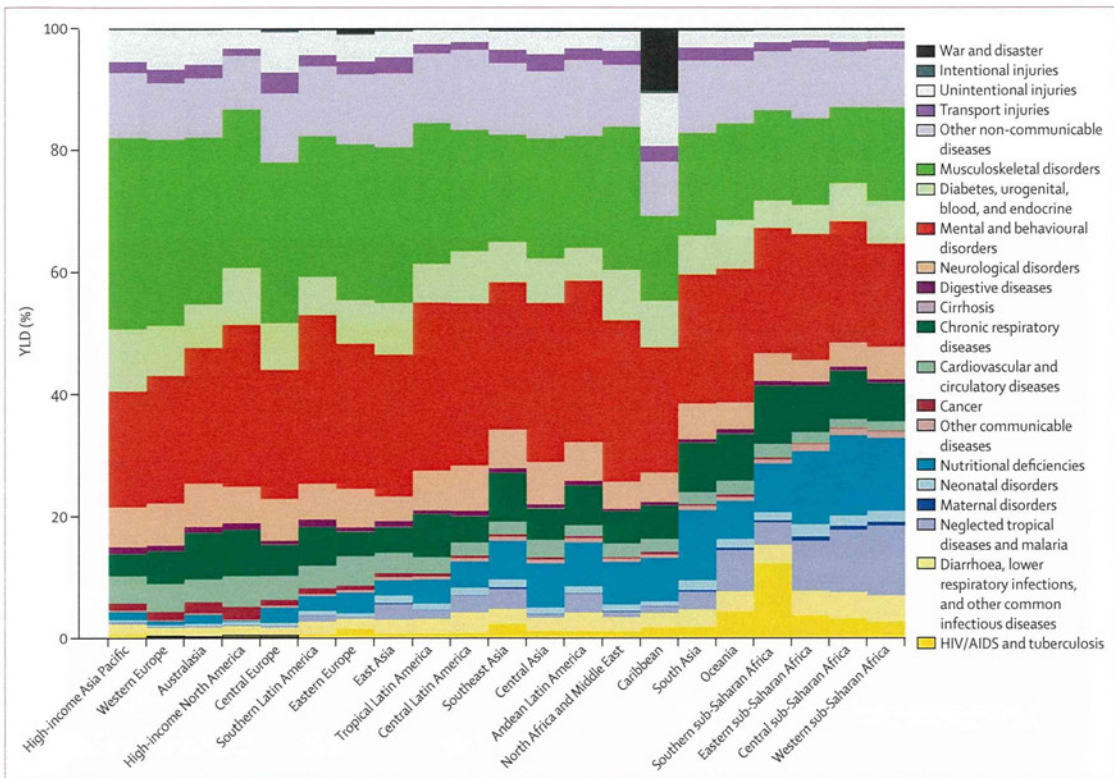

Figure 5: **Percentage of years lived with disability (YLDs) by 21 major cause groupings and region for 2010**
An interactive version of this figure is available online at http://healthmetricsandevaluation.org/gbd/visualizations/regional.

rates to the lowest rates, ranges from 9·71 in post-neonatal boys to 1·39 in men aged 80 years or older. This range is much smaller than we saw for YLLs across the same region-age-sex groups (the highest being 84·90 in male individuals aged 1–4 years and the lowest being 2·04 in male individuals aged 80 years or older).

Figure 5 shows how the broad composition of the causes of YLDs varied by region in 2010. At the 21 cause-group level, which is level 2 in the GBD cause hierarchy,[29] we detected a clear association between the demographic and epidemiological transition. Mental and behavioural, musculoskeletal, other non-communicable, and chronic respiratory causes were consistently important in all regions. Some causes played a much more important part in regions that are less advanced in the demographic and epidemiological transition as measured by the mean age of death.[86] HIV/AIDS and tuberculosis, neglected tropical diseases, and nutritional deficiencies stand out as being the most variable. For example, neglected tropical diseases and malaria ranged from 11·4% of total YLDs in western sub-Saharan Africa to less than 0·01% in high-income North America. Injuries have made a greater contribution to overall disability, in percentage terms, in those regions that are more advanced in the demographic and epidemiological transition. The contribution of stroke and diabetes, urogenital, blood, and endocrine diseases also increased with the demographic and epidemiological transition. Cardiovascular diseases did not contribute more than 5% of YLDs. The large fraction in the Caribbean attributable to war and disaster in 2010 is related to the Haiti earthquake.

Figure 6 shows how the leading causes of YLDs varied by region in 2010. Causes were included if they were in the 25 most common globally or in the 25 most common for any region. By contrast with a similar analysis for YLLs,[68] we recorded much consistency in the ranking of causes of YLDs for the 15 most common causes, with the exception of iron-deficiency anaemia, which was the third most common cause globally. Iron-deficiency anaemia ranged from the most common cause in sub-Saharan Africa (western, eastern, and central) to the 88th most common cause in high-income North America. Other causes that were highly variable across regions included malaria, cataracts, hookworm disease, sickle cell anaemia, thalassaemia, lymphatic filariasis, onchocerciasis, and schistosomiasis. The consistency of ranks for most major causes is related to the comparatively small variation in the prevalence of major mental and behavioural disorders and musculoskeletal disorders across different regions of the world.

Injuries accounted for a total of 47·2 million YLDs in 2010, up from 34·1 million in 1990. Table 2 provides the

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Ranking legend
1–10 11–20 21–30
31–50 51–90 91–176

Cause	Global	High-income Asia Pacific	Western Europe	Australasia	High-income North America	Central Europe	Southern Latin America	Eastern Europe	East Asia	Tropical Latin America	Central Latin America	Southeast Asia	Central Asia	Andean Latin America	North Africa and Middle East	Caribbean	South Asia	Oceania	Southern sub-Saharan Africa	Eastern sub-Saharan Africa	Central sub-Saharan Africa	Western sub-Saharan Africa
Low back pain	1	1	1	1	1	1	1	1	1	1	2	2	2	2	1	4	1	2	4	3	3	2
Major depressive disorder	2	4	2	2	2	2	2	2	2	2	1	1	1	1	2	2	3	1	2	2	2	3
Iron-deficiency anaemia	3	26	48	22	88	14	11	10	15	6	6	3	3	3	3	3	2	3	3	1	1	1
Neck pain	4	3	4	3	4	4	3	3	3	3	3	6	5	5	6	8	7	8	6	6	7	5
Chronic obstructive pulmonary disease	5	21	9	10	6	10	8	11	8	12	18	4	8	10	8	16	4	9	5	5	5	7
Other musculoskeletal disorders	6	2	5	4	3	5	4	4	4	8	4	8	7	6	7	12	8	10	8	9	10	11
Anxiety disorders	7	8	6	6	5	6	5	12	12	4	5	7	4	4	4	6	6	7	7	4	6	9
Migraine	8	11	8	8	15	8	13	8	17	7	8	5	6	8	11	10	5	12	10	25	12	8
Diabetes mellitus	9	7	7	11	8	7	12	5	5	13	7	12	9	17	5	5	11	4	18	27	29	23
Falls	10	5	3	5	12	3	7	9	7	16	21	11	11	16	12	11	12	15	20	26	24	26
Osteoarthritis	11	6	13	15	10	9	14	7	6	11	10	17	12	12	10	14	19	14	17	19	26	20
Drug use disorders	12	12	11	9	7	16	6	17	18	9	11	10	14	11	9	13	9	16	12	16	21	21
Other hearing loss	13	13	18	19	20	12	15	14	11	15	15	9	15	14	17	18	10	19	14	10	18	13
Asthma	14	15	12	7	11	21	10	25	39	5	12	18	21	7	13	9	15	11	9	8	8	12
Alcohol use disorders	15	16	17	17	16	18	9	6	9	10	16	20	10	9	35	17	14	13	11	30	33	40
Schizophrenia	16	17	21	13	9	13	16	16	10	14	13	13	16	15	15	19	17	18	16	21	23	19
Road injury	17	19	14	14	27	11	19	15	13	22	22	15	13	19	14	15	13	17	21	24	22	25
Bipolar affective disorder	18	20	19	20	19	19	17	19	14	17	14	16	17	18	16	20	16	20	19	18	25	22
Dysthymia	19	22	20	21	21	20	20	20	16	20	19	19	19	22	19	22	20	23	22	20	31	27
Epilepsy	20	32	33	44	32	25	23	28	31	18	9	21	20	13	20	25	26	24	15	13	17	14
Ischaemic heart disease	21	18	15	18	17	15	22	13	19	21	25	28	18	31	22	27	31	29	34	41	48	37
Eczema	22	24	26	23	25	22	24	24	22	23	17	23	22	20	21	21	22	22	23	17	20	24
Diarrhoeal diseases	23	30	31	31	29	41	27	37	24	25	20	24	25	21	18	23	23	25	25	14	14	15
Alzheimer's disease and other dementias	24	10	10	12	14	17	18	18	26	28	31	40	30	33	41	30	50	69	48	64	67	64
Benign prostatic hyperplasia	25	9	16	16	13	23	25	29	20	31	36	34	42	36	29	36	45	51	47	61	56	57
Tuberculosis	26	38	83	93	102	56	56	34	42	42	56	14	24	27	24	24	18	6	13	22	16	32
Neonatal encephalopathy*	27	62	66	58	55	44	45	45	29	29	30	30	29	30	31	37	24	30	28	15	27	18
Other vision loss	28	27	22	25	26	27	26	27	33	19	24	26	26	23	26	26	34	26	26	34	39	45
Refraction and accommodation disorders	29	74	60	68	75	24	63	21	37	64	51	32	32	41	28	60	21	36	39	35	37	35
Conduct disorder	30	39	42	38	37	38	32	44	30	27	23	31	27	24	25	32	29	27	30	23	30	29
Periodontal disease	31	31	29	26	35	28	21	23	23	24	27	29	28	28	38	46	40	73	45	33	47	50
Cataracts	32	60	46	67	65	30	52	32	49	49	35	25	40	26	33	44	25	52	58	51	66	52
Thalassaemias	33	41	36	37	46	40	47	48	28	38	50	22	33	54	27	68	32	28	42	49	72	51
Dental caries	34	64	59	71	67	29	50	33	25	37	34	33	31	34	32	40	28	34	32	38	38	36
Edentulism	35	28	27	27	28	26	28	22	41	26	33	45	35	29	36	31	37	59	44	55	57	68
HIV/AIDS	36	131	76	89	50	99	62	31	88	61	52	56	76	68	95	34	55	33	1	11	19	16
Cerebrovascular disease	38	14	23	29	18	34	38	26	27	41	53	42	49	64	68	43	61	70	78	94	85	82
Chronic kidney diseases	39	25	25	30	23	33	30	39	38	32	26	37	47	44	46	54	63	66	62	71	74	71
Malaria	41	154	152	146	147	152	158	149	148	101	116	44	158	111	94	93	57	21	74	12	4	4
Iodine deficiency	42	66	45	53	82	37	79	36	59	56	73	51	23	56	23	38	33	31	24	29	15	38
Rheumatoid arthritis	43	23	24	24	24	31	31	35	45	34	40	58	37	38	53	42	58	62	54	63	63	61
Sickle cell disorders	45	51	32	66	22	80	78	100	114	30	29	123	93	81	50	28	52	101	94	44	9	10
Hookworm disease	49	141	163	159	161	162	76	163	32	40	28	27	133	63	89	63	46	5	29	40	34	49
Schistosomiasis	52	163	163	159	161	162	167	163	122	82	152	147	167	169	54	98	171	167	27	7	11	6
Lymphatic filariasis	53	163	163	159	161	162	167	163	171	136	162	62	167	169	128	147	27	63	79	31	58	17
Exposure to forces of nature	62	86	79	77	79	60	65	30	67	76	74	66	59	55	55	1	73	65	68	72	69	66
Food-borne trematodiases	70	69	153	159	161	162	167	137	21	171	170	64	148	25	102	169	163	167	170	154	172	173
Adverse effects of medical treatment	79	63	65	59	53	76	60	41	82	97	86	85	86	83	76	7	91	89	88	93	91	89
Onchocerciasis	97	163	163	159	161	162	167	163	171	171	170	170	167	169	171	169	171	167	170	58	13	43

Figure 6: **Variation in the leading causes of years lived with disability (YLDs), by region, in 2010**
Causes in the figure are ordered according to global ranks for causes. The figure shows all causes that are in the 25 leading causes in at least one region. Ranks are also colour shaded to indicate rank intervals. *Includes birth asphyxia/trauma. An interactive version of this figure is available online at http://healthmetricsandevaluation.org/gbd/visualizations/regional.

results of YLDs for each external cause of injury (see appendix pp 37–270 for more detailed results by age and sex). In terms of external causes, falls and road injuries combined accounted for more than two-thirds (69·8%) of all YLDs due to injuries. YLDs from injuries stem from the nature of the injury rather than the external cause. Figure 7 shows the global breakdown of the nature of injury by age. In terms of the nature of injury that health services should address, 52·3% of YLDs were accounted for by the following: lacerations, multiple wounds, other dislocations, and eye injuries; fractures of the patella, fibula, tibia, or ankle; and moderate-to-severe traumatic brain injury. The number of YLDs from lacerations, multiple wounds, other dislocations, and eye injuries stemmed from the large numbers of people who had this type of injury and the evidence from follow-up studies that some individuals have long-term decreases in functioning. More severe injuries such as spinal cord injury are much less common according to the hospital and non-hospital data for external cause and nature of injury, even though they have more severe long-term consequences for individuals affected. The age pattern shows a slow rise by age of the fraction of the nature of injury due to fractures of the sternum, face, and pelvis. The percentage due to burns decreased with age as did moderate to severe brain trauma. (figure 7).

An important innovation in GBD 2010 was the assessment of selected impairments overall as well as their attribution by cause. The results of the impairment analysis are not easily discernible in table 2 because the burden is distributed across multiple disease or injury sequelae. Anaemia was perhaps the most important of these disorders in terms of its overall contribution to global YLDs. The burden of anaemia overall was large—68·2 million YLDs or almost a tenth (8·8%) of all YLDs worldwide, showing the high prevalence as well as the moderately severe disability weight especially for severe anaemia. By far the most important contributor to this health loss was iron-deficiency anaemia, which accounted for 62·2% of anaemia YLDs globally. However, our assessment of iron-deficiency anaemia was based on the results of iron supplementation trials which by their nature will capture both iron deficiency anaemia due to inadequate dietary intake but also some anaemia due to blood loss that is iron sensitive. The second leading specific cause of anaemia YLDs was thalassaemia (6·7% of total anaemia YLDs) followed by malaria (4·9%). Hookworm and sickle cell anaemia together account for a further 7·2%. Figure 8 shows the YLD rate per 100 000 individuals across regions; YLD rates varied from nearly 2300 in central sub-Saharan Africa to less than 300 in high-income North America. The cause composition of anaemia YLDs also varied across regions. In sub-Saharan Africa, higher anaemia rates were caused mainly by malaria, hookworm, schistosomiasis, sickle cell anaemia, and higher iron-deficiency anaemia. South Asia had the highest rates after sub-Saharan Africa, with the largest contributor being iron-deficiency anaemia. Although in absolute terms not a major cause of global anaemia, chronic kidney diseases accounted for a substantial proportion of anaemia burden in high-income regions.

Left-side and right-side heart failure was another impairment that was included in the GBD cause-sequelae list in many locations. Worldwide, we recorded an estimated 37·7 million cases of prevalent heart failure in 2010, leading to 4·2 million YLDs. This assessment of heart failure includes only symptomatic heart failure and does not include the large number of individuals with pre-symptomatic disease. For those with symptoms, the average disability weight was 0·12, although severity varies widely between individuals. Heart failure was distributed across 17 causes (figure 9). Slightly more than two-thirds (68·7%) of heart failure globally was due to four causes: ischaemic heart disease, COPD, hypertensive heart disease, and rheumatic heart disease. The pattern varied by region: ischaemic heart disease and COPD caused proportionally more YLDs in developed regions, whereas hypertensive heart disease, rheumatic heart disease, and cardiomyopathy and myocarditis made a larger contribution in some developing regions.

Another important cause of global YLDs is blindness and low vision. Overall, visual impairment accounted for 21·1 million YLDs or 2·7% of the global total. Figure 10 shows the main causes of low vision and blindness. The largest global cause of YLDs from vision impairment globally was other vision loss (mainly from trauma, occupational exposures, and idiopathic disorders), which accounted for 29·5% of the total number of vision-loss

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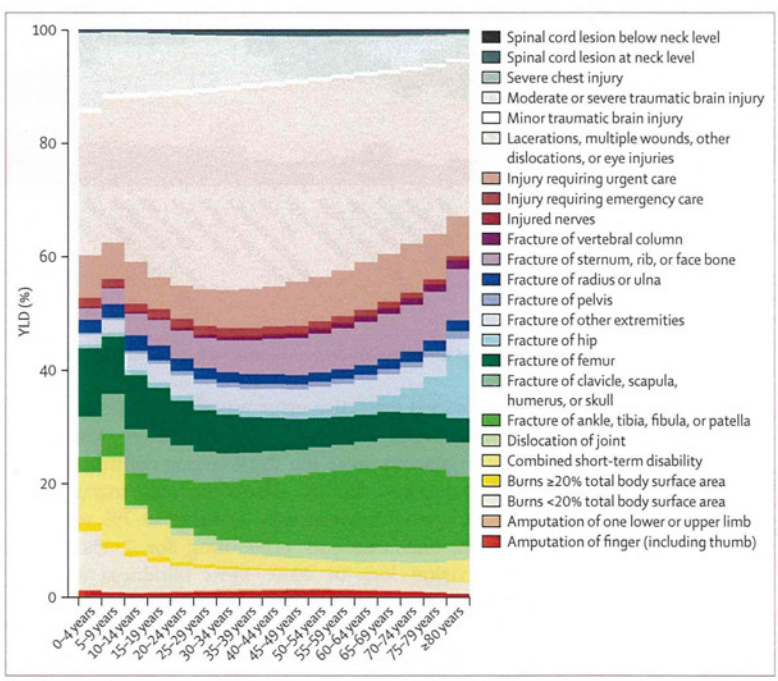

Figure 7: **Global years lived with disability (YLDs) for injury in 2010, by type of injury and age**

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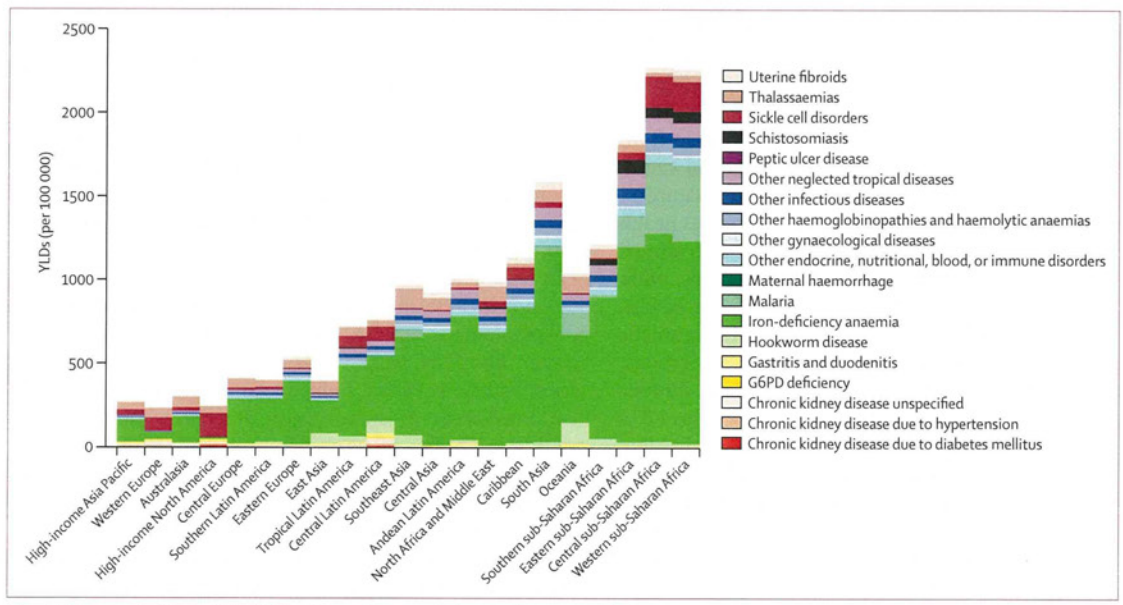

Figure 8: **Years lived with disability (YLD) estimates for anaemia in 2010, by cause and region**

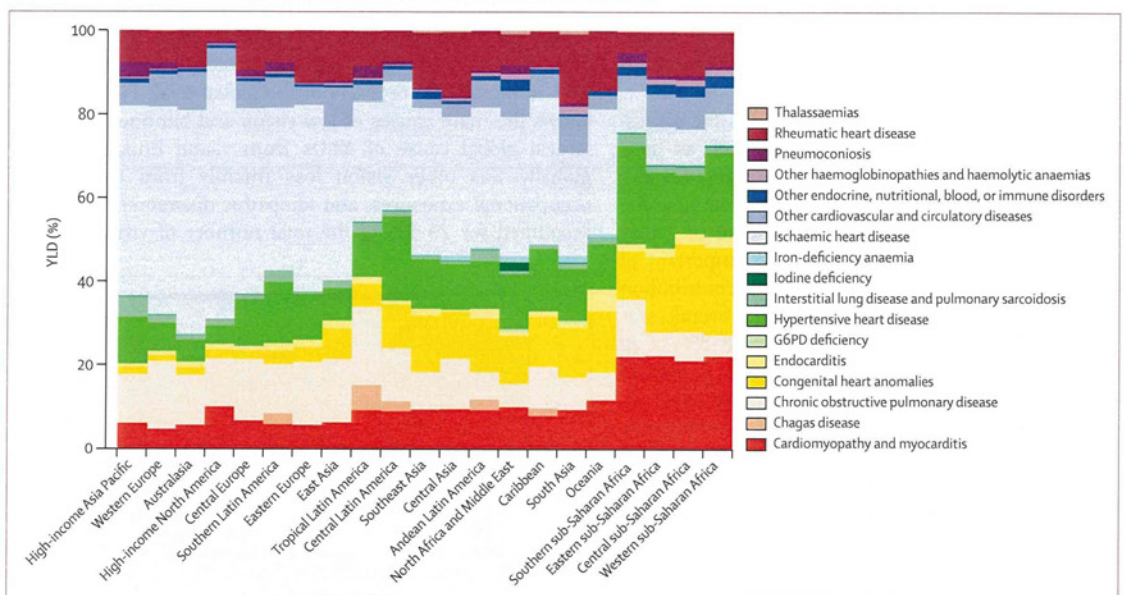

Figure 9: **Years lived with disability (YLD) estimates for heart failure in 2010, by cause and region**

YLDs. Uncorrected refractive error was the second most common cause and accounted for 26·5% of vision impairment. Cataracts were the third largest contributor (22·4% of vision-loss YLDs). Glaucoma and macular degeneration together accounted for a further 10·7%, with trachoma and onchocerciasis accounting for 2·1% of YLDs from vision loss in 2010. Most blindness and low vision YLDs were in individuals aged 45 years or older. We recorded a substantial increase in the absolute number of YLDs from low vision and blindness since 1990, primarily driven by changes in population age structure. The regional pattern shows that in sub-Saharan Africa, uncorrected refractive error, trachoma, onchocerciasis, and vitamin A deficiency play a much greater part than in other regions. As expected in more epidemiologically advanced regions, the composition of causes of blindness and low vision burden was shifted towards macular degeneration, glaucoma, diabetes, and other vision loss.

Hearing impairment accounted for 19·9 million YLDs—2·6% of the total number of YLDs. Adult-onset hearing loss unrelated to a specific disease process accounted for 79·0% of the total YLDs due to hearing

impairment. Other major causes included otitis media, which caused 14·1% of hearing loss YLDs. Smaller causes included congenital hearing loss and meningitis. Of the 19·9 million YLDs due to hearing loss, mild-to-moderate severity accounted for 74·7%, whereas complete hearing loss accounted for only 3·7%. We detected a substantial increase in the number of YLDs due to hearing impairment since 1990, again driven by the ageing of populations.

Intellectual disability and borderline intellectual impairment accounted for 3·1 million YLDs. The prevalence of these disorders were quite low, ranging from 0·5% in high-income Asia Pacific to 2·2% in sub-Saharan Africa and south Asia, with disability weights from 0·003 for mild disorders to 0·149 for profound disorders. Prevalence varied across regions by about two-fold from east sub-Saharan Africa to high-income Asia Pacific. Figure 11 shows YLD rates per 100 000 people across regions by cause. Globally, the main causes of intellectual disability YLDs were idiopathic, Down's syndrome, autism, preterm birth, and other congenital disorders. Some causes, however, were much more important in selected regions, such as meningitis in west and central sub-Saharan Africa and cretinism in south Asia. In terms of YLD rates, the largest variation across regions was from idiopathic causes.

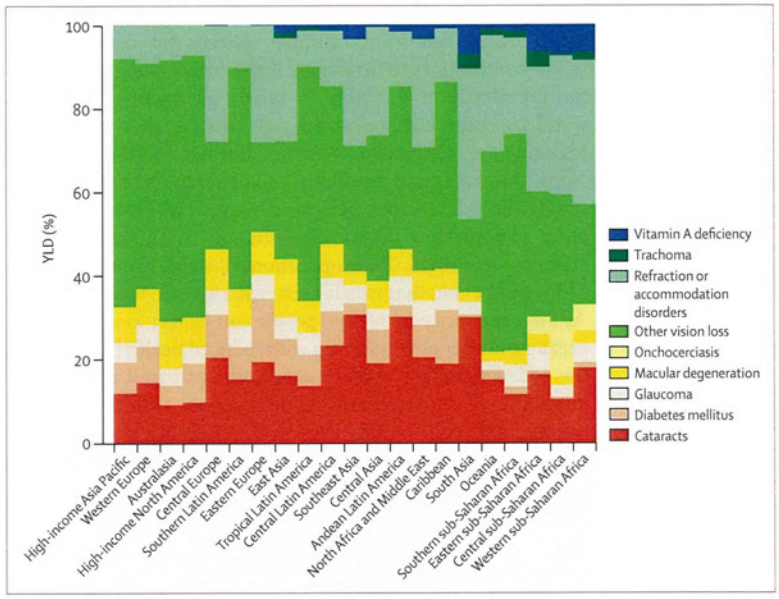

Figure 10: Years lived with disability (YLD) estimates for vision loss in 2010, by cause and region

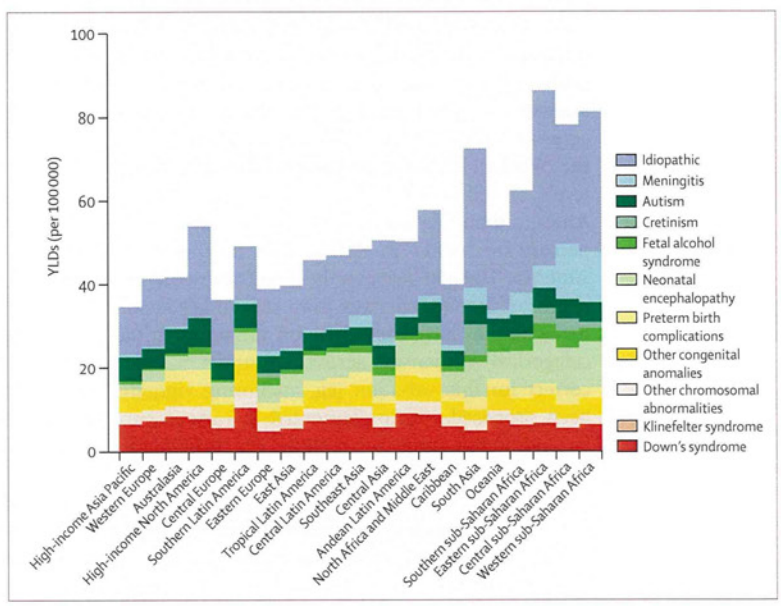

Figure 11: Years lived with disability (YLDs) estimates for intellectual disability in 2010, by cause and region

Discussion

We know of no other complete assessment of the prevalence of sequelae from diseases and injuries and their associated YLDs since GBD 1990. Prevalences of the 1160 sequelae ranged by more than a factor of 100 000 from the least to the most common. Taking into account severity, on average, every person in the world had an 11% reduction in their overall health in 2010 because of diseases and injuries. The prevalence of diseases and injuries and YLDs per person increased steadily with age in all regions. We have identified the main causes that contributed to YLDs as mental and behavioural disorders and musculoskeletal disorders. Neurological disorders, chronic respiratory diseases, some neglected tropical diseases, gynaecological disorders, and long-term disability from injuries were also important causes of YLDs. Compared with causes of mortality and years of life lost because of premature mortality, the main drivers of disability were much more consistent across regions. YLDs from non-communicable diseases ranged from 62·0% (central sub-Saharan Africa) to 92·6% (high-income North America) of the total. However, we detected large regional variation when assessing all disorders; the 25 most common disorders in any region included 49 different disorders globally.

There has been much debate in demographic, epidemiological, and gerontological studies about whether the prevalence of morbidity and disability increases or decreases with the epidemiological transition.[87–93] Fries[88] argued that with mortality reduction the onset of disabling chronic illness could be delayed, leading to individuals spending fewer years with morbidity—this hypothesis is known as the compression of morbidity hypothesis. Alternative views have stressed the effect of medical intervention in extending the lifespan of people with disabling disorders,[92] which is commonly referred to as expansion of morbidity. Manton and colleagues[94] argued using self-reported data that the prevalence of disability in elderly people in the USA was decreasing, providing support for the compression hypothesis. Demographic historians have noted the rise in reported morbidity as mortality decreases,[87,89] which could be indicative of a real rise in disease pathology or a changing perception of the

importance of lesser morbidities. The results reported here, constructed from multiple sources for nearly all major contributors to functional impairment, suggest that the prevalence of disability in nearly all regions of the world has been stable over the past two decades. In four regions (the Caribbean, western Europe, high-income North America, and southern sub-Saharan Africa), age-standardised YLDs per person increased, whereas in all other regions they decreased, although in all cases the changes were small. The implications of stable age-specific YLDs per person that steadily rise with age are important. As life expectancy increases, people can expect to spend a greater number of years living with reduced health because the added years are at older ages with increased rates of disability. If compression is defined as a decreasing number of years of life lived with disability, then our findings are not consistent with this hypothesis. Of course, the evidence for some causes of YLDs over time is scarce, which might mean that we did not identify important secular decreases in disability. However, for the leading causes of YLDs, such as major depressive disorder and most musculoskeletal disorders, much available evidence does not suggest clear trends in age-specific prevalences.

We detected a clear difference between patterns of self-rated health and the YLD rate per person estimated in the GBD 2010, which was constructed from a careful assessment of the evidence for 1160 disabling sequelae across regions. Analysis of the general health question in the World Health Survey,[95] for example, suggests that levels of self-reported health are much lower in North America than they are in Africa. Yet we saw that YLDs per person are higher in Africa than they were in North America. The gap between these self-assessments and the results of the GBD derives from several key factors. First, many studies have been done on variations in the use of categorical responses across cultures;[96–98] attempts to correct for this variation (eg, anchoring vignettes) have been proposed and implemented in various surveys.[99,100] Second, in this study, we assumed the health loss, but not the welfare loss, associated with a sequela would be the same over time or across populations. Responses to general health questions could be confounded by other welfare or wellbeing considerations. In this analysis, however, we saw that self-rated functional health status measured using SF-12 or EQ5D survey instruments in cohort follow-up studies provided useful inputs into the assessment of long-term disability after an event and the distribution of severity within a disorder. Yet the same self-rated health data seem problematic when used to compare overall prevalence of functional impairment across linguistic or cultural groups. Our view of the gap is that substantial research will be needed to enhance the cross-population comparability of self-rated health instruments to the point at which they can be useful inputs for the assessment of the level of YLDs across populations.

The largest contributor to global YLDs were mental and behavioural disorders. In this study, the number of mental and behavioural disorders that we included increased from eight in GBD 1990 to 22 in GBD 2010. The present analysis used a much more extensive database than was used for GBD 1990, using data from multiple sources and survey programmes. Prevalence estimates for these disorders are based largely on self-reported symptoms with standardised screening instruments. In GBD 1990 and 2000, we included three specific anxiety disorders: post-traumatic stress disorder, panic disorder, and obsessive-compulsive disorder. On the basis of the high degree of comorbidity across anxiety disorders, we chose to assess the burden of all anxiety disorders but not to provide estimates for specific forms of anxiety disorders. Despite some claims to the contrary,[101,102] our systematic analysis and meta-regression have not detected notable trends in the age-specific prevalences of these disorders overall; a notable exception is the rise in some regions in drug use disorders. The overall YLDs per person due to mental and behavioural disorders ranged from 2·0% in western sub-Saharan Africa to 3·3% in high-income North America. This narrow variation in the estimated YLD rates contrasts with some published analyses of variations in prevalence; the differences stem from both the data sources used and the methods applied for meta-regression.[103] The findings of large and increasing YLDs due to mental and behavioural disorders draws attention to the urgent need for identification and implementation of effective and affordable strategies for this set of problems.

The second largest contributor to YLDs globally and in nearly all regions were musculoskeletal (MSK) disorders. Osteoarthritis (OA) of the knees and hips combined was the third most prevalent MSK disorder, and, because we did not include OA in other joints or the spine, is an underestimate of OA, although the burden of OA in other joints or the spine was captured under the categories of low back pain, neck pain, and other MSK. Low back pain stands out as the leading MSK disorder because of a combination of similarly high prevalence and a greater disability weight associated with this health state. Low back pain was one of the four most common disorders in all regions, and was the leading cause of YLDs in all developed countries; neck pain was also a major contributor in many regions. Low back and neck pain accounted for 70% of all YLDs from musculoskeletal disorders, and for every YLD due to neck pain there were 2·5 YLDs related to low back pain. The burden as estimated here is substantially higher than previously assessed in the GBD 1990 and GBD 2000 rounds of estimations. We believe the estimates presented here are more accurate because the empirical basis for prevalence generated through the systematic reviews and the analysis of survey data such as the World Health Survey is much stronger than in the past and a greater body of data was available for analysis. The increase in burden is also attributable to the higher disability weights that emerged from the disability weight surveys of the general population. Across all countries surveyed, respondents

consistently recorded high levels of health loss caused by pain. These findings combined with the 33·3% increase in YLDs from 1990 to 2010 driven largely by population growth and ageing have important implications for health systems. Health systems will need to develop effective and affordable strategies to respond to this growing and nearly universal burden.

Intellectual disability (ID) accounted for 3·1 million YLDs, or 0·4% of the global total. This magnitude of ID is small compared with some claims about cognitive impairment in developing countries.[102] There are several explanations for this discrepancy. First, the epidemiological data, especially those from low-income settings, are very scarce and our estimations consequently have large uncertainty intervals. Better data collection for ID would help in future revisions to narrow uncertainty intervals. Second, the disability weights selected by the general public for mild, moderate, severe, and profound intellectual disability ranged from 0·031 to 0·157, which were quite low. Some studies of anaemia and of helminth infections have reported evidence of irreversible cognitive deficits associated with these disorders.[103–109] The reversible component of cognitive deficit associated with anaemia that is related to lethargy is captured in the disability weight for anaemia. The important issue, however, is the irreversible component of ID. In this analysis, this burden is classified as idiopathic intellectual disability. In the allocation of ID to different causes, 1·0 million YLDs were allocated to the idiopathic category in developing countries. If there are irreversible cognitive deficits associated with anaemia and helminth infections that lead to affected individuals being classified as disabled, we would capture this health loss in our estimates of intellectual disability. In sub-Saharan Africa and south Asia, the residual category of intellectual disability is larger than in other regions, which might be an indication of the effect of these other disorders. Nevertheless, the number of YLDs from idiopathic intellectual disability is not large enough to substantially change the ranks of the parasitic diseases or nutritional deficiencies presented here. Also, only IQs below 85 are assigned a disability weight so that if parasitic infections or nutritional deficiencies lowered IQ by two or three points in individuals but did not lower them below the threshold of 85, this effect would not be represented here. The disability weight, even for borderline ID (IQs of 70–84), is very small, suggesting that the general public does not consider small IQ reductions as a health loss; although such changes might have important effects on the general welfare of populations.

Hearing impairments accounted for less than 3% of all YLDs, which was a smaller contribution than that estimated in the GBD 2004 revision (4·5%).[8] The main reason for this lower estimate is that disability weights for severe hearing loss are substantially lower in the current study than in the GBD 1990. As discussed by Salomon and colleagues,[30] the main basis for estimation of disability weights comes from population-based surveys in which respondents make a series of paired comparisons between health states presented as brief lay descriptions. For hearing loss, the lay descriptions focused on the hearing impairment itself, excluding other possible outcomes that might accompany severe levels of hearing loss—eg, depression or learning disabilities. So far as these outcomes are part of the construct being measured in the Global Burden of Disease, their exclusion from the descriptions for hearing outcomes would be expected to lower the overall burden estimated for these causes. Furthermore, findings from some studies suggest that hearing loss can itself be a contributor to depression and other outcomes.[110–112] To the extent that these relations are causal, the YLDs estimated in the present study for hearing loss do not capture these relations. These issues might also apply to the YLDs estimated for blindness or low vision.

A study of this magnitude with so many outcomes estimated for many different age-sex-country-years inevitably has many limitations. In view of the GBD philosophy that it is better to make estimates based on the best available evidence than not to make estimates, some YLD figures are based on a restricted database. The uncertainty intervals are meant to convey the strength of the evidence. Nevertheless, there are likely sources of uncertainty that have not been captured. In the GBD 2010 causes of death analysis,[68] we used out-of-sample predictive validity to more objectively quantify the validity of uncertainty intervals. We have not been able to apply this approach to the Bayesian meta-regression step in the YLD analysis for two reasons. First, the meta-regression step with DisMod-MR needed too much computing time to allow for repeated out-of-sample predictive validity testing. Future improvements in computational efficiency might allow such analysis, but at present it is not feasible. Second, data for many disorders are more scarce than they are for causes of death. Out-of-sample predictive validity testing is not very stable when data are very scarce. Another important limitation of the study is the disease and sequelae list itself. Although we included 1160 sequelae, there are many smaller sequelae of diseases and less common diseases that are only captured in the residual categories in the cause list. The estimates for these residual categories are, by their nature, very approximate. Compared with GBD 2000, the percentage of YLDs estimated in these residual categories has decreased from 9·0% to less than 2·0%. Future iterations of the GBD could add more disorders and reduce the uncertainty that stems from the residual categories.

Other limitations of this study include the restricted evidence-base for some disorders for crosswalking (adjusting data inputs based on less desirable study characteristics to the expected level of data inputs from optimally conducted studies) different case definitions or item recall periods such as 12-month versus 1-month recall. These crosswalks are estimated on the basis of a comparison of datapoints identified as having the desirable case definition, recall period, or other study