WHO methods and data sources for global burden of disease estimates 2000-2011

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Estimates and analysis are available at:
http://www.who.int/gho/mortality_burden_disease/en/index.html

For further information about the estimates and methods, please contact healthstat@who.int

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1 Introduction

1.1 Background

A consistent and comparative description of the burden of diseases and injuries, and the risk factors that cause them, is an important input to health decision-making and planning processes. Information that is available on mortality and health in populations in all regions of the world is fragmentary and sometimes inconsistent. Thus, a framework for integrating, validating, analyzing and disseminating such information is useful to assess the comparative importance of diseases and injuries in causing premature death, loss of health, and disability in different populations.

The World Bank commissioned the first Global Burden of Disease (GBD) study for its World Development Report 1993 (World Bank, 1993) and the study was carried out in a collaboration between the Harvard School of Public Health and the World Health Organization. This first GBD study quantified the health effects of more than 100 diseases and injuries for eight regions of the world in 1990 (Murray & Lopez, 1996). It generated comprehensive and internally consistent estimates of mortality and morbidity by age, sex and region. The study also introduced a new metric – the disability-adjusted life year (DALY) – as a single measure to quantify the burden of diseases, injuries and risk factors (Murray, 1996). The DALY is based on years of life lost from premature death and years of life lived in less than full health; it is described in more detail in Section 2.

Drawing on extensive databases and information provided by Member States, WHO produced annually updated GBD estimates for years 2000 to 2002. These were published in the WHO's annual *World Health Reports,* followed by two stand-alone reports for the year 2004 *(WHO, 2008; WHO, 2009a)*. The new estimates reflected an overhaul of methods for mortality estimation in the setting of sparse data, improved approaches for dealing with problems in cause of death certification, new cause of death modelling strategies, and use of improved tools for ensuring internal consistency of mortality and epidemiological estimates (Mathers, Lopez & Murray, 2006; WHO, 2008). The GBD results for the year 2001 also provided a framework for cost-effectiveness and priority setting analyses carried out for the Disease Control Priorities Project (DCPP), a joint project of the World Bank, WHO, and the National Institutes of Health, funded by the Bill & Melinda Gates Foundation (Jamison et al, 2006a). The GBD results were documented in detail, with information on data sources and methods, and analyses of uncertainty and sensitivity, in a book published as part of the DCPP (Lopez et al, 2006). The GBD cause list was expanded to 136 causes (giving a total of 160 cause categories, including group totals). The WHO GBD updates incrementally revised and updated estimates of incidence, prevalence and years of healthy life lost due to disability (YLDs) for non-fatal health outcomes. By the time of the GBD 2004 study, 97 of the 136 causes had been updated, including all causes of public health importance or with significant YLD contribution to DALYs.

In 2007, the Bill & Melinda Gates Foundation provided funding for a new GBD 2010 study, led by the Institute for Health Metrics and Evaluation at the University of Washington, with key collaborating institutions including WHO, Harvard University, Johns Hopkins University, and the University of Queensland. This study also drew on wider epidemiological expertise through a network of about 40 expert working groups, comprising hundreds of disease and injury subject-matter experts including many working in WHO programs. The GBD 2010 study developed new methods for assessing causes of death and for synthesizing epidemiological data to produce estimates of incidence and prevalence of conditions for 21 regions of the world.

The results were published in a series of papers in the Lancet in December 2012 (Murray et al, 2012a; Murray et al, 2012b; Murray et al, 2012d; Lozano et al, 2012; Vos et al, 2012a; Salomon et al, 2012a; Salomon et al, 2012c) and welcomed by the WHO as representing an unprecedented effort to improve

global and regional estimates of levels and trends in the burden of disease. In many areas, the GBD 2010 results presented in the Lancet papers were similar to WHO's recently published estimates. In others, however, the GBD 2010 study came to conclusions that differed substantially from the analysis by WHO and UN interagency groups. Pending the availability of more detailed information on the data and methods used in these areas, and the opportunity to review and assess the reasons for differences, the WHO did not endorse the GBD results.

To meet WHO's need for comprehensive global health statistics, which brings together WHO and interagency estimates for all-cause mortality and priority diseases and injuries, as well as drawing on the work of academic collaborators, including IHME, updated Global Health Estimates (GHE) for mortality, causes of death, and disease burden, are being progressively released. This commenced with the release in mid-2013 of updated regional-level estimates of deaths by cause, age and sex for years 2000-2011 (WHO, 2013).

To meet the need for DALY estimates consistent with the GHE for cause-specific mortality, WHO has now released regional-level estimates of DALYs by cause, age and sex for years 2000 and 2011 at http://www.who.int/healthinfo/global_health_estimates/en/.

This technical paper documents the data sources and methods used for preparation of these regional-level burden of disease estimates for years 2000-2011.

1.2 Analysis categories

Annex Table A lists the cause categories and their definitions in terms of the International Classification of Diseases, Tenth Revision (ICD-10). The cause categories are grouped into three broad cause groups: Group I (communicable, maternal, perinatal and nutritional conditions), Group II (noncommunicable diseases); and Group III (injuries). The cause list has a hierarchical structure so that different levels of aggregation are included. At each cause level, the list provides a set of mutually exclusive and collectively exhaustive categories.

These estimates are available for years 2000 and 2011 for selected regional groupings of countries, at http://www.who.int/healthinfo/global_health_estimates/en/. Estimates are disaggregated by sex and age for the following age groups: neonatal (<28 days), 1-59 months, 5-14, 15-29, 30-49, 50-69, 70 years and older.

1.3 What is new in this update for years 2000-2011

These WHO GHE provide a comprehensive and comparable set of DALY estimates from year 2000 onwards, consistent with and incorporating UN agency, interagency and WHO estimates for population, births, all-cause deaths and specific causes of death, as well as GBD 2010 analyses for YLDs, with some revisions and methodological differences as summarized below:

- A simpler form of DALY, used by the GBD 2010 study (Murray et al, 2012b), has been adopted. This form is easier to explain and use (see Section 2). Age-weighting and time discounting are dropped, and the YLDs are calculated from prevalence estimates rather than incidence estimates. YLDs are also adjusted for independent comorbidity.
- The standard life table used for calculation of years of life lost for a death at a given age is based on the projected frontier life expectancy for 2050, with a life expectancy at birth of 92 years (see Section 2.2)
- The years of life lost from mortality (YLLs) are calculated using recently revised WHO estimates of deaths by region, cause, age and sex for years 2000-2011 (WHO, 2013a; WHO, 2013b).

- These make use of latest death registration data reported to WHO (WHO, 2013b) and incorporate assessments of levels and trends for specific causes of death by WHO programs and UN interagency groups. These include:
    - Neonatal, infant and child mortality rates – UN-IGME
    - Older child and adult mortality rates –WHO, UN Population Division and UNAIDS
    - Tuberculosis –WHO
    - HIV – UNAIDS and WHO
    - Malaria – WHO
    - Vaccine-preventable child causes – WHO
    - Other major child causes – WHO and CHERG
    - Maternal mortality –MMEIG
    - Cancers – IARC
    - Road traffic accidents – WHO
    - Conflict and natural disasters – WHO and the Collaborating Center for Research on the Epidemiology of Disasters (CRED)
- Estimates of YLD draw on the GBD 2010 analyses (Vos et al, 2012a), with selected revisions to disability weights and prevalence estimates as noted below.
- Limited revisions have been made to disability weights for infertility, intellectual disability, vision loss, hearing loss, dementia, drug use disorders and low back pain. These revisions have been carried out in a way that preserves consistency with the other GBD 2010 disability weights both in terms of the construct being valued (loss of health) and in terms of the decrements associated with functioning in different domains of health (Section 3).
- WHO estimates of vision and hearing loss prevalence by country and their cause distributions have been used to calculate YLDs for vision and hearing loss sequelae.
- The GBD 2010 did not include problem use as a sequela for alcohol use disorders as was done in the GBD 2004. YLDs for problem use of alcohol have been estimated and added to the YLDs for alcohol dependence.
- Revised severity distributions have been taken into account in estimating YLDs for migraine, back/neck pain and skin disorders. Acne and alopecia areata have been excluded from GHE estimates pending availability of further information on GBD 2010 data and methods.

Because these estimates draw on new data and on the results of the GBD 2010 study, and there have been substantial revisions to methods for many causes, these estimates for the years 2000-2011 are not directly comparable with previous WHO estimates of DALYs for year 2004 and earlier years. Section 5 of this paper summarizes the differences between the GHE estimates and the previous GBD 2004 estimates. These are provisional estimates and will be further revised in the process of extending the series to 2012 for release at country level. WHO and collaborators will continue to include new data and improve methods, and it is anticipated that some causes will be further updated in the next revision.

2 The disability-adjusted life year

The DALY is a summary measure which combines time lost through premature death and time lived in states of less than optimal health, loosely referred to as "disability". The DALY is a generalization of the well-known Potential Years of Life Lost measure (PYLLs) to include lost good health. One DALY can be thought of as one lost year of 'healthy' life and the measured disease burden is the gap between a population's health status and that of a normative reference population. DALYs for a specific cause are calculated as the sum of the YLLs from that cause and the YLDs for people living in states of less than good health resulting from the specific cause:

$$DALY(c,s,a,t) = YLL(c,s,a,t) + YLD(c,s,a,t)$$ for given cause c, age a, sex s and year t

The YLLs for a cause are essentially calculated as the number of cause-specific deaths multiplied by a loss function specifying the years lost for deaths as a function of the age at which death occurs. The basic formula for YLLs is the following for a given cause *c*, age *a*, sex *s* and year *t*:

$$YLL(c,s,a,t) = N(c,s,a,t) \times L(s,a)$$

where:

$N(c,s,a,t)$ is the number of deaths due to the cause *c* for the given age *a* and sex *s* in year *t*

$L(s,a)$ is a standard loss function specifying years of life lost for a death at age *a* for sex *s*

The GBD 1990 study chose not to use an arbitrary age cut-off such as 70 years for the loss function used in the calculation of YLLs, but rather specified the loss function in terms of the life expectancies at various ages in standard life tables with life expectancy at birth fixed at 82.5 years for females and 80.0 years for males. These represented approximately the highest observed life expectancies for females in the mid-1990s, together with an assumed biologically-determined minimum male-female difference.

The GBD 1990 and subsequent WHO updates used an incidence perspective for the calculation of YLDs. To estimate YLDs for a particular cause in a particular time period, the number of incident cases in that period is multiplied by the average duration of the disease and a weight factor that reflects the severity of the disease on a scale from 0 (perfect health) to 1 (dead):

$$YLD(c,s,a,t) = I(c,s,a,t) \times DW(c,s,a) \times L(c,s,a,t)$$

where:

$I(c,s,a,t)$ = number of incident cases for cause *c*, age *a* and sex *s*

$DW(c,s,a)$ = disability weight for cause *c*, age *a* and sex *s*

$L(c,s,a,t)$ = average duration of the case until remission or death (years)

The 'valuation' of time lived in non-fatal health states formalises and quantifies the loss of health for different states of health as *disability weights*.

In the standard DALYs reported by the original GBD study and in subsequent WHO updates, calculations of YLDs and YLLs used an additional 3% time discounting and non-uniform age weights that give less weight to years lost at young and older ages (Murray, 1996). Using discounting and age weights, a death in infancy corresponds to 33 DALYs, and deaths at ages 5–20 years to around 36 DALYs.

2.1 Simplified DALY

Following the publication of the GBD 1990, there has been extensive debate on all the key value choices incorporated into the DALY – the years lost on death, the disability weights, age weights and time discounting (Anand & Hanson, 1997; Williams, 1999; Murray et al, 2002; Lyttkens, 2003; Arnesen & Kapiriri, 2004; Bognar, 2008). Additionally, the incidence-based perspective required substantial modelling of incidence and average durations for many diseases where the available data mainly related to prevalence. The GBD 2010 study held a consultation in July 2011 with 21 philosophers, ethicists, and economists to advise on the value choices that should be incorporated into the DALY summary measure used for the GBD 2010. An earlier expert consultation in 2008 addressed the conceptual, ethical and measurement issues in undertaking a comprehensive revision of disability weights (Salomon, 2008).

Following these consultations, the GBD 2010 study chose to simplify the calculation of DALYs (Murray et al, 2012b; Murray et al, 2012c) as follows:

- Use of a new normative standard life table for the loss function used to compute YLLs;
- Calculation of YLDs simply as the prevalence of each sequela multiplied by the relevant disability weight
- Adjustment for comorbidity in the calculation of YLDs
- No discounting for time or unequal age weights

Following informal consultations with relevant WHO programs, collaborators and expert advisory groups in late 2012, WHO decided to adopt the simplified calculation methods for DALYs as described in more detail in the following sections, albeit with an updated loss function for the computation of YLLs.

2.2 Standard expected years of life lost for calculation of YLLs

The standard reference life table for the GBD 1990 was based on the highest observed life expectancy at the time, Japanese females with a life expectancy at birth close to 82.5 years. Based on the observed male-female gap in life expectancy in the best-off communities within high-income countries, the standard reference life expectancy was set to 80·0 years at birth for males. The standard reference life table is intended to represent the potential maximum life span of an individual in good health at a given age. For the GBD 2010 study, it was decided to use the same reference standard for males and females and to use a life table based on the lowest observed death rate for each age group in countries of more than 5 million in population. The new GBD 2010 reference life table has a life expectancy at birth of 86·0 years for males and females.

However, some of the experts consulted by WHO argued that it was not appropriate to set the normative loss of years of life in terms of currently observed death rates, since even for the lowest observed death rates there are a proportion of deaths which are preventable or avertable. In fact, Japanese females have already exceeded the GBD 2010 reference life expectancy at birth, with a life expectancy at birth in 2013 of 87.1 years. Since the loss function is intended to represent the maximum life span of an individual in good health, who is not exposed to avoidable health risks, or severe injuries, and receives appropriate health services, we chose to base this on the frontier national life expectancy projected for the year 2050 by the World Population Prospects 2012 (UN Population Division, 2013).

The highest projected life expectancies for the year 2050 are projected to be achieved by women in Japan and the Republic of Korea, with a life expectancy at birth of 91.9 years. While this may still not represent the ultimate achievable human life spans, it does represent a set of life spans which are thought likely to be achieved by a substantial number of people who are alive today. Table 2.1

summarizes the loss function used for the calculation of YLLs in the WHO GHE. Annex Table B tabulates the full loss function by single years of age.

Figure 2.1 compares the age distribution of global YLLs in the year 2011 calculated using the various loss functions in Table 2.1. Loss functions corresponding to longer life expectancies result in an increased share of YLLs by older ages. Age-weighting and time discounting used in the GBD 1990 gives less weight to younger and older ages, and more weight to young adults.

Table 2.1 Standard loss functions used in Global Burden of Disease studies and for WHO Global Health Estimates

	GBD 1990 age-weighted, discounted		GBD 1990 no age-weights or discounting		GBD 2010	WHO GHE
Age range	Male	Female	Male	Female	Persons	Persons
Neonatal	33.27	33.38	79.94	82.43	86.01	91.93
Postneonatal	34.22	34.34	78.85	81.36	85.68	91.55
1-4	35.17	35.29	77.77	80.28	83.63	89.41
5-9	37.22	37.36	72.89	75.47	78.76	84.52
10-14	37.31	37.47	67.91	70.51	73.79	79.53
15-19	36.02	36.22	62.93	65.55	68.83	74.54
20-24	33.84	34.08	57.95	60.63	63.88	69.57
25-29	31.11	31.39	52.99	55.72	58.94	64.60
30-34	28.08	28.40	48.04	50.83	54.00	59.63
35-39	24.91	25.30	43.10	45.96	49.09	54.67
40-44	21.74	22.19	38.20	41.13	44.23	49.73
45-49	18.63	19.16	33.38	36.36	39.43	44.81
50-54	15.65	16.26	28.66	31.68	34.72	39.92
55-59	12.82	13.52	24.07	27.10	30.10	35.07
60-64	10.19	10.96	19.65	22.64	25.55	30.25
65-69	7.80	8.60	15.54	18.32	21.12	25.49
70-74	5.71	6.45	11.87	14.24	16.78	20.77
75-79	4.00	4.59	8.81	10.59	12.85	16.43
80-84	2.68	3.09	6.34	7.56	9.34	12.51
85+	1.37	1.23	3.82	3.59	5.05	7.60

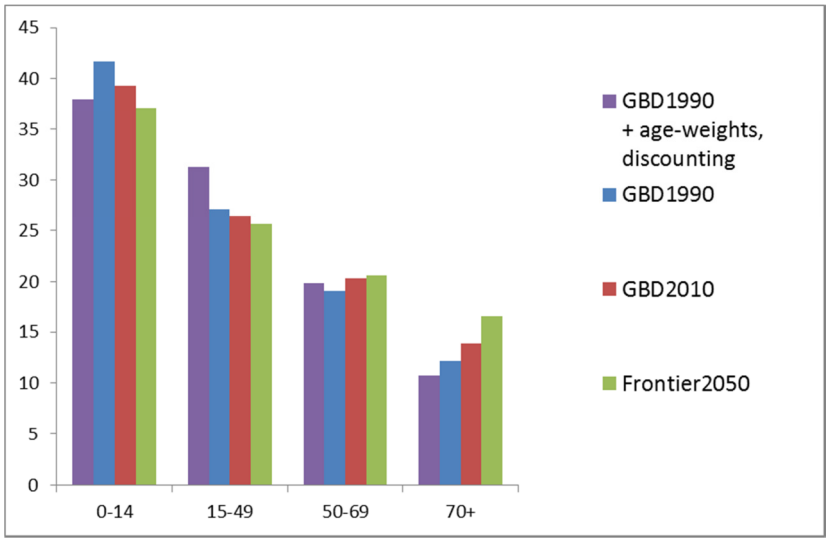

Figure 2.1 Age distribution of global YLLs for the year 2011 using various loss functions

Table 2.2 compares distributions of global YLLs by sex, major cause groups, country income groups and age. The WHO GHE standard gives 2 additional percentage points to noncommunicable diseases, reflecting the somewhat greater relative emphasis this standard gives to deaths at older ages. The sex distribution is largely unchanged, but the WHO GHE standard gives a slightly greater share of global YLLs to both high income and low income countries compared to the GBD 2010 standard.

Table 2.2 Distribution of global YLLs for the year 2011 by major cause group, sex, income group, and age

	YLL standard used			
	GBD 1990 (age weights & discounting)	GBD 1990 (no age weights or discounting)	GBD 2010	WHO GHE
Total YLLs (millions)	765	1567	1775	2016
By cause (%)				
Communicable, maternal, neonatal and nutritional	43	45	43	41
Noncommunicable diseases	43	42	44	46
Injuries	14	13	13	12
By sex (%)				
Male	55	54	56	56
Female	45	46	44	44
By income group (%)				
High income	7	8	8	9
Upper middle income	23	23	22	22
Lower middle income	45	46	45	44
Low income	24	24	24	25
By age (%)				
0-14	38	42	39	37
15-49	31	27	26	26
50-69	20	19	20	21
70+	11	12	14	16

2.3 Age weighting and time discounting

The original GBD 1990 study and subsequent WHO updates published DALYs computed with a 3% discount rate for future lost years of healthy life and an alternative set with a 0% discount rate. The arguments for discounting future health were couched mainly in terms of avoiding various decision-making paradoxes when future costs of health interventions are discounted (Murray & Acharya, 2002). Critics have argued that there is no intrinsic reason to value a year of health as less important simply because it is in the future (Tsuchiya, 2002) and the experts consulted for the GBD 2010 study also advised against discounting, particularly in the context where the DALY has been more explicitly defined as quantifying loss of health, rather than the social value of loss of health. This also avoids the inconsistency in the original DALY method, where the start time for discounting future stream of YLDs was the year of incidence, whereas the start time for discounting YLLs was the year of death rather than the year of incidence.

The original GBD 1990 study and subsequent WHO updates also incorporated age-weighting in the standard DALYs used in most publications and analyses. The standard age weights gave less weight to years of healthy life lost at young ages and older ages (Murray, 1996). With the clearer conceptualization of DALYs as purely a measure of population health loss rather than broader aspects of social welfare, it is difficult to justify the inclusion of age weights, and the GBD 2010 study dropped them (Murray et al, 2012b; Jamison et al, 2006b) has argued for an alternate form of age-weighting, for

incorporating stillbirths and deaths around the time of birth into the DALY. This modifies the loss function for years of life lost for a death at a given age (or gestational age) to reflect "acquired life potential", by which the fetus or infant only gradually acquires the full life potential reflected in the standard loss function. Murray et al (2012c) have argued that such considerations should be reflected in social priorities rather than in the basic health measure itself.

Following informal consultations in 2012, WHO decided to adopt the same approach as GBD 2010 in computing DALYs with a time discount rate of 0% and no age-weighting. This change results in a substantial increase in the absolute number of DALYs lost (Table 2.3) and a relative increase in the share of DALYs at younger and older ages (Table 2.2 and Figure 2.1).

Table 2.3 Distribution of global DALYs for the year 2004 with and without age weighting and discounting.*

	YLL standard used			
	GBD 1990 (age weights & discounting)	GBD 1990 (no age weights or discounting)	GBD 2010 (no age weights or discounting)	WHO GHE (no age weights or discounting)
Total YLLs (millions)	765	1567	1775	2016
Total YLDs (millions)				
Total DALYs (millions)				
By age (%)				
0-14	38	42	39	37
15-49	31	27	26	26
50-69	20	19	20	21
70+	11	12	14	16

* illustrated using WHO estimates of DALYs for year 2004 (WHO 2008).

2.4 Prevalence versus incidence YLDs

DALYs were calculated in the GBD 1990 and subsequent WHO updates using an incidence perspective for YLDs. Incident YLDs were computed as the stream of future health loss associated with disease sequelae incident in the reference year. This was done to ensure consistency with the YLL calculation, which takes an inherently incidence perspective, although prevalence-based YLDs were also calculated for other purposes, such as the calculation of period healthy life expectancy.

The incidence-based YLD approach has three major disadvantages. First, it will not reflect the current prevalent burden of disabling sequelae for a condition for which incidence has been substantially reduced. Secondly, the YLD calculation requires estimates of both incidence and average duration of disease sequelae, whereas for many health conditions it is primarily prevalence data that are collected. Third, in an incidence perspective, all YLDs for a condition are assigned to the age-groups at which the condition is incident, whereas the policy-maker is often more interested in the ages at which the loss of health is experienced. Finally, incorporation of comorbidity is more straightforward in a prevalence approach than an incidence approach.

Given these advantages of a prevalence approach, both the GBD 2010 and WHO have decided to switch to a prevalence-based approach to calculation of YLDs. The major impact of this is to shift the age distribution of YLDs significantly (Figure 2.2). Thus for example YLDs for congenital hearing loss will be spread relatively evenly across all age groups in the prevalence perspective, whereas they will all fall at age 0 in an incidence perspective.

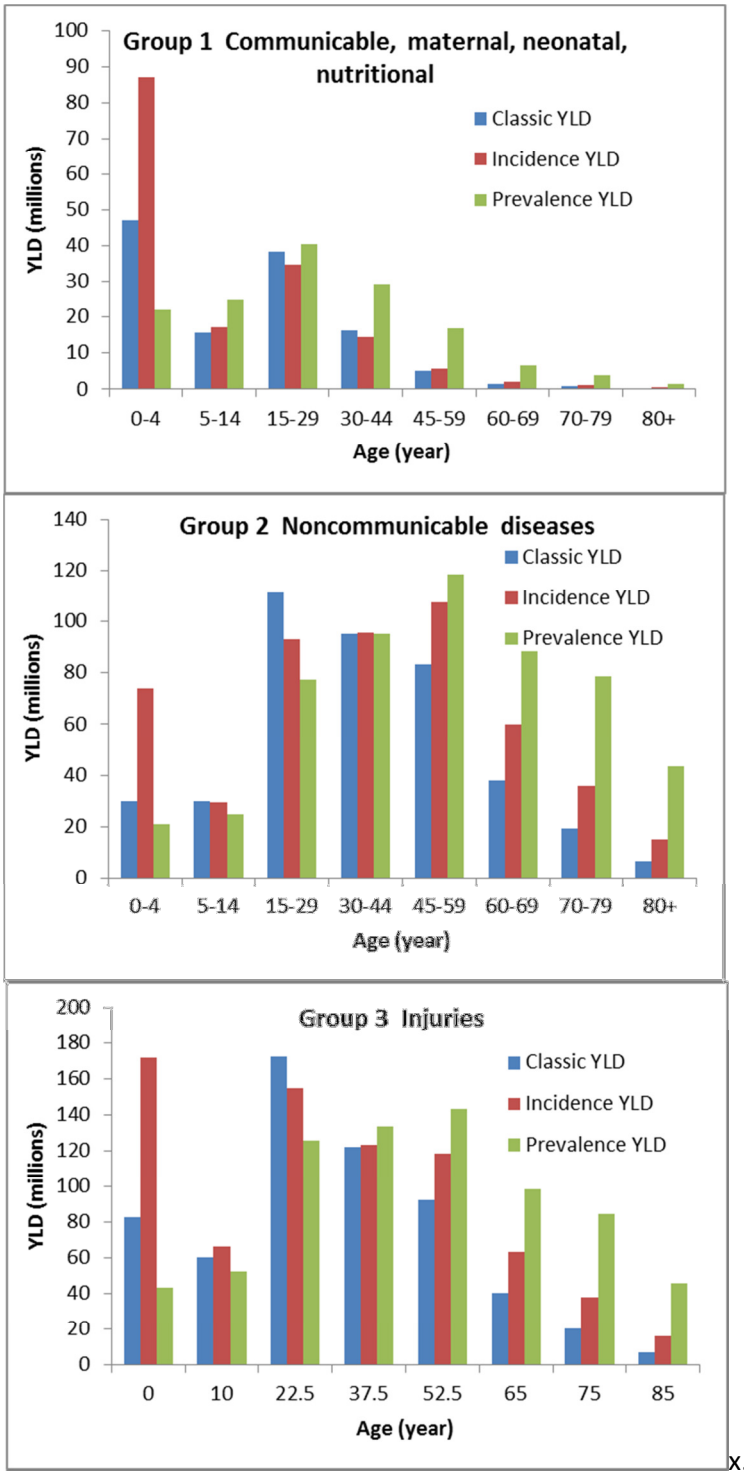

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Figure 2.2 Age distribution of global YLD for the year 2004 (WHO 2008). Classic YLD are incidence-based with age-weighting and 3% time discounting; incidence and prevalence YLD are not age-weighted or discounted.

2.5 Comorbidity adjustment

Earlier versions of the GBD reported YLDs calculated separately for individual disease and injury causes without adjustment for comorbidity. These were added across causes to obtain total all-cause YLDs. Some limited adjustments for comorbidity were incorporated into subsequent WHO updates. For example, prevalence estimates for depression, substance use disorders and anxiety disorders were adjusted to take into account quite substantial levels of comorbidity between these conditions, so that double or triple counting did not occur for DALYs for these individuals. More comprehensive adjustments for comorbidity across all conditions was required for the calculation of healthy life expectancy. The first WHO estimates for HALE adjusted for YLD comorbidity assuming independence of conditions (the probability of having two comorbid conditions is the product of the individual probabilities of the two conditions). Later, a method for taking dependent comorbidity into account was applied (Mathers, Iburg & Begg, 2006).

Because many people have more than one disease or injury, particularly at older ages, addition of YLDs across causes may result in overestimation of the total loss of health. This is particularly important at the oldest ages, where summed YLDs may approach or exceed 100% of person-years. Following expert consultations, the GBD 2010 study implemented adjustments for independent comorbidity so that summed YLDs across causes reflect the sum of the overall lost health at the individual. Individuals with the same functional health loss are then treated as like regardless of whether that functional health loss came from one or several contributing conditions.

The GBD 2010 study estimated comorbidities using the assumption of independence within age-sex groups:

$$p_{1+2} = p_1 + p_2 - p_1 \times p_2 = 1 - (1 - p_1) \times (1 - p_2) \qquad (1)$$

where p_{1+2} is the prevalence of the two comorbid diseases 1 and 2, p_1 is the prevalence of disease 1 and p_2 the prevalence of disease 2.

It tested this assumption using UW Medical Expenditure Panel Survey data and concluded that the error in magnitude of YLDs from using the independence assumption was minimal. The combined disability weight for individuals with multiple conditions is estimated assuming a multiplicative model as follows:

$$DW_{1+2} = 1 - (1 - DW_1) \times (1 - DW_2)$$

Since prevalence YLDs are calculated for each individual cause as:

$$YLD_i = DW_i \times p_i \qquad (2)$$

the two preceding equations can be combined into a single calculation resulting in:

$$YLD_{1+2} = 1 - (1\text{-}YLD_1) \times (1 - YLD_2) \qquad (3)$$

Using the GBD 2004 estimates for non-age-weighted, undiscounted YLDs as an example, adjustment for independent comorbidity reduces global all-age YLDs by 6% and YLDs for ages 60 and over by 11%.

3 Disability weights for calculation of YLDs

3.1 Evolution of methods for estimation of disability weights

In order to use time as a common currency for non-fatal health states and for years of life lost due to mortality, we must define, measure and numerically value time lived in non-fatal health states. While death is not difficult to define, non-fatal health states are. They involve multiple domains of health which relate to different functions, capacities or aspects of living. In the GBD studies, the numerical valuation of time lived in non-fatal health states is through the so-called disability weights, which quantify loss of functioning on a scale where 1 represents perfect health and 0 represents a state equivalent to death. Depending on how these weights are derived and what they are attempting to quantify, they are variously referred to as disability weights, quality-adjusted life year (QALY) weights, health state valuations, utilities or health state preferences.

In the earliest version of the GBD 1990 study, the burden of disease was defined as loss of welfare/subjective well-being/quality of life (World Bank, 1993). Murray (1996) subsequently argued that the health state values should reflect societal judgements of the value of averting different diseases rather than individual judgments of the disutility of the diseases. As a result, the 1996 version of the GBD 1990 used two forms of the person-trade-off (PTO) method to assess social preferences for health states and asked small groups of health professionals in weighting exercises to make a composite judgment on the severity distribution of the condition and the social preference for time spent in each severity level (Murray, 1996). This was to a large extent necessitated by the lack of population information on the severity distribution of most conditions at the global and regional level. Dutch researchers subsequently used the same methods to estimate disability weights for the Netherlands (Stouthard et al, 1997; Stouthard, Essink-Bot & Bonsel, 2000). The version of PTO used by the GBD study was criticized as unethical by a number of commentators (Arnesen & Nord, 1999) and rejected for the same reason by project participants in a European multi-country study following on from the Dutch study (Schwarzinger et al, 2003). Other criticism of the GBD 1990 approach to valuation of health states related to the use of judgements from health professionals rather than the general population, or those with the conditions, and to the use of universal weights rather than weights that varied with social and cultural environment.

During the period 2000-2008 in which WHO was carrying out updates of the GBD using the original disability weights, with some revisions and additions (Mathers, Lopez & Murray, 2006), the conceptual thinking behind the GBD made explicit the aspiration to quantify loss of health, rather than the social value of the loss of health, or of wellbeing (Murray & Acharya, 2002c; Salomon et al, 2003a). In this conceptualization, health state valuations formalize the intuitive notions that health levels lie on a continuum and that we may characterize an individual as being more or less healthy than another at a particular moment in time. Health state valuations quantify departures from perfect health, i.e., the reductions in health associated with particular health states. Thus in the GBD terminology, the term *disability* is used broadly to refer to departures from optimal health in any of the important domains of health and disability weights should reflect the general population judgments about the 'healthfulness' of defined states, not any judgments of quality of life or the worth of persons or the social undesirability or stigma of health states.

There has also been extensive debate about whether it is in principle possible to make judgements about level of health per se rather than the value of health, the latter involving value judgements about the relative importance of various dimensions of health (Hausman, 2012).

The GBD 2010 study undertook a comprehensive re-estimation of disability weights through a large-scale empirical investigation with a major emphasis on surveying respondents from the general

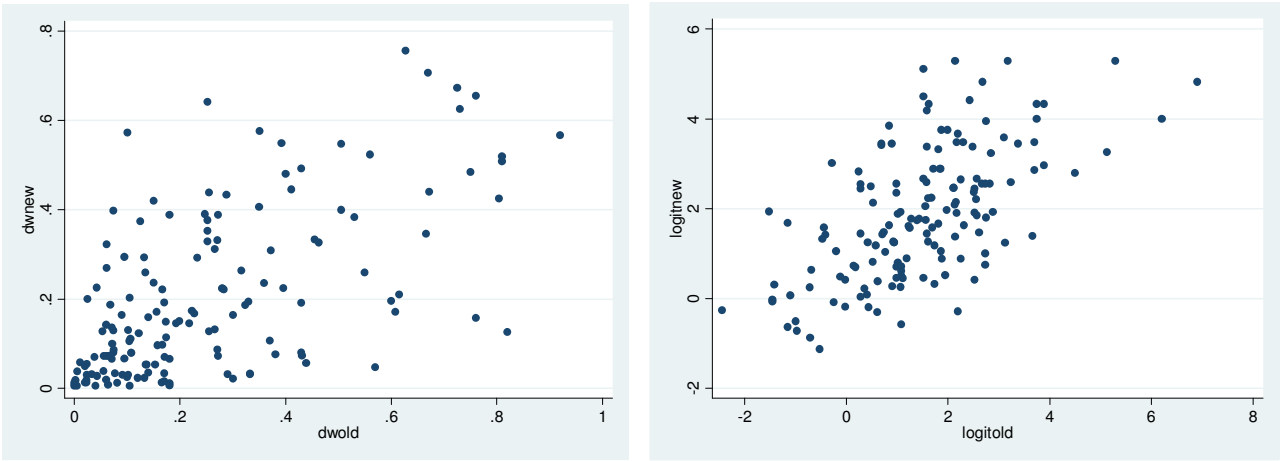
population, in which judgements about health losses associated with many causes of disease and injury were elicited through a new standardized approach. The GBD 2010 study estimated disability weights for 220 health states using a method involving discrete choice comparisons of "health" for pairs of health states described using lay descriptions consisting of a brief summary of the health state of an average or modal case in 30 words or less (see Salomon et al 2012 for details of lay descriptions, survey and statistical methods). Paired comparisons data were collected from 13,902 individuals in household surveys in five countries, supplemented by an open-access web-based survey of 16,328 people. This study represents the most extensive empirical effort to date to measure disability weights. Salomon et al (2012) also concluded that they found strong evidence of highly consistent results across the samples from different cultural environments.

3.2 Comparison of GBD 2010 weights with previous weights

In the GBD 2010 disability weights paper, Salomon et al (2012a). note that the new disability weights are much higher for some health states (such as heroin addiction, acute low back pain) and much lower for a larger number of health states, including infertility (0.01, previously 0.18), moderate to profound hearing loss (0.02-0.03, previously 0.12-0.33), blindness (0.20, previously 0.60) and intellectual disability (for severe intellectual disability 0.126, previously 0.82).

Figure 1 compares the GBD 2010 weights (dwnew) for 152 health states with the previous GBD/Dutch weights (dwold). The mapping of health states for this comparison is given in Annex Table 2. The left-hand figure is a scatterplot of the new weights against the old weights, and it can be seen that there are some health states with very substantial changes in disability weights, in both directions. The right-hand figure compares the weights using a logit transformation. Transformed to logits (logitnew = ln[(1-dwnew)/dwnew] etc, the correlation between logitnew and logitold is r=0.61.

Figure 1. Scatterplot of new GBD 2010 weights against previous GBD/Dutch weights



Soon after publication of the GBD 2010 results, experts from the GBD Vision Loss Expert Group noted the surprisingly low disability weights for severe vision disorders – e.g. 0.19 for blindness (Taylor et al, 2013). They suggested that the cause was inadequate descriptions of the consequences of vision disorders. Nord has argued that the problems are deeper and more general, mostly due to a

fundamental change in what burden of disease is supposed to mean. In the GBD 2010, the understanding of disability weights as measures of losses of 'health' has been fully implemented, with particular emphasis on the point that they are not intended to represent loss of well-being ('welfare'). The survey instrument used by the GBD disability weights study explicitly frames the discrete choice comparisons of sequelae in terms of "who is healthier".

Nord (2013) argues that the focus on 'health' is plausibly a cause of low weights for physical disabilities such as blindness. Even if blindness is highly undesirable, blind people are – in everyday language – not 'sick' or 'ill'. Given this, many respondents may not have thought of blind people as being in poor health. Other states with which this semantic and conceptual point may have led to unreasonably low weights are for example 'deafness' (dw = 0.03), 'amputations of legs and two artificial legs' (0.05) and 'paralysed below the waist, moves about with a wheelchair' (0.05).

For permanent long-term disabilities not necessarily associated with illness or injury, it is possible that respondents were less likely to consider these to represent significant loss of health. In the following section, we use a set of standardized health state descriptions for the GBD 2010 sequelae to examine whether the disability weights for a set of permanent long-term disabilities are substantially lower than would be implied by the functional limitations associated with them, calibrated by the full set of disability weights for all the other health states. This analysis is described in the following sections.

Examination of the GBD 2010 disability weights, and with some additional average weights derived for some sequelae by averaging across severity levels and/or proportion of time symptomatic, will quickly turn up a number of examples of questionable face validity. Some examples are:

- Amputation of both arms with treatment (0.044) less severe than amputation of one arm with treatment (0.13)
- Urinary incontinence (0.142) more severe than "treated" paraplegia (0.047), which usually involves incontinence also
- Complete hearing loss (0.033) of similar severity to mild anxiety disorder (0.030) or mild neck pain (0.040)
- Mild intellectual disability, IQ 50-69 (0.031) of similar severity to viral warts (0.030)
- Severe intellectual disability , IQ 20-34 (0.126) lower in severity than urinary incontinence (0.142)
- Heroin dependence (0.64) more severe than cancer terminal phase (0.51)

Addressing these issues for specific disability weights will largely need to wait for further empirical research as it is likely that an important cause of these inconsistencies relates to the framing and wording of lay descriptions. In some cases, these are apparent in hindsight, in others more subtle effects may require further research.

3.3 Euroqol 5D+ descriptions of health states

Soon after the original GBD study, Stouthard et al (1997, 2000) used the same valuation methods in a Dutch study involving panels of health professionals and lay persons, and included a number of health states not in GBD. Comparative analysis by Mathers, Vos & Stevenson(1999) concluded that the two sets of weights were broadly consistent. Salomon et al (2012b)'s mapping of 126 health states to previous GBD 2004 health has been extended to 152 health states, with some corrections, and addition of some health states from the Dutch study.

Stouthard et al summarized health states using the Euroqol 5D+ (Brooks, 1996), which has six dimensions (mobility, self-care, usual activities, pain, anxiety/depression, cognition), each with three levels (no problems, some problems, severe or unable) (see Table 1). These were included in the dataset for all corresponding health states. We have written EQ5D+ for all other health states included in the GBD 2010 study, using the lay descriptions from GBD 2010 to identify levels on the six domains (Salomon et al, 2012b). For some health states, the Dutch study assigned a distribution of EQ5D+ descriptions (for example, when only a subset of cases have limitations in a domain). This was also done in some cases for the GBD 2010 states (for example, where a state was described as experiencing problems once a week, or experiencing mild pain only). The limited use of a distribution of EQ5D+ states allows a more nuanced summary of the severity of limitations that better matches the lay descriptions for health problems with a number of severity levels (such as vision loss, hearing loss). The EQ5D+ descriptions are given in Annex Table B.

Table 3.1. Euroqol 5D+ (EQ5D+) health state descriptions

Dimension	Level	EQ5D+	
1	1	mobility	no problems walking about
1	2		some problems
1	3		confined to bed
2	1	self-care	no problems washing or dressing
2	2		some problems
2	3		unable to
3	1	usual activities	no problems
3	2		some problems
3	3		unable to perform daily activities
4	1	pain/discomfort	no pain or discomfort
4	2		moderate
4	3		extreme
5	1	anx/depression	not anxious or depressed
5	2		moderately anxious or depressed
5	3		extremely
6	1	cognition	no problems (memory, concentration, coherence, IQ)
6	2		some problems
6	3		extreme problems

3.4 Examination of consistency of disability weights for "non-health" states

Dummy variables were created for levels 2 and 3 of the EQ5D+ dimensions as follows

d_{ij} = 1 if dimension i has level j, 0 otherwise

Thus d23=1 implies that the second dimension of the EQ5D+ description has level 3.

A dummy variable was added to the dataset to identify these health states (nonhlth=1) . There are 32 health states with nonhlth=1 (listed in Table 2) and 188 with nonhlth=0.

The transformed variable lnew =ln(1- dwnew) was then regressed against these dummy variables plus nonhlth as follows:

$$lnew = \alpha + \beta_{12}*d_{12} + \ldots\ldots \beta_{63}*d_{63} + \chi*nonhlth + \varepsilon$$

Table 3.2. Health states identified as potential "non-health" states

	Disability weight			*Disability weight*	
Health state	*GBD 2010*	*Previous*	*Health state*	*GBD 2010*	*Previous*
Infertility: primary	0.011	0.180			
Infertility: secondary	0.006	0.180			
Intellectual disability: mild	0.031	0.290	Fetal alcohol syndrome: mild	0.017	
Intellectual disability: moderate	0.08	0.430	Fetal alcohol syndrome: moderate	0.057	
Intellectual disability: severe	0.126	0.820	Fetal alcohol syndrome: severe	0.177	
Intellectual disability: profound	0.157	0.760	Hearing loss: mild, with ringing	0.038	
Hearing loss: mild	0.005	0.040	Hearing loss: moderate, with ringing	0.058	
Hearing loss: moderate	0.023	0.120	Hearing loss: severe, with ringing	0.065	
Hearing loss: profound	0.031	0.333	Hearing loss: profound, with ringing	0.088	
Hearing loss: severe	0.032	0.333	Hearing loss: complete, with ringing	0.092	
Hearing loss: complete	0.033		Disfigurement: level 1	0.013	0.023
Near vision impairment	0.013	0.020	Disfigurement: level 2	0.072	0.056
Distance vision: mild impairment	0.004		Disfigurement: level 3	0.398	0.074
Distance vision: moderate impairment	0.033	0.170	Amputation of both arms: long term, with treatment	0.044	
Distance vision: severe impairment	0.191	0.430	Amputation of one leg: long term, with treatment	0.021	0.300
Distance vision blindness	0.195	0.600	Amputation of both legs: long term, with treatment	0.051	
Speech problems	0.054		Spinal cord lesion below neck: treated	0.044	

Exploratory regression analysis found that the nonhlth indicator variable was associated with a large positive coefficient which was statistically highly significant. In other words, the average disability weights for the "non-health" states are significantly milder than expected on the basis of their EQ5D+ descriptions. The same regression was run on the 152 observations with "old GBD 2004" disability weights. In this case the nonhlth coefficient was small and not statistically different from zero.

3.5 Estimation of a multiplicative health state valuation function

The EQ5D+ regression equation for disability weights was re-estimated on the GBD 2010 weights for the nonhlth=0 observations only (N=188) by estimating the following equation:

$$ln(1\text{-}dw) = \alpha + \beta_{12}*d_{12} + \ldots\ldots\beta_{63}*d_{63} + \chi*onestate + \varepsilon$$

where onestate is an additional indicator variable for the healthstate 111111 associated with disease. The predicted disability weights for long-term impairments with nonhlth=1, based on their EQ5D+ profiles, are shown below in Table 3.3.

In several cases, the EQ5D+ descriptions used by Stouthard et al were modified, based on feedback from GBD 2010 Expert Groups or published literature. Thus, the descriptions intellectual disability were modified for the more severe levels of intellectual disability to include a component of anxiety and depression (White et al, 2005), and the descriptions for more severe levels of hearing loss to include some cognitive impacts. Based on advice from the GBD Hearing Loss Expert Group that congenital or early childhood acquired hearing loss was associated with considerable problems for cognitive development, separate EQ5D+ descriptions which included some problems with cognition were developed for childhood-onset hearing loss (see Annex Table D). Predicted disability weights for these sequelae are also shown in Table 3.3.

Given the very coarse-grained scale in the EQ5D+ with only three levels (no problems, some problems, severe problems), not much can be made of the differences between the observed and predicted weights for the mild states in Table 3.3. For the more severe states, the predicted weights are higher than the GBD 2010 weights, and on average are around one half of the previous GBD weights, except for deafness which is quite similar to previously.

This analysis shows that the GBD 2010 weights undervalued health states associated with infertility, sensory impairments and cognitive impairments, relative to other health states, controlling for severity distributions on EQ5D+ domains. Disability weights for computation of YLDs for WHO GHE have been revised using the predicted weights for infertility, intellectual disability, vision loss and hearing loss. The weight for mild hearing loss, with ringing was left unchanged.

Although the sequelae for Alzheimer's disease and other dementias were not considered as "non-health" states, their GBD 2010 disability weights were also relatively low. In order to maintain relativities with intellectual disability, their predicted weights (shown in Table 3.4) have also been used in the WHO GHE. Table 3.4 also includes predicted weights for sequelae for mild and moderate back pain, and for moderate migraine headache (see Sections 4.x and 4.y for further information, and Annex Table D for EQ5D+ descriptions). The GBD 2010 included alcohol dependence (mild, moderate and severe) as sequelae for alcohol use disorders, but did not include problem use as formerly in the GBD 2004. An EQ5D+ description was written for alcohol problem use (112121(33%), 112111(67%)) and the disability weight of 0.115 estimated using the valuation function.

Table 3.3. Predicted disability weights for long-term impairments (states with nonhlth=1)

Health state	Predicted disability weight	GBD 2010 disability weight	Previous GBD weight
Infertility: primary	0.056	0.011	0.180
Infertility: secondary	0.026	0.006	0.180
Fetal alcohol syndrome: mild	0.023	0.017	
Fetal alcohol syndrome: moderate	0.104	0.057	
Fetal alcohol syndrome: severe	0.262	0.177	
Intellectual disability: mild	0.127	0.031	0.290
Intellectual disability: moderate	0.293	0.080	0.430
Intellectual disability: severe	0.383	0.126	0.820
Intellectual disability: profound	0.444	0.157	0.760
Hearing loss: mild	0.005	0.005	0.040
Hearing loss: moderate	0.050	0.023	0.120
Hearing loss: severe	0.167	0.032	0.333
Hearing loss: profound	0.281	0.031	0.333
Hearing loss: complete	0.281	0.033	0.333
Hearing loss: mild, with ringing	0.037	0.038	
Hearing loss: moderate, with ringing	0.095	0.058	
Hearing loss: severe, with ringing	0.220	0.065	
Hearing loss: profound, with ringing	0.327	0.088	
Hearing loss: complete, with ringing	0.320	0.092	
Childhood-onset hearing loss: mild	0.005		
Childhood-onset hearing loss: moderate	0.077		0.11
Childhood-onset hearing loss: severe	0.215		0.23
Childhood-onset hearing loss: profound	0.312		
Childhood-onset hearing loss: complete	0.314		
Childhood-onset hearing loss: mild, with ringing	0.037		
Childhood-onset hearing loss: moderate, with ringing	0.122		
Childhood-onset hearing loss: severe, with ringing	0.265		
Childhood-onset hearing loss: profound, with ringing	0.356		
Childhood-onset hearing loss: complete, with ringing	0.351		
Distance vision: mild impairment	0.005	0.004	
Distance vision: moderate impairment	0.089	0.033	0.170
Distance vision: severe impairment	0.314	0.191	0.430
Distance vision blindness	0.338	0.195	0.600
Near vision impairment	0.047	0.013	0.020
Amputation of both arms: long term, with treatment	0.208	0.044	
Amputation of one leg: long term, with treatment	0.051	0.021	0.300
Amputation of both legs: long term, with treatment	0.161	0.051	
Spinal cord lesion below neck: treated	0.157	0.047	0.570
Disfigurement: level 1	0.013	0.013	0.023
Disfigurement: level 2	0.182	0.072	0.056
Disfigurement: level 3	0.326	0.398	0.074
Speech problems	0.221	0.054	

Table 3.4. Predicted single dimension weights for EQ5D+ domains (based on new and old disability weights)

Health state	Predicted disability weight	GBD 2010 disability weight	Previous GBD weight
Dementia: mild	0.165	0.082	
Dementia: moderate	0.388	0.346	0.666
Dementia: severe	0.545	0.438	0.940
Alcohol problem use	0.115		0.134
Migraine headache: moderate	0.267		0.160
Low back pain: mild	0.030		
Low back pain: moderate	0.072		0.061

3.6 Drug use disorders

The GBD 2010 included estimates of health loss for amphetamine, cannobis, cocaine, opioid dependence and other drug use disorders (Degenhardt et al, 2013). The GBD 2010 disability weights for drug dependence (cannabis, amphetamines, cocaine, heroin) are substantially higher than those used in previous versions of the GBD 2010. Salomon et al (2012a) noted the very high disability weight of 0.641 for heroin dependence, almost double the previous weight of 0.36. This weight is comparable to the new weights for severe traumatic brain injury and untreated quadriplegia.

Salomon et al (2012a) attributed the increase in disability weights for drug use disorders to the fact that the drug use lay descriptions attributed functional outcomes to particular causes (such as heroin use), which was deliberately avoided in most other lay descriptions. The lay description for heroin dependence was "…uses heroin daily and has difficulty controlling the habit. When the effects wear off, the person feels severe nausea, agitation, vomiting and fever. The person has a lot of difficulty in daily activities." Explicit reference to use of or addiction to illicit drugs as the cause of the functional outcomes described could have biased disability weights upwards by introducing wellbeing considerations beyond "loss or health", or reflecting moral or social disapproval.

Salomon (2013) carried out a framing experiment using the lay description for caffeine addiction and replacing the label "coffee" by various other labels ranging through "medicine", "addictive substance", "addictive drug", "illegal, addictive drug" (Table 3.5)

Table 3.5. Framing experiment using caffeine (Salomon, 2013)

Alternative descriptions for caffeine addiction	**Disability weights**
…**drinks several cups of coffee a day** in order to increase energy and stay alert. When the effects wear off, the person feels tired and irritable and sometimes gets headaches	0.018
…**takes medication several times a day** in order to increase energy and stay alert. When the effects wear off, the person feels tired and irritable and sometimes gets headaches	0.064
…**uses an addictive substance several times a day** in order to increase energy and stay alert. When the effects wear off, the person feels tired and irritable and sometimes gets headaches	0.067
…**uses an addictive drug several times a day** in order to increase energy and stay alert. When the effects wear off, the person feels tired and irritable and sometimes gets headaches	0.136
…**uses an illegal, addictive drug several times a day** in order to increase energy and stay alert. When the effects wear off, the person feels tired and irritable and sometimes gets headaches	0.198

This shows clearly that people provide different responses to an identical functional outcome when the cause of that outcome is presented in different ways (i.e. as drinking coffee, or taking medication, or taking an addictive drug, or taking an illegal addictive drug), and that the effects are minimized when referring to a generic medication as opposed to a named illegal drug. Since the YLDs are intended to quantify functional losses in a comparable way across sequelae, and to exclude non-health aspects, we use a set of disability weights for the drug dependence sequelae derived from lay descriptions in which the drug name is masked by being described as "use of medication" (Table 3.6).

Table 3.7 shows the GBD 2010 disability weights, the weights used in previous GBD analyses, the weights based on EQ5D+ descriptions and the masked weights. The masked weights are lower than the unmasked weights, and in fact, are quite similar to the previous GBD weights and to the weights predicted from the EQ5D+ descriptions (which summarize the functional limitations described in the lay descriptions). The GBD 2010 used the weights derived from the unmasked descriptions in part because experts argued that the drug names convey additional information relating to the severity of health loss. This may be the case but it is clear from the caffeine experiment that the drug names also convey non-health information that has a very substantial biasing effect on the health state comparisons. Any information specific to functional limitations conveyed by the drug names is impossible to disentangle from the framing effects without further research to develop improved lay descriptions.

Table 3.6. Unmasked and masked lay descriptions for drug use disorders

Sequela	'Unmasked' description	'Masked' descriptions
Amphetamine abuse and dependence disorders	uses stimulants (drugs) and has difficulty controlling the habit. The person sometimes has depression, hallucinations and mood swings, and has difficulty in daily activities.	takes medication and has difficulty going without it. The medicine sometimes causes depression, hallucinations and mood swings, and difficulty in daily activities.
Cannabis abuse and dependence disorders	uses marijuana daily and has difficulty controlling the habit. The person sometimes has mood swings, anxiety and hallucinations, and has some difficulty in daily activities.	takes daily medication and has difficulty going without it. The medicine sometimes causes mood swings, anxiety and hallucinations, and some difficulty in daily activities.
Cocaine abuse and dependence disorders	uses cocaine and has difficulty controlling the habit. The person sometimes has mood swings, anxiety, paranoia, hallucinations and sleep problems, and has some difficulty in daily activities.	takes medication and has difficulty going without it. The medicine sometimes causes mood swings, anxiety, paranoia, hallucinations and sleep problems, and some difficulty in daily activities.
Heroin and other opioid dependence	uses heroin daily and has difficulty controlling the habit. When the effects wear off, the person feels severe nausea, agitation, vomiting and fever. The person has a lot of difficulty in daily activities.	takes daily medication and has difficulty going without it. When the effects of the medicine wear off, the person feels severe nausea, agitation, vomiting and fever. The person has a lot of difficulty in daily activities.

Table 3.7. Disability weights for drug use disorders

Health state	GBD 2010	Previous	EQ5D+based	Masked
Cannabis dependence	0.329	0.237	0.224	0.19
Amphetamine dependence	0.353	0.297	0.269	0.24
Cocaine dependence	0.376	0.237	0.224	0.26
Heroin and other opioid dependence	0.641	0.363	0.395	0.34

3.7 Revised disability weights for the WHO Global Health Estimates

The limited revisions to the disability weights used in the WHO GHE have been carried out in a way that preserves consistency with the other GBD 2010 disability weights both in terms of the construct being valued (loss of health) and in terms of the decrements associated with functioning in different domains. Further revisions to disability weights may be made for selected conditions if additional evidence on EQ5D+ distributions associated with sequelae is identified or if there are further valuation exercises carried out using the GBD 2010 methods with revised lay descriptions. Annex Table E tabulates the revised disability weights for 234 health states.

4 Estimation of years lost due to disability (YLDs)

4.1 General approach for estimation of YLDs for diseases and injuries

The GBD 2010 study computed YLD as the prevalence of a sequela multiplied by the disability weight for that sequela without age weighting or discounting. The YLDs arising from a disease or injury are the sum of the YLDs for each of the sequelae associated with that disease. The GBD 2010 study estimated YLDs by country, age, sex for 1160 sequelae of 289 diseases and injuries (Vos et al, 2012a). In the GBD 1990, 483 disease sequelae were identified and 632 in the GBD 2004.

Sequelae for each condition in the GBD 2010 study were developed by collaborating expert groups in consultation with the core team. The main outcomes from a disease that could potentially make an important contribution to the burden of a given disease or injury and which could in principle be measured were included. The 1160 sequelae were designed to capture the direct consequences of disease or injury. Across sequelae, there were 220 common sequelae called health states (see Section 3). For example, anaemia is a sequela of 19 diseases in the cause list and three health states are associated with anaemia: mild anaemia, moderate anaemia, and severe anaemia.

For 1160 sequelae, the GBD 2010 study attempted to systematically estimate prevalence, incidence, remission, and duration by country, sex, age for 1990, 2000, 2005 and 2010 (Vos et al, 2012). For most sequelae, the GBD 2010 study used a Bayesian meta-regression method, DisMod-MR, designed to address key limitations in descriptive epidemiological data, including missing data, inconsistency, and large methodological variation between data sources. For some disorders, natural history models, back calculation from mortality rates, or other methods were used. YLDs by cause at age, sex, country, and year levels were adjusted for comorbidity with simulation methods.

For selected impairments, WHO and other collaborators estimated the overall prevalence of the impairment (see Sections 4.3-4.6). These “envelope” prevalences constrained the estimates for sequelae related to that impairment to sum to estimates of the overall impairment prevalence. For example, nine disorders have blindness as a sequela. The prevalence of all blindness sequelae was constrained to sum to blindness prevalence. The GBD 2010 estimated impairment prevalence envelopes for anaemia, blindness, low vision, hearing impairment, infertility, heart failure, epilepsy, and intellectual disability.

The WHO GHE draws on the GBD 2010 analyses for YLDs with some caveats. Selected disability weights are revised as described in Section 3 above. Other revisions for prevalence estimates, cause distributions and severity distributions are summarized in the following sections 4.3-4.10. Documentation of GBD 2010 analyses for YLDs remains limited and detailed prevalence estimates, severity distributions, and documentation of assumptions and methods is not yet available for many causes. WHO is thus not yet in a position to evaluate and endorse the detailed estimates underlying many of the YLD estimates. There may thus be further revisions of these by WHO and collaborators, and by IHME and GBD 2.0 collaborators.

4.2 Comorbidity adjustments for YLDs

Cause-specific YLDs estimated for the GBD 2010 study were adjusted for independent comorbidity as described in the supplementary appendix for Vos et al (2012b). The GBD 2010 detailed YLD cause estimates have been released only in comorbidity-adjusted form. For those causes where WHO YLDs have been calculated from WHO prevalence estimates, it is necessary to adjust for independent comorbidity. The adjustment process is summarized below.

Let Y_i represent the YLDs from cause i

$Y_i = DW_i \times p_i$

Assuming independent comorbidity and multiplicative disability weights

$$Y_{ij} = (p_i - p_i p_j) * DW_i + (p_j - p_i p_j) * DW_j + p_i * p_j * (1 - (1 - DW_i) * (1 - DW_j))$$
$$= p_i DW_i + p_j DW_j - p_i p_j DW_i DW_j$$
$$= 1 - (1 - p_i DW_i) * (1 - p_j DW_j)$$
$$= 1 - (1 - Y_i) * (1 - Y_j)$$

Generalizing to many causes:

$$Total\ Y = 1 - \prod(1-Y_i)$$

To first order, this is approximately

$$Total\ Y = \sum_i Y_i - \sum_i \sum_{j \neq i} Y_i Y_j$$

If we apportion the "comorbid" adjustment proportionately between cause i and cause j in proportion to relative YLDs of each, then the adjustment for cause i can be written as

$$Y_i' = Y_i * (1 - \phi_i)$$

$$\phi_i = \sum_{j \neq i} Y_i Y_j / (Y_i + Y_j)$$

So starting with the GBD 2010 set of comorbidity adjusted Y_i', we made a first order estimate of Y_i using the comorbidity adjustment factor calculated using the Y_i' as follows:

$$\phi_i' = \sum_{j \neq i} Y_i' Y_j' / (Y_i' + Y_j')$$

$$Y_i = Y_i' / (1 - \phi_i') \quad \textit{to first order approximation.}$$

Next, to calculate the comorbidity adjustment for a specific cause where unadjusted YLDs have been recalculated, we take the set of imputed Yi estimated above and revise all those where WHO is adjusting prevalences or disability weights. The revised set (Z_i) is then used to compute the comorbidity adjustment factor needed for specific causes k as:

$$\phi_k = \sum_{i \neq k} Z_i Z_k / (Z_i + Z_k)$$

and the comorbidity-adjusted YLDs as

$$YLD_k = Z_k * (1 - \phi_k)$$

For all other causes not revised, the comorbidity-adjusted Y_i are used as is, the imputed estimates are only used for the adjustment for causes k.

4.3 Vision loss

WHO and the GBD 2010 Vision Loss Expert Group carried out a systematic review of medical literature from 1 January 1980 to 31 January 2012 which identified indexed articles containing data on incidence, prevalence and causes of blindness and vision impairment (Bourne et al, 2013a). Only cross-sectional population-based representative studies were selected from which to extract data for a database of age- and sex-specific data of prevalence of 4 distance and one near visual acuity sequelae (presenting and best-corrected). Unpublished data and data from studies using 'rapid assessment' methodology were later added. Despite extensive data seeking, data were not available for many countries and years, were

reported using incomparable definitions of vision impairment, or were representative of a subnational or community area only.

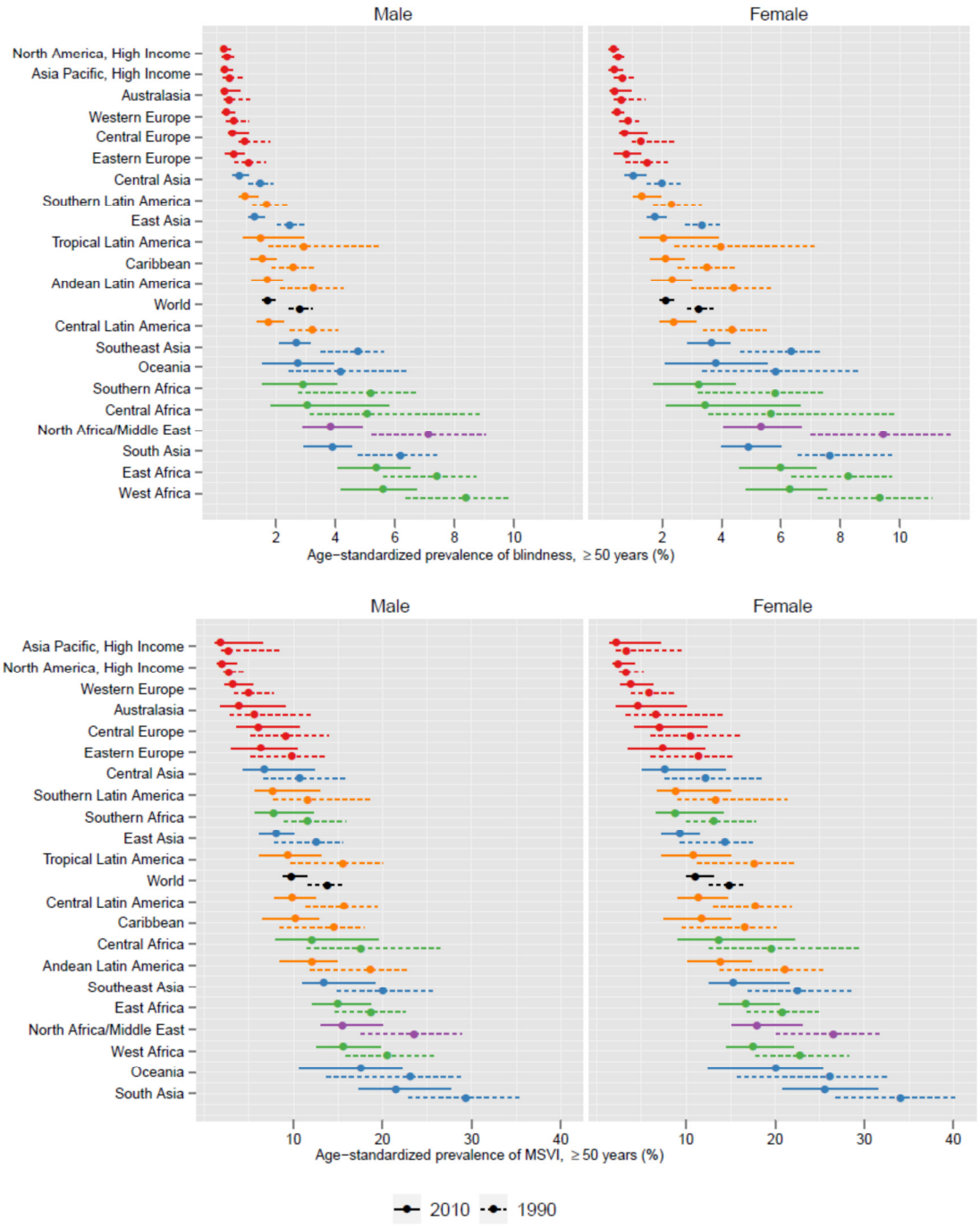


Figure 4.1. Age-standardized prevalence of blindness and moderate and severe vision impairment (MSVI) by region and by gender for 1990 and 2010.

Statistical methods were used to generate estimates of the prevalence and causes of blindness and moderate and severe vision impairment (MSVI) for each country and year, 1990-2010, in 190 countries nested in 21 GBD subregions (Stevens et al, 2013b; Bourne et al, 2013b). The statistical analysis was carried out in three main steps. First, a series of regression equations were used to estimate the prevalence of blindness (visual acuity <3/60) and MSVI (visual acuity <6/18 but ≥3/60) when other definitions of vision impairment were reported. Second, two hierarchical logistic regressions were fitted to both presenting and best-corrected vision impairment data to estimate the prevalence of presenting MSVI and blindness by age, country, and year (Figure 4.1).

These models were also used to estimate the contribution of uncorrected refractive error based on the estimated difference between presenting and best-corrected vision impairment. Third, separate models were fit to calculate the proportion of blindness and MSVI caused by cataracts, glaucoma, diabetic retinopathy and trachoma. Statistical uncertainty was estimated at each stage of the statistical analysis and is reflected in the final estimates of vision impairment prevalence by cause.

Vision loss YLDs were recalculated using WHO prevalence estimates for the causes listed in Table 4.1. In addition, onchocerciasis YLDs were adjusted upwards by a factor of 1.15 (taking into account the vision loss contribution to overall YLDs for onchocerciasis) and YLDs for vitamin A deficiency by a factor 1.63. The resulting YLDs were adjusted for comorbidity with other causes as in Section 4.2. Table 4.1 compares the unadjusted and adjusted YLDs calculated using the GBD 2010 disability weights and the revised GHE disability weights.

WHO prevalences for vision loss are somewhat lower than those estimated by the GBD 2010, resulting 18.0 million YLDs globally in 2011 compared to 19.9 reported by GBD 2010, using GBD 2010 disability weights. After revision of disability weights, the global total YLDs for vision loss rise to 31.4 million (Table 4.1).

Table 4.1. YLDs for vision-related causes 2011. The first column shows YLDs imputed from GBD 2010. The following columns show YLDs derived from WHO prevalence estimates, using GBD 2010 and revised GHE weights, unadjusted and adjusted for comorbidity.

		Unadjusted for comorbidity		Adjusted for comorbidity	
Cause	YLDs (GBD 2010)	WHO YLDs (GBD 2010 DW)	WHO YLDs (GHE DW)	WHO YLDs (GBD 2010 DW)	WHO YLDs (GHE DW)
Trachoma	350,238	167,651	317,287	162,377	307,503
Diabetic retinopathy*	351,994*	402,390	780,576	351,994	683,815
Glaucoma	974,736	696,319	1,297,900	648,783	1,210,451
Cataracts	4,739,218	4,316,405	8,189,777	3,682,253	7,000,164
Refractive errors	5,710,345	7,487,474	15,200,000	6,582,117	13,400,000
Macular degeneration	1,387,769	809,665	1,528,619	727,464	1,374,981
Other vision loss	6,359,209	4,142,317	8,086,520	3,797,546	7,423,050
Total	19,873,509	18,022,221	35,400,679	15,952,535	31,399,964

**Published GBD 2010 YLDs are summed across vision loss and other sequelae. WHO YLDs for vision sequelae only (GBD 2010 weights, adjusted for comorbidity) are shown for GBD 2010 YLDs.*

4.4 Hearing loss

Hearing loss data from epidemiological studies published in a systematic review in 2009 (Pascolini & Smith, 2009) were considered for inclusion. In order to obtain detailed data for specific age, sex, hearing thresholds and hearing aid usage, requests were sent to the investigators identified in the above-mentioned review. Unpublished data sources were also sought. In order to be included, studies 1) reported better ear hearing level, 2) were representative of the general population, and 3) reported hearing loss prevalence by age. In addition, measurements of mild or moderate hearing loss in a potentially noising environment were excluded.

The data from the included studies were modeled using a Bayesian hierarchical logistic regression model (Stevens et al, 2011). We generated estimates by age, sex and severity of hearing impairment, for all ages 5 years and greater. Hearing impairment in children < 5 years was estimated in a second step. Using data on etiology of hearing impairment among school-aged children, the contribution of congenital vs. acquired hearing impairment was estimated. This was applied to the estimates of hearing impairment in school-aged children to determine the prevalence of hearing impairment present by the end of the perinatal period.

We estimated the use of hearing aids in high-income countries, and adjusted the prevalence of hearing loss for hearing aid use in high-income countries (Stevens et al, 2011; see figures 4.2 and 4.3). We assumed that hearing aid use improved hearing level by one category (i.e., instead of having moderately severe hearing loss, the hearing aid user would experience moderate hearing loss). We did not have sufficient data to estimate hearing aid use in developing countries, but suspect that coverage is small to negligible.

The six severity thresholds used in this analysis are defined in Table 4.2. Note that the labeling of the severity-specific sequelae in this table and in the IHME YLD paper differ from the labels used in the GBD 2010 disability weights study – however the definitions and lay descriptions match. Note also that these severity levels are more detailed than those used by WHO previously.

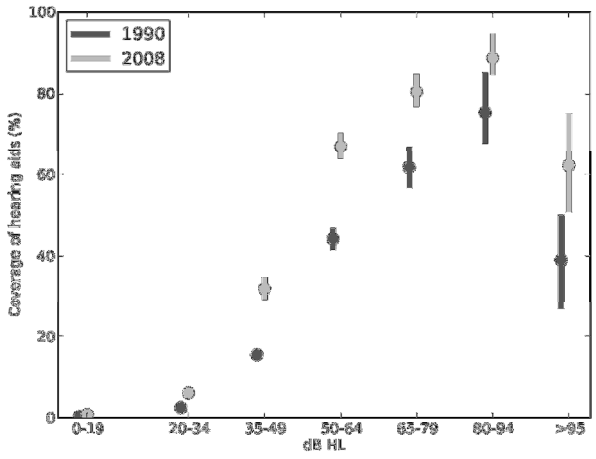


Figure 4.2. Hearing aid coverage in the high-income region, by hearing impairment category and year. Source: Stevens et al., 2012.

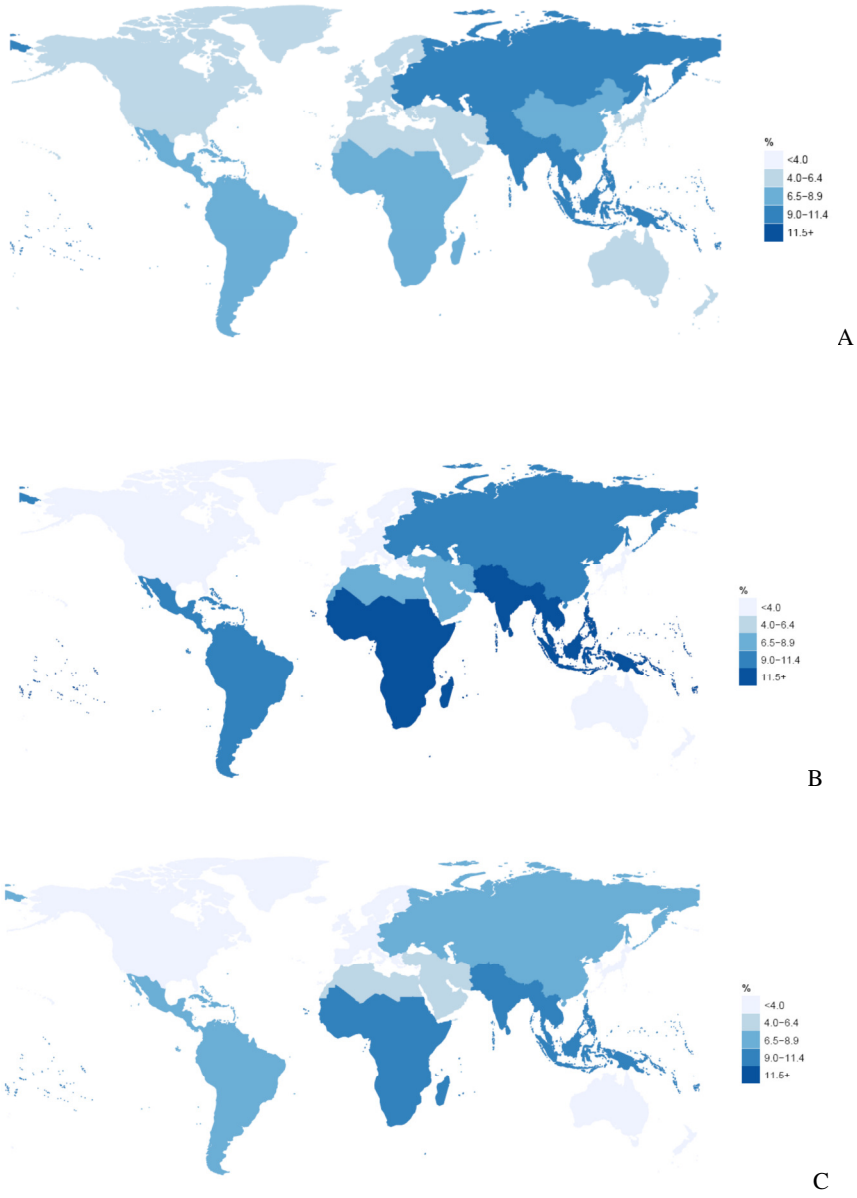


Figure 4.3. Hearing impairment ≥35 dB HL adjusted for use of a hearing aid in 8 world regions, A) prevalence in 2008, B) age-standardized male prevalence in 2008; and C) age-standardized female prevalence in 2008. Source: Stevens et al., 2012.

Table 4.2 Hearing loss sequelae: definitions and lay descriptions

Sequela	Definition	Lay descriptions
Hearing loss, mild	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 20-34 dB. Measured with hearing aid if one is normally used.	This person has occasional difficulty following a conversation in a noisy environment but no other hearing problems.
Hearing loss, moderate	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 35-49 dB. Measured with hearing aid if one is normally used.	has difficulty following a conversation in a noisy environment but no other hearing problems.
Hearing loss, moderately severe	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 50-64 dB. Measured with hearing aid if one is normally used.	has difficulty hearing a normal voice and great difficulty following a conversation in a noisy environment.
Hearing loss, severe	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 65-79 dB. Measured with hearing aid if one is normally used.	has great difficulty hearing in any situation or in using a phone.
Hearing loss, profound	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 80-94 dB. Measured with hearing aid if one is normally used.	has great difficulty hearing in any situation and is not able to use a phone.
Hearing loss, complete	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 95 dB or greater. Measured with hearing aid if one is normally used.	cannot hear at all, even loud sounds.
Hearing loss, moderate, with ringing	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 35-49 dB. Measured with hearing aid if one is normally used.	This person has difficulty following a conversation in a noisy environment, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss, moderately severe, with ringing	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 50-64 dB. Measured with hearing aid if one is normally used.	This person has difficulty hearing a normal voice, has great difficulty following a conversation in a noisy environment, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss, severe, with ringing	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 65-79 dB. Measured with hearing aid if one is normally used.	This person has great difficulty hearing in any situation, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss, profound, with ringing	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 80-94 dB. Measured with hearing aid if one is normally used.	This person always has great difficulty hearing in any situation, cannot use a phone, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss, complete, with ringing	Audiometric hearing threshold level (averaged over 0.5, 1, 2, 4kHz in the better ear) of 95 dB or greater. Measured with hearing aid if one is normally used.	This person has difficulty following a conversation in a noisy environment, and has ringing in the ears for more than 5 minutes, almost every day.

We then modeled the following causes as fractions of total hearing loss: meningitis, otitis media, and congenital. For meningitis and congenital hearing loss, we accessed cross-sectional studies of the etiology of hearing impairment in school-aged children (Stevens et al, 2012). For congenital hearing loss, we fit a logistic regression with percent of hearing impairment with a congenital origin as the independent variable, and log GDP per capita as the independent variable. For meningitis, we fit a similar regression for developing countries. For high-income countries, we fit a logistic regression with percent of hearing impairment caused by meningitis as the independent variable and year as the dependent variable. Finally, for otitis media, we used all cross-sectional data in which the percent of hearing impairment caused by otitis media was reported. We fit a logistic regression with percent of hearing impairment caused by otitis media as the dependent variable, and year and a restricted cubic spline of age as the independent variables. When the sum of meningitis, otitis media, and congenital exceeded the total estimated number of people with hearing loss, we rescaled the sub-causes proportionally so that their sum was equal to the total cases of hearing loss. When the sum of meningitis, otitis media, and congenital was lower than the total estimated number of people with hearing loss, we attributed the difference to hearing loss from other causes. The “other hearing loss”

category includes hearing loss due to old age, occupational hazards, injury, and other causes. We did not have data to generate separate estimates for each of these causes.

There are separate hearing states for hearing loss with tinnitus (ringing in the ears). The prevalence of tinnitus at each hearing loss threshold was estimated from 3 studies (see Table 4.3). The resulting average weights for all hearing loss are shown in Table 4.4 by hearing loss threshold. We assumed the same distribution of tinnitus across all causes of hearing loss.

Table 4.3 Estimated proportion experiencing tinnitus daily / at least 5 minutes per day

	Unilateral HL	Mild	Moderate	Moderate–severe	Severe	Profound	Almost total
		20 to 34.9	35 to 49.9	50 to 64.9	65 to 79.9	80 to 94.5	95+
Sample size	164	1373	439	169	55	30	11
Number with tinnitus	51	287	133	55	35	19	6
Central estimate	0.309	0.209	0.302	0.325	0.638	0.641	0.545
Lower CL	0.241	0.188	0.260	0.256	0.496	0.439	0.234
Upper CL	0.388	0.232	0.348	0.402	0.762	0.801	0.833

Sources: NHANES 1999-2004 (CDC & NCHS) reanalysis by Howard Hoffman (NIDCD/NIH), Davis(1989)- reanalysis by author, Davis et al (2007) . reanalysis by author.

Table 4.4 Average disability weights for hearing loss by threshold (with and without tinnitus)

		Average disability weight		
Threshold	Severity level	GBD 2010	GHE adult onset	GHE childhood onset
25 dB	Mild	0.0031	0.0031	0.0031
35 dB	Moderate	0.0150	0.0150	0.0150
50 dB	Moderately severe	0.0344	0.0646	0.0916
65 dB	severe	0.0531	0.2008	0.2469
80 dB	Profound	0.0675	0.3105	0.3402
95 dB	Complete	0.0652	0.3023	0.3342

Table 4.5 YLDs for hearing-related causes 2011. The first column shows YLDs imputed from GBD 2010. The following columns show YLDs derived from WHO prevalence estimates, using GBD 2010 and revised GHE weights, unadjusted and adjusted for comorbidity.

		Unadjusted for comorbidity		Adjusted for comorbidity	
Cause	YLDs (GBD 2010)	WHO YLDs (GBD 2010 DW)	WHO YLDs (GHE DW)	WHO YLDs (GBD 2010 DW)	WHO YLDs (GHE DW)
Meningitis	202,024*	202,024	287,127	198,165	281,623
Otitis media	1,625,232*	1,625,232	2,110,541	1,579,540	2,049,389
Other hearing loss	15,900,000	13,300,000	25,000,000	11,500,000	21,400,000
Other congenital anomalies	812,986	1,159,973	1,859,817	1,151,055	1,845,486
Total	18,540,242	16,287,229	29,257,485	14,428,760	25,576,498

**Published GBD 2010 YLDs are summed across hearing loss and other sequelae. WHO YLDs for hearing sequelae only (GBD 2010 weights, adjusted for comorbidity) are shown for GBD 2010 YLDs.*

Hearing loss YLDs were recalculated using WHO prevalence estimates for the causes listed in Table 4.5. The resulting YLDs were adjusted for comorbidity with other causes as described in Section 4.2. Table 4.5 compares the unadjusted and adjusted YLDs calculated using the GBD 2010 disability weights and the revised GHE disability weights. WHO prevalences for hearing loss are lower than those estimated by the GBD 2010, resulting 16.3 million YLDs globally in 2011 compared to approximately 18.5 based on the GBD 2010, using GBD 2010 disability weights. After revision of disability weights, the global total YLsD for hearing loss rise to 25.6 million (Table 4.5).

4.5 Intellectual disability

Intellectual disability was not included as a health condition or cause in the GBD 1990 study. The WHO revisions carried out from 2000 to 2008 included mental retardation attributable to lead exposure (Fewtrell et al, 2004, Pruss-Ustun et al, 2004). It also included Down's syndrome in the congenital anomalies causes, and Down's syndrome is an important cause of mental retardation. Cognitive impairment/mental retardation/developmental disability were also listed as a sequelae for meningitis, Japanese encephalitis, trichuriasis, hookworm disease, protein-energy malnutrition, iodine deficiency, and iron-deficiency anaemia.

For the GBD 2010 study, it was decided to estimate the total prevalence of intellectual disability and the proportion of prevalence associated with relevant causes. Consideration as an "envelope condition" will improve the internal consistency and ensure that the total of prevalences across sequelae adds to the measured total prevalences for populations.

During 2009-2010, WHO established an informal expert advisory group to advise on the analysis of population data on intellectual disability. This group also contributed substantially to the identification of relevant published and unpublished data, including a number of population-based registers. Following advice from the group, five sequelae were defined for intellectual disability as summarized in Table 4.6.

Table 4.6 Sequelae for intellectual disability: severity levels, definitions and lay descriptions

Severity level	Definition	Lay description
Borderline	ICD-10 definition, IQ range 70-84	This person does not do well in school, has some difficulty doing complex or unfamiliar tasks, has trouble concentrating. The person may also have behavioral problems.
Mild	ICD-10 definition, IQ range 50-69	This person has low intelligence and is slow in learning at school. As an adult, the person can work at simple supervised jobs and live independently, but often needs help to raise children.
Moderate	ICD-10 definition, IQ range 35-49	This person has low intelligence and is slow in learning to speak and do simple tasks. As an adult, the person requires a lot of support to work productively, live independently, and raise children.
Severe	ICD-10 definition, IQ range 20-34	This person has low intelligence and cannot speak more than a few words, needs help with most basic daily activities, and can do only simple tasks under close supervision.
Profound	ICD-10 definition, IQ range <20	This person has low intelligence, cannot understand basic requests or instructions, and requires constant assistance for nearly all activities.

WHO carried out a systematic review of published studies on the population prevalence of intellectual disability and also collected data from unpublished studies and population-based registers (Maulik et al, 2011). The systematic review identified studies published between 1980 and 2009. PubMed, Embase, CINAHL, and PsycInfo were searched with a strategy that included keywords, MeSH terms or thesaurus words, and text words. Cochrane Library, WHOLIS, and LILACS were also searched using only keywords. Search terms were divided into three categories:

- Terms characterising outcome – intellectual disability, mental retardation, mental subnormality, mental insufficiency
- Terms characterising study design – cross-sectional studies, longitudinal studies, panel studies, cohort studies, case-control studies
- Terms related to outcome – epidemiology, prevalence, incidence, mortality, etiology

Studies that reported on prevalence of intellectual disability in the general population were included if they specified the case definition and diagnostic criteria. Studies were excluded if they related to special subpopulations such as special schools, psychiatric institutions or prisons, or to those with specific diagnoses such as low birthweight or congenital anomalies such as Down's syndrome, or if they did not corroborate results with standardized diagnostic systems or clinical judgment.

Both qualitative and quantitative information was abstracted by two reviewers independently. In case of any disagreement a third reviewer was consulted. Additional unpublished data were obtained from a number of population-based registers including the National Intellectual Disability Database (Ireland), the Metropolitan Atlanta Developmental Disabilities Surveillance Program (USA), Intellectual Disability Explore Answers (Australia), the Leicestershire Learning Disability Register (UK), the Developmental Disability Registry (Singapore) and the Autism and Developmental Disabilities Monitoring Network (USA).

After inclusion of additional summary data from a number of population-based registers, the final dataset included 481 data points from 74 studies, of which 75% related to developed countries and 60% were from population-based registers (Table 7). Most of these studies were relatively old, with 57% of the data points from the 1980s, 25% from the 1990s and 17% from the 2000s. Figure 2 shows the geographic distribution of the studies.

For studies which used non-standard IQ thresholds for reported prevalences, prevalences at standard thresholds were interpolated from the log cumulative prevalence distribution across thresholds. The final number of study data points by national income category and level are shown in table 4.7.

Table 4.7. Study data points by country income category and IQ threshold.

IQ threshold	High income	Low and middle income	Total
20	44	5	49
35	53	1	54
50	135	63	198
70	112	45	157
85	17	6	23
Total	361	120	481

Maulik et al (2011) carried out a meta-analysis of this data using random effects to account for heterogeneity. Sub-group analyses were also done. The prevalence of intellectual disability across 52 studies included in the meta-analysis was 1.04% (95%CI 0.96-1.12). The rates varied according to the income group of the country ranging from 0.92% (95%CI 0.85-1.00) in high income countries up to 1.64 (95%CI 1.11-2.17) in low income countries. Overall, the rates form low- and middle-income countries were almost twice that in high income countries. Studies based on identification of cases by using psychological assessments or scales showed higher prevalence compared to those using standard diagnostic systems and disability instruments. Prevalence was higher among studies based on children/adolescents, compared to those on adults.

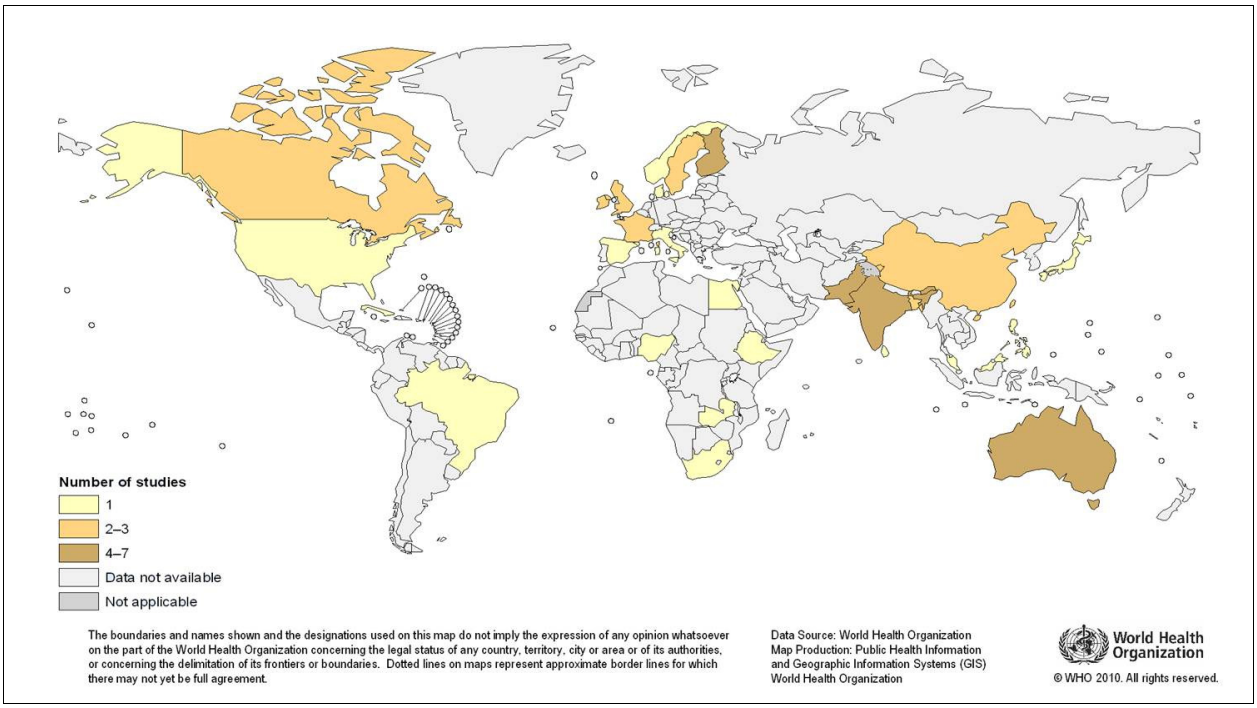


Figure 4.4. countries with studies used for the assessment of the prevalence of intellectual disability.

Challenges for the assessment of prevalence of intellectual disability according to region, age and severity level include the increasing heterogeneity of measurement types and measurement errors with decreasing severity threshold, and in particular, considerable issues of under-ascertainment for borderline intellectual disability. For high income countries, the study data on prevalence of severe or profound intellectual disability (IQ<35) were broadly consistent, with a prevalence of around 0.3 to 0.4%.

Apart from the predominance of older studies, estimation issues were compounded by the limited numbers of surveys in developing countries that used instruments that identified intellectual disability in terms of IQ, and the fact that most of the studies were for younger children. Completeness of ascertainment tends to rise to around age 10, and many cases of intellectual disability are not identified until children have been in school for some years.

In almost 50% of cases of intellectual disability, the cause is not identified. An identifiable etiology is present in up to 70% of children with severe mental retardation but in only 24% of children with mild mental retardation. The causes could be environmental or genetic. For example, Down syndrome is a common genetic cause of intellectual disability. The common environmental causes include birth asphyxia and trauma, intrauterine growth retardation, maternal infection, malnutrition, iodine deficiency, and lead exposure.

Estimation of the prevalence of intellectual disability by severity threshold was carried out for the GBD 2010 study using the DISMOD-MR meta-analysis tool as described by Vos et al (2012b). Inclusion of a health system access index as a fixed effect allowed for inference from older data points when estimating more current prevalences. The resulting regional prevalences of intellectual disability (IQ<70) at age 10 are summarized in Table 4.8. The overall prevalence of intellectual disability globally in 2005 was 1.3% and the high income countries prevalence of 0.7% was around half than for the low- and

middle-income countries. These results are broadly consistent with the results of the meta-analysis by Maulik et al (2011), whose results were a little higher as they were not adjusted for time trends.

The GBD 2010 study estimated aetiology-specific intellectual disability prevalences for autism, preterm birth, neonatal encephalopathy, Down's syndrome, unbalanced chromosomal rearrangements, Klinefelter syndrome, other congenital disorders, meningitis, cretinism, and fetal alcohol syndrome. These prevalences were subtracted from the overall prevalence of intellectual disability to estimate the prevalence of idiopathic intellectual disability as described by Vos et al (2012b).

Table 4.8 GBD 2010 study prevalences of intellectual disability (IQ<70) at age 10 years in 2005 (source)

GBD 2010 region	ID prevalence (%)	GBD 2010 region	ID prevalence (%)
Asia Pacific, High Income	0.63	Latin America, Andean	1.06
Asia, Central	1.19	Latin America, Central	1.06
Asia, East	1.05	Latin America, Southern	0.86
Asia, South	1.61	Latin America, Tropical	1.06
Asia, Southeast	1.19	North Africa + Middle East	1.13
Australasia	0.68	North America, High Income	0.96
Caribbean	1.02	Oceania	1.23
Europe, Central	0.88	Sub-Saharan Africa, Central	1.66
Europe, Eastern	1.04	Sub-Saharan Africa, East	1.81
Europe, Western	0.72	Sub-Saharan Africa, Southern	1.31
		Sub-Saharan Africa, West	1.71
World	1.30		

A subset of studies with detailed prevalences by threshold were used to estimate the distribution of intellectual disability by threshold for high income and low and middle income countries (see rightmost columns in table 4.9. The proportion shown for borderline intellectual disability is not a proportion of total intellectual disability, since the definition of borderline intellectual disability does not fall within the intellectual disability envelope, rather it is an estimate of the ratio of borderline intellectual disability to the intellectual disability envelope.

Table 4.9 shows the distribution of intellectual disability by severity, and the GBD 2010 and GHE disability weights. The overall GHE average disability weight for intellectual disability is close to 3.5 times higher than the GBD 2010 disability weight in both high-income (HIC) and low-and-middle-income (LMIC) countries. For other health states, where ID is one among a number of sequelae, the overall adjustment factors for YLDs are lower:

- Down syndrome: 2.3 (age<50), 2.0 (50-54), 1.6 (55-59), 1.4 (60+)
- Other chromosomal anomalies: 2.5

Table 4.9. Revised disability weights for intellectual disability

Severity (IQ range)	GHE	GBD 2010	Distribution (%) HIC*	LMIC*
Borderline (70-85)	0.0034	0.0034	53	53
Mild (50-69)	0.1270	0.0310	43	65
Moderate (35-49)	0.2930	0.0800	37	24
Severe (20-34)	0.3830	0.1260	15	8
Profound (<20)	0.4440	0.1570	5	3
All ID (LMIC) including borderline	0.1968	0.0541		
All ID (HIC) including borderline	0.2427	0.0697		

**HIC: high income countries, LMIC: low and middle income countries*

4.6 Infertility

Estimation of the burden of infertility was carried out in 5 steps: (1) application of a consistent definition of infertility to survey data; (2) adjustment of extracted data for known biases as needed; (3) application of a statistical model to estimate infertility prevalence and exposure proportion trends by country and age of the female partner; and (4) estimation of the proportion of infertility attributable to the male partner vs. to the female partner; and (5) estimation of the disease causes of infertility.

We estimated the prevalence of infertility by applying a consistent algorithm to available demographic and reproductive health surveys. Data from 227 household surveys were analyzed, including the surveys including the Demographic and Health Surveys (DHS), World Fertility Surveys (WFS), Reproductive Health Surveys (RHS), and Family and Fertility Surveys (FFS; complete list available in Mascarenhas et al, 2012b). A demographic infertility measure was used, with live birth as the outcome, and a 5-year exposure period based on union status, contraceptive use, and desire for a child (Mascarenhas et al, 2012a). Although infertility occurs in couples and may have a male or a female cause, estimates are indexed on the woman in each couple. We calculated prevalences for 5-year age groups for women aged 20–44 years, excluding infertility during the beginning (15–19 years) and end (45–49 years) of the reproductive period, when fewer couples are seeking a child and estimates of prevalence are less stable. We calculated four parameters, two each for primary and secondary infertility: 1) prevalence of exposure to infertility of that type, and 2) prevalence of infertility of that type among exposed women. We corrected the survey estimates of infertility prevalence for bias due to incomplete reporting of past contraceptive use (details are available in Mascarenhas et al, 2012b).

DisMod-MR was used with the survey analysis described above, to estimate all four parameters for every country, for 1990, 2005 and 2010 for the GBD 2010 study (Vos et al, 2012b). Estimates for primary and secondary infertility at the population level (i.e., among all women) were calculated by multiplying the estimates of prevalence of infertility among exposed women by the prevalence of exposure to infertility.

To obtain data on the sex and cause breakdown for infertility, Vos et al. (2012b) carried out a systematic literature search. In total, 15 studies were included in their analysis for the sex breakdown among infertile couples. Because infertility in some couples is attributable to both partners rather than just one, the sum of the proportion of couples' prevalence due to male factor infertility and due to female factor infertility is greater than 1. As before, only estimates for ages 20-44 years were used in subsequent stages of the analysis.

Published literature was also used to determine the proportion of female infertility due to sexually transmitted diseases, polycystic ovarian syndrome, and endometriosis. The remaining proportion of female infertility was assigned to "other female infertility". Sexually transmitted diseases were further divided into sexually transmitted chlamydial diseases, gonococcal infection, and other sexually transmitted diseases in a 30:20:50 ratio, based on the approximate ratio of prevalent cases due to each type of disease (Vos et al, 2012b). Male infertility was not divided according to cause.

YLDs were estimated using the revised disability weights for primary and secondary infertility (Table 3.3) resulting in an overall 4.7 fold increase in YLDs for infertility compared to the GBD 2010 estimates.

4.7 Anaemia

Trends in the distributions of blood haemoglobin and in the prevalences of anaemia and severe anaemia for children 6-59 months of age, non-pregnant women, and pregnant women for the period 1995-2011 have been estimated by the Nutrition Impact Model Study (Stevens et al, 2013b, de Regil et al, 2013), based on 257 population-representative data sources on haemoglobin and/or anaemia for children and women of childbearing age from 107 countries in every world region. A Bayesian hierarchical mixture model was used to estimate haemoglobin distributions, systematically addressing missing data, non-linear time trends, and representativeness of data sources. Trends between 1995 and 2011 in the distributions of blood haemoglobin for children aged 6-59 months and for women of reproductive age (15-49 years), separately by pregnancy status, were also estimated. Total anaemia was defined based on WHO thresholds of haemoglobin < 110 g/L for children under 5 years of age and pregnant women, and < 120 g/L for non-pregnant women. Severe anaemia was defined as blood haemoglobin < 70 g/L for children under 5 years and pregnant women, and < 80 g/L for non-pregnant women.

The analysis included three steps: 1) identifying data sources on haemoglobin and anaemia accessing and extracting data, and systematically assessing population representativeness of data; (2) adjusting haemoglobin for altitude; and (3) applying a statistical model to estimate trends in blood haemoglobin distributions and their uncertainties for children and for women of reproductive age by pregnancy status. WHO was a collaborating partner in the Nutrition Impact Model Study, and the prevalence estimates are now WHO official estimates.

IHME used a subset of these data to inform the global anaemia prevalence envelope calculations for the GBD 2010 study (Vos et al, 2012b). Predicted hemoglobin levels were used to calculate the total hemoglobin shift from "normal" and predict the prevalence of mild, moderate, and severe anemia in each setting. Then, estimated shifts of mean hemoglobin due to the following diseases were accessed: malaria, hookworm, schistosomiasis, maternal hemorrhage, chronic kidney disease, thalassemias, sickle cell disorders, G6PD deficiency, gastritis and duodenitis, and peptic ulcer disease. For each cause, the mean shift was multiplied by prevalence. All ten shift*prevalence figures were then added together and compared to the total hemoglobin shift predicted above.

To determine an appropriate distribution of the remainder, IHME performed a regression on data from multiple WHO-sanctioned randomised control trials (RCTs) on iron supplementation of anemic persons, determining that approximately 80% of the increase in hemoglobin concentration in these settings can be ascribed to iron. This group also included those with anemia from acute and/or chronic hemorrhage. The other roughly 20% was assigned to the not-otherwise-specified (NOS) pool, which contained the final six causes for which we had no separate prevalence estimates: other neglected tropical diseases, other infectious diseases, uterine fibroids, other gynecological disorders, other endocrine and nutritional disorders, and other hemoglobinopathies and hemolytic anemias. The NOS envelope was distributed to the causes in an age- and sex-specific manner based on findings of an additional supplemental literature review.

4.7 Back pain

The GBD 2010 estimated disability weights for the symptomatic state for back and neck pain using the following lay descriptions (Table 4.10).

Table 4.10 Back and neck pain sequelae in the GBD 2010 study: lay descriptions and disability weights

Health state	Lay description	GBD 2010 DW
Low back pain: acute, without leg pain	has severe back pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly and feels worried.	0.269
Low back pain: acute, with leg pain	has severe back and leg pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly and feels worried.	0.322
Low back pain: chronic, without leg pain	has constant back pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly, is worried, and has lost some enjoyment in life.	0.366
Low back pain: chronic, with leg pain	has constant back and leg pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly, is worried, and has lost some enjoyment in life.	0.374
Neck pain: acute, mild	has neck pain, and has difficulty turning the head and lifting things.	0.04
Neck pain: acute, severe	has severe neck pain, and difficulty turning the head and lifting things. The person gets headaches and arm pain, sleeps poorly, and feels tired and worried.	0.221
Neck pain: chronic, mild	has constant neck pain, and has difficulty turning the head, holding arms up, and lifting things.	0.101
Neck pain: chronic, severe	has constant neck pain and arm pain, and difficulty turning the head, holding arms up, and lifting things. The person gets headaches, sleeps poorly, and feels tired and worried.	0.286

While there are disability weights for mild and severe neck pain, all the lay descriptions for low back pain describe “severe” or “constant” back pain followed by listing of considerable difficulties in daily living and problems with sleep and affect. The prevalence of low back pain assessed by the GBD 2010 is quite high: the global all-age prevalence for 2010 is 9.2% (Table 4.11). As a result, low back pain is the leading cause of YLDs globally and the first or second ranked cause of YLDs in 17 of the 21 GBD 2010 regions.

Table 4.11. GBD 2010 global prevalence and YLD estimates for back and neck pain, 2010.

	YLDs (millions)	Point prevalence (millions)	Prevalence(%) 2010	Implied average disability weight
Low back pain	83.06	632	9.2	0.131
Neck pain	33.64	332	4.8	0.101

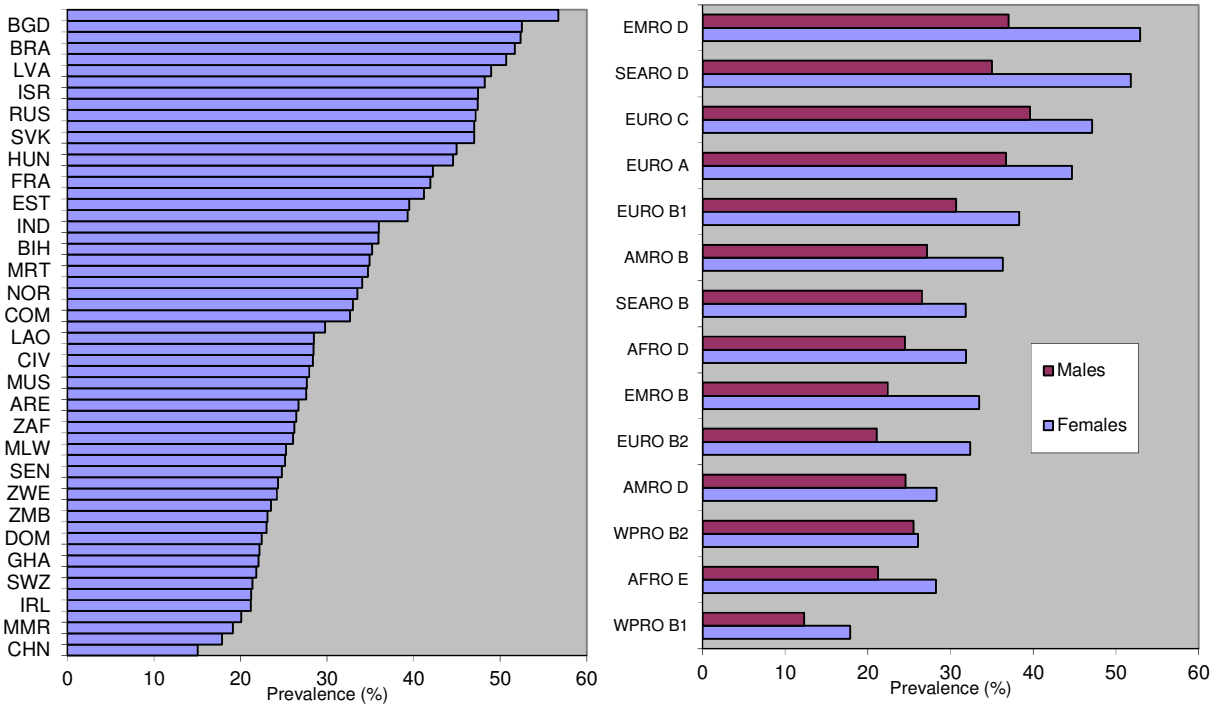


Figure 4.5. Average adult prevalence of reported back pain in the last 30 days in the World Health Surveys – by country and by WHO subregions.

Prevalence estimates for low back pain were based on data from 165 studies from 54 countries (Hoy, 2011). As for the previous GBD analysis of low back pain, many of these studies would have been reporting so-called "one-month" or "annual" prevalences, meaning the proportion of respondents who had experienced an episode of back pain in the last month or twelve months respectively. Other studies may have reported point prevalences (*do you have back pain now?*). Details of case definitions and data analysis are not yet released, so it is not yet possible to review the assumptions and methods for estimation of point prevalences, durations and severity of back pain episodes. Without such further information, it seems premature to accept that over 9% of the world's population are currently (at any point in time) experience severe back pain with an average disability weight of 0.13, comparable to a fractured backbone or amputation of one arm.

We carried out an analysis of the severity of self-reported back pain in the last month using data for 58 countries from the WHO World Health Survey (WHO Multi-Country Studies Data Archive 2013) and for six countries from the WHO SAGE surveys carried out in 2011-2013 in China, Ghana, India, Mexico, Russia and South Africa (Kowal et al, 2012). Figure 4.5 shows the average one month prevalences for countries and subregions of WHO regions.

Data collected in the World Health Surveys and the SAGE surveys on experience of bodily aches and pain in the last 30 days (none, mild, moderate, severe) was analysed for respondents who reported experiencing back pain in the last 30 days. The disability weight for mild low back pain was assumed to be the same as that for mild musculoskeletal problems of the legs (0.023). The disability weight for moderate back pain was estimated using the EQ5D+ valuation function for an EQ5D+ description of

212211(50%), 111211(50%). For severe back pain, the weight 0.269 for severe back pain, acute without leg pain, was used. The resulting disability weights for mild (0.023), moderate (0.072) and severe (0.269) back pain were used together with the global average severity distribution based on the World Health Surveys and SAGE surveys to derive an average disability weight for all back pain of 0.061, slightly less than half of the average GBD 2010 disability weight of 0.131 for low back pain. The provisional revision of back pain YLDs will be revisited when GBD 2010 analyses are published. Even with this provisional revision, back and neck pain remain the second leading cause of YLDs globally.

Table 4.12. Average distribution of back pain severity in the SAGE and World Health Surveys.

	Male severity distribution (%)				Female severity distribution (%)			
	none	mild	moderate	severe	none	mild	moderate	severe
Asia, South	20.9	35.9	23.4	19.9	14.1	29.1	26.1	30.7
Central and Eastern Europe and Central	30.0	30.4	24.5	15.1	18.7	26.9	29.0	25.4
East Asia and Pacific	25.9	42.5	23.8	7.8	23.0	41.4	27.0	8.6
High income	35.7	29.7	21.3	13.3	24.7	31.0	26.8	17.6
Latin America and Caribbean	28.8	31.2	25.5	14.5	21.2	25.6	28.5	24.7
North Africa + Middle East	32.8	17.7	23.8	25.7	18.7	18.9	20.5	42.0
Sub-Saharan Africa	31.3	27.6	22.6	18.6	24.7	27.5	26.1	21.8
World	27.9	34.5	23.3	14.3	20.9	32.1	26.6	20.3
SAGE surveys	16.2	34.7	28.9	20.2	16.2	34.7	28.9	20.2

4.8 Alcohol problem use

The GBD 2010 included alcohol dependence (mild, moderate and severe) as sequelae for alcohol use disorders, but did not include problem use as formerly in the GBD 2004. In revising alcohol use disorders YLD to include problem use, an EQ5D+ description was written for alcohol problem use (112121(33%), 112111(67%)) and the disability weight of 0.111 estimated using the valuation function.

WHO is currently revising the estimated prevalence of alcohol dependence and problem use for a forthcoming global report. In the interim, the ratio of prevalence of problem use to dependence was assumed to be the same as that estimated for the GBD 2004 estimates (WHO, 2008).

4.9 Migraine and non-migraine headache

The GBD 2010 estimated disability weights for the symptomatic state for migraine and non-migraine headache using the following lay descriptions (Table 4.13).

Table 4.13 Headache sequelae in the GBD 2010 study: lay descriptions and disability weights

Health state	Lay description	GBD 2010 DW
Headache: migraine	has severe, throbbing head pain and nausea that cause great difficulty in daily activities and sometimes confine the person to bed. Moving around, light, and noise make it worse.	0.433
Headache: tension-type	has a moderate headache that also affects the neck, which causes difficulty in daily activities.	0.040

Information on frequency and duration of headache episodes was pooled to derive estimates of the proportion of time spent in episodes (5.3% for migraine and 2.4% for tension-type headaches) (Steiner, Stovner & Birbeck, 2013). The global all-age prevalence of migraine was estimated at 14.7% and tension-type headache at 20.8% (see Table 4.14). The disability weight estimated for migraine episodes was 0.433, for tension-type headache it was much lower at 0.04. As a result, the YLD burden of migraine is much higher than tension-type headache.

Table 4.14. Global YLD, prevalence and disability weight assumptions for migraine and tension-type headache.

	YLD (2010)	Prevalence(%) 2010	% of time symptomatic	Symptomatic period disability weight
Migraine	22,362,325	14.7	0.053	0.433
Tension-type headache	1,778,682	20.8	0.024	0.040

Previous burden estimates for migraine produced by WHO assumed there was a distribution of migraine severity (23% mild, 52% moderate and 25% severe) and frequency, and that the average duration of migraine was lower in developed countries where effective treatment was available to a proportion of sufferers. As a result, the GBD 2000 estimates of per cent of time symptomatic ranged from 2.3% in developed countries to 9.2% in low income countries.

The GBD 2010 lay description (see above) describes a severe migraine episode and was applied to all migraine episodes. Pending publication of the detailed severity information used in the GBD 2010, and further review, we assume that 50% of migraine episodes are severe and 50% moderate severity. For moderate severity migraine episodes, we use the disability weight of 0.267 calculated for moderate headache using the EQ5D+ valuation function. The resulting average disability weight for migraine episodes is 0.35.

4.10 Skin diseases

The GBD 2010 estimated the YLD burden for 15 categories of skin disease, resulting in an estimate of 33.7 million YLD for 2010, 4.3% of total YLDs for all causes. Estimated global all age prevalences for some skin conditions were extremely high (see table 4.15). To date, only summary information on the data and assumptions for the skin conditions have been published (Johns et al, 2013). Available information is summarized in Table 4.15, including average disability weights calculated using information from the Medical Expenditure Panel Survey (MEPS), 2000-2009, USA to assess per cent of time symptomatic and severity distributions.

Table 4.15. Global YLD, prevalence and disability weight assumptions for migraine and tension-type headache.

	GBD 2010 YLDs	Global prevalence (%)	GBD 2010 average disability weight	GHE average disability weight
Eczema	8,896,814	3.3	0.0391	0.0042
Psoriasis	1,058,733	1.5	0.0100	0.0100
Cellulitis	375,868	0.2	0.0371	0.0371
Impetigo	417,615	2.0	0.0054	0.0054
Abscess and other bacterial skin infections	904,509	1.2	0.0029	0.0029
Scabies	1,579,681	1.5	0.0133	0.0133
Fungal skin diseases	2,302,797	14.5	0.0024	0.0024
Viral warts	2,460,967	13.0	0.0296	0.0069
Molluscum contagiosum	269,813	1.8	0.0022	0.0022
Acne vulgaris	4,001,776	9.4	0.0063	-
Alopecia areata	1,352,473	0.1	0.0038	-
Pruritus	2,086,451	4.0	0.0079	0.0079
Urticaria	2,599,599	1.0	0.0321	0.0321
Decubitus ulcer	476,012	0.1	0.1215	0.1215
Other skin diseases	4,960,696	11.7	0.0062	0.0030
All skin diseases	33,743,804			

Pending availability of more detailed information on the case defintions, prevalence estimates, severity distributions and per cent of time symptomatic, allowing review of the GBD 2010 estimates, we have excluded acne and alopecia areata from the WHO GHE and revised other YLD estimates using the provisional disability weights shown in the final column of Table 4.15. The revised total for skin disease is slightly more than halved to 15.1 million YLDs.

5 Overview of results

5.1 Global distribution of YLDs and DALYs by cause, age and sex

Figure 5.1 summarizes the proportional distributions of YLDs by age, sex and cause for years 2000 and 2011 at global level. Figure 5.2 provides a similar summary for DALYs. More detailed regional tabulations of YLLs, YLDs and DALYs by cause, age and sex for years 2000 and 2011 are available in the WHO Global Health Observatory (www.who.int/gho) and at http://www.who.int/healthinfo/global_health_estimates/en/ as downloadable Excel spreadsheets.

Figure 5.1 Proportional age distribution of global YLDs by cause and sex, 2000 and 2011.

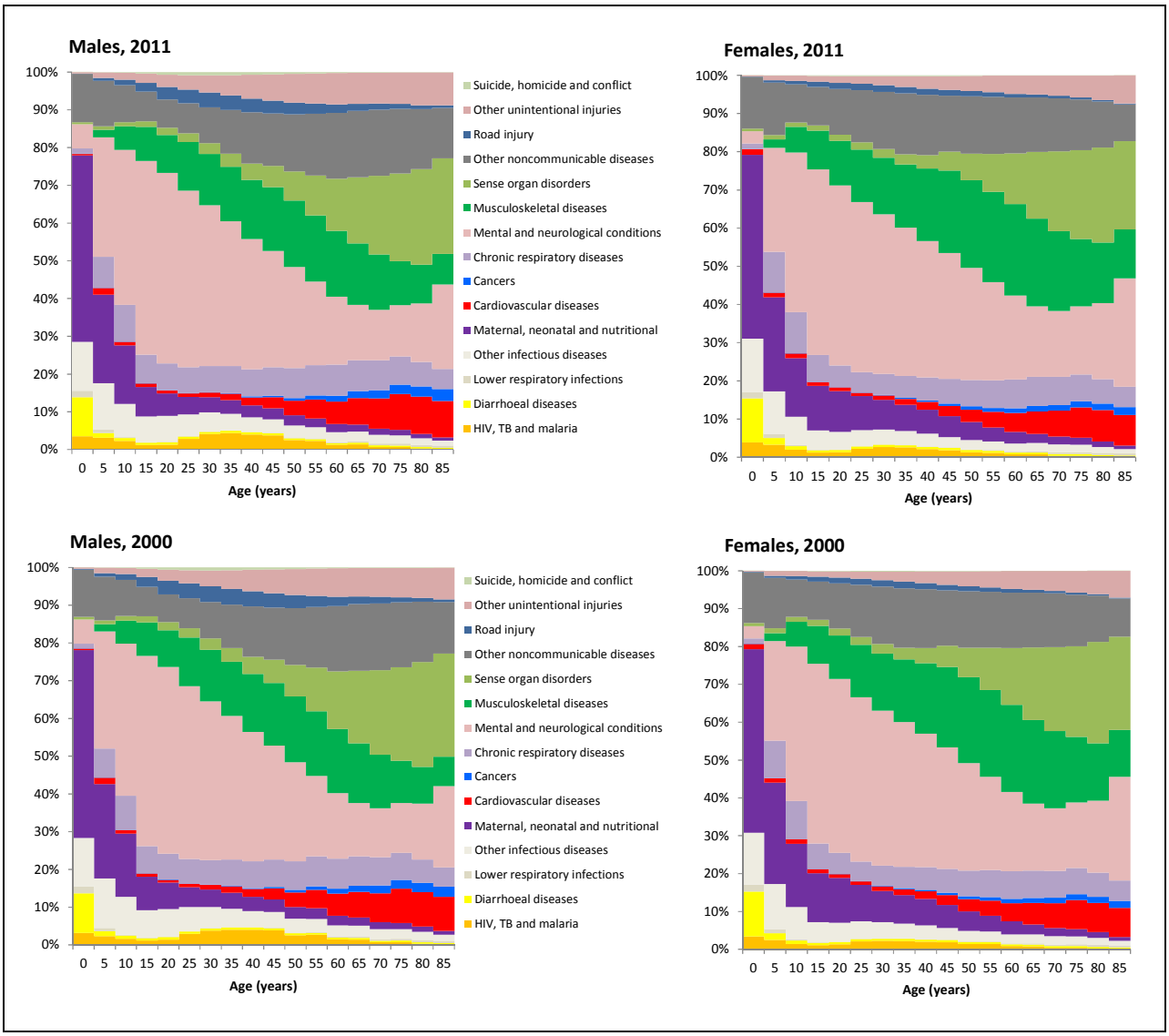


Figure 5.2 Proportional age distribution of global DALYs by cause and sex, 2000 and 2011.

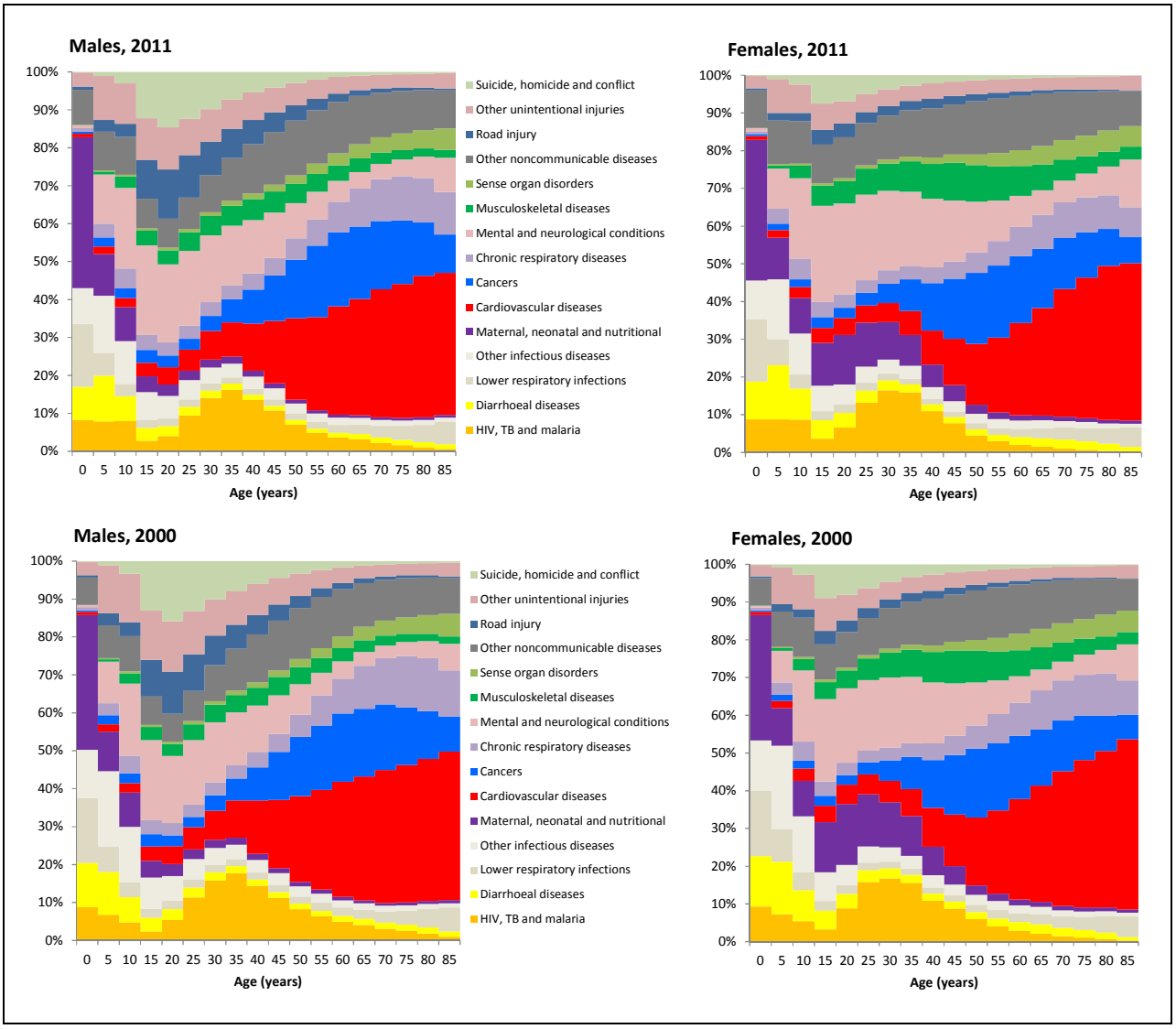


Figure 5.3 summarizes the proportional contributions of YLLs and YLDs to global DALYs in 2000 and 2011 by age group, and Figure 5.4 summarizes their proportional contributions for high income countries and for low and middle income countries by WHO Region.

Figure 5.3 Proportional YLL and YLD contributions to global DALYs by age group, 2000 and 2011.

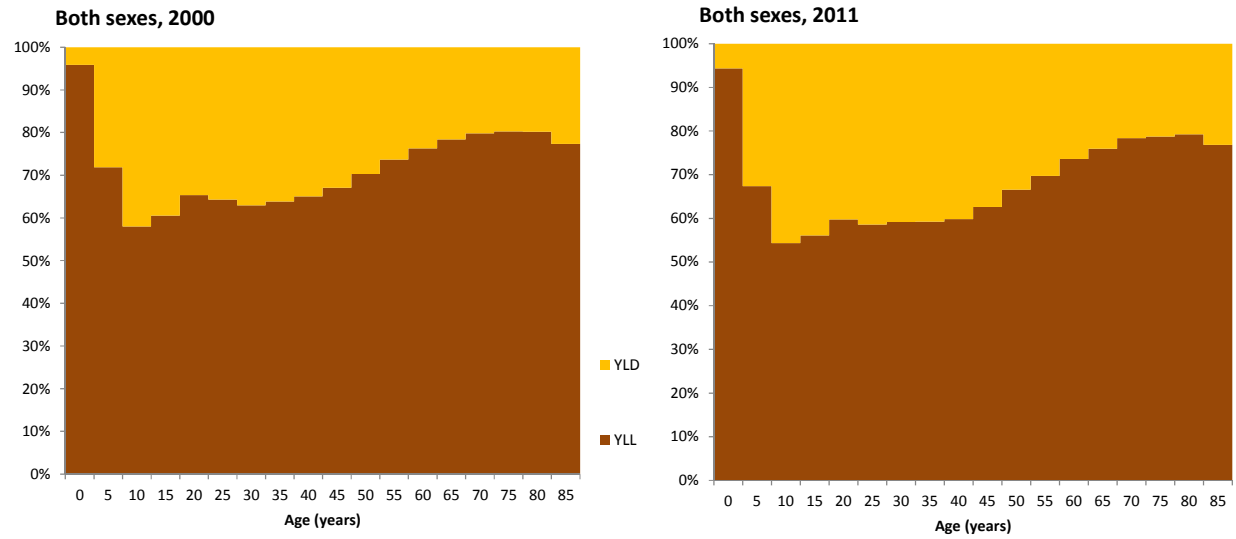
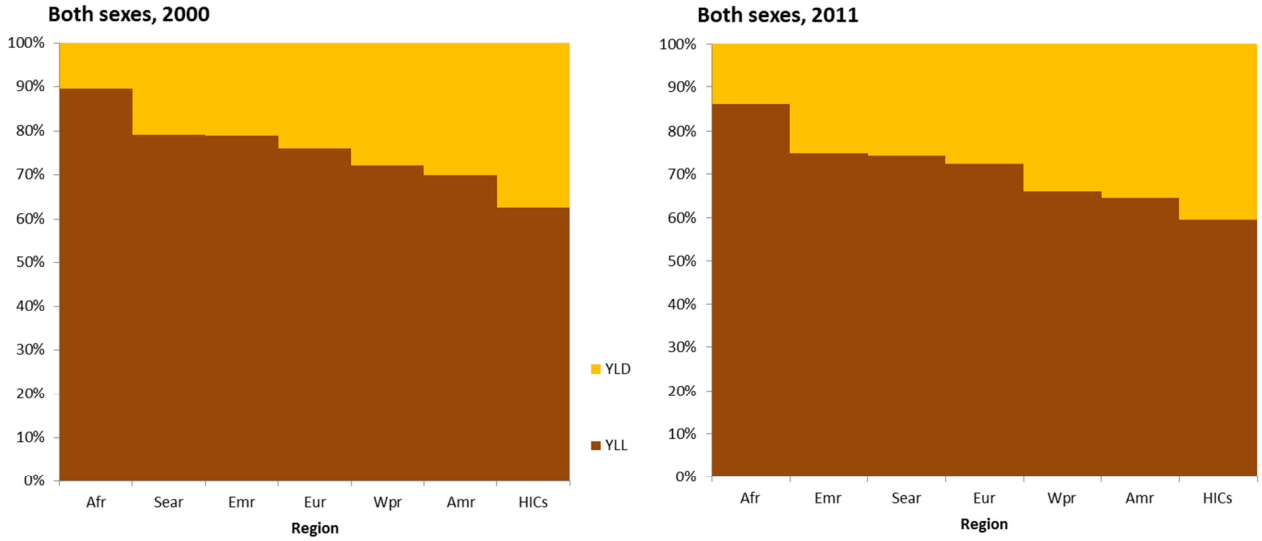


Figure 5.4 Proportional YLL and YLD contributions global DALYs by region, 2000 and 2011.



5.2 Leading causes of YLDs and DALYs

Figure 5.5 shows the 20 leading causes of YLDs at global level in 2000 and 2011. There is little change in rankings across this period, and the nine leading causes of YLDs remain unchanged. While unipolar depressive disorders were also the leading cause of YLDs in the GBD 2004 estimates, low back pain was only ranked 19th at global level, and the other leading causes in 2004 were also quite different (see Section 5.3). Figure 5.6 shows the 20 leading causes of DALYs at global level in 2000 and 2011. The leading child causes of disease burden declined in rankings across this period and rankings for chronic diseases increased, reflecting trends for improving child survival and population ageing.

Figure 5.5 Change in 20 leading causes of YLDs at global level, 2000 to 2011.

WORLD, 2000				WORLD, 2011		
Cause	**DALYs (millions)**	**Rank**		**Rank**	**Cause**	**DALYs (millions)**
Unipolar depressive disorders	63.9	1		1	Unipolar depressive disorders	74.9
Back and neck pain	43.8	2		2	Back and neck pain	52.6
Iron-deficiency anaemia	43.3	3		3	Iron-deficiency anaemia	42.2
COPD	24.4	4		4	COPD	29.8
Anxiety disorders	23.1	5		5	Anxiety disorders	27.0
Diabetes mellitus	16.7	6		6	Diabetes mellitus	21.8
Other hearing loss	15.7	7		7	Other hearing loss	21.3
Falls	15.6	8		8	Falls	19.9
Migraine	15.4	9		9	Migraine	18.2
Alcohol use disorders	13.8	10		10	Osteoarthritis	17.4
Pervasive developmental disorc	13.6	11		11	Alcohol use disorders	15.7
Skin diseases	13.4	12		12	Pervasive developmental disorc	15.4
Osteoarthritis	13.3	13		13	Skin diseases	15.2
Refractive errors	12.7	14		14	Asthma	13.9
Asthma	12.3	15		15	Road injury	13.5
Road injury	12.1	16		16	Refractive errors	13.4
Childhood behavioural disorder:	12.0	17		17	Schizophrenia	13.1
Bipolar disorder	10.9	18		18	Bipolar disorder	13.0
Schizophrenia	10.7	19		19	Childhood behavioural disorder:	12.4
Endocrine, blood, immune disor	9.2	20		20	Drug use disorders	10.5
Drug use disorders	8.8	21		21	Endocrine, blood, immune disor	10.2

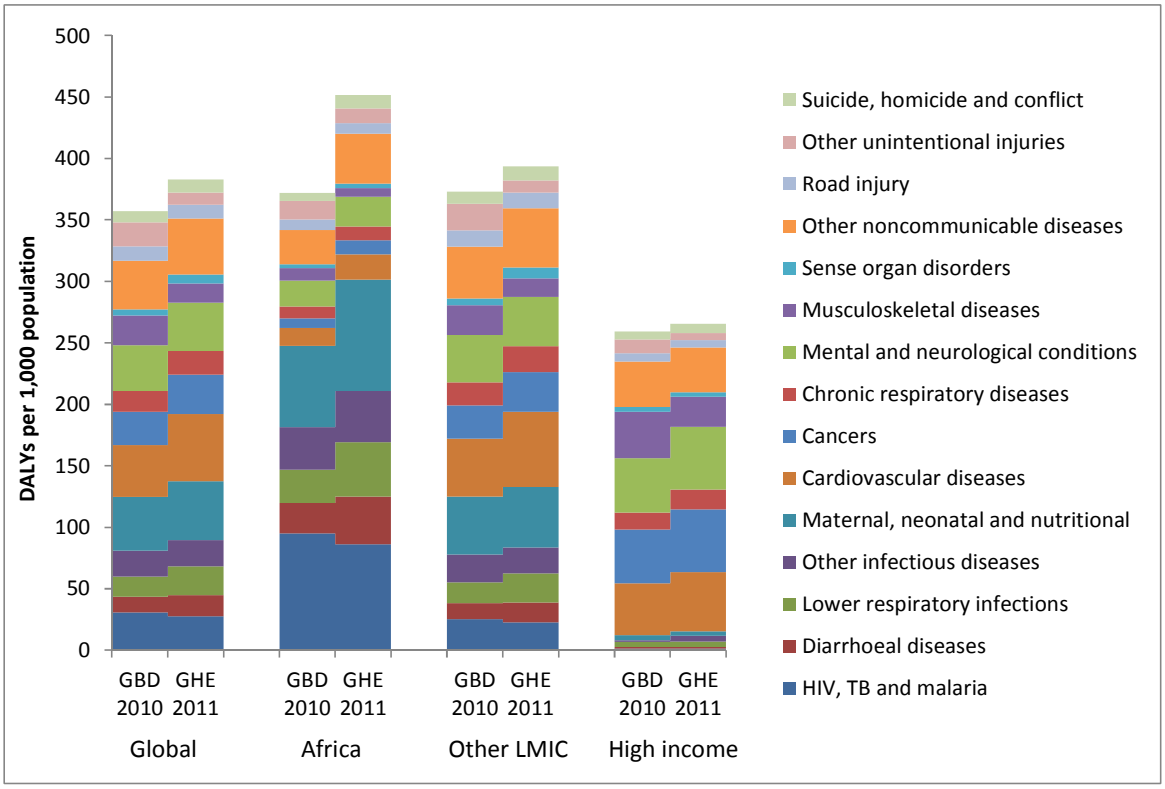
Figure 5.6 Change in 20 leading causes of DALYs at global level, 2000 to 2011.

WORLD, 2000				WORLD, 2011		
Cause	**DALYs (millions)**	**Rank**		**Rank**	**Cause**	**DALYs (millions)**
Lower respiratory infections	213.4	1		1	Lower respiratory infections	164.8
Diarrhoeal diseases	173.6	2		2	Ischaemic heart disease	159.7
Ischaemic heart disease	142.6	3		3	Stroke	135.4
Prematurity	130.5	4		4	Diarrhoeal diseases	118.8
Stroke	126.9	5		5	Prematurity	110.7
HIV/AIDS	98.0	6		6	HIV/AIDS	95.2
Birth asphyxia and birth trauma	94.3	7		7	COPD	89.6
COPD	89.8	8		8	Road injury	78.8
Malaria	73.1	9		9	Birth asphyxia and birth trauma	78.2
Road injury	67.9	10		10	Unipolar depressive disorders	75.0
Unipolar depressive disorders	64.0	11		11	Congenital anomalies	57.7
Congenital anomalies	59.6	12		12	Diabetes mellitus	56.4
Tuberculosis	56.7	13		13	Malaria	55.4
Measles	55.7	14		14	Back and neck pain	52.7
Iron-deficiency anaemia	47.1	15		15	Iron-deficiency anaemia	46.2
Self-harm	46.3	16		16	Tuberculosis	42.2
Back and neck pain	43.8	17		17	Falls	40.8
Diabetes mellitus	43.6	18		18	Self-harm	39.8
Protein-energy malnutrition	40.6	19		19	Trachea, bronchus, lung cancers	37.3
Neonatal sepsis and infections	39.7	20		20	Cirrhosis of the liver	34.9
Falls	34.4	21		21	Protein-energy malnutrition	33.2
Cirrhosis of the liver	32.5	23				
Trachea, bronchus, lung cancers	31.0	24		25	Neonatal sepsis and infections	29.1
				46	Measles	14.8

5.3 Comparison with GBD 2010 results for year 2010

Figure 5.7 shows the GHE estimates for DALYs for year 2011 (using the WHO GHE standard loss function for YLLs) and the GBD 2010 estimates for year 2010 (as published, using the GBD 2010 standard loss function) for 15 major cause groups. The higher normative years of life lost for deaths at various ages used in the GHE estimates results in a somewhat larger DALY rates in all regions, but particularly in Africa where there are more deaths at younger ages. Cause distributions are generally quite similar at this very aggregated regional level, with differences arising from revisions to disability weights and prevalences in the YLD estimates, from differences of estimates of deaths for some important causes, and from the use of a different YLL loss function.

Figure 5.7 Comparison of total DALYs for 15 major cause groups, GHE estimates for year 2011 and GBD 2010 estimates for year 2010, for world, high income countries, Africa and other low- and middle-income countries.



5.4 Comparison with previous WHO GBD results

These estimates for years 2000-2011 supercede and replace all previous estimates for global and regional DALYs published by WHO. They are not directly comparable with previous WHO estimates for 2004 and earlier years and differences should not be interpreted as trends. Figures 5.8 and 5.9 provide summary comparisons of the GHE estimates for year 2004 with the previous WHO estimates for year 2004 published in 2008 (WHO, 2008). The GBD 2004 DALYs are recalculated using various DALY standards, as explained in the captions. At this level of cause aggregation, at the global level, the GHE

DALY estimates for year 2004 are quite similar to the undiscounted, non-age-weighted DALYs calculated using the original GBD 1990 YLL standard loss function. Of course, the GHE YLDs are adjusted for independent comorbidity, whereas the GBD 2004 YLDs have not been.

Figure 5.8 Comparison of global YLD, YLL and DALYs for 15 major cause groups, GBD 2004 estimates (WHO 2008) and GHE estimates for year 2004. Prefix C denotes classic DALYs with incidence YLD, age weighting and discounting. Prefix P denotes prevalence YLD (no discounting or age weighting), YLL00 also have no discounting or age weighting and use the GBD 1990 standard loss function. DALY00=PYLD+YLL00. YLL and DALY are calculated using the GHE loss function for YLL.

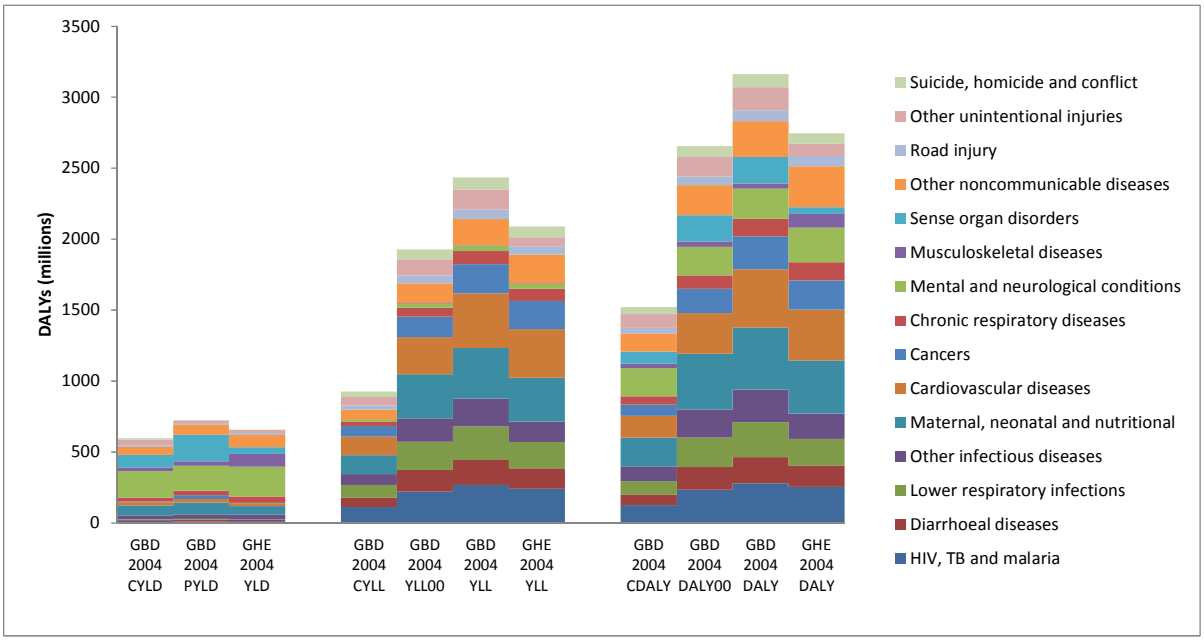


Table 5.1. Comparison of global YLDs, YLLs and DALYs (all in millions), GBD 2004 estimates (WHO, 2008) and GHE estimates for year 2004, calculated using various calculation standards. Refer to Figure 5.8 for explanation of column headings.

Causes	GBD 2004 CYLD	GBD 2004 PYLD	GHE YLD	GBD 2004 CYLL	GBD 2004 YLL00	GBD 2004 YLL	GHE YLL	GBD 2004 CDALY	GBD 2004 DALY00	GBD 2004 DALY	GHE DALY
HIV, TB and malaria	15	12	14	111	221	267	241	127	233	279	255
Diarrhoeal diseases	6	8	8	67	153	176	143	73	162	185	151
Lower respiratory infections	4	9	2	90	199	237	184	94	208	246	186
Other infectious diseases	28	32	34	78	165	197	145	105	197	229	179
Maternal, neonatal and nutritional	71	83	62	134	311	355	310	204	394	438	372
Cardiovascular diseases	22	25	19	129	260	385	341	152	285	410	360
Cancers	4	27	4	74	145	205	200	78	172	232	203
Chronic respiratory diseases	28	32	45	31	63	93	84	59	95	125	129
Mental and neurological	185	174	209	14	28	38	36	200	202	211	245
Musculoskeletal diseases	30	33	91	1	2	3	4	31	36	37	95
Sense organ disorders	87	186	48	0	0	0	0	87	186	186	48
Other noncommunicable diseases	57	71	86	69	141	184	203	126	211	254	289
Road injury	10	6	13	31	56	70	59	41	62	75	71
Other unintentional injuries	38	24	24	59	113	139	62	97	138	163	86
Suicide, homicide, conflict	10	5	2	39	69	86	76	49	75	92	77
All causes	596	727	659	926	1,927	2,435	2,088	1,522	2,654	3,163	2,747

Figure 5.9 Comparison of age distributions of YLDs for 3 main cause groups, GBD 2004 estimates (WHO, 2008) and GHE estimates for year 2004. Prefix C denotes classic incidence YLDs with age weighting and discounting. Prefix P denotes prevalence YLDs (no discounting or age weighting).

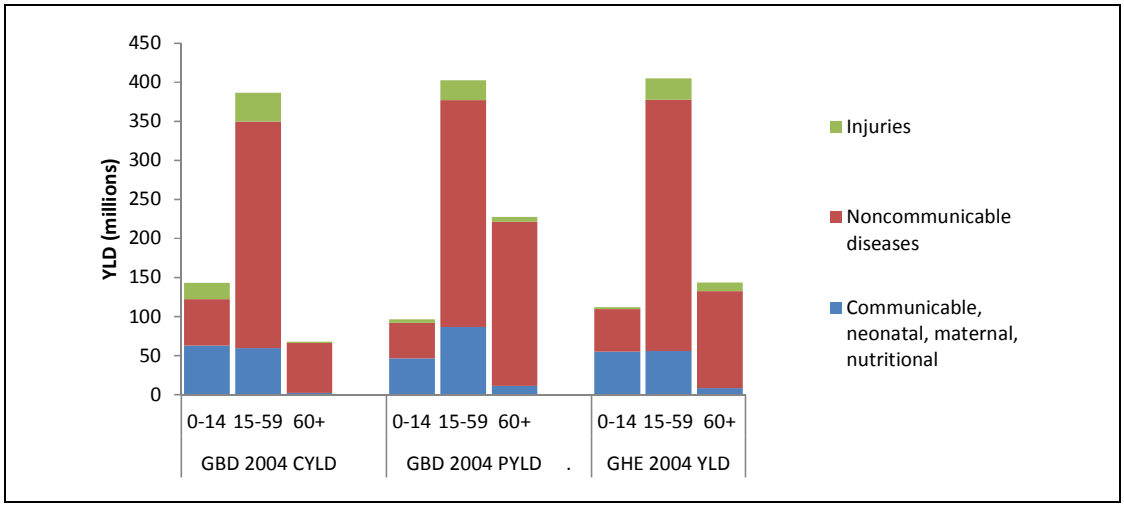
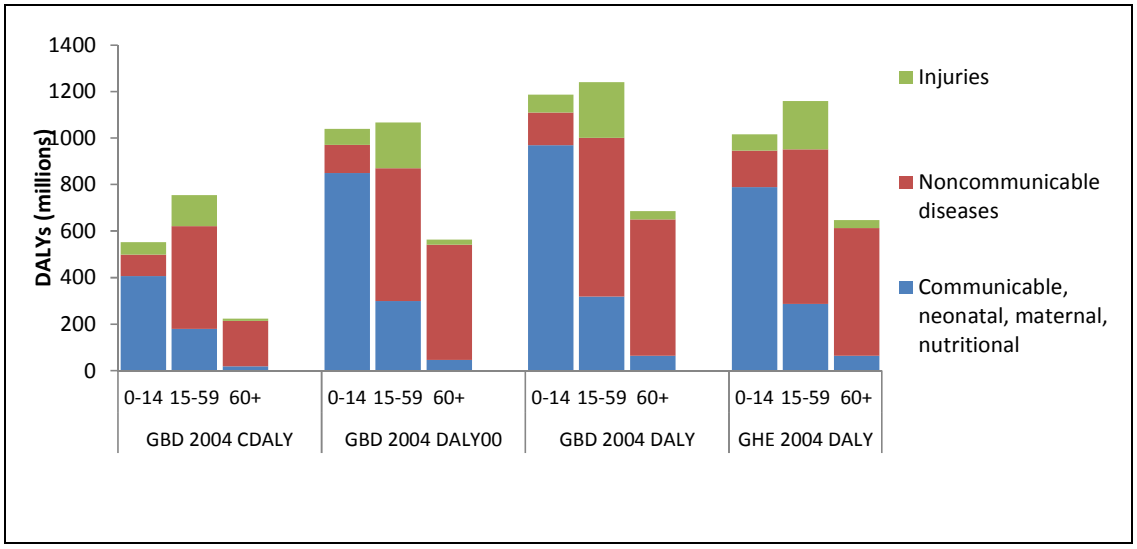


Figure 5.10 Comparison of age distributions of DALYs for 3 main cause groups, GBD 2004 estimates (WHO, 2008) and GHE estimates for year 2004. Prefix C denotes classic DALYs with incidence YLDs, age weighting and discounting. DALY00 is the sum of prevalence YLDs (no discounting or age weighting) and YLL00 with no discounting or age weighting and using the GBD 1990 standard loss function. The two righthand groups of DALYs are calculated using the GHE loss function for YLLs.



5.5 Conclusions

WHO's adoption of health estimates is affected by a number of factors, including a country consultation process for country-level health estimates, existing multi-agency and expert group collaborative mechanisms, and compliance with minimum standards around data transparency, data and methods sharing. More detailed information on quality of data sources and methods, as well as estimated uncertainty intervals, is provided in referenced sources for specific causes.

Calculated uncertainty ranges depend on the assumptions and methods used. In practice, estimating uncertainty in a consistent way across health indicators has had limited success (i.e., estimates with uncertainty typically reflect some, but not all, source of uncertainty). Most methods for estimation of uncertainty rely on statistical techniques to assess variations across observations and take into account sampling error but are less successful in dealing with unknown systematic bias in observations. In particular, there is not yet sufficient research or consensus on the interpretation and use of verbal autopsy studies to ensure that systematic bias in assigning underlying cause of death can be fully addressed or resulting uncertainty fully quantified.

The type and complexity of models used for global health estimates varies widely by research/institutional group and health estimate. Where data are available and of high quality, estimates from different institutions are generally in agreement. Discrepancies are more likely to arise for countries where data are poor and for conditions where data are sparse and potentially biased. This is best addressed through improving the primary data.

Although the GHE estimates for years 2000-2011 have large uncertainty ranges for some causes and some regions, they provide useful information on broad relativities of disease burden, on the relative importance of different causes of death and disability, and on regional patterns and inequalities. The data gaps and limitations in high-mortality regions reinforces the need for caution when interpreting global comparative cause of death assessments and the need for increased investment in population health measurement systems. The use of verbal autopsy methods in sample registration systems, demographic surveillance systems and household surveys provides some information on causes of death in populations without well-functioning death registration systems, but there remain considerable challenges in the validation and interpretation of such data.

We anticipate that the GBD 2.0 will further revise disease models and estimates for prevalence, disability weights and mortality and also that WHO and collaborating agencies and expert groups will also continue to improve and revise estimates for priority conditions and for all-cause mortality. These regional DALY estimates are provisional estimates and will be further revised in the process of updating to 2012 for WHO release at country level.

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Annex Table A GHE cause categories and ICD-10 codes

Code	GHE cause name	ICD-10 code
1	**I. Communicable, maternal, perinatal and nutritional conditions**[a]	A00-B99, G00-G04, N70-N73, J00-J22, H65-H68, O00-O99, P00-P96, E00-E02, E40-E46, E50-E64, D50-D53, D64.9, U04
2	**A. Infectious and parasitic diseases**	A00-B99, G00, G03-G04, N70-N73
3	1. Tuberculosis	A15-A19, B90
4	2. Sexually transmitted diseases (STDs) excluding HIV	A50-A64, N70-N73
5	a. Syphilis	A50-A53
6	b. Chlamydia	A55-A56
7	c. Gonorrhoea	A54
8	d. Trichomoniasis	A59
9	e. Other STDs	A57-A58, A60-A64, N70-N73
10	3. HIV/AIDS	B20-B24
11	4. Diarrhoeal diseases[b]	A00, A01, A03, A04, A06-A09
12	5. Childhood-cluster diseases	A33-A37, B05
13	a. Whooping cough	A37
14	b. Diphtheria	A36
15	c. Measles	B05
16	d. Tetanus	A33-A35
17	6. Meningitis	A39, G00, G03
18	7. Encephalitis[b]	A83-A86, B94.1, G04
19	8. Hepatitis B	B16-B19 (minus B17.1, B18.2)
20	9. Hepatitis C	B17.1, B18.2
21	10. Parasitic and vector diseases	A30, A71, A82, A90-A91, B50-B57, B65, B73, B74.0-B74.2
22	a. Malaria	B50-B54, P37.3, P37.4
23	b. Trypanosomiasis	B56
24	c. Chagas disease	B57
25	d. Schistosomiasis	B65
26	e. Leishmaniasis	B55
27	f. Lymphatic filariasis	B74.0-B74.2
28	g. Onchocerciasis	B73
29	h. Leprosy	A30
30	i. Dengue	A90-A91
31	j. Trachoma	A71
32	k. Rabies	A82
33	11. Intestinal nematode infections	B76-B77, B79
34	a. Ascariasis	B77
35	b. Trichuriasis	B79
36	c. Hookworm disease	B76
37	12. Other infectious diseases	A02, A05, A20-A28, A31, A32, A38, A40-A49, A65-A70, A74-A79, A80-A81, A87-A89, A92-A99, B00-B04, B06-B15, B25-B49, B58-B60, B64, B66-B72, B74.3-B74.9, B75,B78, B80-B89, B91-B99 (minus B94.1)
38	**B. Respiratory infections**[b]	J00-J22, H65-H68,P23, U04

Code	GHE cause name	ICD-10 code
39	1. Lower respiratory infections	J09-J22, P23, U04
40	2. Upper respiratory infections	J00-J06
41	3. Otitis media	H65-H68
42	**C. Maternal conditions**	O00-O99
43	1. Maternal haemorrhage	O44-O46, O67, O72
44	2. Maternal sepsis	O85-O86
45	3. Hypertensive disorders of pregnancy	O10-O16
46	4. Obstructed labour	O64-O66
47	5. Abortion	O00-O07
48	6. Other maternal conditions	O20-O43, O47-O63, O68-O71, O73-O75, O87-O99
49	**D. Neonatal conditions**	P00-P96 excl P37.3, P37.4
50	1. Preterm birth complications [b]	P05, P07, P22, P27-P28
51	2. Birth asphyxia and birth trauma [b]	P03, P10-P15, P20-P21, P24-P26, P29
52	3. Neonatal sepsis and infections	P35-P39 (excluding P37.3, P37.4)
53	4. Other neonatal conditions	P00-P02, P04, P08, P50-P96
54	**E. Nutritional deficiencies**	E00-E02, E40-E46, E50-E64, D50-D53, D64.9
55	1. Protein-energy malnutrition	E40-E46
56	2. Iodine deficiency	E00-E02
57	3. Vitamin A deficiency	E50
58	4. Iron-deficiency anaemia	D50, D64.9
59	5. Other nutritional disorders	D51-D53, E51-E64
60	**II. Noncommunicable diseases [a]**	C00-C97, D00-D48, D55-D64 (minus D 64.9), D65-D89, E03-E07, E10-E16, E20-E34, E65-E88, F01-F99, G06-G98, H00-H61, H68-H93, I00-I99, J30-J98, K00-K92, N00-N64, N75-N98, L00-L98, M00-M99, Q00-Q99, X41-X42[b], X45[b]
61	**A. Malignant neoplasms**	C00-C97
62	1. Mouth and oropharynx cancers[d]	C00-C14
63	2. Oesophagus cancer[d]	C15
64	3. Stomach cancer[d]	C16
65	4. Colon and rectum cancers[d]	C18-C21
66	5. Liver cancer	C22
67	6. Pancreas cancer	C25
68	7. Trachea, bronchus and lung cancers	C33-C34
69	8. Melanoma and other skin cancers[d]	C43-C44
70	9. Breast cancer[d]	C50
71	10. Cervix uteri cancer[d]	C53
72	11. Corpus uteri cancer[d]	C54-C55
73	12. Ovary cancer	C56
74	13. Prostate cancer[d]	C61
75	14. Bladder cancer[d]	C67
76	15. Lymphomas and multiple myeloma[d]	C81-C90, C96
77	16. Leukaemia[d]	C91-C95
78	17. Other malignant neoplasms[d]	C17, C23, C24, C26-C32, C37-C41, C45-C49, C51, C52,C57-C60, C62-C66, C68-C80, C97
79	**B. Other neoplasms**	D00-D48

Code	GHE cause name	ICD-10 code
80	**C. Diabetes mellitus**	E10-E14
81	**D. Endocrine, blood, immune disorders**	D55-D64 (minus D64.9), D65-D89, E03-E07, E15-E34, E65-E88
82	**E. Mental and behavioural disorders**	F04-F99, X41-X42[c], X45[c]
83	1. Unipolar depressive disorders	F32-F33, F34.1
84	2. Bipolar affective disorder	F30-F31
85	3. Schizophrenia	F20-F29
86	4. Alcohol use disorders	F10, X45[c]
87	5. Drug use disorders	F11-F16, F18-F19, X41-X42[c]
88	6. Anxiety disorders	F40-F44
89	7. Eating disorders	F50
90	8. Pervasive developmental disorders	F84
91	9. Childhood behavioural disorders	F90-F92
92	10. Idiopathic intellectual disability	F70-F79
93	11. Other mental and behavioural disorders	F04-F09, F17, F34-F39 (minus F34.1), F45-F48, F51-F69, F80-F83, F88-F89, F93-F99
94	**F. Neurological conditions**	F01-F03, G06 -G98
95	1. Alzheimer's disease and other dementias	F01-F03, G30-G31
96	2. Parkinson disease	G20-G21
97	3. Epilepsy	G40-G41
98	4. Multiple sclerosis	G35
99	5. Migraine	G43
100	6. Non-migraine headache	G44
101	7. Other neurological conditions	G06-G12, G23-G25, G36-G37, G45-G98
102	**G. Sense organ diseases**	H00-H61, H69-H93
103	1. Glaucoma	H40
104	2. Cataracts	H25-H26
105	3. Refractive errors	H49-H52
106	4. Macular degeneration	H35.3
107	5. Other vision loss	H30-H35 (minus H35.3), H53-H54
108	6. Other hearing loss	H90-H91
109	7. Other sense organ disorders	H00-H21, H27, H43-H47, H55-H61, H69-H83, H92-H93
110	**H. Cardiovascular diseases**	I00-I99
111	1. Rheumatic heart disease	I01-I09
112	2. Hypertensive heart disease	I10-I15
113	3. Ischaemic heart disease[e]	I20-I25
114	4. Stroke	I60-I69
115	5. Cardiomyopathy, myocarditis, endocarditis	I30-I33, I38, I40, I42
116	6. Other cardiovascular diseases[e]	I00, I26-I28, I34-I37, I44-I51, I70-I99
117	**I. Respiratory diseases**	J30-J98
118	1. Chronic obstructive pulmonary disease	J40-J44
119	2. Asthma	J45-J46
120	3. Other respiratory diseases	J30-J39, J47-J98
121	**J. Digestive diseases**	K20-K92
122	1. Peptic ulcer disease	K25-K27

Code	GHE cause name	ICD-10 code
123	2. Cirrhosis of the liver	K70, K74
124	3. Appendicitis	K35-K37
125	4. Other digestive diseases	K20-K22, K28-K31, K38-K66, K71-K73, K75-K92
126	**K. Genitourinary diseases**	N00-N64, N75-N76, N80-N98
127	1. Kidney diseases	N00-N19
128	2. Hyperplasia of prostate	N40
129	3. Urolithiasis	N20-N23
130	4. Other genitourinary disorders	N25-N39, N41-N45, N47-N51
131	5. Infertility	N46, N97
132	6. Gynecological diseases	N60-N64, N75-N76, N80-N96, N98
133	**L. Skin diseases**	L00-L98
134	**M. Musculoskeletal diseases**	M00-M99
135	1. Rheumatoid arthritis	M05-M06
136	2. Osteoarthritis	M15-M19
137	3. Gout	M10
138	4. Back and neck pain	M45-M48, M50-M54
139	5. Other musculoskeletal disorders	M00, M02, M08, M11-M13, M20-M43, M60-M99
140	**N. Congenital anomalies**	Q00-Q99
141	1. Neural tube defects	Q00, Q05
142	2. Cleft lip and cleft palate	Q35-Q37
143	3. Down syndrome	Q90
144	4. Congenital heart anomalies	Q20-Q28
145	5. Other chromosomal anomalies	Q91-Q99
146	6. Other congenital anomalies	Q01-Q04, Q06-Q18, Q30-Q34, Q38-Q89
147	**O. Oral conditions**	K00-K14
148	1. Dental caries	K00-K04, K06-K14
149	2. Periodontal disease	K05
150	3. Edentulism	—
151	**III. Injuries**	V01-Y89
152	**A. Unintentional injuries**[f]	V01-X40, X43-X44, X46-59, Y40-Y86, Y88, Y89
153	1. Road injury[g]	V01-V04, V06, V09-V80, V87, V89, V99
154	2. Poisonings	X40, X43-X44, X46-X49
155	3. Falls	W00-W19
156	4. Fire, heat and hot substances	X00-X19
157	5. Drownings	W65-W74
158	6. Exposure to forces of nature	X30-X39
159	7. Other unintentional injuries	Rest of V, W20-W64, W75-W99, X20-X29, X50-X59, Y40-Y86, Y88, Y89
160	**B. Intentional injuries**[f]	X60-Y09, Y35-Y36, Y870, Y871
161	1. Self-harm	X60-X84, Y870
162	2. Interpersonal violence	X85-Y09, Y871
163	3. Collective violence and legal intervention	Y35-Y36

—, not available

[a] Deaths coded to "Symptoms, signs and ill-defined conditions" (R00-R99) are distributed proportionately to all causes within Group I and Group II.

[b] For deaths under age 5, refer to classification in Annex Tables B and C.

[c] As from 2006, deaths from causes F10-F19 with fourth character .0 (Acute intoxication) are coded to the category of accidental poisoning according to the updated ICD-10 instructions.

[d] Cancer deaths coded to ICD categories for malignant neoplasms of other and unspecified sites including those whose point of origin cannot be determined, and secondary and unspecified neoplasms (ICD-10 C76, C80, C97) were redistributed pro-rata across the footnoted malignant neoplasm categories within each age–sex group, so that the category "Other malignant neoplasms" includes only malignant neoplasms of other specified sites (Ref Mathers et al 2006 DCP chapter).

[e] Ischaemic heart disease deaths may be miscoded to a number of so-called cardiovascular "garbage" codes. These include heart failure, ventricular dysrhythmias, generalized atherosclerosis and ill-defined descriptions and complications of heart disease. Proportions of deaths coded to these causes were redistributed to ischaemic heart disease as described in (GPE discussion paper). Relevant ICD-10 codes are I47.2, I49.0, I46, I50, I51.4, I51.5, I51.6, I51.9 and I70.9.

[f] Injury deaths where the intent is not determined (Y10-Y34, Y872) are distributed proportionately to all causes below the group level for injuries.

[g] For countries with 3-digit ICD10 data, for "Road injury" use: V01-V04, V06, V09-V80, V87, V89 and V99. For countries with 4-digit ICD10 data, for "Road injury" use:

V01.1-V01.9, V02.1-V02.9, V03.1-V03.9, V04.1-V04.9, V06.1-V06.9, V09.2, V09.3, V10.3-V10.9, V11.3-V11.9, V12.3-V12.9, V13.3-V13.9, V14.3-V14.9, V15.4-V15.9, V16.4-V16.9, V17.4-V17.9, V18.4-V18.9, V19.4-V19.9, V20.3-V20.9, V21.3-V21.9, V22.3-V22.9, V23.3-V23.9, V24.3-V24.9, V25.3-V25.9, V26.3-V26.9, V27.3-V27.9, V28.3-V28.9, V29.4-V29.9, V30.4.V30.9, V31.4-V31.9, V32.4-V32.9, V33.4-V33.9, V34.4-V34.9, V35.4-V35.9, V36.4-V36.9, V37.4-V37.9, V38.4-V38.9, V39.4-V39.9, V40.4-V40.9, V41.4-V41.9, V42.4-V42.9, V43.4-V43.9, V44.4-V44.9, V45.4-V45.9, V46.4-V46.9, V47.4-V47.9, V48.4-V48.9, V49.4-V49.9, V50.4-V50.9, V51.4-V51.9, V52.4-V52.9, V53.4-V53.9, V54.4-V54.9, V55.4-V55.9, V56.4-V56.9, V57.4-V57.9, V58.4-V58.9, V59.4-V59.9, V60.4-V60.9, V61.4-V61.9, V62.4-V62.9, V63.4-V63.9, V64.4-V64.9, V65.4-V65.9, V66.4-V66.9, V67.4-V67.9, V68.4-V68.9, V69.4-V69.9, V70.4-V70.9, V71.4-V71.9, V72.4-V72.9, V73.4-V73.9, V74.4-V74.9, V75.4-V75.9, V76.4-V76.9, V77.4-V77.9, V78.4-V78.9, V79.4-V79.9, V80.3-V80.5, V81.1, V82.1, V82.8-V82.9, V83.0-V83.3, V84.0-V84.3, V85.0-V85.3, V86.0-V86.3, V87.0-V87.9, V89.2-V89.3, V89.9, V99 and Y850.

Annex Table B WHO Standard Life Table for Years of Life Lost (YLL)

Age	SEYLL*	Age	SEYLL	Age	SEYLL
0	91.94	35	57.15	70	23.15
1	91.00	36	56.16	71	22.23
2	90.01	37	55.17	72	21.31
3	89.01	38	54.18	73	20.40
4	88.02	39	53.19	74	19.51
5	87.02	40	52.20	75	18.62
6	86.02	41	51.21	76	17.75
7	85.02	42	50.22	77	16.89
8	84.02	43	49.24	78	16.05
9	83.03	44	48.25	79	15.22
10	82.03	45	47.27	80	14.41
11	81.03	46	46.28	81	13.63
12	80.03	47	45.30	82	12.86
13	79.03	48	44.32	83	12.11
14	78.04	49	43.34	84	11.39
15	77.04	50	42.36	85	10.70
16	76.04	51	41.38	86	10.03
17	75.04	52	40.41	87	9.38
18	74.05	53	39.43	88	8.76
19	73.05	54	38.46	89	8.16
20	72.06	55	37.49	90	7.60
21	71.06	56	36.52	91	7.06
22	70.07	57	35.55	92	6.55
23	69.07	58	34.58	93	6.07
24	68.08	59	33.62	94	5.60
25	67.08	60	32.65	95	5.13
26	66.09	61	31.69	96	4.65
27	65.09	62	30.73	97	4.18
28	64.10	63	29.77	98	3.70
29	63.11	64	28.82	99	3.24
30	62.11	65	27.86	100	2.79
31	61.12	66	26.91	101	2.36
32	60.13	67	25.96	102	1.94
33	59.13	68	25.02	103	1.59
34	58.14	69	24.08	104	1.28
				105	1.02

*SEYLL: standard expected years of life lost. Based on projected frontier period life expectancy and life table for year 2050 (UN Population Division 2013).

Annex Table C Health states and lay descriptions used in the GBD 2010 disability weights study.

Rreproduced from Salomon et al. 2012.

Health state	Lay description
Infectious disease	
Infectious disease: acute episode, mild	has a low fever and mild discomfort , but no difficulty with daily activities.
Infectious disease: acute episode, moderate	has a fever and aches, and feels weak, which causes some difficulty with daily activities.
Infectious disease: acute episode, severe	has a high fever and pain, and feels very weak, which causes great difficulty with daily activities.
Infectious disease: post-acute consequences (fatigue, emotional lability, insomnia)	is always tired and easily upset. The person feels pain all over the body and is depressed.
Diarrhoea: mild	has diarrhea three or more times a day with occasional discomfort in the belly.
Diarrhoea: moderate	has diarrhea three or more times a day, with painful cramps in the belly and feeling thirsty
Diarrhoea: severe	has diarrhea three or more times a day with severe belly cramps. The person is very thirsty and feels nauseous and tired.
Epididymo-orchitis	has swelling and tenderness in the testicles and pain during urination.
Herpes zoster	has a blistering skin rash that causes pain, with some burning and itching.
HIV cases: symptomatic, pre-AIDS	has weight loss, fatigue, and frequent infections.
HIV/AIDS cases: receiving antiretroviral treatment	has occasional fevers and infections. The person takes daily medication that sometimes causes diarrhea.
AIDS cases: not receiving antiretroviral treatment	has severe weight loss, weakness, fatigue, cough and fever, and frequent infections, skin rashes and diarrhea.
Intestinal nematode infections: symptomatic	has cramping pain and a bloated feeling in the belly.
Lymphatic filariasis: symptomatic	has swollen legs with hard and thick skin, which causes difficulty in moving around.
Ear pain	has an ear-ache that causes some difficulty with daily activities.
Tuberculosis: without HIV infection	has a persistent cough and fever, is short of breath, feels weak, and has lost a lot of weight.
Tuberculosis: with HIV infection	has a persistent cough and fever, shortness of breath, night sweats, weakness and fatigue and severe weight loss.
Cancer	
Cancer: diagnosis and primary therapy	has pain, nausea, fatigue, weight loss and high anxiety.
Cancer: metastatic	has severe pain, extreme fatigue, weight loss and high anxiety.
Mastectomy	had one of her breasts removed and sometimes has pain or swelling in the arms.
Stoma	has a pouch attached to an opening in the belly to collect and empty stools.
Terminal phase: with medication (for cancers, end-stage kidney/liver disease)	has lost a lot of weight and regularly uses strong medication to avoid constant pain. The person has no appetite, feels nauseous, and needs to spend most of the day in bed.
Terminal phase, without medication (for cancers, end-stage kidney or liver disease)	has lost a lot of weight and has constant pain. The person has no appetite, feels nauseous, and needs to spend most of the day in bed.
Cardiovascular and circulatory disease	

Health state	Lay description
Acute myocardial infarction: days 1-2	has severe chest pain that becomes worse with any physical activity. The person feels nauseous, short of breath, and very anxious.
Acute myocardial infarction: days 3-28	gets short of breath after heavy physical activity, and tires easily, but has no problems when at rest. The person has to take medication every day and has some anxiety.
Angina pectoris: mild	has chest pain that occurs with strenuous physical activity, such as running or lifting heavy objects. After a brief rest, the pain goes away.
Angina pectoris: moderate	has chest pain that occurs with moderate physical activity, such as walking uphill or more than half a kilometer (around a quarter-mile) on level ground. After a brief rest, the pain goes away.
Angina pectoris: severe	has chest pain that occurs with minimal physical activity, such as walking only a short distance. After a brief rest, the pain goes away. The person avoids most physical activities because of the pain.
Cardiac conduction disorders and cardiac dysrhythmias	has periods of rapid and irregular heartbeats and occasional fainting.
Claudication	has cramping pains in the legs after walking a medium distance. The pain goes away after a short rest.
Heart failure: mild	is short of breath and easily tires with moderate physical activity, such as walking uphill or more than a quarter-mile on level ground. The person feels comfortable at rest or during activities requiring less effort.
Heart failure: moderate	is short of breath and easily tires with minimal physical activity, such as walking only a short distance. The person feels comfortable at rest but avoids moderate activity.
Heart failure: severe	is short of breath and feels tired when at rest. The person avoids any physical activity, for fear of worsening the breathing problems.
Stroke: long-term consequences, mild	has some difficulty in moving around and some weakness in one hand, but is able to walk without help.
Stroke: long-term consequences, moderate	has some difficulty in moving around, and in using the hands for lifting and holding things, dressing and grooming.
Stroke: long-term consequences, moderate plus cognition problems	has some difficulty in moving around, in using the hands for lifting and holding things, dressing and grooming, and in speaking. The person is often forgetful and confused.
Stroke: long-term consequences, severe	is confined to bed or a wheelchair, has difficulty speaking and depends on others for feeding, toileting and dressing.
Stroke: long-term consequences, severe plus cognition problems	is confined to bed or a wheelchair, depends on others for feeding, toileting and dressing, and has difficulty speaking, thinking clearly and remembering things.
Diabetes, digestive and genitourinary disease	
Diabetic foot	has a sore on the foot that is swollen and causes some difficulty in walking.
Diabetic neuropathy	has pain, tingling and numbness in the arms, legs, hands and feet. The person sometimes gets cramps and muscle weakness.
Chronic kidney disease (stage IV)	tires easily, has nausea, reduced appetite and difficulty sleeping.
End-stage renal disease: with kidney transplant	sometimes feels tired and down, and has some difficulty with daily activities.
End-stage renal disease: on dialysis	is tired and has itching, cramps, headache, joint pains and shortness of breath. The person needs intensive medical care every other day lasting about half a day.
Decompensated cirrhosis of the liver	has a swollen belly and swollen legs. The person feels weakness, fatigue and loss of appetite.
Gastric bleeding	vomits blood and feels nauseous.
Crohn's disease or ulcerative colitis	has cramping abdominal pain, has diarrhea several times a day, and feels very tired for two months every year. When the

Health state	Lay description
	person does not have symptoms, there is anxiety about them returning.
Benign prostatic hypertrophy: symptomatic cases	feels the urge to urinate frequently, but when passing urine it comes out slowly and sometimes is painful.
Urinary incontinence	cannot control urinating.
Impotence	has difficulty in obtaining or maintaining an erection.
Infertility: primary	wants to have a child and has a fertile partner, but the couple cannot conceive.
Infertility: secondary	has at least one child, and wants to have more children. The person has a fertile partner, but the couple cannot conceive.
Chronic respiratory diseases	
Asthma: controlled	has wheezing and cough once a month, which does not cause difficulty with daily activities.
Asthma: partially controlled	has wheezing and cough once a week, which causes some difficulty with daily activities.
Asthma: uncontrolled	has wheezing, cough and shortness of breath more than twice a week, which causes difficulty with daily activities and sometimes wakes the person at night.
COPD and other chronic respiratory problems: mild	has cough and shortness of breath after heavy physical activity, but is able to walk long distances and climb stairs.
COPD and other chronic respiratory problems: moderate	has cough, wheezing and shortness of breath, even after light physical activity. The person feels tired and can walk only short distances or climb only a few stairs.
COPD and other chronic respiratory problems: severe	has cough, wheezing and shortness of breath all the time. The person has great difficulty walking even short distances or climbing any stairs, feels tired when at rest, and is anxious.
Neurological conditions	
Dementia: mild	has some trouble remembering recent events, and finds it hard to concentrate and make decisions and plans.
Dementia: moderate	has memory problems and confusion, feels disoriented, at times hears voices that are not real, and needs help with some daily activities.
Dementia: severe	has complete memory loss; no longer recognizes close family members; and requires help with all daily activities.
Headache: migraine	has severe, throbbing head pain and nausea that cause great difficulty in daily activities and sometimes confine the person to bed. Moving around, light, and noise make it worse.
Headache: tension-type	has a moderate headache that also affects the neck, which causes difficulty in daily activities.
Multiple sclerosis: mild	has mild loss of feeling in one hand, is a little unsteady while walking, has slight loss of vision in one eye, and often needs to urinate urgently.
Multiple sclerosis: moderate	needs help walking, has difficulty with writing and arm coordination, has loss of vision in one eye and cannot control urinating.
Multiple sclerosis: severe	has slurred speech and difficulty swallowing. The person has weak arms and hands, very limited and stiff leg movement, has loss of vision in both eyes and cannot control urinating.
Epilepsy: treated, seizure free	had sudden seizures in the past, but they have stopped now with medicines. The person has some drowsiness, difficulty concentrating and some anxiety about future episodes.
Epilepsy: treated, with recent seizures	has sudden seizures once a month, with violent muscle contractions and stiffness and loss of consciousness. Between seizures the person has some drowsiness, difficulty concentrating and anxiety about future episodes.
Epilepsy: untreated	has sudden seizures twice a month, with violent muscle contractions and stiffness, loss of consciousness, and loss of urine or stool control. Between seizures the person has anxiety about future episodes.

Health state	Lay description
Epilepsy: severe	has sudden, prolonged seizures once a week, with violent muscle contractions and stiffness, loss of consciousness, and loss of urine or stool control. Between seizures the person has drowsiness, memory loss, difficulty concentrating and anxiety.
Parkinson's disease: mild	has mild tremors and moves a little slowly, but is able to walk and do daily activities without assistance.
Parkinson's disease: moderate	has moderate tremors and moves slowly, which causes some difficulty in walking and daily activities. The person has some trouble swallowing, talking, sleeping, and remembering things.
Parkinson's disease: severe	has severe tremors and moves very slowly, which causes great difficulty in walking and daily activities. The person falls easily and has a lot of difficulty talking, swallowing, sleeping, and remembering things.
Mental, behavioral and substance use disorders	
Alcohol use disorder: mild	drinks a lot of alcohol and sometimes has difficulty controlling the urge to drink. While intoxicated, the person has difficulty performing daily activities.
Alcohol use disorder: moderate	drinks a lot, gets drunk almost every week and has great difficulty controlling the urge to drink. Drinking and recovering cause great difficulty in daily activities, sleep loss, and fatigue.
Alcohol use disorder: severe	gets drunk almost every day and is unable to control the urge to drink. Drinking and recovering replace most daily activities. The person has difficulty thinking, remembering and communicating, and feels constant pain and fatigue.
Fetal alcohol syndrome: mild	is a little slow in developing physically and mentally, which causes some difficulty in learning but no other difficulties in daily activities.
Fetal alcohol syndrome: moderate	is slow in developing physically and mentally, which causes some difficulty in daily activities.
Fetal alcohol syndrome: severe	is very slow in developing physically and mentally, which causes great difficulty in daily activities.
Cannabis dependence	uses marijuana daily and has difficulty controlling the habit. The person sometimes has mood swings, anxiety and hallucinations, and has some difficulty in daily activities.
Amphetamine dependence	uses stimulants (drugs) and has difficulty controlling the habit. The person sometimes has depression, hallucinations and mood swings, and has difficulty in daily activities.
Cocaine dependence	uses cocaine and has difficulty controlling the habit. The person sometimes has mood swings, anxiety, paranoia, hallucinations and sleep problems, and has some difficulty in daily activities.
Heroin and other opioid dependence	uses heroin daily and has difficulty controlling the habit. When the effects wear off, the person feels severe nausea, agitation, vomiting and fever. The person has a lot of difficulty in daily activities.
Anxiety disorders: mild	feels mildly anxious and worried, which makes it slightly difficult to concentrate, remember things, and sleep. The person tires easily but is able to perform daily activities.
Anxiety disorders: moderate	feels anxious and worried, which makes it difficult to concentrate, remember things, and sleep. The person tires easily and finds it difficult to perform daily activities.
Anxiety disorders: severe	constantly feels very anxious and worried, which makes it difficult to concentrate, remember things and sleep. The person has lost pleasure in life and thinks about suicide.
Major depressive disorder: mild episode	has constant sadness and has lost interest in usual activities. The person can still function in daily life with extra effort, but sleeps badly, feels tired, and has trouble concentrating.

Health state	Lay description
Major depressive disorder: moderate episode	has constant sadness and has lost interest in usual activities. The person has some difficulty in daily life, sleeps badly, has trouble concentrating, and sometimes thinks about harming himself (or herself).
Major depressive disorder: severe episode	has overwhelming, constant sadness and cannot function in daily life. The person sometimes loses touch with reality and wants to harm or kill himself (or herself).
Bipolar disorder: manic episode	is hyperactive, hears and believes things that are not real, and engages in impulsive and aggressive behavior that endanger the person and others.
Bipolar disorder: residual state	has mild mood swings, irritability and some difficulty with daily activities
Schizophrenia: acute state	hears and sees things that are not real and is afraid, confused, and sometimes violent. The person has great difficulty with communication and daily activities, and sometimes wants to harm or kill himself (or herself).
Schizophrenia, residual state	hears and sees things that are not real and has trouble communicating. The person can be forgetful, has difficulty with daily activities, and thinks about hurting himself (or herself).
Anorexia nervosa	feels an overwhelming need to starve and exercises excessively to lose weight. The person is very thin, weak and anxious.
Bulimia nervosa	has uncontrolled overeating followed by guilt, starving, and vomiting to lose weight.
Attention deficit hyperactivity disorder	is hyperactive and has difficulty concentrating, remembering things, and completing tasks.
Conduct disorder	has frequent behavior problems, which are sometimes violent. The person often has difficulty interacting with other people and feels irritable.
Asperger's syndrome	has difficulty interacting with other people, and is slow to understand or respond to questions. The person is often preoccupied with one thing and has some difficulty with basic daily activities.
Autism	has severe problems interacting with others and difficulty understanding simple questions or directions. The person has great difficulty with basic daily activities and becomes distressed by any change in routine.
Intellectual disability: mild	has low intelligence and is slow in learning at school. As an adult, the person can work at simple supervised jobs and live independently, but often needs help to raise children.
Intellectual disability: moderate	has low intelligence and is slow in learning to speak and do simple tasks. As an adult, the person requires a lot of support to work productively, live independently and raise children.
Intellectual disability: severe	has low intelligence and cannot speak more than a few words, needs help with most basic daily activities, and can do only simple tasks under close supervision.
Intellectual disability: profound	has low intelligence, cannot understand basic requests or instructions, and requires constant assistance for nearly all activities.
Hearing and vision loss	
Hearing loss: mild	has difficulty following a conversation in a noisy environment but no other hearing problems.
Hearing loss: moderate	has difficulty hearing a normal voice and great difficulty following a conversation in a noisy environment.
Hearing loss: severe	has great difficulty hearing in any situation or in using a phone.
Hearing loss: profound always	has great difficulty hearing in any situation and is not able to use a phone.
Hearing loss: complete	cannot hear at all, even loud sounds.
Hearing loss: mild, with ringing	has great difficulty following a conversation in a noisy environment, and has ringing in the ears for more than 5 minutes,

Health state	Lay description
	almost every day.
Hearing loss: moderate, with ringing	has difficulty hearing a normal voice or using a phone, has great difficulty following a conversation in a noisy environment, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss: severe, with ringing	has great difficulty hearing in any situation or in using a phone, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss: profound, with ringing	always has great difficulty hearing in any situation, cannot use a phone, and has ringing in the ears for more than 5 minutes, almost every day.
Hearing loss: complete, with ringing	cannot hear at all, even loud sounds, cannot use a phone, and has ringing in the ears for more than 5 minutes, almost every day.
Distance vision: mild impairment	has some difficulty with distance vision, for example reading signs, but no other problems with eyesight.
Distance vision: moderate impairment	has vision problems that make it difficult to recognize faces or objects across a room.
Distance vision: severe impairment	has severe vision loss, which causes difficulty in daily activities, some emotional impact (for example worry), and some difficulty going outside the home without assistance.
Distance vision blindness	is completely blind, which causes great difficulty in some daily activities, worry and anxiety, and great difficulty going outside the home without assistance.
Near vision impairment	has difficulty seeing things that are nearer than 3 feet, but has no difficulty with seeing things at a distance.
Musculoskeletal disorders	
Low back pain: acute, without leg pain	has severe back pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly and feels worried.
Low back pain: acute, with leg pain	has severe back and leg pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly and feels worried.
Low back pain: chronic, without leg pain	has constant back pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly, is worried, and has lost some enjoyment in life.
Low back pain: chronic, with leg pain	has constant back and leg pain, which causes difficulty dressing, sitting, standing, walking, and lifting things. The person sleeps poorly, is worried, and has lost some enjoyment in life.
Neck pain: acute, mild	has neck pain, and has difficulty turning the head and lifting things.
Neck pain: acute, severe	has severe neck pain, and difficulty turning the head and lifting things. The person gets headaches and arm pain, sleeps poorly, and feels tired and worried.
Neck pain: chronic, mild	has constant neck pain, and has difficulty turning the head, holding arms up, and lifting things.
Neck pain: chronic, severe	has constant neck pain and arm pain, and difficulty turning the head, holding arms up, and lifting things. The person gets headaches, sleeps poorly, and feels tired and worried.
Musculoskeletal problems: legs, mild	has pain in the leg, which causes some difficulty running, walking long distances, and getting up and down.
Musculoskeletal problems: legs, moderate	has moderate pain in the leg, which makes the person limp, and causes some difficulty walking, standing, lifting and carrying heavy things, getting up and down and sleeping.
Musculoskeletal problems: legs, severe	has severe pain in the leg, which makes the person limp and causes a lot of difficulty walking, standing, lifting and carrying heavy things, getting up and down, and sleeping.
Musculoskeletal problems: arms, mild	has mild pain and stiffness in the arms and hands. The person has some difficulty lifting, carrying and holding things.

Health state	Lay description
Musculoskeletal problems: arms, moderate	has moderate pain and stiffness in the arms and hands, which causes difficulty lifting, carrying, and holding things, and trouble sleeping because of the pain.
Musculoskeletal problems: generalised, moderate	has pain and deformity in most joints, causing difficulty moving around, getting up and down, and using the hands for lifting and carrying. The person often feels fatigue.
Musculoskeletal problems: generalised, severe	has severe, constant pain and deformity in most joints, causing difficulty moving around, getting up and down, eating, dressing, lifting, carrying and using the hands. The person often feels sadness, anxiety and extreme fatigue.
Gout: acute	has severe pain and swelling in the leg, making it very difficult to get up and down, stand, walk, lift, and carry heavy things. The person has trouble sleeping because of the pain.
Injuries	
Amputation of finger(s), excluding thumb: long term, with treatment	has lost part of the fingers of one hand, causing difficulties in using the hand, pain, and tingling in the stumps.
Amputation of thumb: long term	has lost one thumb, causing some difficulty in using the hand, pain, and tingling in the stump.
Amputation of one arm: long term, with or without treatmentc	has lost one hand and part of the arm, leaving pain and tingling in the stump and flashbacks from the injury. The person requires help lifting objects and in daily activities such as cooking.
Amputation of both arms: long term, with treatment	has lost part of both arms, leaving pain and tingling in the stumps and flashbacks from the injury. The person has comfortable artificial arms and is mostly independent.
Amputation of both arms: long term, without treatment	has lost part of both arms, leaving pain and tingling in the stumps and flashbacks from the injury. The person needs help with basic daily activities such as eating and using the toilet.
Amputation of toe	has lost one toe, leaving occasional pain and tingling in the stump.
Amputation of one leg: long term, with treatment	has lost part of one leg, leaving pain and tingling in the stump. The person has a comfortable artificial leg and only slight difficulties moving around.
Amputation of one leg: long term, without treatment	has lost part of one leg, leaving pain and tingling in the stump. The person does not have an artificial leg, has frequent sores, and uses crutches.
Amputation of both legs: long term, with treatment	has lost part of both legs, leaving pain and tingling in the stumps. The person has two comfortable artificial legs, which allow for movement.
Amputation of both legs: long term, without treatment	has lost part of both legs, leaving pain, tingling, and frequent sores in the stumps. The person has great difficulty moving around and has episodes of depression, anxiety and flashbacks to the injury.
Burns of <20% total surface area without lower airway burns: short term, with or without treatment	has a burn on part of the body. Parts of the burned area are painful, and other parts have lost feeling.
Burns of <20% total surface area or <10% total surface area if head or neck, or hands or wrist involved: long term, with or without treatment	has scars caused by a burn. The scars are sometimes painful and itchy.
Burns of ≥20% total surface area: short term, with or without treatment	has a painful burn over a large part of the body. Parts of the burned area have lost feeling, and the person feels anxious and unwell.
Burns of ≥20% total surface area or ≥10% total surface area if head or neck, or hands or wrist involved: long term, with treatment	has scars caused by burns over a large part of the body. The scars are frequently painful and itchy, and the person is often sad.

Health state	Lay description
Burns of ≥20% total surface area or ≥10% total surface area if head or neck, or hands or wrist involved: long term, without treatment	has severe, disfiguring and itchy scars caused by burns over a large part of the body. The person cannot move some joints, feels sad, and has great difficulty with self-care such as dressing and toileting.
Lower airway burns: with or without treatment	has a burn in the throat and lungs, which causes great difficulty breathing and a lot of anxiety.
Crush injury: short or long term, with or without treatment	had part of the body crushed, leaving pain, swelling, tingling and limited feeling in the affected area.
Dislocation of hip: long term, with or without treatment	walks with a limp and feels discomfort when walking.
Dislocation of knee: long term, with or without treatment	has a knee out of joint, causing pain and difficulty moving the knee, which sometimes gives way. The person needs crutches for walking and help with self-care such as dressing.
Dislocation of shoulder: long term, with or without treatment	has a shoulder that is out of joint, causing pain and difficulty moving. The person has difficulty with daily activities such as dressing and cooking.
Other injuries of muscle and tendon (includes sprains, strains and dislocations other than shoulder, knee, or hip)	has a strained muscle that causes pain and swelling.
Drowning and non-fatal submersion: short or long term, with or without treatment	has breathlessness, anxiety, cough, and vomiting.
Fracture of clavicle, scapula, or humerus: short or long term, with or without treatment	has a broken shoulder bone, which is painful and swollen. The person cannot use the affected arm and has difficulty with getting dressed.
Fracture of face bone: short or long term, with or without treatment	has a broken cheek bone, broken nose, and chipped teeth, with swelling and severe pain.
Fracture of foot bones: short term, with or without treatment	has a broken foot bone, which causes pain, swelling, and difficulty walking.
Fracture of foot bones: long term, without treatment	had a broken foot in the past that did not heal properly. The person now has pain in the foot and has some difficulty walking.
Fracture of hand: short term, with or without treatment	has a broken hand, causing pain and swelling.
Fracture of hand: long term, without treatment	has stiffness in the hand and a weak grip.
Fracture of neck of femur: short term, with or without treatment	has broken a hip and is in pain. The person cannot stand or walk, and needs help washing, dressing, and going to the toilet.
Fracture of neck of femur: long term, with treatment	had a broken hip in the past, which was fixed with treatment. The person can only walk short distances, has discomfort when moving around, and has some difficulty in daily activities.
Fracture of neck of femur: long term, without treatment	had a broken hip bone in the past, which was never treated and did not heal properly. The person cannot get out of bed and needs help washing and going to the toilet.
Fracture, other than neck of femur: short term, with or without treatment	has a broken thigh bone. The person has severe pain and swelling and cannot walk.
Fracture, other than neck of femur: long term, without treatment	had a broken thigh bone in the past, which was never treated and did not heal properly. The person now has a limp and discomfort when walking.
Fracture of patella, tibia or fibula, or ankle: short term, with or without treatment	has a broken shin bone, which causes severe pain, swelling, and difficulty walking.
Fracture of patella, tibia or fibula, or ankle: long term,	had a broken shin bone in the past that did not heal properly. The person has pain in the knee and ankle, and has difficulty

Health state	Lay description
with or without treatment	walking.
Fracture of pelvis: short term	has a broken pelvis bone, with swelling and bruising. The person has severe pain, and cannot walk or do daily activities.
Fracture of pelvis: long term	had a broken pelvis in the past and now walks with a limp. There is often pain in the back and groin, and when urinating and sitting for a long time.
Fracture of radius or ulna: short term, with or without treatment	has a broken forearm, which causes severe pain, swelling, and limited movement.
Fracture of radius or ulna: long term, without treatment	had a broken forearm in the past that did not heal properly, causing some pain and limited movement in the elbow and wrist. The person has difficulty with daily activities such as dressing.
Fracture of skull: short or long term, with or without treatment	has a broken skull, but does not have brain damage. The broken area is painful and swollen.
Fracture of sternum or fracture of one or two ribs: short term, with or without treatment	has a broken rib that causes severe pain in the chest, especially when breathing in. The person has difficulty with daily activities such as dressing.
Fracture of vertebral column: short or long term, with or without treatment	has broken back bones and is in pain, but still has full use of arms and legs.
Fractures: treated, long term	has slight pain in a bone that was broken in the past.
Injured nerves: short term	has a nerve injury, which causes difficulty moving and some loss of feeling in the affected area.
Injured nerves: long term	had a nerve injury in the past, which continues to cause some difficulty moving. The person often injures the affected part because it is numb.
Injury to eyes: short term	has an injury to one eye, which causes pain and difficulty seeing.
Severe traumatic brain injury: short term, with or without treatment	cannot concentrate and has headaches, memory problems, dizziness, and feels angry.
Traumatic brain injury: long-term consequences, minor, with or without treatment	has episodes of headaches, memory problems, and difficulty concentrating.
Traumatic brain injury: long-term consequences, moderate, with or without treatment	has frequent headaches, memory problems, difficulty concentrating, and dizziness. The person is often anxious and moody.
Traumatic brain injury: long-term consequences, severe, with or without treatment	cannot think clearly and has frequent headaches, memory problems, difficulty concentrating and dizziness. The person is often anxious and moody, and depends on others for feeding, toileting, dressing and walking.
Open wound: short term, with or without treatment	has a cut in the skin, which causes pain and numbness around the cut.
Poisoning: short term, with or without treatment	has drowsiness, stomach pain and vomiting.
Severe chest injury: long term, with or without treatment	had a severe chest injury in the past that has now healed. The person still gets breathless when walking and feels discomfort in the chest.
Severe chest injury: short term, with or without treatment	has a serious chest injury, which causes severe pain, shortness of breath and anxiety.
Spinal cord lesion below neck: treated	is paralyzed from the waist down and cannot feel or move the legs. The person uses a lightweight and comfortable wheelchair to move around.
Spinal cord lesion below neck: untreated	is paralyzed from the waist down and cannot feel or move the legs. Legs are in fixed, bent positions, and the person gets frequent infections and pressure sores.
Spinal cord lesion at neck: treated	is paralyzed from the neck down and cannot feel or move the arms and legs.

Health state	Lay description
Spinal cord lesion at neck level: untreated	is paralyzed from the neck down and cannot feel or move the arms and legs. Arms and legs are in fixed, bent positions, and the person gets frequent infections and pressure sores.
Other	
Abdominopelvic problem: mild	has some pain in the belly that causes nausea but does not interfere with daily activities.
Abdominopelvic problem: moderate	has pain in the belly and feels nauseous. The person has difficulties with daily activities.
Abdominopelvic problem: severe	has severe pain in the belly and feels nauseous. The person is anxious and unable to carry out daily activities.
Anaemia: mild	feels slightly tired and weak at times, but this does not interfere with normal daily activities.
Anaemia: moderate	feels moderate fatigue, weakness, and shortness of breath after exercise, making daily activities more difficult.
Anaemia: severe	feels very weak, tired and short of breath, and has problems with activities that require physical effort or deep concentration.
Periodontitis	has minor bleeding of the gums from time to time, with mild discomfort.
Dental caries: symptomatic	has a toothache, which causes some difficulty in eating.
Severe tooth loss	has lost more than 20 teeth including front and back, and has great difficulty in eating meat, fruits, and vegetables.
Disfigurement: level 1	has a slight, visible physical deformity that others notice, which causes some worry and discomfort.
Disfigurement: level 2	has a visible physical deformity that causes others to stare and comment. As a result, the person is worried and has trouble sleeping and concentrating.
Disfigurement: level 3	has an obvious physical deformity that makes others uncomfortable, which causes the person to avoid social contact, feel worried, sleep poorly, and think about suicide.
Disfigurement: level 1 with itch or pain	has a slight, visible physical deformity that is sometimes sore or itchy. Others notice the deformity, which causes some worry and discomfort.
Disfigurement: level 2, with itch or pain	has a visible physical deformity that is sore and itchy. Other people stare and comment, which causes the person to worry. The person has trouble sleeping and concentrating.
Disfigurement: level 3, with itch or pain	has an obvious physical deformity that is very painful and itchy. The physical deformity makes others uncomfortable, which causes the person to avoid social contact, feel worried, sleep poorly, and think about suicide.
Generic uncomplicated disease: worry and daily medication	has a chronic disease that requires medication every day and causes some worry but minimal interference with daily activities.
Generic uncomplicated disease: anxiety about diagnosis	has a disease diagnosis that causes worry about the future.
Iodine-deficiency goiter	has a large mass in the front of the neck. The person sometimes has weakness and fatigue, constipation and weight gain.
Kwashiorkor	is very tired and irritable and has diarrhea.
Severe wasting	is extremely skinny and has no energy.
Speech problems	has difficulty speaking, and others find it difficult to understand.
Motor impairment: mild	has some difficulty in moving around but is able to walk without help.
Motor impairment: moderate	has some difficulty in moving around, and difficulty in lifting and holding objects, dressing and sitting upright, but is able to walk without help.
Motor impairment: severe	is unable to move around without help, and is not able to lift or hold objects, get dressed or sit upright.

Health state	Lay description
Motor plus cognitive impairments: mild	has some difficulty in moving around, and is slow in learning at school. The person can walk without help, work at simple supervised jobs and live independently, but often needs help to raise children.
Motor plus cognitive impairments: moderate	has some difficulty in moving around, holding objects, dressing and sitting upright, and is slow in learning to speak and do simple tasks. The person can walk without help, but requires a lot of help with daily activities.
Motor plus cognitive impairments: severe	cannot move around without help, and cannot lift or hold objects, get dressed or sit upright. The person also has low intelligence, speaks few words, and needs a lot of help with all basic daily activities.
Rectovaginal fistula	has an abnormal opening between her vagina and rectum causing flatulence and faeces to escape through the vagina. The person gets infections in her vagina, and has pain when urinating.
Vesicovaginal fistula	has an abnormal opening between the bladder and the vagina, which makes her unable to control urinating. The woman is anxious and depressed.

Annex Table D GBD 2010 states, weights, mappings to previous GBD states, and EQ5D+ descriptions

A complete table of GBD 2010 states, weights and mapped states/weights from GBD 2004 and Stouthard et al.

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Infectious disease						
Infectious disease: acute episode, mild	0.005	0.002	0.011	Schistosomiasis - infection	0.005	111211
Infectious disease: acute episode, moderate	0.053	0.033	0.081	Pertussis - episodes	0.137	112211(50%), 212211(50%)
Infectious disease: acute episode, severe	0.21	0.139	0.298	Meningitis - episodes	0.615	323311(50%), 323312(50%)
Infectious disease: post-acute consequences (fatigue, emotional lability, insomnia)	0.254	0.17	0.355			112221
Diarrhoea: mild	0.061	0.036	0.093			111211(50%), 112211(50%)
Diarrhoea: moderate	0.202	0.133	0.299	Diarrheal diseases - episodes	0.105	112211
Diarrhoea: severe	0.281	0.184	0.399			112311
Epididymo-orchitis	0.097	0.063	0.137	Chlamydia - epididymitis	0.167	111221
Herpes zoster	0.061	0.039	0.094			111221
HIV: symptomatic, pre-AIDS	0.221	0.146	0.31	HIV/AIDS - AIDS cases on ART	0.167	111121
HIV/AIDS: receiving antiretroviral treatment	0.053	0.034	0.079	HIV/AIDS - HIV cases	0.135	111221
AIDS: not receiving antiretroviral treatment	0.547	0.382	0.715	HIV/AIDS - AIDS cases not on ART	0.505	222221
Intestinal nematode infections: symptomatic	0.03	0.016	0.048	Ascariasis - intestinal obstruction	0.024	112211
Lymphatic filariasis: symptomatic	0.11	0.073	0.157	Lymphatic filariasis - lymphoedema	0.106	212211
Ear pain	0.018	0.009	0.031	Otitis media - chronic infection	0.023	112211
Tuberculosis: without HIV infection	0.331	0.222	0.45	Tuberculosis - cases	0.271	112211(40%), 222221(60%)
Tuberculosis: with HIV infection	0.399	0.267	0.547	HIV/AIDS - AIDS cases not on ART	0.505	112221
Cancer						
Cancer: diagnosis and primary therapy	0.294	0.199	0.411	Cancer - diagnosis / therapy	0.095	111221(35%), 112221(15%), 112231(22.5%), 112331(12.5%), 123231(10%), 222331(5%)
Cancer: metastatic	0.484	0.33	0.643	Cancer - metastasis	0.750	212221(33%), 212331(33%), 223332(33%)
Mastectomy	0.038	0.022	0.059	Breast cancer - mastectomy	0.055	111111(80%),111211(20%)
Stoma	0.086	0.055	0.131	Colorectal cancer - stoma	0.075	111111(50%),111211(50%)
Terminal phase: with medication (for cancers, end-stage kidney or liver disease)	0.508	0.348	0.67	Cancer - terminal	0.810	333332

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Terminal phase: without medication (for cancers, end-stage kidney or liver disease)	0.519	0.356	0.683	Cancer - terminal	0.810	333332
Cardiovascular diseases						
Acute myocardial infarction: days 1-2	0.422	0.284	0.566			323331
Acute myocardial infarction: days 3-28	0.056	0.035	0.082	Ischemic heart disease - acute myocardial infarction	0.439	212121
Angina pectoris: mild	0.037	0.022	0.058	Coronary Heart disease mild stable angina*		111121
Angina pectoris: moderate	0.066	0.043	0.095	Ischemic heart disease - angina pectoris, treated	0.095	212221
Angina pectoris: severe	0.167	0.109	0.234	Ischemic heart disease - angina pectoris, untreated	0.227	212321
Cardiac conduction disorders and cardiac dysrhythmias	0.145	0.097	0.205	Other cardiovascular diseases: Cases	0.193	112111(90%), 112211(10%)
Claudication	0.016	0.008	0.028			211111(75%), 211211(25%)
Heart failure: mild	0.037	0.021	0.058	Dutch study mild heart failure (NYHA 1-2)	0.006	111211
Heart failure: moderate	0.07	0.044	0.102	Ischemic heart disease - congestive heart failure, treated	0.171	222211
Heart failure: severe	0.186	0.128	0.261	Ischemic heart disease - congestive heart failure, untreated	0.323	223321
Stroke: long-term consequences, mild	0.021	0.011	0.037			212111
Stroke: long-term consequences, moderate	0.076	0.05	0.11			222111
Stroke: long-term consequences, moderate plus cognition problems	0.312	0.211	0.433	Cerebrovascular disease - long-term stroke survivors	0.266	222222
Stroke: long-term consequences, severe	0.539	0.363	0.705	Stroke - moderate permanent impairments *		333221
Stroke: long-term consequences, severe plus cognition problems	0.567	0.394	0.738	Stroke - severe permanent impairments*	0.920	233323
Diabetes, digestive, and genitourinary disease						
Diabetic foot	0.023	0.012	0.039	Diabetes mellitus - diabetic foot	0.133	211211
Diabetic neuropathy	0.099	0.066	0.145	Diabetes mellitus - neuropathy	0.072	111111(75%), 222221(20%), 222331(5%)
Chronic kidney disease (stageIV)	0.105	0.069	0.154	Nephritis and nephrosis: Acute glomerulonephritis	0.104	112121(80%), 113231(20%)

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
End-stage renal disease: with kidney transplant	0.027	0.015	0.043			112121
End-stage renal disease: on dialysis	0.573	0.397	0.749	Nephritis and nephrosis: End-stage renal disease	0.101	112220(70%), 323220(30%)
Decompensated cirrhosis of the liver	0.194	0.127	0.273	Cirrhosis of the liver - symptomatic cases	0.330	123322
Gastric bleeding	0.323	0.214	0.461			122321
Crohn's disease or ulcerative colitis	0.225	0.152	0.314	Peptic ulcer disease - cases not treated with antibiotics	0.042	111111(20%), 111211(60%), 112211(10%), 112221(10%)
Benign prostatic hypertrophy: symptomatic	0.07	0.046	0.102	Benign prostatic hypertrophy: Symptomatic cases	0.038	111211
Impotence	0.019	0.01	0.034	Prostate cancer - impotence / incontinence	0.060	111121
Urinary incontinence	0.142	0.094	0.204	Prostate cancer - impotence / incontinence	0.060	112211(50%), 111221(50%)
Infertility: primary	0.011	0.005	0.021	Chlamydia - infertility	0.180	111111(75%), 111121(25%)
Infertility: secondary	0.006	0.002	0.013	Chlamydia - infertility	0.180	111111(90%), 111121(10%)
Chronic respiratory diseases						
Asthma: controlled	0.009	0.004	0.018	Asthma/COPD mild to moderate*		111111(97%), 112111(3%)
Asthma: partially controlled	0.027	0.015	0.045	Asthma - cases	0.043	111111(85%), 112211(15%)
Asthma: uncontrolled	0.132	0.087	0.19	Asthma/COPD severe*		111121(67%), 112221(33%)
COPD and other chronic respiratory diseases: mild	0.015	0.007	0.028	COPD - mild and moderate symptomatic cases	0.170	111111(80%), 112211(20%)
COPD and other chronic respiratory diseases: moderate	0.192	0.129	0.271	COPD - mild and moderate symptomatic cases	0.170	212221
COPD and other chronic respiratory diseases: severe	0.383	0.259	0.528	COPD - severe symptomatic cases	0.530	223231
Neurological disorders						
Dementia: mild	0.082	0.055	0.117			112122(33%), 112112(67%)
Dementia: moderate	0.346	0.233	0.475	Alzheimer and other dementias - cases	0.666	123122
Dementia: severe	0.438	0.299	0.584	Dementia - severe*	0.940	233123(50%), 333133(50%)
Headache: migraine	0.433	0.287	0.593	Migraine - cases	0.288	323322
Headache: moderate migraine						212321
Headache: tension-type	0.04	0.025	0.062			112211

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Multiple sclerosis: mild	0.198	0.137	0.278			212111
Multiple sclerosis: moderate	0.445	0.303	0.593	Multiple sclerosis - cases	0.411	222221
Multiple sclerosis: severe	0.707	0.522	0.857	Dutch study: MS progressive phase	0.670	222221(50%), 333321(50%)
Epilepsy: treated, seizure free	0.072	0.047	0.106	Epilepsy - cases, treated	0.065	112111
Epilepsy: treated, with recent seizures	0.319	0.211	0.445			112122
Epilepsy: severe	0.657	0.464	0.827			223232
Epilepsy: untreated	0.42	0.279	0.572	Epilepsy - cases, untreated	0.150	112232
Parkinson's disease: mild	0.011	0.005	0.021	M. Parkinson - initial stage*		212121
Parkinson's disease: moderate	0.263	0.179	0.36	Parkinson disease - cases, treated	0.316	223222
Parkinson's disease: severe	0.549	0.383	0.711	Parkinson disease - cases, untreated	0.392	333232
Mental, behavioural, and substance use disorders						
Alcohol use disorder: mild	0.259	0.176	0.359	GBD 2004: harmful use of alcohol	0.134	112121
Alcohol use disorder: moderate	0.388	0.262	0.529	GBD2004: alcohol dependence	0.180	113221
Alcohol use disorder: severe	0.549	0.384	0.708			123232
Alcohol problem use				GBD 2004: harmful use of alcohol	0.134	112121(33%), 112111(67%)
Fetal alcohol syndrome: mild	0.017	0.008	0.032			111112
Fetal alcohol syndrome: moderate	0.057	0.036	0.087			112112
Fetal alcohol syndrome: severe	0.177	0.117	0.255			123113
Cannabis dependence	0.329	0.223	0.455	Drug use disorders - cases	0.252	112121
Amphetamine dependence	0.353	0.215	0.525	Drug use disorders - cases	0.252	113121
Cocaine dependence	0.376	0.235	0.553	Drug use disorders - cases	0.252	112121
Heroin and other opioid dependence	0.641	0.459	0.803	Drug use disorders - cases	0.252	123221
Anxiety disorders: mild	0.03	0.017	0.048	Panic disorder - cases, treated	0.091	111111(50%), 111122(50%)
Anxiety disorders: moderate	0.149	0.101	0.21	Panic disorder - cases, untreated	0.173	112122
Anxiety disorders: severe	0.523	0.365	0.684	Dutch study: average across severe panic, phobia, OCD, PTSD, GAD	0.560	123132
Major depressive disorder: mild episode	0.159	0.107	0.223	Unipolar depressive disorders - mild depressive episode	0.140	112121
Major depressive disorder: moderate episode	0.406	0.276	0.551	Unipolar depressive disorders - moderate depressive episode	0.350	112222

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Major depressive disorder: severe episode	0.655	0.469	0.816	Unipolar depressive disorder - severe depressive episode	0.760	123232
Bipolar disorder: manic episode	0.48	0.323	0.642	Bipolar affective disorder - cases, untreated	0.400	123122
Bipolar disorder: residual state	0.035	0.021	0.055	Bipolar affective disorder - cases, treated	0.140	112121
Schizophrenia: acute state	0.756	0.571	0.894	Schizophrenia - cases, untreated	0.627	222122(50%), 223233(50%)
Anorexia nervosa	0.223	0.151	0.313	Dutch study: eating disorders	0.280	112121(80%), 212221(20%)
Schizophrenia: residual state	0.576	0.399	0.756	Schizophrenia - cases, treated	0.351	112122
Bulimia nervosa	0.223	0.15	0.31	Dutch study: eating disorders	0.280	112121(80%), 212221(20%)
Attention-deficit hyperactivity disorder	0.049	0.031	0.074	Dutch study: mild behavioural disorder (hyperactivity)	0.020	111112
Conduct disorder	0.236	0.154	0.337	Dutch study: moderate to severe behavioural disorder (hyperactivity)	0.150	112111(75%), 113121(25%)
Asperger's syndrome	0.11	0.073	0.157			112112
Autism	0.259	0.177	0.362	Dutch study: autism	0.550	113123
Intellectual disability: mild	0.031	0.018	0.049	Dutch study: mild ID (IQ 50-69)	0.290	112113
Intellectual disability: moderate	0.08	0.053	0.114	Dutch study: moderate ID (IQ 35-49)	0.430	123113 (80%), 123123 (20%)
Intellectual disability: severe	0.126	0.085	0.176	Dutch study: severe ID (IQ 20-34)	0.820	123113 (75%), 123123 (20%), 123133 (5%)
Intellectual disability: profound	0.157	0.107	0.221	Dutch study: profound ID (IQ <20)	0.760	123113 (50%), 123123 (30%), 123133 (20%)
Hearing and vision loss						
Hearing loss: mild	0.005	0.002	0.012	Dutch study: mild hearing loss, adult onset	0.040	111111
Hearing loss: moderate	0.023	0.013	0.038	Hearing loss, adult onset - moderate, untreated	0.120	112111
Hearing loss: severe	0.032	0.018	0.051	Hearing loss, adult onset - severe or profound, untreated	0.333	112111(50%), 113121(50%)
Hearing loss: profound	0.031	0.018	0.049	Hearing loss, adult onset - severe or profound, untreated	0.333	113121(75%), 113122(25%)
Hearing loss: complete	0.033	0.02	0.052			113121(75%), 113122(25%)
Hearing loss: mild, with ringing	0.038	0.024	0.058			111111(50%), 111211(50%)

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Hearing loss: moderate, with ringing	0.058	0.037	0.085	Noise related (post early youth) - moderate*		112111(25%), 112211(75%)
Hearing loss: severe, with ringing	0.065	0.041	0.094	Noise related (post early youth) - severe*		112211(50%), 113221(50%)
Hearing loss: profound, with ringing	0.088	0.058	0.127			113221(75%), 113222(25%)
Hearing loss: complete, with ringing	0.092	0.061	0.134			113221(50%), 113321(25%), 113322(25%)
Childhood-onset hearing loss: mild						111111
Childhood-onset hearing loss: moderate				Dutch study: hearing disorders in childhood: mild to moderate congenital or early acquired	0.11	112111(50%), 112112(50%)
Childhood-onset hearing loss: severe				Dutch study: hearing disorders in childhood: severe congenital or early acquired	0.23	112112(50%), 113122(50%)
Childhood-onset hearing loss: profound						113122
Childhood-onset hearing loss: complete						113122(90%), 113123(10%)
Childhood-onset hearing loss: mild, with ringing						111111(50%), 111211(50%)
Childhood-onset hearing loss: moderate, with ringing						112111(25%), 112211(25%), 112212(50%)
Childhood-onset hearing loss: severe, with ringing						112212(50%), 113222(50%)
Childhood-onset hearing loss: profound, with ringing						113222
Childhood-onset hearing loss: complete, with ringing						113222(50%), 113322(40%), 113323(10%)
Distance vision: mild impairment	0.004	0.001	0.01			111111
Distance vision: moderate impairment	0.033	0.02	0.052	Glaucoma - low vision	0.170	112111(80%), 112121(20%)
Distance vision: severe impairment	0.191	0.129	0.269	Dutch study: vision disorders, severe impairment	0.430	213121(50%), 223121(50%)
Distance vision blindness	0.195	0.132	0.272	Glaucoma - blindness	0.600	213121(50%), 323121(50%)
Near vision impairment	0.013	0.006	0.024	Dutch study: some difficulty reading small print, no difficulty at 4 m	0.020	112111(50%), 111111(50%)
Musculoskeletal disorders						
Low back pain: acute, without leg pain (severe)	0.269	0.184	0.373	Low back pain - episode of limiting low back pain	0.061	223221(50%), 212211(50%)

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Low back pain: acute, with leg pain (severe)	0.322	0.219	0.447	Low back pain: Episode of intervertebral disc displacement or herniation	0.061	223321(50%), 212211(50%)
Low back pain: chronic, without leg pain	0.366	0.248	0.499			223221(50%), 212211(50%)
Low back pain: chronic, with leg pain	0.374	0.252	0.506	Low back pain: Chronic intervertebral disc	0.125	223321(50%), 212211(50%)
Low back pain: acute (moderate)						111211(50%),212211(50%
Low back pain: : acute (mild)						111211
Neck pain: acute, mild	0.04	0.023	0.064			112111(50%), 112211(50%)
Neck pain: acute, severe	0.221	0.15	0.305			122311(50%), 112311(50%)
Neck pain: chronic, mild	0.101	0.067	0.149			112111(50%), 112211(50%)
Neck pain: chronic, severe	0.286	0.197	0.398			122321(50%), 112311(50%)
Musculoskeletal problems: legs, mild	0.023	0.013	0.039			211211(50%), 111111(50%)
Musculoskeletal problems: legs, moderate	0.079	0.053	0.115	Osteoarthritis - knee, treated	0.108	111111(70%), 211211(10%), 212211(10%), 222311(10%)
Musculoskeletal problems: legs, severe	0.171	0.117	0.24	Osteoarthritis - knee, untreated	0.156	211211(50%), 212211(25%), 222311(25%)
Musculoskeletal problems: arms, mild	0.024	0.014	0.041			112111(25%), 111111(50%), 111211(25%)
Musculoskeletal problems: arms, moderate	0.114	0.077	0.159	Rheumatoid arthritis - cases, treated	0.174	122211
Musculoskeletal problems: generalised, moderate	0.292	0.197	0.41	Rheumatoid arthritis - cases, untreated	0.233	222221
Musculoskeletal problems: generalised, severe	0.606	0.421	0.771	Rheumatoid arthritis - severe*		222331(50%), 333331(50%)
Gout: acute	0.293	0.198	0.404	Gout - cases	0.132	223321
Injuries						
Amputation of finger(s), excluding thumb: long term, with treatment	0.03	0.018	0.048	Amputation - finger	0.102	112211(25%), 111111(75%)
Amputation of thumb: long term	0.013	0.006	0.025	Amputation - thumb	0.165	111211(25%), 111111(75%)
Amputation of one arm: long term, with or without treatment	0.13	0.088	0.185	Amputation - arm	0.102	112211
Amputation of both arms: long term, with treatment	0.044	0.028	0.067			111211
Amputation of both arms: long term, without treatment	0.359	0.242	0.497			133221
Amputation of toe	0.008	0.003	0.017	Amputation - toe	0.064	112211(5%), 111111(95%)

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Amputation of one leg: long term, with treatment	0.021	0.011	0.035	Amputation - foot	0.300	111211
Amputation of one leg: long term, without treatment	0.164	0.111	0.229	Amputation - leg	0.300	212211
Amputation of both legs: long term, with treatment	0.051	0.032	0.076			112211(50%), 111211(50%)
Amputation of both legs: long term, without treatment	0.494	0.341	0.654			322221
Burns of <20% total surface area without lower airway burns: short term, with or without treatment	0.096	0.062	0.14	Burns <20%, short-term	0.157	112311
Burns of <20% total surface area or <10% total surface area if head or neck, or hands or wrist involved: long term, with or without treatment	0.018	0.01	0.032	Burns <20%, long-term	0.002	111211(50%), 111111(50%)
Burns of ≥20% total surface area: short term, with or without treatment	0.333	0.22	0.472	Burns >20% short-term	0.455	223321
Burns of ≥20% total surface area or ≥10% total surface area if head or neck, or hands or wrist involved: long term, with treatment	0.127	0.086	0.183	Burns >20% long-term	0.255	112121
Burns of ≥20% total surface area or ≥10% total surface area if head or neck, or hands or wrist involved: long term, without treatment	0.438	0.298	0.588	Burns >20% long-term	0.255	122221
Lower airway burns: with or without treatment	0.373	0.248	0.521			313221
Crush injury: short or long term, with or without treatment	0.145	0.093	0.211	Crushing	0.218	122211
Dislocation of hip: long term, with or without treatment	0.017	0.008	0.03			211211(50%), 211111(50%)
Dislocation of knee: long term, with or without treatment	0.129	0.087	0.178	Other dislocation	0.074	222211
Dislocation of shoulder: long term, with or without treatment	0.08	0.053	0.116	Dislocation of shoulder, elbow or hip	0.074	122211
Other injuries of muscle and tendon (includes sprains, strains, and dislocations other than shoulder, knee, or hip)	0.009	0.004	0.018	permanent impairment luxation or distorsion of ankle or foot*		112211(75%), 212211(25%)
Drowning and non-fatal submersion: short or long term, with or without treatment	0.288	0.191	0.403			212221
Fracture of clavicle, scapula, or humerus: short or long term, with or without treatment	0.053	0.033	0.08	Fracture - clavicle, scapula or humerus	0.153	122211

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Fracture of face bone: short or long term, with or without treatment	0.173	0.111	0.257	Fracture - face bones	0.223	112311
Fracture of foot bones: short term, with or without treatment	0.033	0.019	0.053	Fracture - foot bones	0.077	212211
Fracture of foot bones: long term, without treatment	0.033	0.019	0.052			211211
Fracture of hand: short term, with or without treatment	0.025	0.013	0.043	Fracture - hand bones	0.100	112211
Fracture of hand: long term, without treatment	0.016	0.008	0.028			111211
Fracture of neck of femur: short term, with or without treatment	0.308	0.205	0.439	Fracture - femure, short-term	0.372	333311
Fracture of neck of femur: long term, with treatment	0.072	0.047	0.105	Fracture - femur, long-term	0.272	222111
Fracture of neck of femur: long term, without treatment	0.388	0.261	0.532	Fracture - femur, long-term	0.272	333211
Fracture other than neck of femur: short term, with or without treatment	0.192	0.121	0.28			333311
Fracture other than neck of femur: long term, without treatment	0.053	0.035	0.079			211211
Fracture of patella, tibia or fibula, or ankle: short term,with or without treatment	0.087	0.055	0.127	Fracture - patella, tibia or fibula	0.271	212311
Fracture of patella, tibia or fibula, or ankle: long term, with or without treatment	0.07	0.047	0.102			211211
Fracture of pelvis: short term	0.39	0.257	0.545	Fracture - pelvis	0.247	323311
Fracture of pelvis: long term	0.194	0.132	0.272			211211
Fracture of radius or ulna: short term, with or without treatment	0.065	0.04	0.101	Fracture - ulna or radius	0.180	122311
Fracture of radius or ulna: long term, without treatment	0.05	0.032	0.075			122211
Fracture of skull: short or long term, with or without treatment	0.073	0.046	0.109	Fracture - skull, short-term	0.431	112211
Fracture of sternum or fracture of one or two ribs: short term, with or without treatment	0.15	0.098	0.215	Fracture - rib or sternum	0.199	223311
Fracture of vertebral column: short or long term, with or without treatment	0.132	0.085	0.195	Fracture - vertebral column	0.266	112311
Fractures: treated, long term	0.003	0.001	0.008			111211(10%), 111111(90%)

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Injured nerves: short term	0.065	0.04	0.096	Injured nerves - short-term	0.071	211211
Injured nerves: long term	0.136	0.092	0.189	Injured nerves - long-term	0.071	211211(50%), 111211(50%)
Injury to eyes: short term	0.079	0.05	0.118	Injury to eyes - short-term	0.108	112211
Severe traumatic brain injury: short term, with or without treatment	0.235	0.156	0.331	Intercranial injuries - short-term	0.359	113223
Traumatic brain injury: long-term consequences, minor, with or without treatment	0.106	0.072	0.147	Dutch study: permanent impairments after mild skull/brain injury	0.370	111212(60%), 111222(40%)
Traumatic brain injury: long-term consequences, moderate, with or without treatment	0.224	0.153	0.314	Intracranial injury - long-term	0.396	112222(50%), 122223(50%)
Traumatic brain injury: long-term consequences, severe,with or without treatment	0.625	0.444	0.789	Dutch study: permanent impairments after moderate or severe skull/brain injury	0.730	233223(75%), 333333(25%)
Open wound: short term, with or without treatment	0.005	0.002	0.013	GBD 1990: Open wound	0.105	111211
Poisoning: short term, with or without treatment	0.171	0.116	0.239	Poisoning	0.608	223211
Severe chest injury: long term, with or without treatment	0.056	0.036	0.082			211211
Severe chest injury: short term, with or without treatment	0.352	0.229	0.484			223321
Spinal cord lesion below neck: treated	0.047	0.029	0.072	Dutch study: paraplegia (stable stage)	0.570	222111
Spinal cord lesion below neck: untreated	0.44	0.29	0.588	Paraplegia (GBD 1990 indicator condition)	0.672	332221
Spinal cord lesion at neck: treated	0.369	0.243	0.513	tetraplegia , stable stage *		332111
Spinal cord lesion at neck: untreated	0.673	0.475	0.837	Injured spinal cord	0.725	333321
Other						
Abdominopelvic problem: mild	0.012	0.005	0.023	Maternal haemorrhage - episodes	0.000	111211
Abdominopelvic problem: moderate	0.123	0.083	0.176	Chlamydia - chronic pelvic pain	0.122	112311(50%), 112211(50%)
Abdominopelvic problem: severe	0.326	0.219	0.451	Appendicitis - episodes	0.463	113321
Anaemia: mild	0.005	0.002	0.011	Iron-deficiency anemia - mild	0.000	111111
Anaemia: moderate	0.058	0.038	0.086	Iron-deficiency anemia - moderate	0.011	212111(50%), 112211(50%)
Anaemia: severe	0.164	0.112	0.228	Iron-deficiency anemia - severe	0.090	212212
Periodontitis	0.008	0.003	0.017	Periodontal disease - cases	0.001	111111(90%), 111211(10%)

GBD 2010 health state	GBD 2010 DW	95% uncertainty interval		Cause-sequela in GBD 2004 and/or Stouthard et al (1997)	Previous DW	EQ5D+ classification
Dental caries:symptomatic	0.012	0.005	0.023	Dental caries - episodes	0.081	111111(80%), 111221(20%)
Severe toothloss	0.072	0.048	0.103	Edentulism - cases, untreated	0.061	111111(75%), 111221(25%)
Disfigurement: level 1	0.013	0.006	0.025	Leishmaniasis - cutaneous	0.023	111111(75%), 111121(25%)
Disfigurement: level 2	0.072	0.048	0.103	Skin diseases - cases	0.056	111121(50%), 111122(50%)
Disfigurement: level 3	0.398	0.271	0.543	Dislocation of shoulder, elbow or hip	0.074	112121(50%), 112132(50%)
Disfigurement: level 1 with itch or pain	0.029	0.016	0.048			111111(75%), 111221(25%)
Disfigurement: level 2, with itch or pain	0.187	0.125	0.264	Onchocerciasis - itching	0.068	111221(50%), 111222(50%)
Disfigurement: level 3, with itch or pain	0.562	0.394	0.725	Constitutional eczema *		112321(50%), 112332(50%)
Generic uncomplicated disease: worry and daily medication	0.031	0.017	0.05	Diabetes mellitus - cases, treated	0.033	111111(90%), 112221(10%)
Generic uncomplicated disease: anxiety about diagnosis	0.054	0.033	0.082			111121
Iodine-deficiency goitre	0.2	0.134	0.283	Iodine deficiency goitre- grade 2	0.025	112211
Kwashiorkor	0.055	0.033	0.085			112221
Severe wasting	0.127	0.081	0.183	Protein energy malnutrition - wasting	0.053	212221
Speech problems	0.054	0.034	0.081			112121
Motor impairment: mild	0.012	0.005	0.022	ADL limitations - none to mild in elderly *	0.010	211111
Motor impairment: moderate	0.076	0.05	0.109	Meningitis - motor deficit	0.381	222111
Motor impairment: severe	0.377	0.251	0.518			333211
Motor plus cognitive impairments: mild	0.054	0.033	0.084	Protein energy malnutrition - developmental disability	0.024	212113
Motor plus cognitive impairments: moderate	0.221	0.141	0.314	Syphilis - tertiary - neurologic	0.283	223113
Motor plus cognitive impairments: severe	0.425	0.286	0.587	Iodine deficiency - cretinism	0.804	333213
Rectovaginal fistula	0.492	0.33	0.66	Obstructed labor - rectovaginal fistula	0.430	122231
Vesicovaginal fistula	0.338	0.228	0.467			122221

** Health state from Stouthard et al (1997) not included in GBD 2004*

Annex Table E Revised health state weights used in WHO Global Health Estimates

Annex Table 2. Revised health state weights for use in WHO Global Health Estimates (GHE), in ascending order.

Health state	GHE	GBD 2010	Previous
Infectious disease			
Infectious disease: acute episode, mild	0.005	0.005	0.005
Infectious disease: acute episode, moderate	0.053	0.053	0.137
Infectious disease: acute episode, severe	0.210	0.210	0.615
Infectious disease: post-acute consequences (fatigue, emotional lability, insomnia)	0.254	0.254	
Diarrhoea: mild	0.061	0.061	
Diarrhoea: moderate	0.202	0.202	0.105
Diarrhoea: severe	0.281	0.281	
Epididymo-orchitis	0.097	0.097	0.167
Herpes zoster	0.061	0.061	
HIV: symptomatic, pre-AIDS	0.221	0.221	0.167
HIV/AIDS: receiving antiretroviral treatment	0.053	0.053	0.135
AIDS: not receiving antiretroviral treatment	0.547	0.547	0.505
Intestinal nematode infections: symptomatic	0.030	0.030	0.024
Lymphatic filariasis: symptomatic	0.110	0.110	0.106
Ear pain	0.018	0.018	0.023
Tuberculosis: without HIV infection	0.331	0.331	0.271
Tuberculosis: with HIV infection	0.399	0.399	0.505
Cancer			
Cancer: diagnosis and primary therapy	0.294	0.294	0.095
Cancer: metastatic	0.484	0.484	0.750
Mastectomy	0.038	0.038	0.055
Stoma	0.086	0.086	0.075
Terminal phase: with medication (for cancers, end-stage kidney or liver disease)	0.508	0.508	0.810
Terminal phase: without medication (for cancers, end-stage kidney or liver disease)	0.519	0.519	0.810
Cardiovascular diseases			
Acute myocardial infarction: days 1-2	0.422	0.422	
Acute myocardial infarction: days 3-28	0.056	0.056	0.439
Angina pectoris: mild	0.037	0.037	
Angina pectoris: moderate	0.066	0.066	0.095
Angina pectoris: severe	0.167	0.167	0.227
Cardiac conduction disorders and cardiac dysrhythmias	0.145	0.145	0.193
Claudication	0.016	0.016	
Heart failure: mild	0.037	0.037	0.006
Heart failure: moderate	0.070	0.070	0.171
Heart failure: severe	0.186	0.186	0.323
Stroke: long-term consequences, mild	0.021	0.021	
Stroke: long-term consequences, moderate	0.076	0.076	
Stroke: long-term consequences, moderate plus cognition problems	0.312	0.312	0.266

Health state	GHE	GBD 2010	Previous
Stroke: long-term consequences, severe	0.539	0.539	
Stroke: long-term consequences, severe plus cognition problems	0.567	0.567	0.920
Diabetes, digestive, and genitourinary disease			
Diabetic foot	0.023	0.023	0.133
Diabetic neuropathy	0.099	0.099	0.072
Chronic kidney disease (stageIV)	0.105	0.105	0.104
End-stage renal disease: with kidney transplant	0.027	0.027	
End-stage renal disease: on dialysis	0.573	0.573	0.101
Decompensated cirrhosis of the liver	0.194	0.194	0.330
Gastric bleeding	0.323	0.323	
Crohn's disease or ulcerative colitis	0.225	0.225	0.042
Benign prostatic hypertrophy: symptomatic	0.070	0.070	0.038
Impotence	0.019	0.019	0.060
Urinary incontinence	0.142	0.142	0.060
Infertility: primary	0.056	0.011	0.180
Infertility: secondary	0.026	0.006	0.180
Chronic respiratory diseases			
Asthma: controlled	0.009	0.009	
Asthma: partially controlled	0.027	0.027	0.043
Asthma: uncontrolled	0.132	0.132	
COPD and other chronic respiratory diseases: mild	0.015	0.015	0.170
COPD and other chronic respiratory diseases: moderate	0.192	0.192	0.170
COPD and other chronic respiratory diseases: severe	0.383	0.383	0.530
Neurological disorders			
Dementia: mild	0.165	0.082	
Dementia: moderate	0.388	0.346	0.666
Dementia: severe	0.545	0.438	0.940
Headache: migraine	0.433	0.433	0.288
Headache: moderate migraine	0.267		
Headache: tension-type	0.040	0.040	
Multiple sclerosis: mild	0.198	0.198	
Multiple sclerosis: moderate	0.445	0.445	0.411
Multiple sclerosis: severe	0.707	0.707	0.670
Epilepsy: treated, seizure free	0.072	0.072	0.065
Epilepsy: treated, with recent seizures	0.319	0.319	
Epilepsy: severe	0.657	0.657	
Epilepsy: untreated	0.420	0.420	0.150
Parkinson's disease: mild	0.011	0.011	
Parkinson's disease: moderate	0.263	0.263	0.316
Parkinson's disease: severe	0.549	0.549	0.392
Mental, behavioural, and substance use disorders			
Alcohol use disorder: mild	0.259	0.259	0.134
Alcohol use disorder: moderate	0.388	0.388	0.180
Alcohol use disorder: severe	0.549	0.549	

Health state	GHE	GBD 2010	Previous
Alcohol problem use	0.115	0.259	0.134
Fetal alcohol syndrome: mild	0.017	0.017	
Fetal alcohol syndrome: moderate	0.057	0.057	
Fetal alcohol syndrome: severe	0.177	0.177	
Cannabis dependence	0.190	0.329	0.252
Amphetamine dependence	0.240	0.353	0.252
Cocaine dependence	0.260	0.376	0.252
Heroin and other opioid dependence	0.340	0.641	0.252
Anxiety disorders: mild	0.030	0.030	0.091
Anxiety disorders: moderate	0.149	0.149	0.173
Anxiety disorders: severe	0.523	0.523	0.560
Major depressive disorder: mild episode	0.159	0.159	0.140
Major depressive disorder: moderate episode	0.406	0.406	0.350
Major depressive disorder: severe episode	0.655	0.655	0.760
Bipolar disorder: manic episode	0.480	0.480	0.400
Bipolar disorder: residual state	0.035	0.035	0.140
Schizophrenia: acute state	0.756	0.756	0.627
Anorexia nervosa	0.223	0.223	0.280
Schizophrenia: residual state	0.576	0.576	0.351
Bulimia nervosa	0.223	0.223	0.280
Attention-deficit hyperactivity disorder	0.049	0.049	0.020
Conduct disorder	0.236	0.236	0.150
Asperger's syndrome	0.110	0.110	
Autism	0.259	0.259	0.550
Intellectual disability: mild	0.127	0.031	0.290
Intellectual disability: moderate	0.293	0.080	0.430
Intellectual disability: severe	0.383	0.126	0.820
Intellectual disability: profound	0.444	0.157	0.760
Hearing and vision loss			
Hearing loss: mild	0.005	0.005	0.040
Hearing loss: moderate	0.050	0.023	0.120
Hearing loss: severe	0.167	0.031	0.333
Hearing loss: profound	0.281	0.032	0.333
Hearing loss: complete	0.281	0.033	
Hearing loss: mild, with ringing	0.038	0.038	
Hearing loss: moderate, with ringing	0.095	0.058	
Hearing loss: severe, with ringing	0.220	0.065	
Hearing loss: profound, with ringing	0.327	0.088	
Hearing loss: complete, with ringing	0.320	0.092	
Childhood-onset hearing loss: mild	0.005		
Childhood-onset hearing loss: moderate	0.077		
Childhood-onset hearing loss: severe	0.215		
Childhood-onset hearing loss: profound	0.312		
Childhood-onset hearing loss: complete	0.314		

Health state	GHE	GBD 2010	Previous
Childhood-onset hearing loss: mild, with ringing	0.037		
Childhood-onset hearing loss: moderate, with ringing	0.122		
Childhood-onset hearing loss: severe, with ringing	0.265		
Childhood-onset hearing loss: profound, with ringing	0.356		
Childhood-onset hearing loss: complete, with ringing	0.351		
Distance vision: mild impairment	0.005	0.004	
Distance vision: moderate impairment	0.089	0.033	0.170
Distance vision: severe impairment	0.314	0.191	0.430
Distance vision blindness	0.338	0.195	0.600
Near vision impairment	0.047	0.013	0.020
Musculoskeletal disorders			
Low back pain: acute, without leg pain (severe)	0.269	0.269	0.061
Low back pain: acute, with leg pain (severe)	0.322	0.322	0.061
Low back pain: chronic, without leg pain	0.366	0.366	
Low back pain: chronic, with leg pain	0.374	0.374	0.125
Low back pain: acute (moderate)	0.072		
Low back pain: : acute (mild)	0.023		
Neck pain: acute, mild	0.040	0.040	
Neck pain: acute, severe	0.221	0.221	
Neck pain: chronic, mild	0.101	0.101	
Neck pain: chronic, severe	0.286	0.286	
Musculoskeletal problems: legs, mild	0.023	0.023	
Musculoskeletal problems: legs, moderate	0.079	0.079	0.108
Musculoskeletal problems: legs, severe	0.171	0.171	0.156
Musculoskeletal problems: arms, mild	0.024	0.024	
Musculoskeletal problems: arms, moderate	0.114	0.114	0.174
Musculoskeletal problems: generalised, moderate	0.292	0.292	0.233
Musculoskeletal problems: generalised, severe	0.606	0.606	
Gout: acute	0.293	0.293	0.132
Injuries			
Amputation of finger(s), excluding thumb: long term, with treatment	0.030	0.030	0.102
Amputation of thumb: long term	0.013	0.013	0.165
Amputation of one arm: long term, with or without treatment	0.130	0.130	0.102
Amputation of both arms: long term, with treatment	0.044	0.044	
Amputation of both arms: long term, without treatment	0.359	0.359	
Amputation of toe	0.008	0.008	0.064
Amputation of one leg: long term, with treatment	0.021	0.021	0.300
Amputation of one leg: long term, without treatment	0.164	0.164	0.300
Amputation of both legs: long term, with treatment	0.051	0.051	
Amputation of both legs: long term, without treatment	0.494	0.494	
Burns of <20% total surface area without lower airway burns: short term, with or without treatment	0.096	0.096	0.157
Burns of <20% total surface area or <10% total surface area if head or neck, or hands or wrist involved: long term, with or without treatment	0.018	0.018	0.002
Burns of ≥20% total surface area: short term, with or without treatment	0.333	0.333	0.455

Health state	GHE	GBD 2010	Previous
Burns of ≥20% total surface area or ≥10% total surface area if head or neck, or hands or wrist involved: long term, with treatment	0.127	0.127	0.255
Burns of ≥20% total surface area or ≥10% total surface area if head or neck, or hands or wrist involved: long term, without treatment	0.438	0.438	0.255
Lower airway burns: with or without treatment	0.373	0.373	
Crush injury: short or long term, with or without treatment	0.145	0.145	0.218
Dislocation of hip: long term, with or without treatment	0.017	0.017	
Dislocation of knee: long term, with or without treatment	0.129	0.129	0.074
Dislocation of shoulder: long term, with or without treatment	0.080	0.080	0.074
Other injuries of muscle and tendon (includes sprains, strains, and dislocations other than shoulder, knee, or hip)	0.009	0.009	
Drowning and non-fatal submersion: short or long term, with or without treatment	0.288	0.288	
Fracture of clavicle, scapula, or humerus: short or long term, with or without treatment	0.053	0.053	0.153
Fracture of face bone: short or long term, with or without treatment	0.173	0.173	0.223
Fracture of foot bones: short term, with or without treatment	0.033	0.033	0.077
Fracture of foot bones: long term, without treatment	0.033	0.033	
Fracture of hand: short term, with or without treatment	0.025	0.025	0.100
Fracture of hand: long term, without treatment	0.016	0.016	
Fracture of neck of femur: short term, with or without treatment	0.308	0.308	0.372
Fracture of neck of femur: long term, with treatment	0.072	0.072	0.272
Fracture of neck of femur: long term, without treatment	0.388	0.388	0.272
Fracture other than neck of femur: short term, with or without treatment	0.192	0.192	
Fracture other than neck of femur: long term, without treatment	0.053	0.053	
Fracture of patella, tibia or fibula, or ankle: short term,with or without treatment	0.087	0.087	0.271
Fracture of patella, tibia or fibula, or ankle: long term, with or without treatment	0.070	0.070	
Fracture of pelvis: short term	0.390	0.390	0.247
Fracture of pelvis: long term	0.194	0.194	
Fracture of radius or ulna: short term, with or without treatment	0.065	0.065	0.180
Fracture of radius or ulna: long term, without treatment	0.050	0.050	
Fracture of skull: short or long term, with or without treatment	0.073	0.073	0.431
Fracture of sternum or fracture of one or two ribs: short term, with or without treatment	0.150	0.150	0.199
Fracture of vertebral column: short or long term, with or without treatment	0.132	0.132	0.266
Fractures: treated, long term	0.003	0.003	
Injured nerves: short term	0.065	0.065	0.071
Injured nerves: long term	0.136	0.136	0.071
Injury to eyes: short term	0.079	0.079	0.108
Severe traumatic brain injury: short term, with or without treatment	0.235	0.235	0.359
Traumatic brain injury: long-term consequences, minor, with or without treatment	0.106	0.106	0.370
Traumatic brain injury: long-term consequences, moderate, with or without treatment	0.224	0.224	0.396
Traumatic brain injury: long-term consequences, severe,with or without treatment	0.625	0.625	0.730
Open wound: short term, with or without treatment	0.005	0.005	0.105
Poisoning: short term, with or without treatment	0.171	0.171	0.608
Severe chest injury: long term, with or without treatment	0.056	0.056	
Severe chest injury: short term, with or without treatment	0.352	0.352	
Spinal cord lesion below neck: treated	0.047	0.047	0.570

Health state	GHE	GBD 2010	Previous
Spinal cord lesion below neck: untreated	0.440	0.440	0.672
Spinal cord lesion at neck: treated	0.369	0.369	
Spinal cord lesion at neck: untreated	0.673	0.673	0.725
Other			
Abdominopelvic problem: mild	0.012	0.012	0.000
Abdominopelvic problem: moderate	0.123	0.123	0.122
Abdominopelvic problem: severe	0.326	0.326	0.463
Anaemia: mild	0.005	0.005	0.000
Anaemia: moderate	0.058	0.058	0.011
Anaemia: severe	0.164	0.164	0.090
Periodontitis	0.008	0.008	0.001
Dental caries:symptomatic	0.012	0.012	0.081
Severe toothloss	0.072	0.072	0.061
Disfigurement: level 1	0.013	0.013	0.023
Disfigurement: level 2	0.072	0.072	0.056
Disfigurement: level 3	0.398	0.398	0.074
Disfigurement: level 1 with itch or pain	0.029	0.029	
Disfigurement: level 2, with itch or pain	0.187	0.187	0.068
Disfigurement: level 3, with itch or pain	0.562	0.562	
Generic uncomplicated disease: worry and daily medication	0.031	0.031	0.033
Generic uncomplicated disease: anxiety about diagnosis	0.054	0.054	
Iodine-deficiency goitre	0.200	0.200	0.025
Kwashiorkor	0.055	0.055	
Severe wasting	0.127	0.127	0.053
Speech problems	0.054	0.054	
Motor impairment: mild	0.012	0.012	0.010
Motor impairment: moderate	0.076	0.076	0.381
Motor impairment: severe	0.377	0.377	
Motor plus cognitive impairments: mild	0.054	0.054	0.024
Motor plus cognitive impairments: moderate	0.221	0.221	0.283
Motor plus cognitive impairments: severe	0.425	0.425	0.804
Rectovaginal fistula	0.492	0.492	0.430
Vesicovaginal fistula	0.338	0.338	