

# Global burden of injury in the year 2000: an overview of methods

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## 1. Introduction

The World Health Organization has undertaken to provide a new assessment of the Global Burden of Disease (GBD 2000) for the year 2000 (1). GBD 2000 Version 1 results reported previously for injuries were based on an extensive analysis of mortality data for all regions of the world (1,2) together with extrapolations of non-fatal burden from a number of recent national burden of disease studies. Version 2 results reported here are based on the most recent WHO cause of death analyses and on previously unanalyzed health service data from 18 Member States.

## 2. GBD 2000 analysis categories

The cause list used for the GBD 2000 has four levels of disaggregation and includes 135 specific diseases and injuries. At the first level, overall mortality is divided into three broad groups of causes: Group I, consisting of communicable diseases, maternal causes, conditions arising in the perinatal period and nutritional deficiencies, Group II encompassing the non-communicable diseases; and Group III, comprising intentional and unintentional injuries. Injury categories within Group III are defined in terms of external cause codes (eg. falls, self-inflicted injuries). Deaths and disability are categorically attributed to one underlying cause using the rules and conventions of the International Classification of Diseases (3, 4). In cases where the ICD rules are ambiguous, the GBD 2000 follows the conventions used in the GBD 1990. For geographic disaggregation of the global burden of disease, the six WHO regions of the world have been further divided into sub regions based on levels of child and adult mortality. A description of the WHO regions and sub regions is given in Murray et al. (1).

## 3. Mortality due to injury

The GBD 2000 uses the latest population estimates for WHO Member States prepared by the UN Population Division (5). WHO has worked extensively with Member States in an effort to verify the best sources of recent data on vital registration and cause of death, and new life tables for the year 2000 have been constructed for all 191 WHO Member States (1, 6). Complete or incomplete vital registration data together with sample registration systems cover 76 per cent of global mortality. Survey data and indirect demographic techniques provide information on levels of child and adult mortality for the remaining 24 per cent of estimated global mortality.

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Causes of death for the WHO sub regions and the world have been estimated based on data from national vital registration systems that capture about 17 million deaths annually. In addition, information from sample registration systems, population laboratories and epidemiological analyses of specific conditions has been used to improve estimates of the cause of death patterns. Cause of death data have been carefully analyzed to take into account incomplete coverage of vital registration in countries and the likely differences in cause of death patterns that would be expected in the uncovered and often poorer sub-populations (1).

Special attention has been given to problems of misattribution or miscoding of causes of death in cardiovascular diseases, cancer, injuries and general ill-defined categories. The category “Injury undetermined whether accidentally or purposely inflicted.” (E980-E989 in the 3 digit ICD-9 codes or Y10–Y34 in ICD-10) can often include a significant share of injury deaths. Except where more detailed local information is available, the GBD 2000 has proportionately allocated these deaths to all other injury causes of death. Deaths coded to 4-digit ICD-9 code E928.9, “Unspecified Accidents” were also redistributed proportionally across the other unintentional injury categories. There is no corresponding ICD-10 code for unspecified accidents, forcing coders to at least specify a broad category of injury.

Estimates of natural disaster mortality are either based on vital registration statistics, if available, or aid agency releases. The latter numbers are added to the non-disaster injury mortality, while ensuring that, in countries with functional death registration systems, the deaths are not already coded as non-natural disaster injury deaths.

The estimation of mortality directly due to conflict is a field of study in itself, and estimates have a wide uncertainty range, sometimes to an order of magnitude. We have used a parsimonious definition of conflict deaths, including only those caused by an injury sustained in a war or civil insurrection. This category includes those killed by injuries after hostilities have ceased (e.g. by landmines or unexploded munitions, or by delayed effects due to conflict injuries). It does not include those deaths due to conflict *as a risk factor*, such as excess malnutrition deaths due to a conflict’s interruption of the food supply.

However, even with a consistent definition of a conflict death, the available estimates vary widely. The majority of published analyses of deaths from conflict have relied on press reports of eyewitness accounts and official announcements of combatants (19). These problematic sources inevitably result in a large degree of uncertainty.

## 4. Disease model for YLD estimation

Years lived with disability (YLD) are the disability component of DALYs. YLD measure the equivalent healthy years of life lost due to the disabling sequelae of diseases and injuries, and require estimation of incidence, average duration of disability and severity of disability.

The injury-related YLD reported here are based on methods developed for the GBD 1990. An incident episode of a non-fatal injury is defined as an episode that is severe enough for the person to

be hospitalized, or which requires emergency room care (if such care is available). Previous burden studies have shown that the main sources of disability from injuries are road traffic accidents, falls, fires, other unintentional injuries and, in some countries, violence and war. The group of 'other unintentional injuries' is often the leading cause of YLD in injuries and is comprised of a wide variety of injuries, including being struck or crushed by an object, machinery accidents and sports injuries. Poisoning, drowning and self-inflicted injuries mainly cause YLL and if disability is incurred, it is usually of short duration and therefore does not contribute significantly to YLD.

The results reported here are based on new analyses of health facility data obtained after an extensive period of negotiation and consultation with Member States. Table 1 summarizes the eighteen Member States from which such data has been received to date, as well as the recency, coverage and source of this information. This list excludes a number of Member States with which negotiations are yet to be finalized.

**Table 1 Health facility data received by WHO from Member States**

WHO sub region	Country	Description of data
WPRO A	Australia	Cause and nature of injury coded unit record data - 2000/2001 (complete coverage)
AMRO A	Canada	Cause and nature of injury coded unit record data - 2000/2001 (complete coverage)
AMRO A	Cuba	Tabulations by limited nature of injury categories, age and sex only
AFRO D	Ghana	Unit record community survey data on injury hospitalisations
EURO A	Israel	Cause and nature of injury coded unit record data from all trauma centers - 2000
AFRO E	Kenya	Tabulation by nature of injury, age and sex only
EURO C	Latvia	Tabulation by nature of injury category only - 2000
WPRO B	Malaysia	Cause and nature of injury coded unit record data - 2000 (unknown coverage)
AFRO D	Mauritius	Cause and nature of injury coded unit record data - 1994/5
AFRO E	Mozambique	Unit record data from one urban hospital
WPRO A	New Zealand	Cause and nature of injury coded unit record data - 2000 (public hospitals only)
WPRO B	Papua New Guinea	Unit record data - 1998 (unknown coverage)
WPRO A	Singapore	Tabulations by cause, age and sex only
AFRO E	South Africa	Cause and nature of injury coded unit record surveillance data
SEARO B	Thailand	Cause and nature of injury coded unit record data - 1999 (65-75% coverage)
AFRO E	Uganda	Surveillance data from 7 districts
EURO A	United Kingdom	Separate nature of injury and cause tabulations by age and sex - 2000
AMRO A	USA	Cause and nature of injury coded unit record data from four states - 1996 (complete coverage)

Incidence rates have been estimated from health facility data using age- and sex-specific ratios of incident non-fatal events to deaths. This approach was developed for the GBD 1990 study, in which it was found that where they have been studied, death-to-incidence ratios by age and sex for a number of injuries are reasonably consistent. For most cause categories, extrapolations from observed death-to-incidence ratios have been derived for all Member States at a regional level, with final adjustments using mortality and per capita GDP as predictors of expected variability in case-fatality. Because numbers of observed non-fatal war events were too small to allow for a meaningful analysis using these techniques, estimates for this category were based on the region-specific ratios from Zwi reported in the GBD 1990 study.

The rules of the International Classification of Disease (ICD) allow for the coding of injuries along two dimensions: according to the external cause of the injury, or according to the physiological damage arising from an injury (Figure 1). The GBD 1990 study established that disability is estimated most accurately from knowledge of the nature of injury, but that estimates should ultimately be attributed back to a cause for policy relevance.

To facilitate the incorporation of both dimensions analytically, the large number of detailed ICD nature of injury codes were collapsed into thirty-three categories in a way that combined similar outcomes. An analysis of health facility data from three countries with data coded in both dimensions demonstrated that the distribution of these nature of injury categories differed both within a given external cause group by age and sex, and between external cause groups. Thus a matrix approach was adopted whereby average distributions of nature of injury categories were generated for each cause, age and sex stratum across the countries analysed.

This approach has been retained in the GBD 2000 revisions. Amongst the eight country-specific data sets listed in Table 1 coded in both dimensions, the similarity between countries on the distribution of nature of injury categories within cause groupings is justification for the adoption of this approach. Data from the remaining countries that could not supply information on both dimensions has been incorporated into the final estimates to the extent that quality, coverage and classification considerations allowed.

Expert opinion provided to the 1990 study was that some nature of injury categories would comprise cases with short-term disability only (e.g. open wounds, fractured arm), while others would be made up of cases all of whom would experience permanent disability (e.g. amputations, spinal cord lesions). A few categories, however, would contain both short- and long-term cases (e.g. head injuries). Due to the paucity of cohort studies on injury at the time, non-empirical methods were adopted whereby participants at the Geneva meeting on disability weights were asked to estimate the severity of treated and untreated forms of the thirty-three each nature of injury categories, as well as their average duration, based on information provided to them. Estimates were also derived on the proportion with life-long disability for certain categories (8).

A decision was made early on as part of the GBD 2000 revisions to retain all 1990 disability weights relating to injury on a provisional basis until the finalization of more refined methods for this aspect of burden of disease estimation. A practical implication flowing from this decision has been the retention of the thirty-three nature of injury categories without modification, including the distinction between short- and long-term disability within some categories. The generation of new weights for injuries is

**Figure 1. ICD and injuries: A two dimensional approach**

<b>Cause of injury:</b>	The cause of the bodily harm, e.g. road traffic accident, falls or fires
<b>Nature of injury:</b>	A description of the actual bodily harm caused by the type of injury, e.g. a fractured hip, brain injury or third degree burns over 20% of body surface

the obvious point at which to revisit the logic underlying this classification, which it could be argued contains certain redundancies, as well as possible omissions.

Sensitivity analysis of the 1990 duration estimates reveals that total injury YLD are largely insensitive to the assumptions regarding short-term injuries. For consistency with the 1990 results, therefore, all short-term duration assumptions have been retained without modification in 2000 revisions, despite their lack of an empirical basis. Effort has been directed towards finding justification for the long-term assumptions. To this end, several cohort studies on injury have been identified as having the potential to provide information on the proportion of cases resulting in long-term disability, although none has been able to provide information in time for these analyses. The results reported here, therefore, are based on the estimates used in the 1990 study, which, for the most part, have limited corroborating evidence in the literature. Assumptions regarding long-term durations, however, are based on new analyses and are discussed in more detail below.

## 5. Case and sequelae definitions

The case definition for an injury is one that leads immediately to death or that is non-fatal but severe enough to warrant hospital treatment, irrespective of whether or not an appropriate medical facility is available. The following tables summarize the cause and nature of injury case definitions used in the GDB 2000 revisions and their corresponding ICD codes.

**Table 2 GBD2000 injury cause categories and ICD codes**

Code	Cause category	ICD-9 code (3 digit)	ICD-10 code (3 digit)
U148	<b>III. Injuries</b>	E800-999	V01-Y89
U149	<b>A. Unintentional injuries</b>	E800-949	V01-X59, Y40-Y86, Y88, Y89
U150	1. Road traffic accidents	E810-819, E826-829	V01-V04, V06, V09-V80, V87, V89, V99
U151	2. Poisonings	E850-869	X40-X49
U152	3. Falls	E880-888	W00-W19
U153	4. Fires	E890-899	X00-X09
U154	5. Drownings	E910	W65-W74
U155	6. Other unintentional injuries	E800-E807, E820-E848, E870-E879, E900-E909, E911-E949	Rest of V, W20-W64, W75-W99, X10-X39, X50-X59, Y40-Y86, Y88, Y89
U156	<b>B. Intentional injuries</b>	E950-978, 990-999	X60-Y09, Y35-Y36, Y87
U157	1. Self-inflicted injuries	E950-959	X60-X84
U158	2. Violence	E960-969	X85-Y09
U159	3. War	E990-999	Y36
U160	Other intentional injuries	E970-E978	Y35, Y87

**Table 3 GBD2000 injury cause categories and case definitions**

<b>Cause category</b>	<b>Case definition</b>
A1. Road traffic accidents	Includes crashes and pedestrian injuries due to motor vehicles.
A2. Poisonings	Only one outcome is included for poisonings.
A3. Falls	Includes falls resulting from osteoporotic fractures.
A4. Fires	Most of the sequelae of fires are due to burns. Some individuals, however, jump from buildings or are otherwise injured due to fires.
A5. Drownings	Other than drowning and near-drowning rates, the only other major disabling sequelae from near-drowning included is quadriplegia.
A6. Other unintentional injuries	This is not a residual category, but includes injuries due to environmental factors, machinery and electrical equipment, cutting and piercing implements, and various other external causes of unintentional injury.
B1. Self-inflicted injuries	Suicide attempts, whether or not resulting in death.
B2. Violence	Interpersonal violence, including assault and homicide.
B3. War	Injuries and deaths directly attributable to war in combatants and non-combatants. For example, the estimates of mortality include deaths to children and adults from landmines.
B4. Other intentional injuries	Injuries and deaths resulting from legal interventions.

**Table 4 GBD2000 nature of injury categories and ICD codes**

Nature of injury category	ICD 9 Code	ICD 10 Code
1. Fractures		
Skull—short-term <sup>1</sup>	800 to 801	S02.0/1/7/9,T90.2
Skull—long-term <sup>1</sup>	800 to 801	S02.0/1/7/9,T90.2
Face bones <sup>1</sup>	802	S02.2/6/8
Vertebral column	805	S12,S22.0/1,S32.0/7,T91.1
Rib or sternum <sup>2</sup>	807	S22.2-9
Pelvis <sup>2</sup>	808	S32.1-5/8,T91.2
Clavicle, scapula or humerus <sup>3</sup>	810-812	S42,S49.7
Radius or ulna <sup>3</sup>	813	S52,S59.7,T10,T92.1
Hand bones <sup>3</sup>	814-817	S62,S69.7,T92.2
Femur—short-term <sup>4</sup>	820-821	S72,S79.7
Femur—long-term <sup>4</sup>	820-821	S72,S79.7
Patella, tibia or fibula <sup>4</sup>	822-823	S82.0-4,S82.7/9,S89.7,T12
Ankle <sup>4</sup>	824	S82.5-6/8
Foot bones <sup>4</sup>	825-826	S92,S99.7
2. Injured spinal cord	806 and 952	S14,S24,S34,T06.0/1,T08,T91.3
3. Dislocations		
Shoulder, elbow or hip	831, 832, 835	S43,S73
Other dislocation	830, 833-834, 836-839	S03.0-3,S13,S23,S33,S53,S63.0/1,S83.1-3,S93.1-3,T03,T11.2,T13.2,T14.3,T92.3,T93.3
4. Sprains	840-848	S03.4/5,S16,S29.0,S39.0,S46,S56,S63.5-7,S66,S76,S83.4/7,S86,S93.4/6,S96,T06.4,T11.5,T13.5,T14.6,T92.5,T93.5
5. Intracranial injuries		
Short-term	850-854	S06,T90.5
Long-term	850-854	S06,T90.5
6. Internal injuries	860-869	S25-S27,S35-S37,S39.6,T06.4,T91.4/5
7. Open wound	870, 872-884, 890-894	S01,S08,S11,S15,S21,S31,S41,S45,S51,S55,S61,S65,S71,S75,S81,S85,S91,S95,T01,T11.1/4,T13.5,T14.6,T90.1,T92.5,T93.5
8. Injury to eyes		
Short-term	871, 950	S05,T90.4
Long-term	871, 950	S05,T90.4
9. Amputations		
Thumb	885	S68.0
Finger	886	S68.1/2
Arm	887	S48,S58,S68.3-9,T05.0/2,T11.6
Toe <sup>5</sup>	895	S98.1/2
Foot <sup>5</sup>	896, 897.0-1	S98.0/3/4,T05.3
Leg <sup>5</sup>	897.2-3	S78,S88,T05.4/6,T13.6
10. Crushing	925-929	S07,S17,S28,S38,S47,S57,S67,S77,S87,S97,T04,T14.7,T92.6,T93.6
11. Burns		
Less than 20%—short-term <sup>6</sup>	940-947, 948.0-1	T31.0/1
Less than 20%—long-term <sup>6</sup>	940-947, 948.0-1	T31.0/1
20 to 60%—short-term <sup>6</sup>	948.2-5	T331.2/5
20 to 60%—long-term <sup>6</sup>	948.2-5	T331.2/5
Greater than 60%—short-term <sup>6</sup>	948.6-9	T31.6/9
Greater than 60%—long-term <sup>6</sup>	948.6-9	T31.6/9
12. Injured nerves		
Short-term	951, 953-957	S04,S44,S54,S64,S74,S84,S94,T06.2,T11.3,T13.3,T14.4
Long-term	951, 953-957	S04,S44,S54,S64,S74,S84,S94,T06.2,T11.3,T13.3,T14.4
13. Poisoning	960-979, 980-989	T36-T65,T96-T97

1 The N-codes 803 and 804 were assigned to fractured skull following the distribution of N-codes 801 and 802.

2 The N-code 809 was assigned to fractured rib, sternum, and pelvis following the distribution of N-codes 807 and 808.

3 The N-codes 818 and 819 were assigned to fractured clavicle, scapula, humerus, radius, ulna and hand bones following the distribution of N-codes 810-817.

4 The N-codes 827 and 828 were assigned to fractured patella, tibia, fibula, ankle and foot bones following the distribution of N-codes 822-826.

5 The N-codes 897.4 to 897.7 were assigned to amputated toe, foot and leg following the distribution of N-codes 895, 896 and 897.0-897.3.

6 The N-code 949 was assigned to burns following the N-codes 940-948. In ICD-10, burns are classified by site (T20–T30) and/or proportion of body surface affected (T31).

## 6. Disability weights

The following tables summarize the disability weights used in these revisions and are taken directly from the GBD 1990 study.

**Table 5 Short-term disability weights by nature of injury, age and treatment category**

Injury category	Treated					Untreated				
	0-4	5-14	15-44	45-59	60+	0-4	5-14	15-44	45-59	60+
Fractured skull	0.431	0.431	0.431	0.431	0.431	0.431	0.431	0.431	0.431	0.431
Fractured face bones	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223	0.223
Fractured vertebral column	0.266	0.266	0.266	0.266	0.266	0.266	0.266	0.266	0.266	0.266
Injured spinal cord										
Fractured rib or sternum	0.199	0.199	0.199	0.199	0.199	0.199	0.199	0.199	0.199	0.199
Fractured pelvis	0.247	0.247	0.247	0.247	0.247	0.247	0.247	0.247	0.247	0.247
Fractured clavicle, scapula or humerus	0.153	0.153	0.136	0.136	0.136	0.153	0.153	0.136	0.136	0.136
Fractured radius or ulna	0.180	0.180	0.180	0.180	0.180	0.180	0.180	0.180	0.180	0.180
Fractured hand bones	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100	0.100
Fractured femur	0.372	0.372	0.372	0.372	0.372	0.372	0.372	0.372	0.372	0.372
Fractured patella, tibia or fibula	0.271	0.271	0.271	0.271	0.271	0.271	0.271	0.271	0.271	0.271
Fractured ankle	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196	0.196
Fractured foot bones	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077	0.077
Other dislocation	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074
Dislocated shoulder, elbow or hip	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074	0.074
Sprains	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064	0.064
Intracranial injuries	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359	0.359
Internal injuries	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208	0.208
Open wound	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108
Injury to eyes	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108	0.108
Amputated thumb										
Amputated finger										
Amputated arm										
Amputated toe										
Amputated foot										
Amputated leg										
Crushing	0.218	0.218	0.218	0.218	0.218	0.218	0.218	0.218	0.218	0.218
Burns < 20%	0.158	0.158	0.158	0.158	0.158	0.156	0.156	0.156	0.156	0.156
Burns >20% and <60%	0.441	0.441	0.441	0.441	0.441	0.469	0.469	0.469	0.469	0.469
Burns > 60%	0.441	0.441	0.441	0.441	0.441	0.469	0.469	0.469	0.469	0.469
Injured nerves	0.064	0.064	0.064	0.064	0.064	0.078	0.078	0.078	0.078	0.078
Poisoning	0.611	0.611	0.608	0.608	0.608	0.611	0.611	0.608	0.608	0.608
Residual										

Source: Murray & Lopez 1996, p 216

**Table 6 Long-term disability weights by nature of injury, age and treatment category**

Injury category	Treated					Untreated				
	0-4	5-14	15-44	45-59	60+	0-4	5-14	15-44	45-59	60+
Fractured skull	0.350	0.350	0.350	0.350	0.404	0.410	0.410	0.410	0.419	0.471
Fractured face bones										
Fractured vertebral column										
Injured spinal cord	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725	0.725
Fractured rib or sternum										
Fractured pelvis										
Fractured clavicle, scapula or humerus										
Fractured radius or ulna										
Fractured hand bones										
Fractured femur	0.272	0.272	0.272	0.272	0.272	0.272	0.272	0.272	0.272	0.272
Fractured patella, tibia or fibula										
Fractured ankle										
Fractured foot bones										
Other dislocation										
Dislocated shoulder, elbow or hip										
Sprains										
Intracranial injuries	0.350	0.350	0.350	0.350	0.404	0.410	0.410	0.410	0.419	0.471
Internal injuries										
Open wound										
Injury to eyes	0.301	0.300	0.298	0.298	0.298	0.354	0.354	0.354	0.354	0.354
Amputated thumb	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165	0.165
Amputated finger	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
Amputated arm	0.257	0.257	0.257	0.257	0.257	0.308	0.308	0.308	0.308	0.308
Amputated toe	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102	0.102
Amputated foot	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Amputated leg	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300	0.300
Crushing										
Burns < 20%	0.001	0.001	0.001	0.001	0.001	0.002	0.002	0.002	0.002	0.002
Burns >20% and <60%	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255
Burns > 60%	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255	0.255
Injured nerves	0.064	0.064	0.064	0.064	0.064	0.078	0.078	0.078	0.078	0.078
Poisoning										
Residual										

Source: Murray &amp; Lopez 1996, p 216

## 7. Treatment proportions

Certain nature of injury categories in the GBD 1990 study were assumed to have different durations and disability weights depending on whether or not treatment was received. In the absence of more recent evidence regarding this aspect of injury epidemiology at a global level, these assumptions have been adopted in the GBD 2000 revisions without modification.

**Table 7 Proportion of incident injury cases receiving treatment by injury category and region**

Injury category	GBD 1990 region							
	EME	FSE	IND	CHN	OAI	SSA	IAC	MEC
Fractured skull	90%	80%	20%	50%	35%	15%	60%	50%
Fractured femur	95%	95%	70%	90%	85%	60%	80%	80%
Internal injuries	90%	80%	40%	70%	75%	35%	75%	65%
Open wound	95%	90%	60%	80%	75%	35%	80%	75%
Injury to eyes	80%	65%	30%	30%	30%	5%	50%	40%
Burns < 20%	80%	70%	15%	40%	25%	5%	45%	35%
Burns >20% and <60%	80%	70%	15%	40%	25%	5%	45%	35%
Burns > 60%	80%	70%	15%	40%	25%	5%	45%	35%
Injured nerves	80%	70%	20%	30%	25%	15%	40%	35%

Source: Murray & Lopez 1996, p418

## 8. Duration

As mentioned previously, the short-term durations used in these revisions have been derived directly from the GBD 1990 study. Life long durations by age, sex and country, however, have been re-estimated from country-specific life-tables on the basis of the most recent WHO population and mortality estimates. For injuries with no excess risk of mortality (e.g. amputations and burns), remission and case-fatality rates of zero have been assumed. For injuries with excess risk of mortality (e.g. head injuries, spinal cord injuries, fractured femur/hip), zero remission and relevant relative risks from the literature have been applied to the life-table calculations (see Table 8). Adjustments have been made to the relative risk estimates according to per capita GDP so as to reflect expected differences in access to and quality of care at a country level.

For a number of nature of injury categories, the GBD 1990 presents proportions of cases resulting in long-term disability. An attempt has been made to validate these assumptions through expert advice and findings in the literature (11- 14), although further work is required in order demonstrate the applicability of these figures to all regions of the world.

**Table 8 Short- and long-term duration assumptions by injury category**

Injury category	Sort-term duration (years)		Long-term duration assumptions		
	Treated*	Untreated*	% long-term*	RR of mortality	
Fractured skull	0.107	0.107	15%	3.8	See intracranial injuries
Fractured face bones	0.118	0.118			
Fractured vertebral column	0.140	0.140			
Injured spinal cord			100%	3.8	DeVivo et al 1999
Fractured rib or sternum	0.115	0.115			
Fractured pelvis	0.126	0.126			
Fractured clavicle, scapula or humerus	0.112	0.112			
Fractured radius or ulna	0.112	0.112			
Fractured hand bones	0.070	0.070			
Fractured femur	0.140	0.241	5%	1.2-2.2	Forsen et al 1999
Fractured patella, tibia or fibula	0.090	0.179			
Fractured ankle	0.096	0.146			
Fractured foot bones	0.073	0.073			
Other dislocation	0.019	0.019			
Dislocated shoulder, elbow or hip	0.034	0.034			
Sprains	0.038	0.038			
Intracranial injuries	0.067	0.067	5%	3.8	Baguley et al 2000
Internal injuries	0.042	0.000			
Open wound	0.024	0.052			
Injury to eyes	0.019	0.019	100%		
Amputated thumb			100%		
Amputated finger			100%		
Amputated arm			100%		
Amputated toe			100%		
Amputated foot			100%		
Amputated leg			100%		
Crushing	0.094	0.094			
Burns < 20%	0.083	0.124	100%	1.0	Manktelow et al 1989
Burns >20% and <60%	0.279	0.279	100%	1.0	Manktelow et al 1990
Burns > 60%	0.279	0.360	100%	1.0	Manktelow et al 1991
Injured nerves			100%		
Poisoning	0.008	0.008			

\*Adapted from Murray and Lopez 1996, p216

## 9. Results

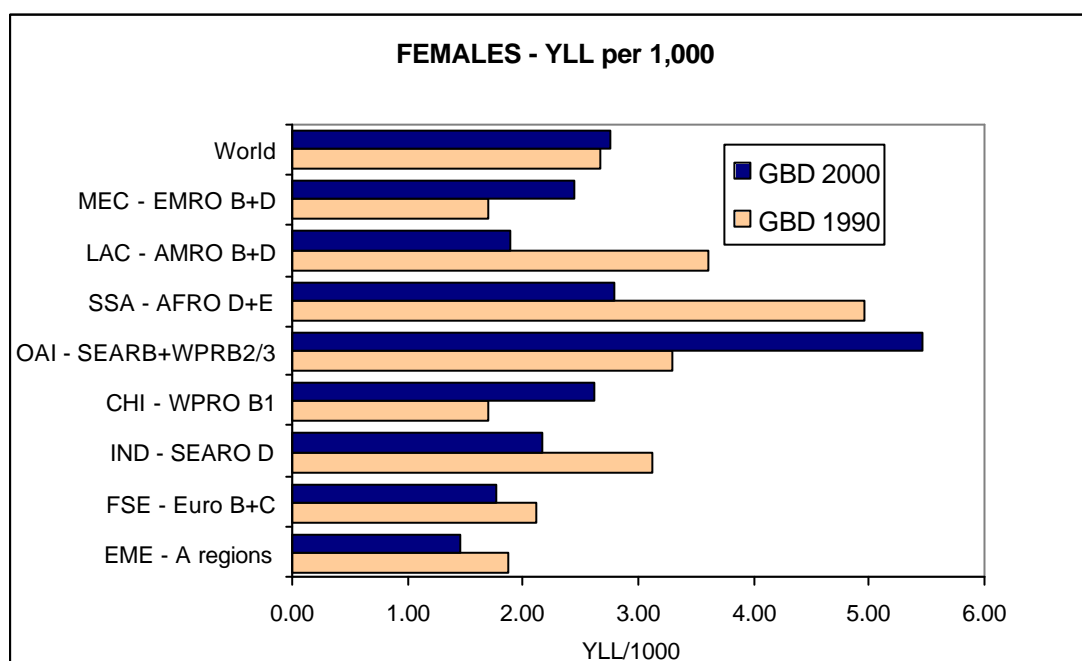
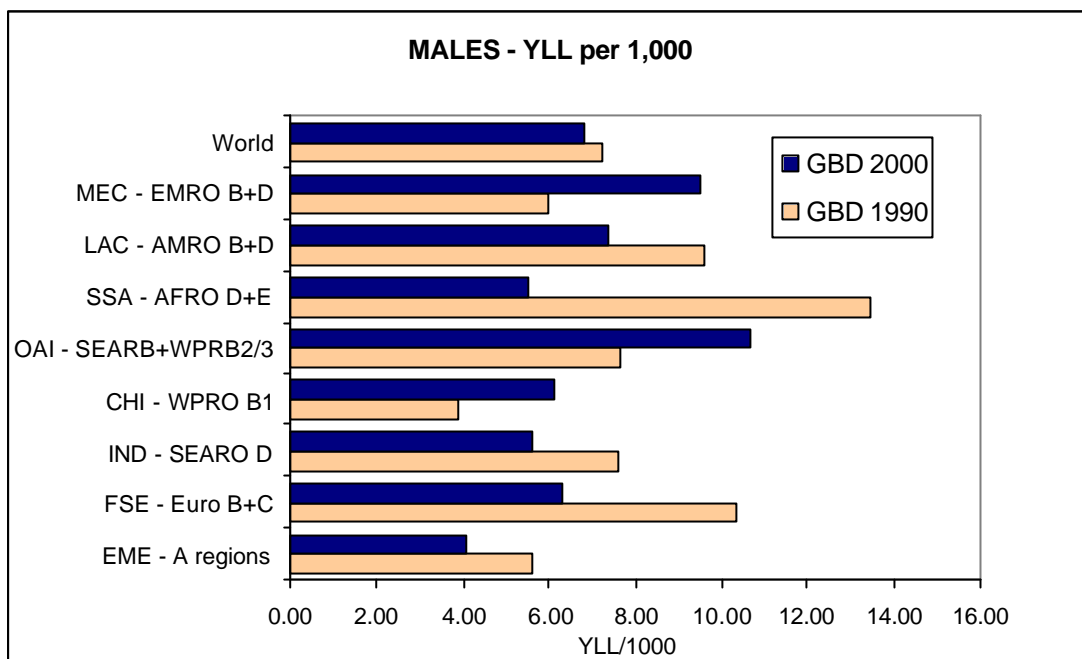
The global burden of injury for the year 2000 is reported in terms of DALYs calculated for Version 2 of the GBD 2000 (3). DALYs sum YLD and YLL (years of life lost due to mortality). DALYs reported here use the standard rates of time discounting (3%) and standard age weights (Murray and Lopez 1996a). Summary results for Version 2 of the GBD 2000 are reported elsewhere (1) and more detailed tables may be downloaded from [www.who.int/evidence](http://www.who.int/evidence) (select the burden of disease link, then Version 2 results for the year 2000). The tables and graphs below summarise the global burden of injury estimates for the GBD 2000 and compare them with those from the GBD 1990 .

**Table 9 Unintentional injuries: global total YLD, YLL and DALY estimates, 1990 and 2000.**

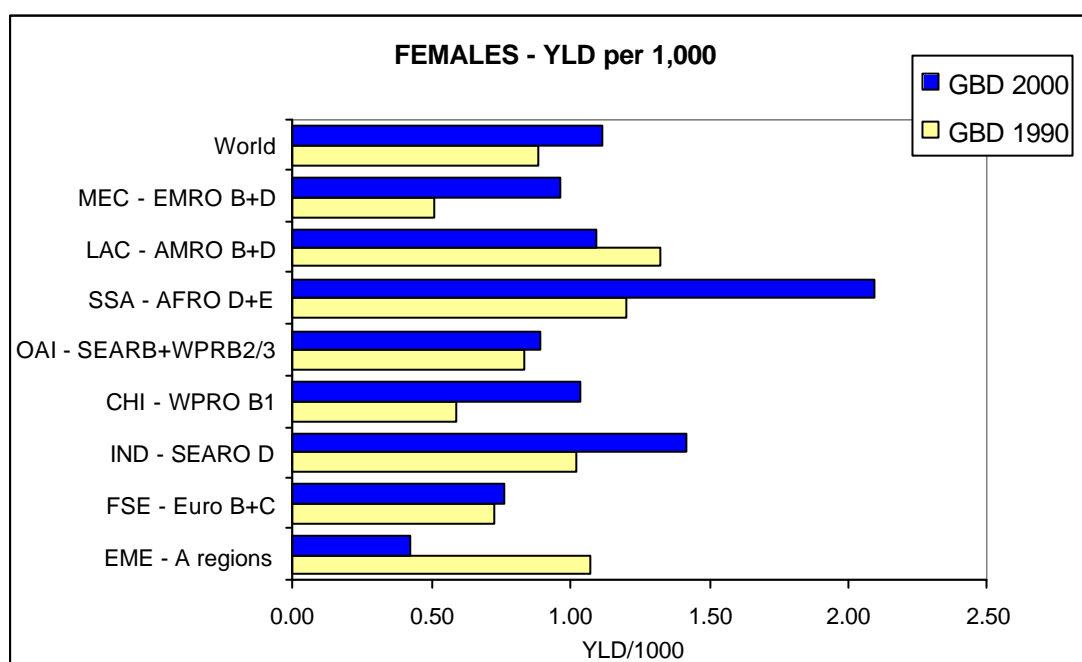
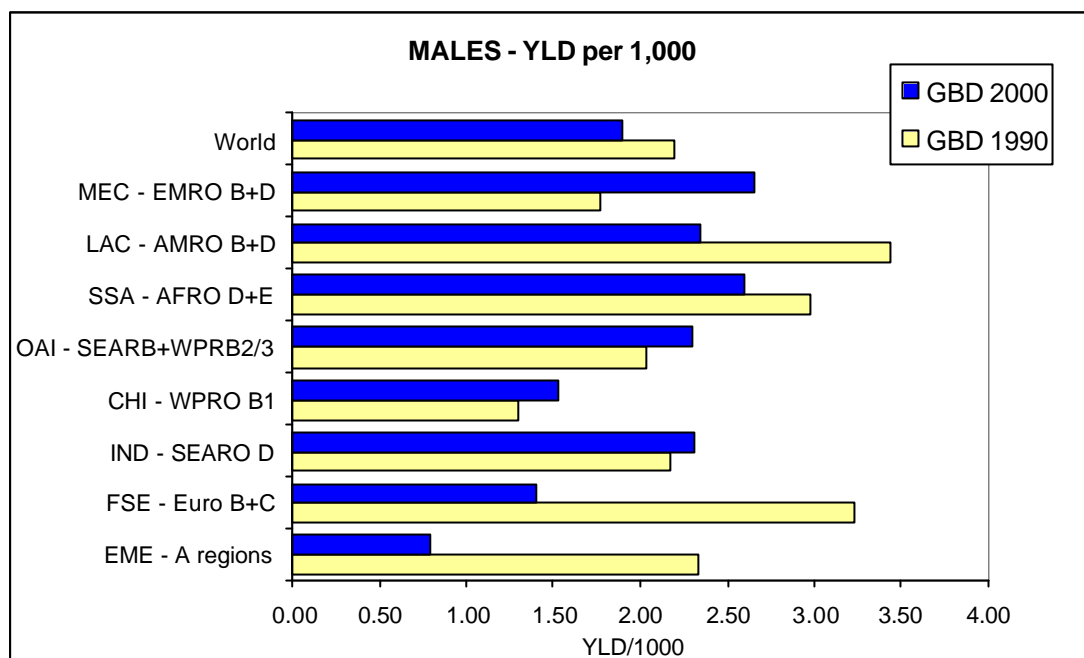
	<i>Males</i>	<i>Females</i>	<i>Persons</i>
<b>YLD('000)</b>			
<i>GBD1990</i>	43,336	24,316	67,652
<i>GBD2000</i>	29,232	18,880	48,112
<b>YLL('000)</b>			
<i>GBD1990</i>	56,474	28,062	84,536
<i>GBD2000</i>	53,808	28,716	82,524
<b>DALY('000)</b>			
<i>GBD1990</i>	99,810	52,378	152,188
<i>GBD2000</i>	83,040	47,596	130,636

**Table 10 Intentional injuries: global total YLD, YLL and DALY estimates, 1990 and 2000.**

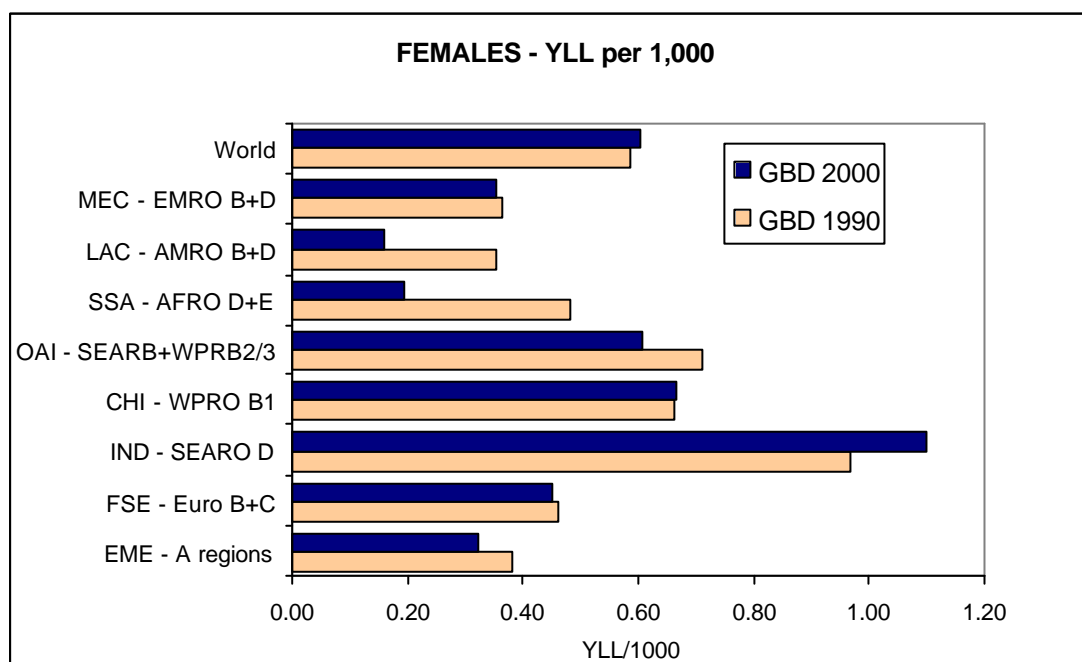
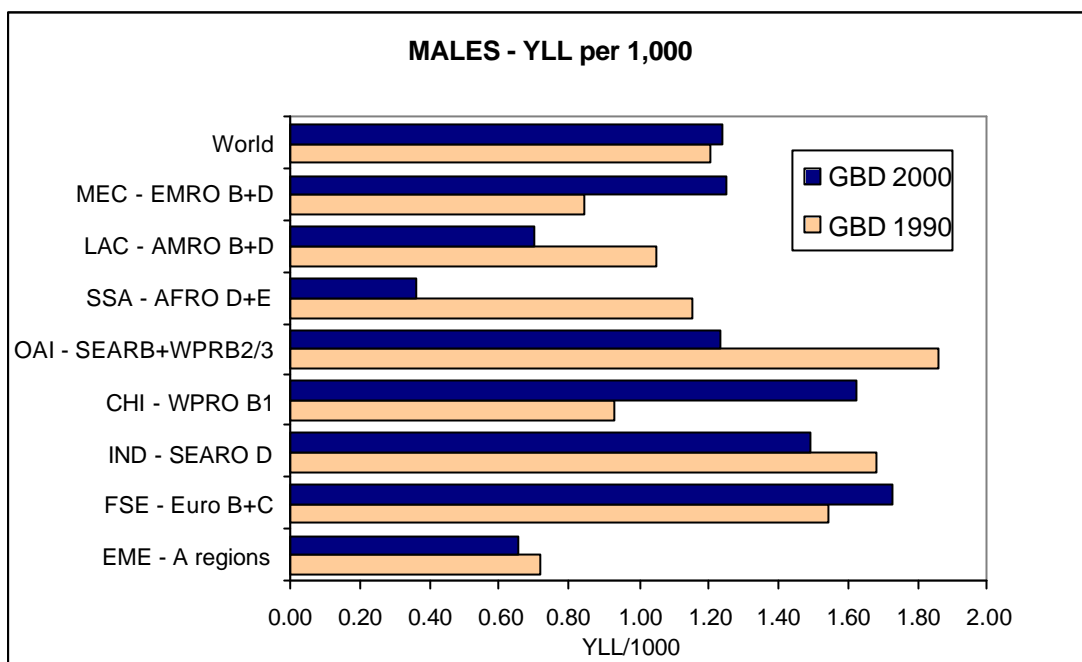
	<i>Males</i>	<i>Females</i>	<i>Persons</i>
<b>YLD('000)</b>			
<i>GBD1990</i>	4,770	3,705	8,475
<i>GBD2000</i>	8,095	3,007	11,102
<b>YLL('000)</b>			
<i>GBD1990</i>	30,651	17,332	47,983
<i>GBD2000</i>	25,839	10,811	36,650
<b>DALY('000)</b>			
<i>GBD1990</i>	35,421	21,037	56,458
<i>GBD2000</i>	33,934	13,818	47,751



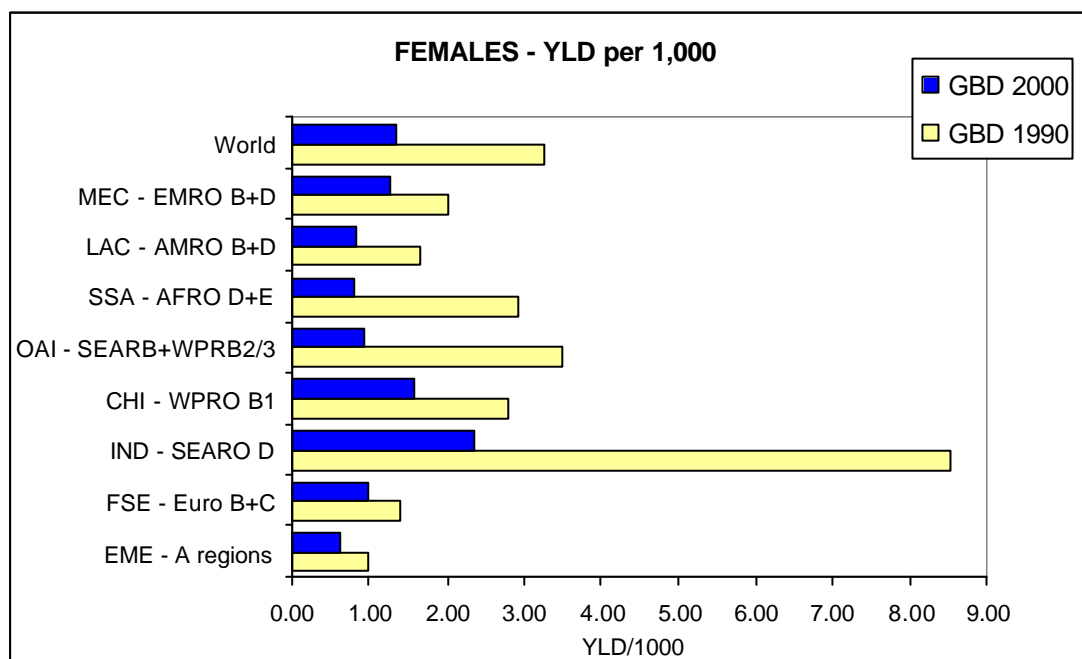
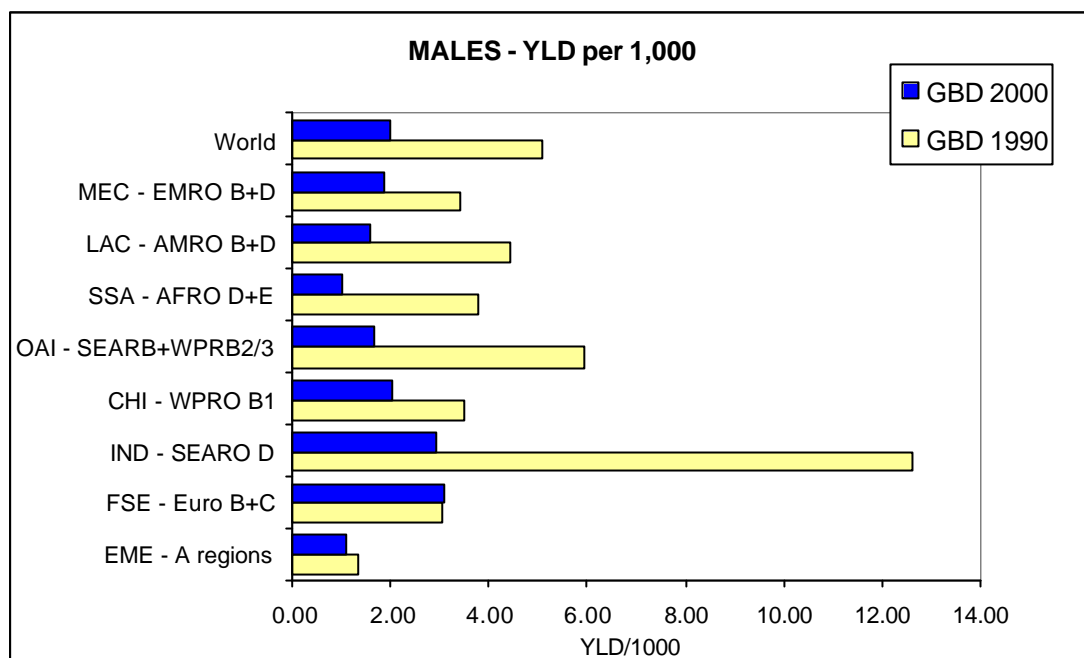
**Figure 1 Total YLL rates for motor vehicle accidents, by sex, broad regions, 1990 and 2000.**



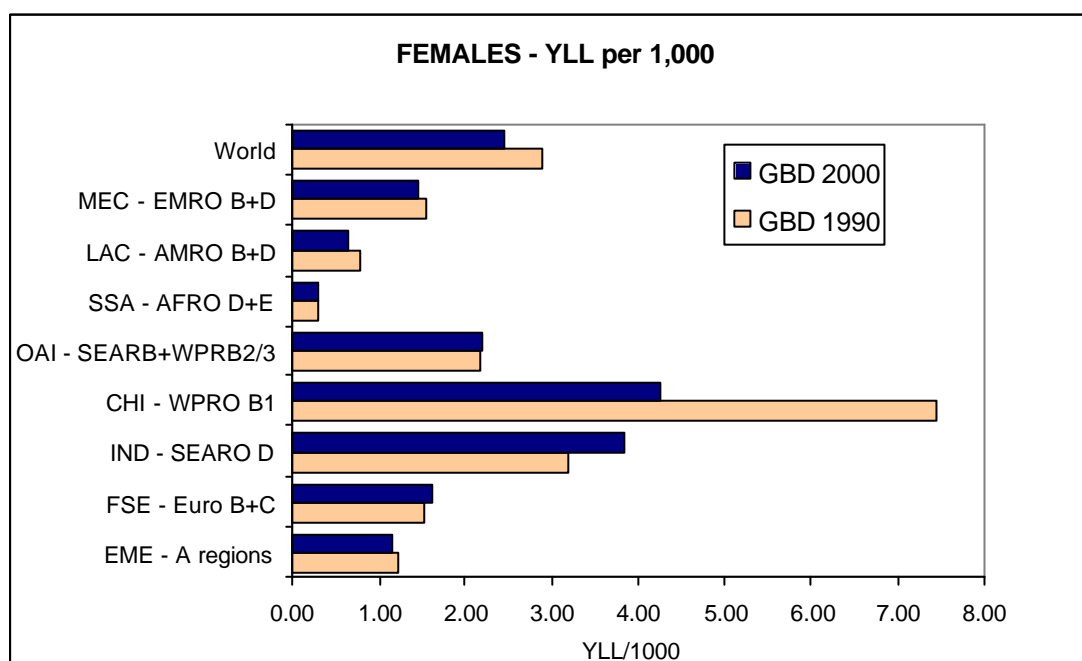
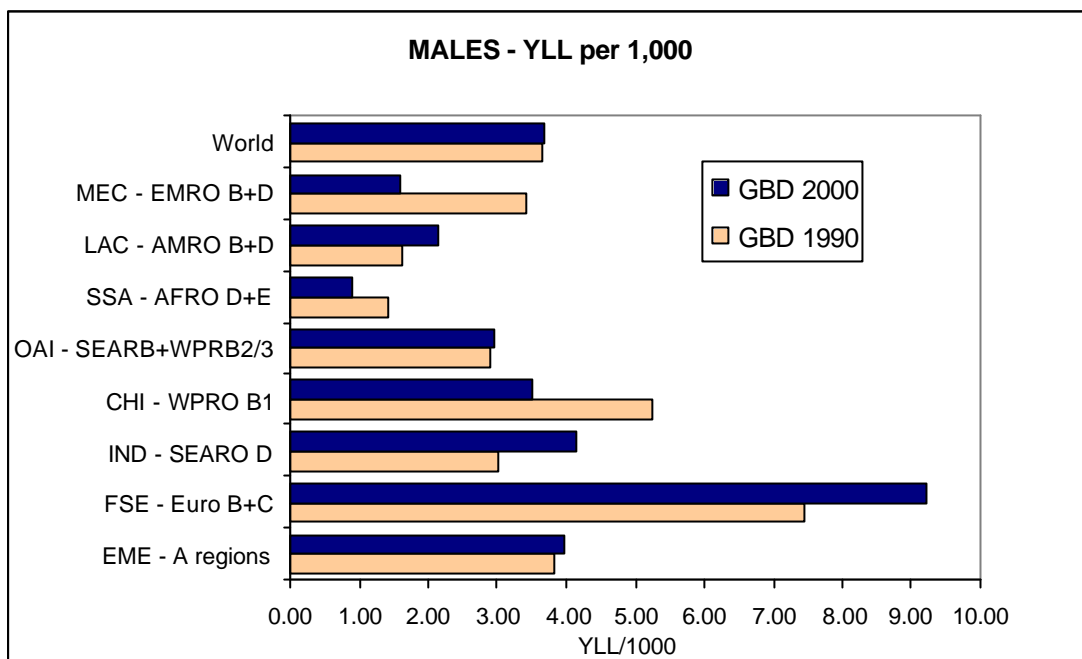
**Figure 2 Total YLD rates for motor vehicle accidents, by sex, broad regions, 1990 and 2000.**



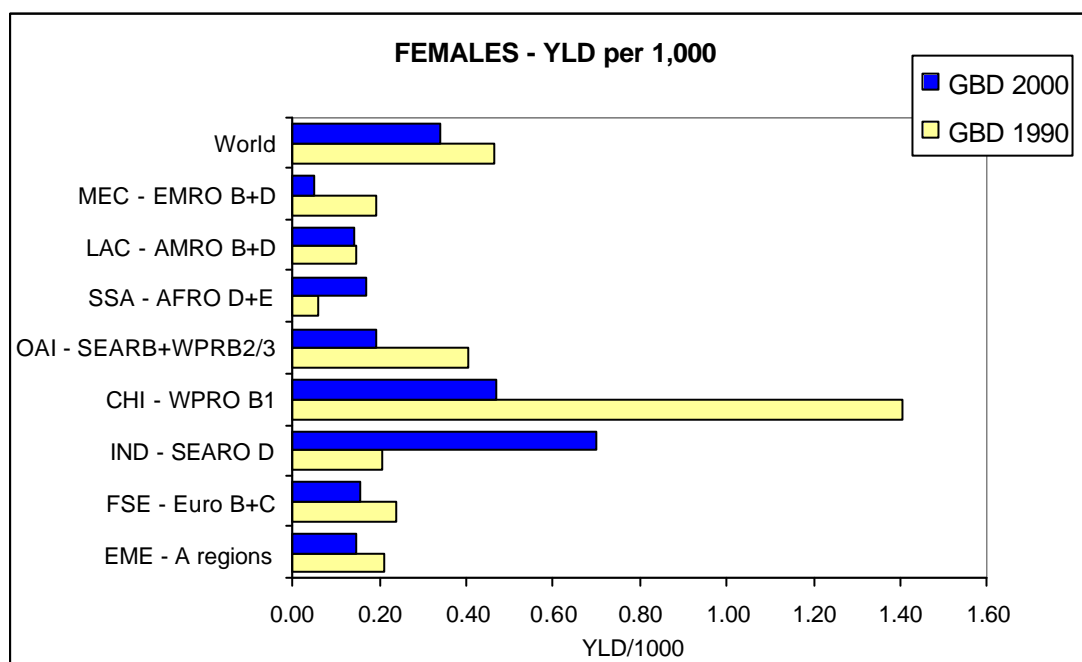
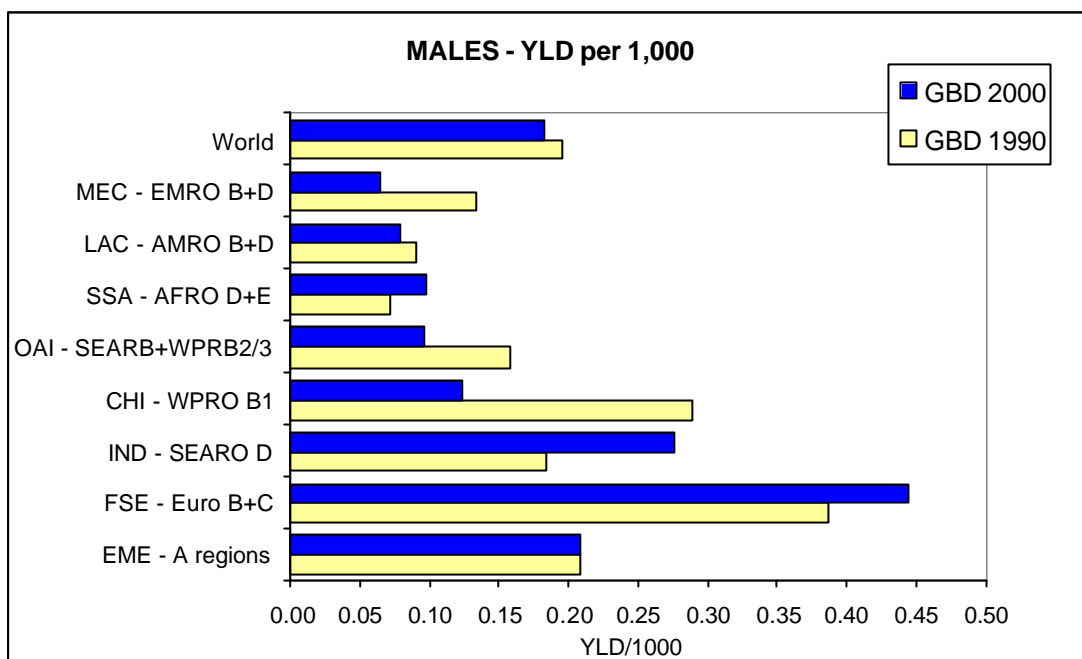
**Figure 3 Total YLL rates for falls, by sex, broad regions, 1990 and 2000.**



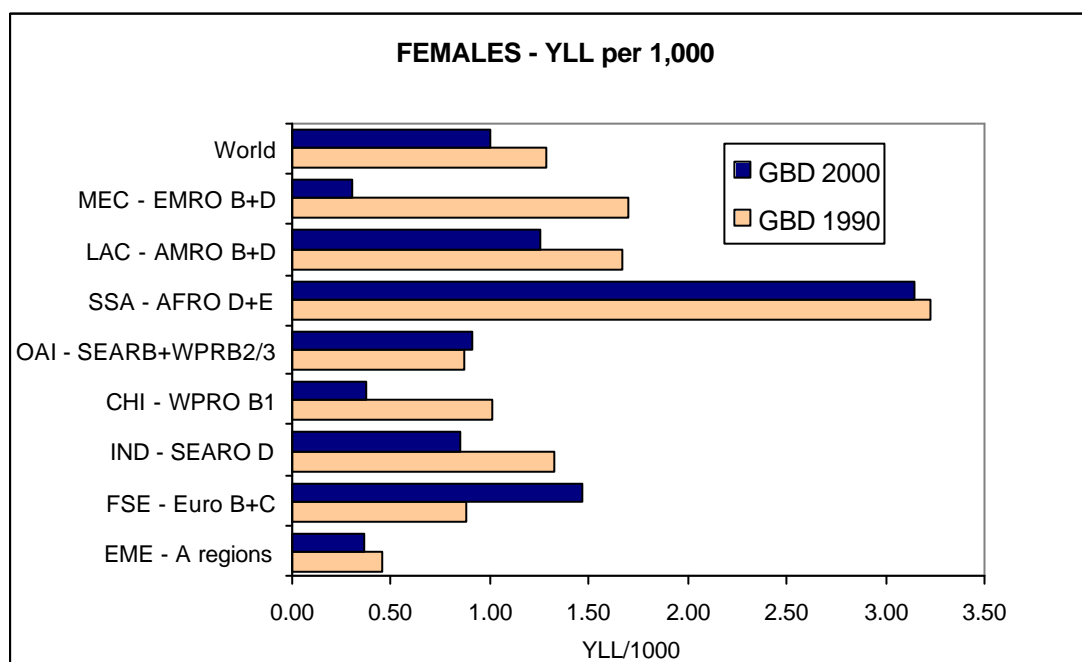
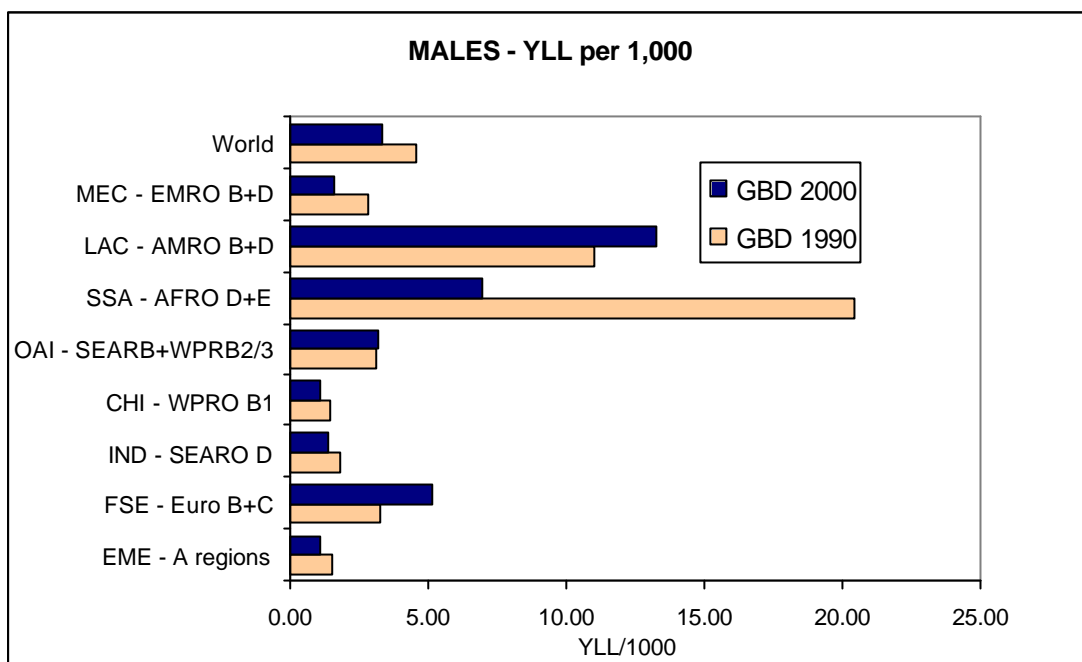
**Figure 4 Total YLD rates for falls, by sex, broad regions, 1990 and 2000.**



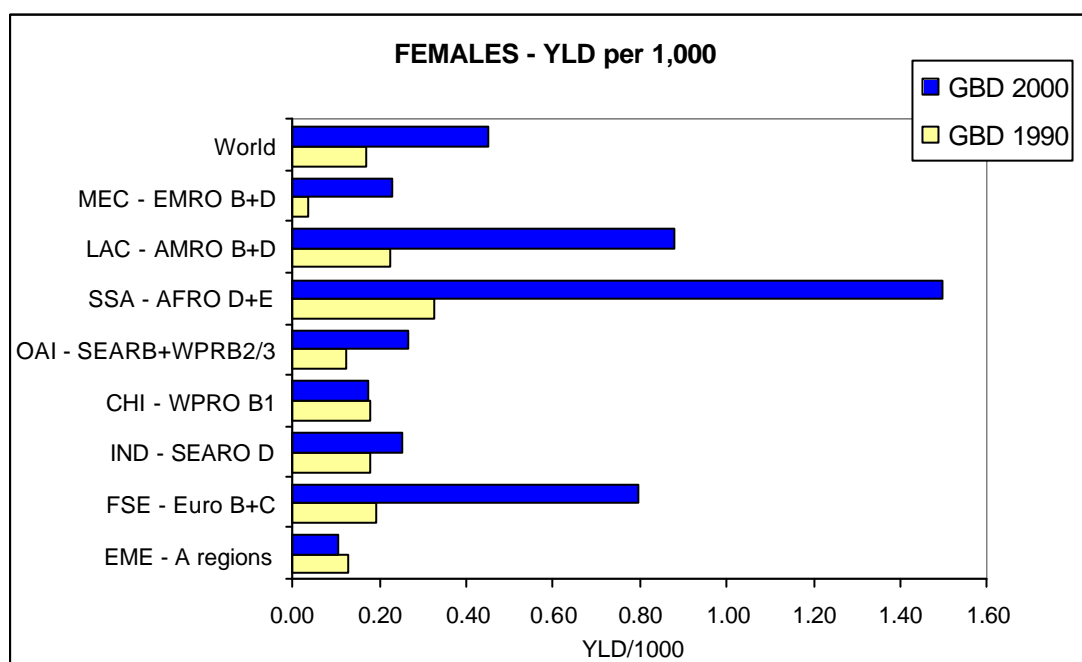
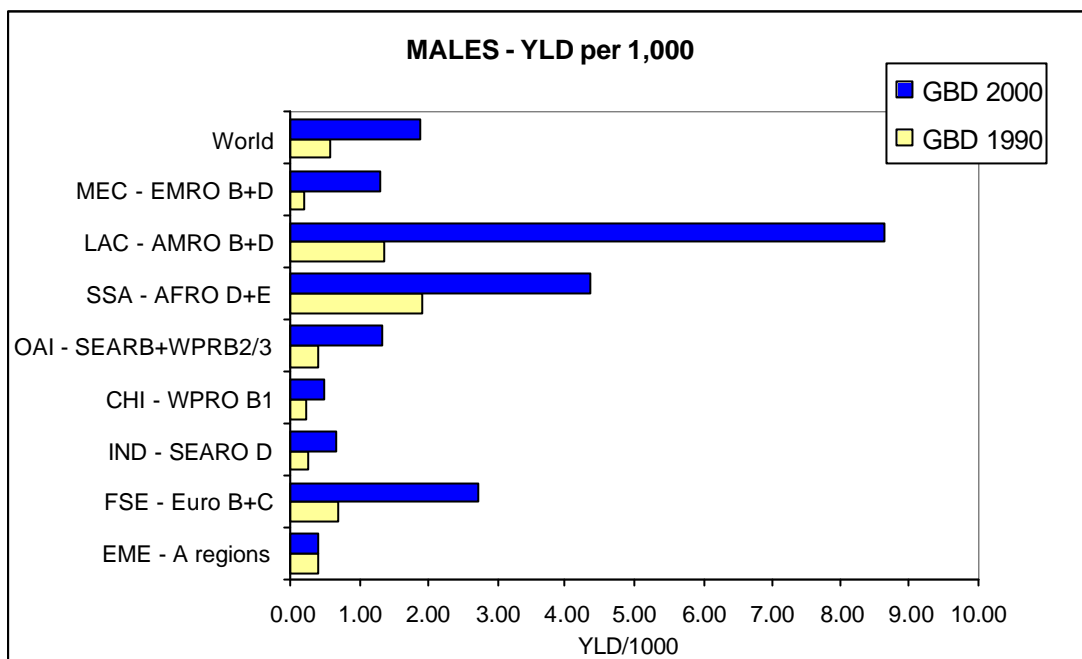
**Figure 5 Total YLL rates for self-inflicted injuries, by sex, broad regions, 1990 and 2000.**



**Figure 6 Total YLD rates for self-inflicted injuries, by sex, broad regions, 1990 and 2000.**



**Figure 7 Total YLL rates for violence, by sex, broad regions, 1990 and 2000.**



**Figure 8 Total YLD rates for violence, by sex, broad regions, 1990 and 2000.**

## 10. Uncertainty analysis

General methods for uncertainty analysis of estimates for the Global Burden of Disease 2000 are outlined elsewhere (10). Uncertainty analysis for injury is currently underway.

## 11. Conclusions

This paper presents version 2 injury estimates for the GBD 2000 and discusses activities currently underway to refine and update these estimates. We welcome comments and criticisms of the methods described, and gratefully receive information on additional sources of data and evidence to support these methods.

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## Acknowledgements

Many people have contributed to the data collections and analyses providing inputs to the Global Burden of Disease 2000 project. We wish to particularly acknowledge the contributions of staff in various WHO programs, and expert groups outside WHO, who have provided advice, collaborated in the reviews of epidemiological data and in the estimation of burden of disease and the conduct of health surveys. We wish also acknowledge the contributions of staff within EIP/GPE who have contributed to the estimation of total injury deaths for each WHO Member State in the year 2000: Omar Ahmad, Brodie Ferguson, Mie Inoue, Rafael Lozano, Doris Ma Fat and Lana Tomaskovic.

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