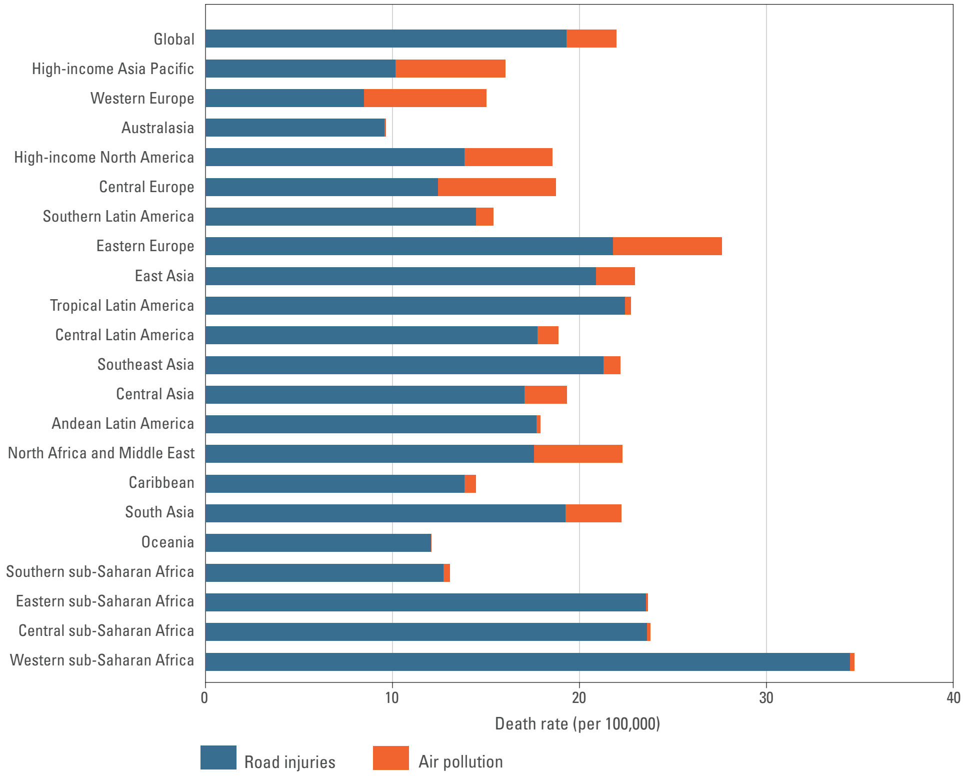
COMPARISONS OF BURDEN OF DISEASE FROM ROAD TRANSPORT ACROSS REGIONS

Figure 7 shows death rates from motorized road transport across different regions in 2010. The figure shows considerable variation in the relative contribution of pollution and injuries by region. The general pattern suggests that in the poorest regions of the world, deaths from road transport are dominated by road injuries. For example, injuries accounted for approximately 99% of total deaths attributable to road transport in sub-Saharan Africa. In contrast, in Western Europe, pollution from vehicles contributed nearly half the burden (44%). These variations are caused by a wide range of factors. These include the relative success or failure of different regions in reducing road injuries and controlling pollution from vehicles. In addition, they reflect differences in ages across regions because road injuries tend to affect young adults, while air pollution has a greater impact on young children and older people.

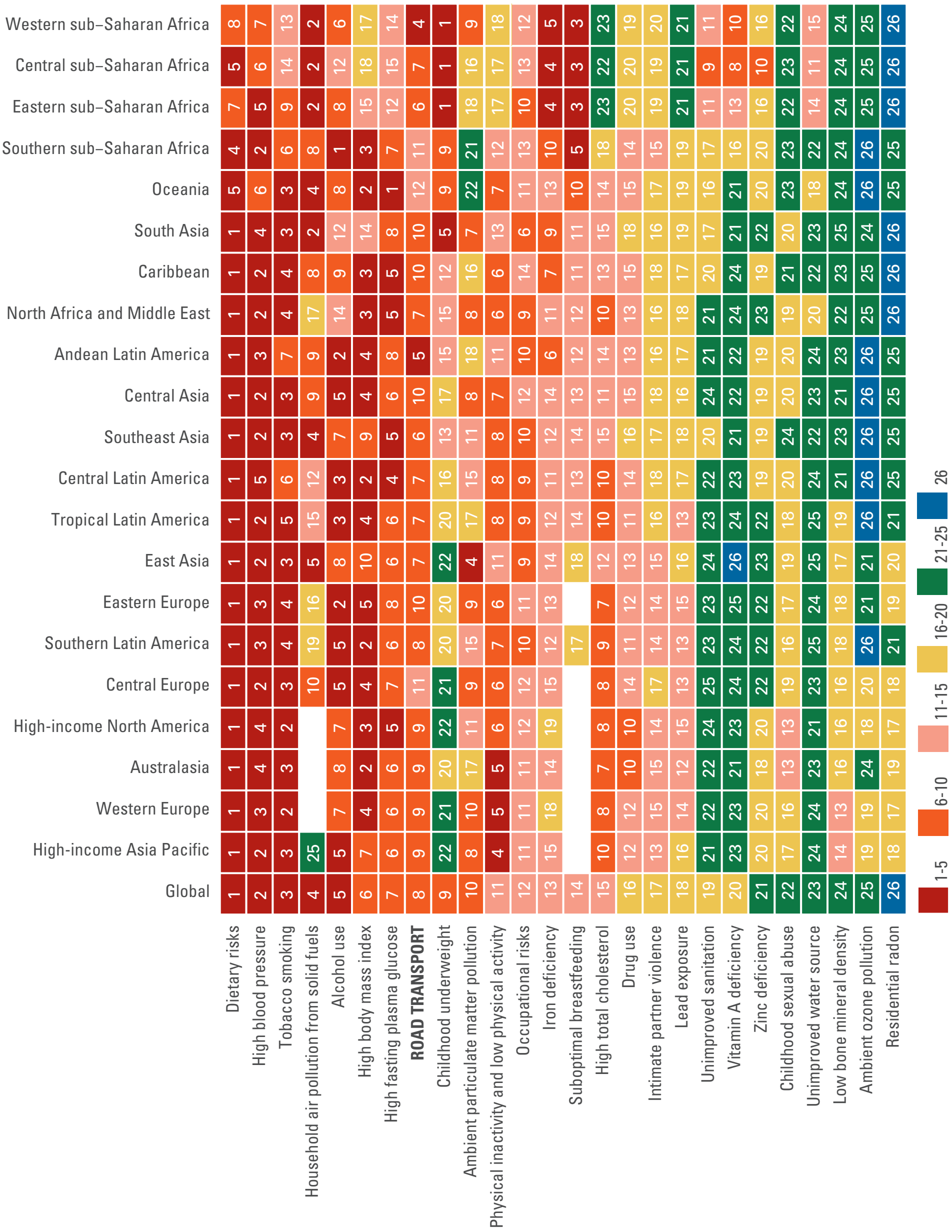
The importance of a risk factor for population health depends on its ranking relative to other risk factors for premature death and disability. Figure 8 ranks the leading risk factors according to their contribution to disease burden in each region. Color-coding is used to indicate how high a risk factor ranks in a region. The leading risk

Figure 7: Death rates from injuries and air pollution due to motorized road transport, 2010



factors are shown in red and orange. Figure 8 illustrates that the burden due to motorized road transport is a leading risk factor in most global regions. It is among the top 10 risk factors in 18 of 21 global regions and is among the top five risk factors in two regions, West sub-Saharan Africa and Andean Latin America.

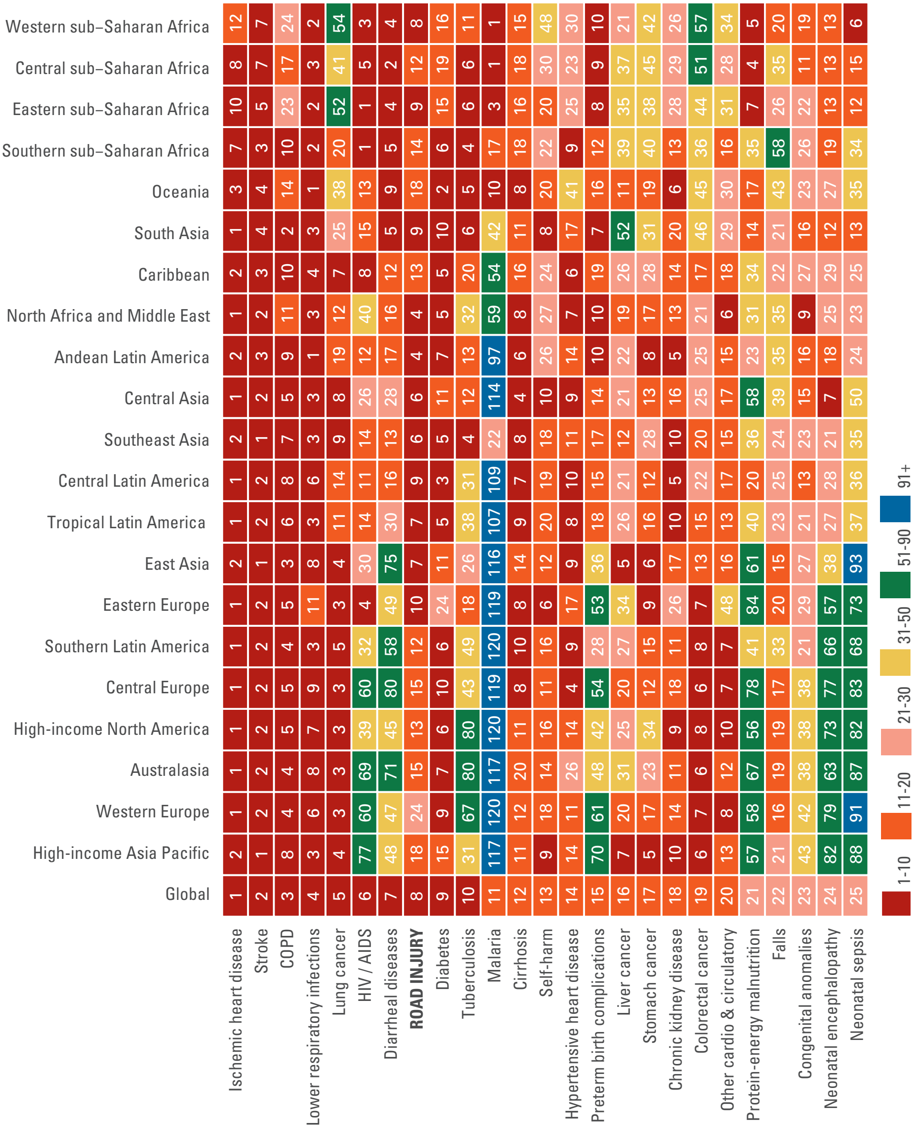
Figure 8: Ranking of health loss (DALYs) attributable to injuries and air pollution due to road transport compared with leading risk factors in global regions, 2010



	Dietary risks	High blood pressure	Tobacco smoking	Household air pollution from solid fuels	Alcohol use	High body mass index	High fasting plasma glucose	**ROAD TRANSPORT**	Childhood underweight	Ambient particulate matter pollution	Physical inactivity and low physical activity	Occupational risks	Iron deficiency	Suboptimal breastfeeding	High total cholesterol	Drug use	Intimate partner violence	Lead exposure	Unimproved sanitation	Vitamin A deficiency	Zinc deficiency	Childhood sexual abuse	Unimproved water source	Low bone mineral density	Ambient ozone pollution	Residential radon
Western sub–Saharan Africa	8	7	13	2	6	17	14	4	1	9	18	12	5	3	23	19	20	21	11	10	16	22	15	24	25	26
Central sub–Saharan Africa	5	6	14	2	12	18	15	7	1	16	17	13	4	3	22	20	19	21	9	8	10	23	11	24	25	26
Eastern sub–Saharan Africa	7	5	9	2	8	15	12	6	1	18	17	10	4	3	23	20	19	21	11	13	16	22	14	24	25	26
Southern sub–Saharan Africa	4	2	6	8	1	3	7	11	9	21	12	13	10	5	18	14	15	19	17	16	20	23	22	24	26	25
Oceania	5	6	3	4	8	2	1	12	9	22	7	11	13	10	14	15	17	19	16	21	20	23	18	24	26	25
South Asia	1	4	3	2	12	14	8	10	5	7	13	6	9	11	15	18	16	19	17	21	22	20	23	25	24	26
Caribbean	1	2	4	8	9	3	5	10	12	16	6	14	7	11	13	15	18	17	20	24	19	21	22	23	25	26
North Africa and Middle East	1	2	4	17	14	3	5	7	15	8	6	9	11	12	10	13	16	18	21	24	23	19	20	22	25	26
Andean Latin America	1	3	7	9	2	4	8	5	15	18	11	10	6	12	14	13	16	17	21	22	19	20	24	23	26	25
Central Asia	1	2	3	9	5	4	6	10	17	8	7	12	14	13	11	15	18	16	24	22	19	20	23	21	26	25
Southeast Asia	1	2	3	4	7	9	5	6	13	11	8	10	12	14	15	16	17	18	20	21	19	24	22	23	26	25
Central Latin America	1	5	6	12	3	2	4	7	16	15	8	9	11	13	10	14	18	17	22	23	19	20	24	21	26	25
Tropical Latin America	1	2	5	15	3	4	6	7	20	17	8	9	12	14	10	11	16	13	23	24	22	18	25	19	26	21
East Asia	1	2	3	5	8	10	6	7	22	4	11	9	14	18	12	13	15	16	24	26	23	19	25	17	21	20
Eastern Europe	1	3	4	16	2	5	8	10	20	9	6	11	13		7	12	14	15	23	25	22	17	24	18	21	19
Southern Latin America	1	3	4	19	5	2	6	8	20	15	7	10	12	17	9	11	14	13	23	24	22	16	25	18	26	21
Central Europe	1	2	3	10	5	4	7	11	21	9	6	12	15		8	14	17	13	25	24	22	19	23	16	20	18
High-income North America	1	4	2		7	3	5	9	22	11	6	12	19		8	10	14	15	24	23	20	13	21	16	18	17
Australasia	1	4	3		8	2	6	9	20	17	5	11	14		7	10	15	12	22	21	18	13	23	16	24	19
Western Europe	1	3	2		7	4	6	9	21	10	5	11	18		8	12	15	14	22	23	20	16	24	13	19	17
High-income Asia Pacific	1	2	3	25	5	7	6	9	22	8	4	11	15		10	12	13	16	21	23	20	17	24	14	19	18
Global	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26

Figure 9 shows the ranking of road injuries as a cause of death independent of pollution from vehicles. Other leading causes of death are also shown. Among the 21 global regions, road injuries ranked in the top 10 causes of death in 11 regions in 2010 (Figure 9). In general, road injuries ranked lowest in the richest regions (such as Western Europe and high-income Asia Pacific). However, as illustrated in Figure 7, low road injury death rates in these regions are accompanied by a relatively high burden from pollution from vehicles. Diseases for which air pollution is a risk factor

Figure 9: Ranking of the top 25 global causes of deaths and their ranking in different regions, 2010



	Ischemic heart disease	Stroke	COPD	Lower respiratory infections	Lung cancer	HIV / AIDS	Diarrheal diseases	**ROAD INJURY**	Diabetes	Tuberculosis	Malaria	Cirrhosis	Self-harm	Hypertensive heart disease	Preterm birth complications	Liver cancer	Stomach cancer	Chronic kidney disease	Colorectal cancer	Other cardio & circulatory	Protein-energy malnutrition	Falls	Congenital anomalies	Neonatal encephalopathy	Neonatal sepsis
Western sub–Saharan Africa	12	7	24	2	54	3	4	8	16	11	1	15	48	30	10	21	42	26	57	34	5	20	19	13	6
Central sub–Saharan Africa	8	7	17	3	41	5	2	12	19	6	1	18	30	23	9	37	45	29	51	28	4	35	11	13	15
Eastern sub–Saharan Africa	10	5	23	2	52	1	4	9	15	6	3	16	20	25	8	35	38	28	44	31	7	26	22	13	12
Southern sub–Saharan Africa	7	3	10	2	20	1	5	14	6	4	17	18	22	9	12	39	40	13	36	16	35	58	26	19	34
Oceania	3	4	14	1	38	13	9	18	2	5	10	8	20	41	16	11	19	6	45	30	17	43	23	27	35
South Asia	1	4	2	3	25	15	5	9	10	6	42	11	8	17	7	52	31	20	46	29	14	21	16	12	13
Caribbean	2	3	10	4	7	8	12	13	5	20	54	16	24	6	19	26	28	14	17	18	34	22	27	29	25
North Africa and Middle East	1	2	11	3	12	40	16	4	5	32	59	8	27	7	10	19	17	13	21	6	31	35	9	25	23
Andean Latin America	2	3	9	1	19	12	17	4	7	13	97	6	26	14	10	22	8	5	25	15	23	35	16	18	24
Central Asia	1	2	5	3	8	26	28	6	11	12	114	4	10	9	14	21	13	16	25	17	58	39	15	7	50
Southeast Asia	2	1	7	3	9	14	13	6	5	4	22	8	18	11	17	12	28	10	20	15	36	24	23	21	35
Central Latin America	1	2	8	6	14	11	16	9	3	31	109	7	19	10	15	21	12	5	22	17	20	25	13	28	36
Tropical Latin America	1	2	6	3	11	14	30	7	5	38	107	9	20	8	18	26	16	10	15	13	40	23	21	27	37
East Asia	2	1	3	8	4	30	75	7	11	26	116	14	12	9	36	5	6	17	13	16	61	15	27	38	93
Eastern Europe	1	2	5	11	3	4	49	10	24	18	119	8	6	17	53	34	9	26	7	48	84	20	29	57	73
Southern Latin America	1	2	4	3	5	32	58	12	6	49	120	10	16	9	28	27	15	11	8	7	41	33	21	66	68
Central Europe	1	2	5	9	3	60	80	15	10	43	119	8	11	4	54	20	12	18	6	7	78	17	38	77	83
High-income North America	1	2	5	7	3	39	45	13	6	80	120	11	16	14	42	25	34	9	8	10	56	19	38	73	82
Australasia	1	2	4	8	3	69	71	15	7	80	117	20	14	26	48	31	23	11	6	12	67	19	38	63	87
Western Europe	1	2	4	6	3	60	47	24	9	67	120	12	18	11	61	20	17	14	7	8	58	16	42	79	91
High-income Asia Pacific	2	1	8	3	4	77	48	18	15	31	117	11	9	14	70	7	5	10	6	13	57	21	43	82	88
Global	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25

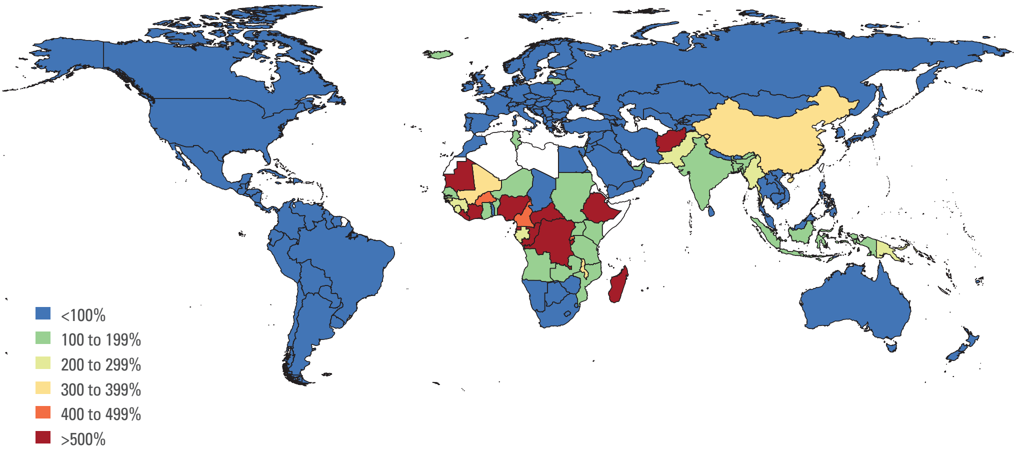
are the top three causes in each of these regions. In general, diseases linked to air pollution are two of the top three causes in most regions, except in sub-Saharan African regions, where communicable diseases, such as HIV, malaria, and diarrheal diseases, dominate the top three causes of death.

ROAD INJURIES ARE UNDERREPORTED IN THE POOREST REGIONS

Figure 10 compares our estimates of road injury death rates by country with those reported in official government statistics. It shows that underreporting of road deaths in many countries exceeds 100%. In some of the poorest parts of the world, such as certain countries in Eastern, Western, and Central sub-Saharan Africa, underreporting exceeds 500%. In general, countries with high death rates have high levels of underreporting. Although underreporting of nonfatal injuries is well documented, even in high-income countries, researchers have usually assumed that deaths are more accurately estimated in official statistics. However, our results illustrate pervasive underreporting even in death counts.

Such large discrepancies cannot be explained by the use of different definitions of road traffic deaths by police across countries. Depending on the country, police databases may report only deaths that occur within one day, one week, or one month of a crash. This issue of different definitions across countries receives

Figure 10: Underreporting of deaths from road injuries in official government statistics, 2010



Notes:

- *Percent underreporting is calculated as 100 x (Our estimate - official statistics)/(official statistics).*
- *Official statistics are the 30-day adjusted country reported statistics from the 2013 World Health Organization's* Global Status Report on Road Safety*.*

substantial attention among international researchers and policymakers seeking to harmonize statistics across countries. For example, WHO recommends countries use a 30-day definition. When using a 30-day definition, all deaths resulting from a road traffic crash that occur within 30 days of the crash should be included in official statistics of road traffic injury mortality. WHO's 2013 *Global Status Report on Road Safety* highlights progress toward countries adopting this standard.

Our report, however, shows that the lack of standardized definitions has a comparatively small effect when compared to the overall magnitude of underreporting of road traffic deaths. In the worst case, when police count only deaths that occur within one day of a crash, they are expected to miss approximately one-fourth of the true death toll. In contrast, our estimates of national road injury deaths are often more than six times the national official statistics, and that is after the official statistics have been corrected to the 30-day reporting standard (Figure 10). Further, these results show that underreporting of deaths from road injuries in official statistics is highest in the poorest regions. In most of these countries, official statistics are derived from crashes reported to traffic police, who likely do not know about most deaths from road injuries.

However, underreporting is a major problem that extends beyond the poorest regions of the world. Compare the official statistics for road traffic deaths in China and India, the two most populous countries, with our estimates (Table 2). While the official statistics for China are furnished by the national traffic police, China also operates a nationally representative sample registration system (the Disease Surveillance Points [DSP] System) that uses verbal autopsy to monitor causes of death and a national death registration system. Our estimates of road traffic deaths rely heavily on the DSP system and are four times greater than the official statistics. The DSP system is used extensively by health researchers and national planners. Our estimates suggest that China ranks 120th globally in road safety. However, if their official statistics based on police-reported road deaths were correct, it would be the 15th-safest country in the world.

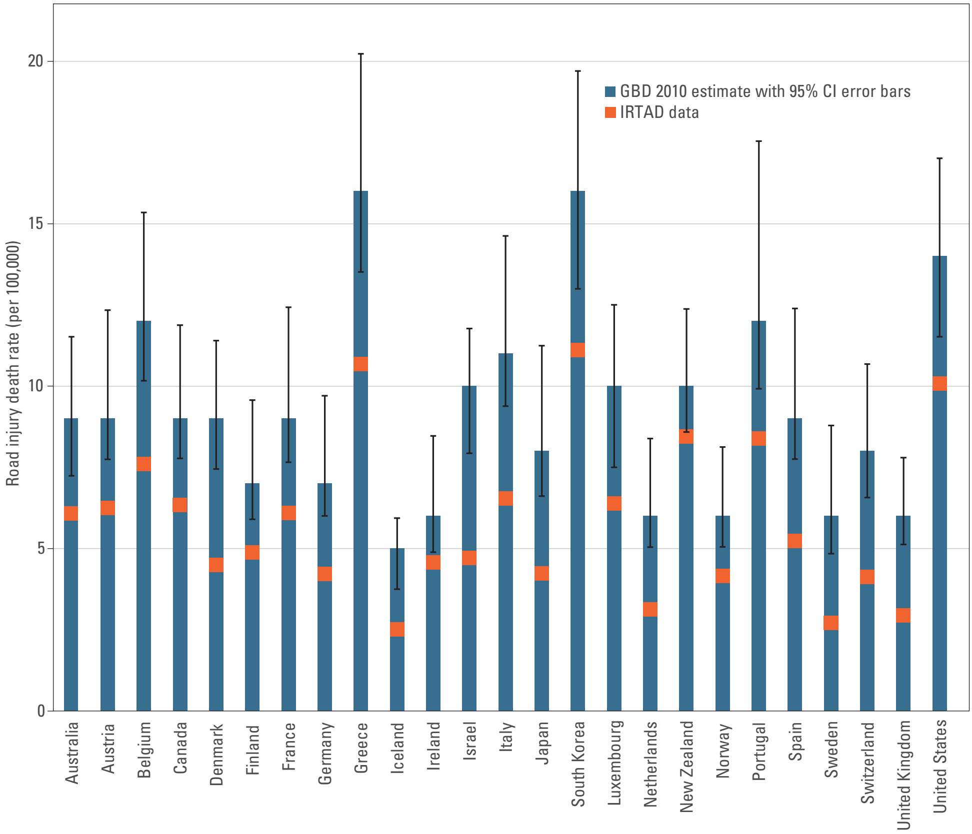
Table 2: Underreporting in official statistics of road traffic deaths in China and India, 2010

China	India
Official national statistics: Data source: traffic police records Reported road death toll: 65,225	**Official national statistics:** Data source: traffic police records Reported road death toll: 130,037
Other national data sources: Disease Surveillance Points System Vital registration statistics	**Other national data sources:** National Sample Registration System
GBD 2010 estimate: 283,000	**GBD 2010 estimate:** 274,000
Underreporting: 334%	**Underreporting:** 111%

Similarly, official government statistics in India are sourced from national traffic police. However, the Registrar General of India operates a Sample Registration System (SRS), which monitors cause-specific mortality using verbal autopsy in a nationally representative sample. Our estimates of road deaths, which are influenced strongly by the SRS, are more than twice the official statistics. The DSP system in China and the SRS in India are widely accepted by health researchers as the best sources of unbiased population health metrics in these countries because the systems are designed to be representative of the population and to allow explicit corrections for completeness of reporting. However, governments in both China and India continue to rely on police-based data instead of using the DSP and SRS systems as their official source for national road traffic injury statistics.

Figure 11 compares GBD 2010 estimates of road injury deaths with official statistics from high-income countries that report to the International Road Traffic Accident Database (IRTAD), which is the database of the Joint Transport Research Center of

Figure 11: National road injury death rates estimated by the GBD 2010 study compared with official national statistics from high-income countries that report to the International Road Traffic and Accident Database, 2010



the Organisation for Economic Co-operation and Development (OECD). On average, GBD estimates are 58% higher than official statistics in these countries. This is explained by differences in definitions and data sources. IRTAD typically relies on police reporting, while GBD relies primarily on death registration data in these countries. Furthermore, IRTAD only includes those deaths that occur within the first 30 days of a crash and excludes motor vehicle-related deaths that do not occur in traffic. In contrast, our estimates provide a more comprehensive estimate of the impact of motor vehicles on population health.

Table 3 ranks countries based on their road safety performance in 2010. With the exception of El Salvador, all 10 of the worst-performing countries are in sub-Saharan Africa and North Africa and the Middle East. Nigeria has the world's highest road injury death rate of about 50 per 100,000. In contrast, road injury death rates in the best-performing region, Western Europe, are more than five times lower (Figure 7). In fact, the best-performing countries in Western Europe (Sweden and Iceland) have death rates that are less than one-tenth of that of Nigeria.

In the least-safe countries of the world, road safety routinely ranks among the top five causes of death, especially for countries in North Africa and the Middle East. In Oman, it is the second-leading cause of death, with only 11% fewer deaths than the leading cause of death, ischemic heart disease. In Iran and Saudi Arabia, it is the third-leading cause of death behind ischemic heart disease and stroke.

Table 3: Countries with the highest death rates due to road injuries among those with at least three epidemiological measurements of road injury mortality, 2010

Rank	Country	Death rate	Deaths	Cause of death rank
1	Nigeria	52.4	74,548	5
2	Oman	47.3	1,090	2
3	Mozambique	46.7	7,154	7
4	Saudi Arabia	42.8	9,128	3
5	Iran	41.0	27,486	3
6	Ethiopia	37.3	21,520	9
7	Sudan	33.3	10,278	6
8	Zimbabwe	33.2	3,527	10
9	Zambia	30.8	2,798	12
10	El Salvador	29.0	1,589	7

Notes:

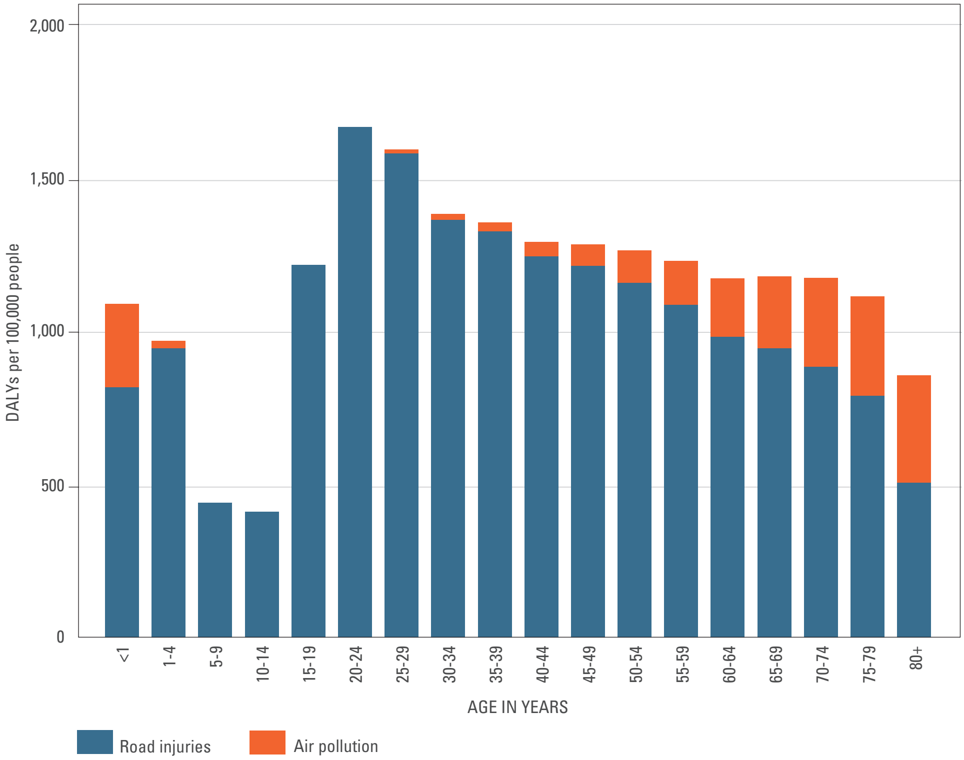
- *Death rates are age-standardized and per 100,000 population.*
- *In these rankings of national road safety performance, we have only considered the 125 countries for which GBD 2010 had access to at least three epidemiological measurements of road injury mortality.*
- *Our estimates for each country are shown in Annex 2.*

HEALTH LOSS DUE TO MOTORIZED ROAD TRANSPORT IMPACTS THE ENTIRE LIFE COURSE

Injuries and air pollution from motorized road transport cause substantial disease burden in both sexes and all ages, except for a brief period between the ages of 5 and 14 years (Figure 12) when exposure to road traffic is comparatively lower. Among children aged less than 1 year, the rate of healthy years lost to injuries is relatively low, but the rate due to pollution from vehicles is high. Disease burden due to road injuries is borne disproportionately by young adults, and burden from road injuries declines with age. However, this decline in injuries is offset by an increasing rate of healthy years lost to pollution from vehicles. The health loss among the older population may be due to injuries that happened at a younger age as well as exposure to air pollution over many years. As a result, the prevalence of health loss due to motorized road transport is relatively similar for most age groups.

Table 4 illustrates the transition in the burden from road injuries to diseases linked to ambient air pollution, such as ischemic heart disease, stroke, and COPD, over the life course. Road injuries begin to become prominent after the first year of life for

Figure 12: Rate of healthy years lost to injuries and air pollution from motorized road transport, 2010



both boys and girls. Among males, road injuries are the leading cause of death from age 5 to 29. Although road injuries rank lower for females, they nevertheless are among the top 10 causes of death from age 1 to 44. Among older ages, road injuries decline in rank, but the leading causes of death are replaced by non-communicable diseases, especially ischemic heart disease, stroke, and COPD, that have strong ties to air pollution, to which vehicles are an important contributor.

Road injuries among young adult males are a key hindrance to the overall health of men. Results from GBD 2010 show that remarkable advances have been made in the last four decades in reducing overall mortality rates (Figure 13). Both men and women have been the beneficiaries. However, the advances have been slowest among young adults, especially among males aged 15 to 39. These are the same age groups in which injuries, especially road injuries, are the cause of a considerable proportion of overall deaths.

Figure 13: Global decline in age-specific death rate among males and females, 1980 to 2010

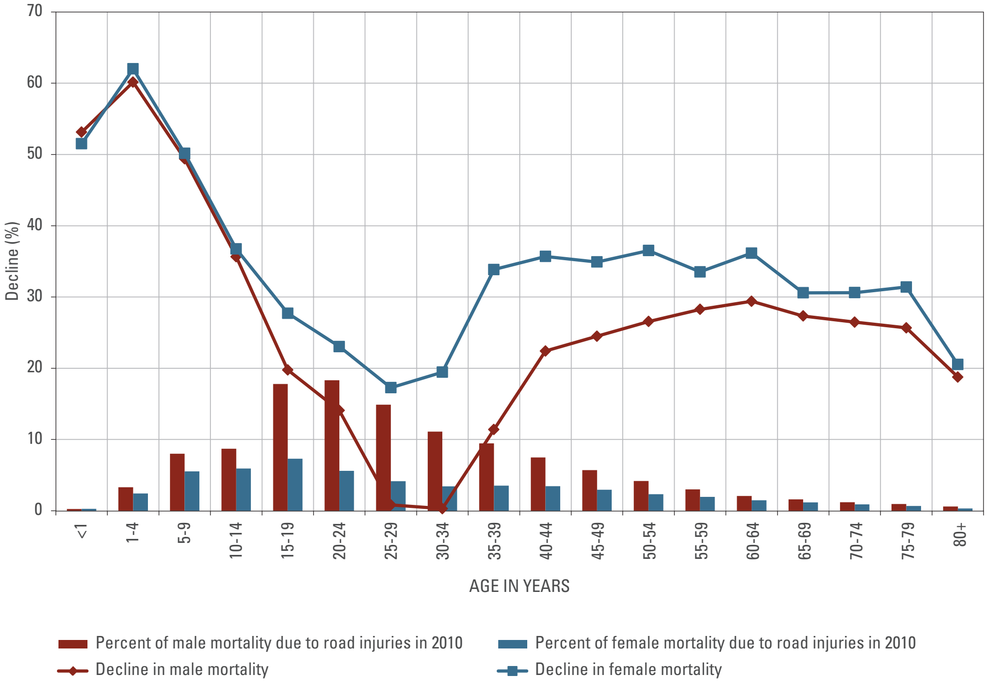


Table 4: Leading causes of death globally by age groups for males and females, 2010

Males

	Under 1	**1-4 years**	**5-14 years**	**15-29 years**
Rank	Cause	Cause	Cause	Cause
1	Preterm birth complications	Malaria	**ROAD INJURY**	**ROAD INJURY**
2	Lower respiratory infections	Lower respiratory infections	HIV/AIDS	Interpersonal violence
3	Neonatal encephalopathy	Diarrheal diseases	Diarrheal diseases	Self-harm
4	Neonatal sepsis	Protein-energy malnutrition	Lower respiratory infections	HIV/AIDS
5	Diarrheal diseases	HIV/AIDS	Malaria	Tuberculosis
6	Congenital anomalies	Drowning	Drowning	Drowning
7	Malaria	Meningitis	Typhoid fevers	Malaria
8	Meningitis	**ROAD INJURY**	Meningitis	Lower respiratory infections
9	Protein-energy malnutrition	Measles	Congenital anomalies	Mechanical forces
10	Syphilis	Fire	Forces of nature	Diarrheal diseases

Females

	Under 1	**1-4 years**	**5-14 years**	**15-29 years**
Rank	Cause	Cause	Cause	Cause
1	Preterm birth complications	Malaria	Diarrheal diseases	HIV/AIDS
2	Lower respiratory infections	Diarrheal diseases	HIV/AIDS	Maternal disorders
3	Neonatal encephalopathy	Lower respiratory infections	Malaria	Self-harm
4	Neonatal sepsis	Protein-energy malnutrition	Lower respiratory infections	**ROAD INJURY**
5	Diarrheal diseases	HIV/AIDS	**ROAD INJURY**	Tuberculosis
6	Congenital anomalies	Meningitis	Meningitis	Malaria
7	Malaria	Measles	Drowning	Fire
8	Protein-energy malnutrition	Congenital anomalies	Typhoid fevers	Diarrheal diseases
9	Meningitis	Drowning	Congenital anomalies	Lower respiratory infections
10	Syphilis	**ROAD INJURY**	Fire	Interpersonal violence

30-44 years Cause	**45-59 years** Cause	**60-74 years** Cause	**75+ years** Cause
HIV/AIDS	Ischemic heart disease	Ischemic heart disease	Ischemic heart disease
ROAD INJURY	Stroke	Stroke	Stroke
Ischemic heart disease	Cirrhosis	COPD	COPD
Tuberculosis	Lung cancer	Lung cancer	Lower respiratory infections
Self-harm	Tuberculosis	Lower respiratory infections	Lung cancer
Interpersonal violence	**ROAD INJURY**	Diabetes	Diabetes
Cirrhosis	HIV/AIDS	Tuberculosis	Hypertensive heart disease
Stroke	Liver cancer	Cirrhosis	Prostate cancer
Lower respiratory infections	COPD	Stomach cancer	Other cardio & circulatory
Liver cancer	Self-harm	Liver cancer	Chronic kidney disease

30-44 years Cause	**45-59 years** Cause	**60-74 years** Cause	**75+ years** Cause
HIV/AIDS	Ischemic heart disease	Ischemic heart disease	Ischemic heart disease
Maternal disorders	Stroke	Stroke	Stroke
Tuberculosis	Breast cancer	COPD	COPD
Ischemic heart disease	Diabetes	Diabetes	Lower respiratory infections
Self-harm	HIV/AIDS	Lower respiratory infections	Diabetes
Stroke	COPD	Lung cancer	Hypertensive heart disease
ROAD INJURY	Lung cancer	Breast cancer	Alzheimer’s disease
Lower respiratory infections	Cirrhosis	Hypertensive heart disease	Other cardio & circulatory
Breast cancer	Tuberculosis	Diarrheal diseases	Lung cancer
Diarrheal diseases	Cervical cancer	Cirrhosis	Chronic kidney disease

ROAD INJURIES ARE AN IMPORTANT THREAT TO MATERNAL AND CHILD HEALTH

Remarkably, road injuries rank among the top 10 causes of death for children after the first year of life, ranking eighth among boys 1 to 4 years old and 10th among girls 1 to 4 years old, globally (Table 4). Road injuries are the leading cause of death among 1- to 4-year-olds in the high-income countries of North America and the second-leading cause of death in Western Europe, Australasia, and the high-income countries of Asia Pacific. In fact, road injuries are a top-five cause of death for 1- to 4-year-olds in 11 of 21 global regions.

MDG 5 focuses on reducing maternal mortality by giving special priority to pregnancy and childbirth. Although the cause of death ranking of road injuries is lower among women than men, road injuries were among the top 10 causes of death for women in every age group between 5 and 44 in 2010 (Table 4). Road injuries were the fourth- and seventh-leading cause of death for women in the age groups 15 to 29 and 30 to 44, respectively. In the maternal age range of 15 to 49, we have estimated 3.5 million deaths from all causes in 2010. While maternal conditions accounted for 7.3% of these deaths, road injuries accounted for 4.0%.

Road injuries rank prominently as a threat to the health of young women in most regions. For instance, among women 15 to 19 years old, road injuries are the leading cause of death in nine regions, are among the top three causes in 17 regions, and are among the top 10 causes in all global regions with the exception of Oceania. In Western sub-Saharan Africa, road injuries were the third-leading cause of death; they ranked among the top 10 causes in other regions of sub-Saharan Africa.

REGIONAL VARIATION IN DEATH RATES AMONG DIFFERENT TYPES OF ROAD USERS

Figure 14 illustrates that at the global level, occupants of motor vehicles with three or more wheels are at the highest risk, accounting for 36% of all fatalities. Pedestrians account for 35% of global road deaths, and riders of motorized two-wheelers make up another 16%. However, there is dramatic variation in death patterns among road users across regions. In general, car occupants make up higher proportions of total road injury deaths in high-income regions, while pedestrians account for higher proportions in poorer regions. In two of the four sub-Saharan African regions (Eastern and Central sub-Saharan Africa), pedestrian deaths make up over half of all fatalities. In contrast, in North America, vehicle occupants account for almost three-fourths (73%) of all fatalities. However, this general pattern has several exceptions. There are many middle-income regions where car occupants make up a high proportion of total road traffic deaths. Overall, in nine of 21 global regions, more than half of all road deaths are vehicle occupants; six of those regions are low- and middle-income regions, including North Africa and the Middle East, Central Asia, Southern Latin America, and the Caribbean. These results suggest that vastly different road safety strategies will be needed to maximize lives saved in different settings across the globe.

Figure 14: Deaths in road crashes by type of road user and region, 2010

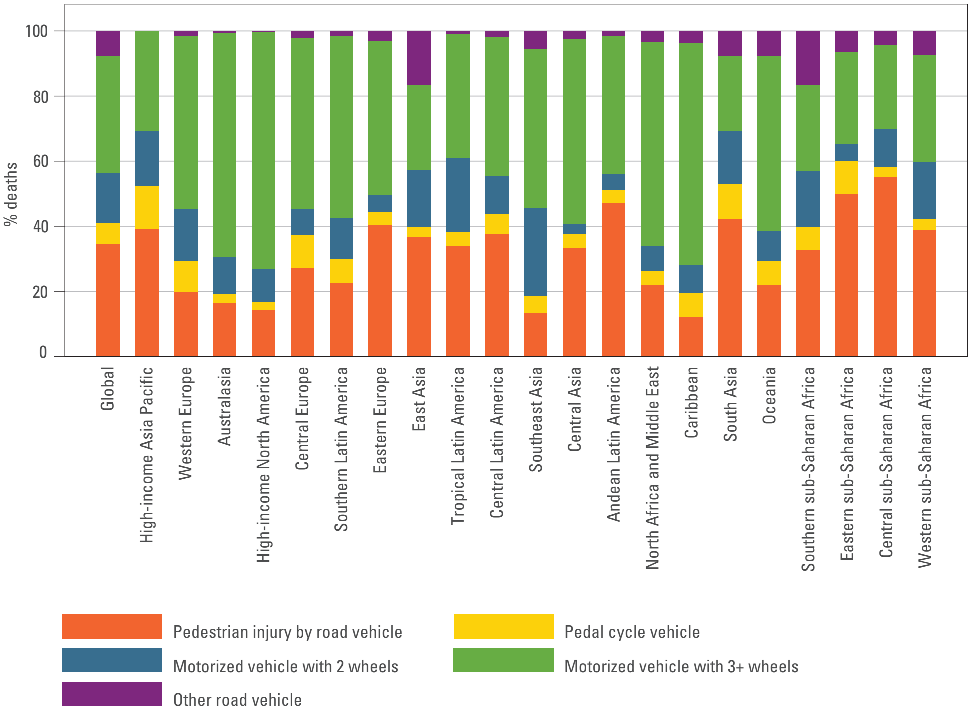
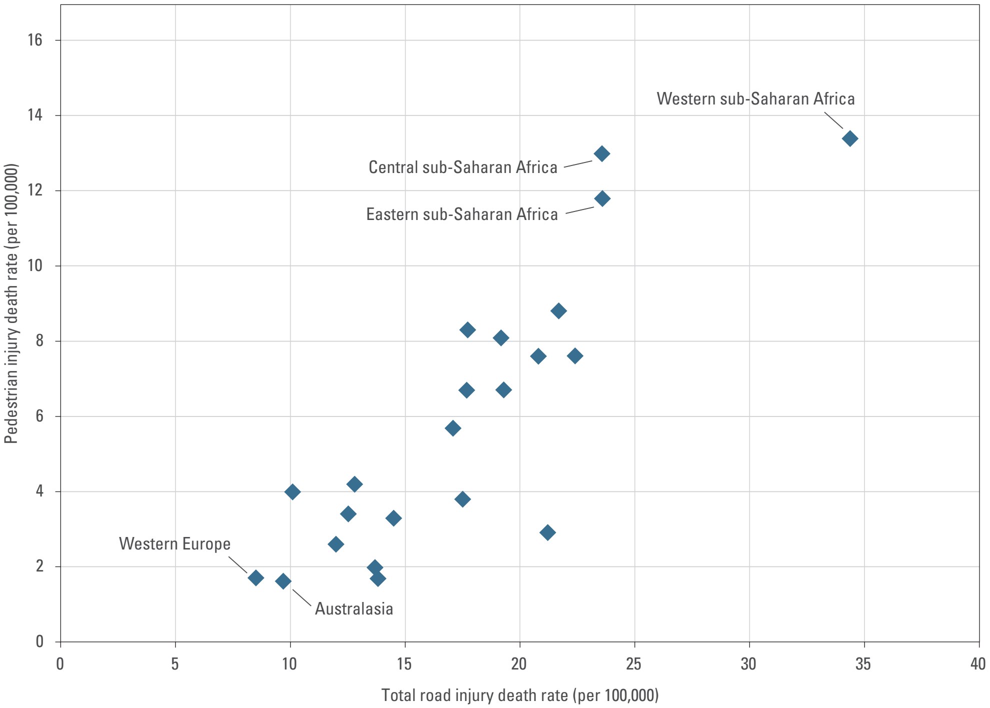


Figure 15 illustrates that regional pedestrian death rates are strongly associated with overall road injury death rates and differ greatly across regions. Rates of death due to pedestrian injury vary by almost an order of magnitude. They are highest in the three sub-Saharan Africa regions and lowest in Western Europe and Australasia. Total road injury death rates in these regions mirror trends in death rates from pedestrian injury.

In addition to being a key part of reducing road injuries, ensuring the safety of pedestrians is essential for reducing emissions from vehicles and increasing physical activity. Promoting active transport by protecting vulnerable road users can reduce the burden of non-communicable diseases, including ischemic heart disease, stroke, lower respiratory infections, COPD, and lung cancer. Research shows that the provision of safety infrastructure for walking and biking is among the most important ways to encourage these active modes of transport.[11] Such infrastructure includes traffic calming measures to reduce vehicle speeds, such as the use of speed bumps, curb extensions, chicanes, and roundabouts, and the provision of separated sidewalks and bicycle lanes to reduce exposure to motor vehicles.[18]

Figure 15: Correlation between regional pedestrian injury death rates and total road injury death rates



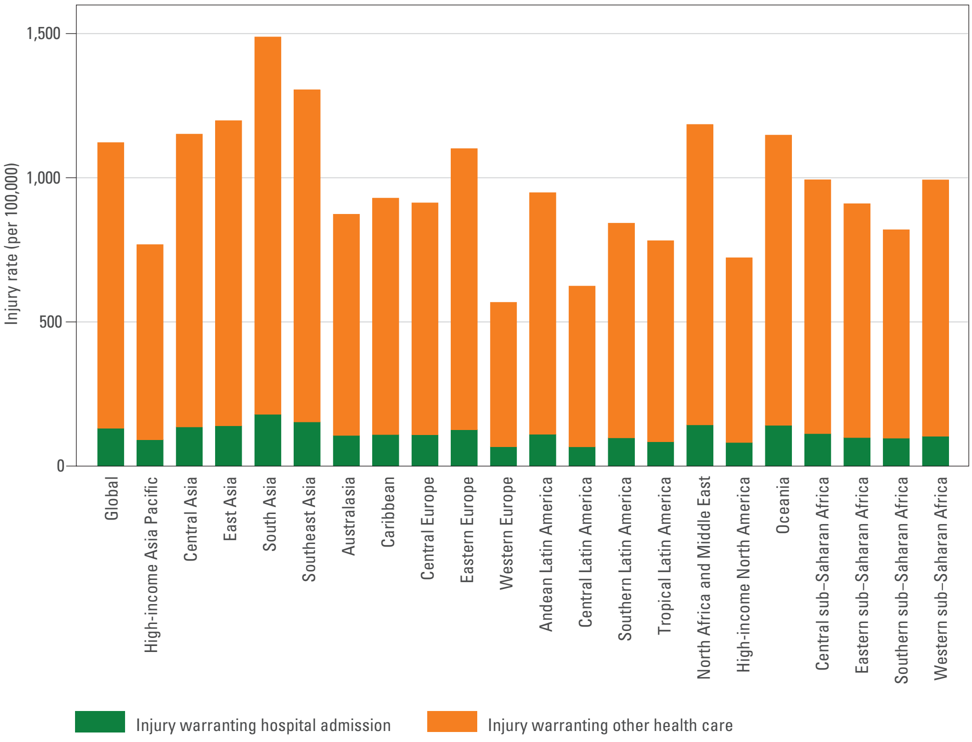
CASES OF DISABLING ROAD INJURIES

Cases of nonfatal road injury are difficult to quantify for several reasons, ranging from the difficulty of measuring injury severity to limited availability of studies from around the world to construct global estimates. GBD 2010 is the first study ever to quantify global cases of nonfatal road injuries. To measure injury severity, we defined two types of injuries: injuries warranting hospital admission (i.e., injuries that would have required at least an overnight hospital stay if adequate access to medical care had been available to the victims), and injuries warranting other health care (i.e., injuries that did not require hospital admission but would have received care by a health care professional had such care been available). Our analysis shows that in 2010, there were 78.2 million road injuries warranting medical care globally. This included 9.2 million road injuries that warranted hospital admission and 69 million road injuries that warranted other medical care.

Figure 16 illustrates that the rate of nonfatal road injuries varies substantially across regions and the pattern differs from that seen in death rates. The highest rate of nonfatal injury cases is in South Asia, where almost 1.5% of the population is injured severely enough to warrant medical care. On the other hand, in Western Europe, nonfatal injury rates are less than half (0.6%) the rate in South Asia.

Even though road injuries requiring hospital admission constitute only 11.7% of road injuries that do not result in death, they are responsible for 97% of total years lived with disability from road injury. Figure 17 illustrates the distribution of sequelae associated with injuries requiring hospital admission. Taken together, fractures of various types account for the majority of cases, amounting to 3.8 million nonfatal road injuries. These contribute one-third of the total health loss associated with nonfatal road injuries. Over one-fourth (27%) of the burden of fractures is due to fractures of the patella, tibia, fibula, and ankle. Open wounds and superficial injuries account for over 2.5 million cases and contribute 47% of the health loss. Severe traumatic brain injuries account for over 1.5 million cases and contribute 10% of the health loss of nonfatal road injuries.

Figure 16: Rate of nonfatal road injuries warranting health care, 2010



We estimated years lived with disability due to road injuries by using a large number of household surveys and hospital records from around the world. However, the science of estimating the incidence of injuries and estimating the resulting disabilities is still in its infancy.[19] Improving the epidemiological foundation of such estimates will require sustained research efforts to improve definitions and standardize data-collection methods and new studies to measure the long-term disability outcomes of injuries.

Figure 17: Cases and burden of nonfatal road injuries warranting hospital admission, 2010