Poverty & Death: Disaster Mortality

1996-2015

Centre for Research on the Epidemiology of Disasters
CRED

UNISDR
The United Nations Office for Disaster Risk Reduction

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Who we are

CRED

The Centre for Research on the Epidemiology of Disasters (CRED) is the world's foremost agency for the study of public health during mass emergencies, including the epidemiology of diseases, plus the structural and socio-economic impacts of natural and technological disasters and human conflicts. Based since 1973 at the School of Public Health of the Université Catholique de Louvain, Belgium, CRED became in 1980 a World Health Organization (WHO) collaboration centre. Since then, CRED has worked closely with United Nations agencies, inter-governmental and governmental institutions, non-governmental organizations (NGOs), research institutes and other universities. Disasters preparedness, mitigation and prevention for vulnerable populations have also gained a higher profile within CRED's activities in recent years.

www.cred.be

EM-DAT

CRED's Emergency Events Database (EM-DAT) contains the world's most comprehensive data on the occurrence and effects of more than 21,000 technological and natural disasters from 1900 to the present day. Created with the support of the WHO and the Belgian government, the main objective of EM-DAT is to inform humanitarian action at the national and international levels in order to improve decision-making in disaster preparedness, provide objective data for assessing communities' vulnerability to disasters and to help policy-makers set priorities. In 1999, a collaboration between the United States Agency for International Development's Office Foreign Disaster Assistance (USAID/OFDA) and CRED was initiated. Since 2014, EM-DAT also georeferences natural disasters, adding geographical values to numeric data which is essential for deeper analysis.

Details of EM-DAT's methodology and partner organizations can be found on our website **www.emdat.be**

UNISDR

The UN Office for Disaster Risk Reduction was established in 1999 and serves as the focal point in the United Nations System for the coordination of disaster risk reduction. It supports the implementation of the Sendai Framework for Disaster Risk Reduction 2015-2030 which maps out a broad people-centered approach towards achieving a substantial reduction in disaster losses from man-made and natural hazards and a shift in emphasis from disaster management to disaster risk management. UNISDR and partners produce the biennial Global Assessment Report on Disaster Risk Reduction which provides evidence for the integration of disaster risk reduction into private investment decision-making and public policy in urban, environmental, social and economic sectors. UNISDR also coordinates the Making Cities Resilient Campaign and Worldwide Initiative for Safe Schools and engages with governments in developing national disaster loss databases.

www.unisdr.org

Foreword

Sustainable development is a matter of life and death. That's the only conclusion that can be reasonably drawn from any examination of mortality trends from major disasters over the last twenty years.

The statistics speak volumes about inequality and the disproportionate price that poor people living in low- and middle-income countries pay in terms of human suffering as a result of earthquakes and climate-related hazards.

It's all too easy for historic events to fade into the background, but the megadisasters which each killed more than 100,000 people during the last 20 years are harbingers of events which have yet to happen, and which will happen if we do not continue global efforts to eradicate poverty and achieve the other sustainable development goals outlined in the 2030 Development Agenda.

Within weeks of the Indian Ocean Tsunami claiming almost 230,000 lives in December 2004, the realization had dawned that this was the world's first global so-called 'natural' disaster, leaving millions bereaved and homeless in the countries that border that vast ocean, along with the families of the 9,000 tourists who died because they happened to be in the wrong place at the wrong time.

The wrong place means a place where exposure to a disaster is exacerbated by poverty, lack of early warning systems, poor risk governance and an absence of the civil protection mechanisms that are taken for granted in high-income countries.

There are a number of stark illustrations in this report. In the Haitian earthquake of 10 January 2010, 223,000 people died, but in that same year equally violent earthquakes claimed much fewer casualties in Chile and no fatalities in New Zealand.

Cyclone Nargis which hit Myanmar in 2008 resulted in 138,000 deaths in a remote coastal region ill-prepared for such a forceful event. Contrast that with the zero casualties achieved by Australia when Category 5 Cyclone Yasi slammed into Queensland in 2010.

A different type of megadisaster is occurring now, almost by stealth, thanks to climate change. Earthquakes may still dominate the headlines and statistics, but weather- and climate-related disasters are taking a heavy toll which is difficult to calculate because of under-reporting in low- and middle-income countries, particularly on mortality for heatwaves.

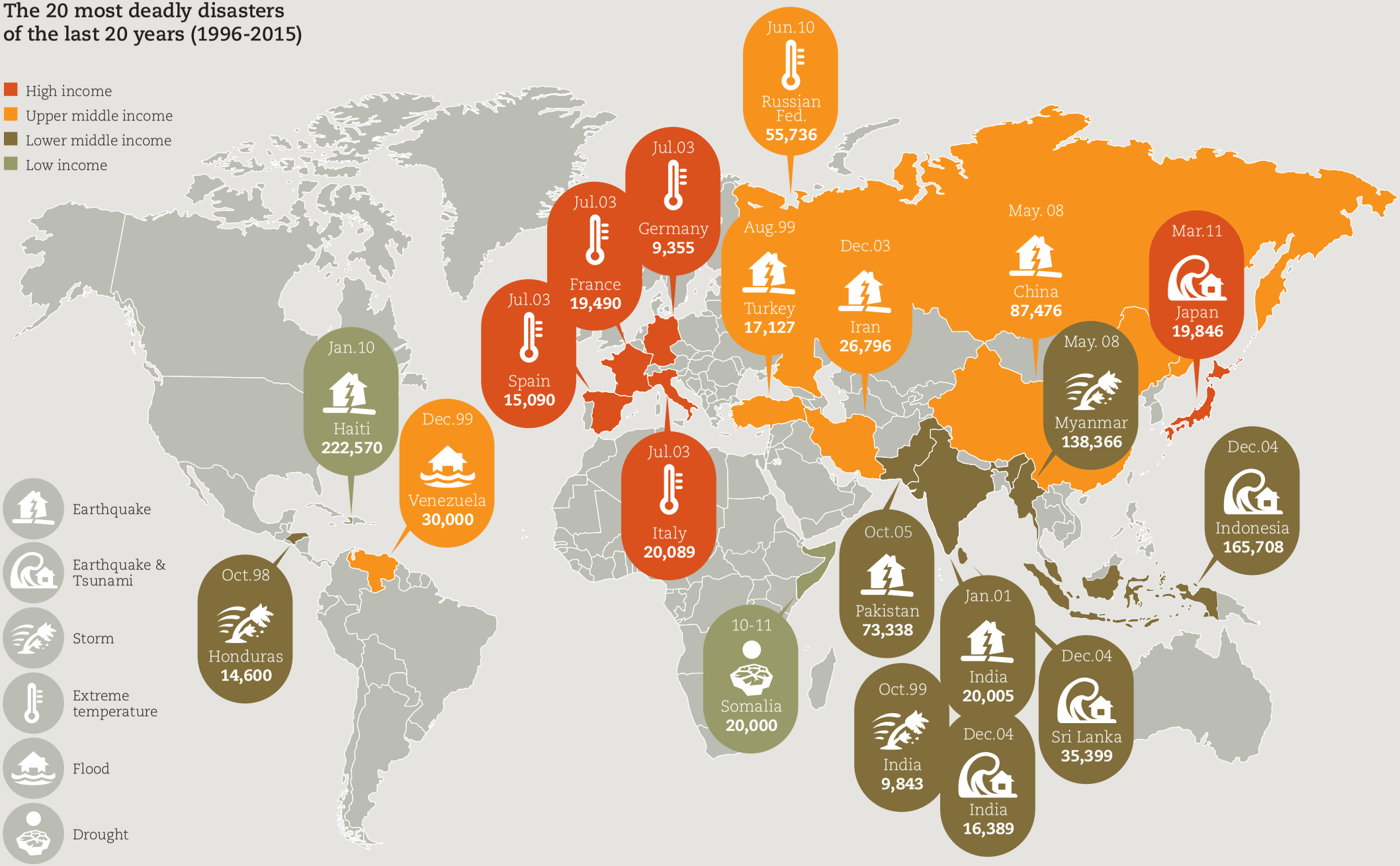
Nonetheless, we know that last year almost as many people died as a result of heatwaves as in the Nepal earthquake. In fact, it is striking that in 15 of the last 20 years climate-related disasters claimed more lives than earthquakes.

As this report goes to print the evidence is mounting that 2016 will replace 2015 as the hottest year on record. That can only increase the challenges facing low- and middle-income countries trying to implement the global plan for reducing mortality and disaster losses, the Sendai Framework for Disaster Risk Reduction 2015-2030, adopted by all UN member States in March 2015.

The first target of the Sendai Framework is to save lives. And that is the theme of this year's International Day for Disaster Reduction on 13 October. It is our hope that this report will spur increased efforts to address risk and reduce the impact of climate change and rapid urbanization, and also boost efforts to increase investment in early warning systems, safe schools and health facilities, disaster-resilient housing and work places.

Robert Glasser
Head of the UN Office for Disaster Risk Reduction UN Special Representative of the Secretary-General for Disaster Risk Reduction

Debarati Guha-Sapir
Professor
Centre for Research on the Epidemiology of Disasters
Institute of Health and Society
Université Catholique de Louvain (UCL), Belgium


The 20 most deadly disasters of the last 20 years (1996-2015)
High income
Upper middle income
Lower middle income
Low income
Earthquake
Earthquake & Tsunami
Storm
Extreme temperature
Flood
Drought
Jun.10
Russian Fed.
55,736
Jul.03
Germany
9,355
Jul.03
France
19,490
Jul.03
Spain
15,090
Aug.99
Turkey
17,127
Dec.03
Iran
26,796
May. 08
China
87,476
Mar.11
Japan
19,846
May. 08
Myanmar
138,366
Dec.04
Indonesia
165,708
Jan.10
Haiti
222,570
Dec.99
Venezuela
30,000
Jul.03
Italy
20,089
Oct.98
Honduras
14,600
10-11
Somalia
20,000
Oct.05
Pakistan
73,338
Jan.01
India
20,005
Dec.04
Sri Lanka
35,399
Oct.99
India
9,843
Dec.04
India
16,389

Executive Summary

Of the 1.35 million people killed by natural hazards over the past 20 years, more than half died in earthquakes, with the remainder due to weather- and climate-related hazards. The overwhelming majority of these deaths occurred in low- and middle-income countries. The poorest nations paid the highest price in terms of the numbers killed per disaster and per 100,000 population

The period 1996 to 2015 saw 7,056 disasters recorded worldwide by EM-DAT, the Emergency Events Database. The frequency of geophysical disasters (primarily earthquakes, including tsunamis, and volcanic eruptions) remained broadly constant throughout this period but there was a sustained rise in climate- and weather-related events (floods, storms and heatwaves in particular) which accounted for the majority of disaster deaths in most years.

In total, the number of weather- and climate-related disasters more than doubled over the past forty years, accounting for 6,392 events in the 20-year period 1996-2015, up from 3,017 in 1976-1995. In 2015, the hottest year on record, almost as many people died in heatwaves as were killed in the Nepalese earthquake. There was also a doubling of major reported droughts (32) by comparison with the annual average of 16 over the decade 2006-2015.

In terms of disaster mortality, EM-DAT recorded 749,000 earthquake deaths in the past 20 years, with 357,000 lives lost between 2006 and 2015, the majority in the devastating earthquake in Haiti in 2010. In the previous decade (1996-2005) earthquakes claimed 392,000 lives, a figure inflated by another megadisaster, the 2004 Indian Ocean Tsunami.

Analysis of EM-DAT data shows that tsunamis were 16 times more deadly than ground movements in terms of the proportion of victims killed. That makes tsunamis (a sub-type of earthquake) the most deadly major hazard on the planet.

The global plan for reducing disaster losses, the Sendai Framework for Disaster Risk Reduction, adopted by all UN member States in March 2015, sets a target for a substantial reduction in global disaster mortality; the statistics in this report point towards several major conclusions with implications for achieving this target:

- The high death tolls from earthquakes, including tsunamis, over the last 20 years is a deeply troubling trend given the pace of urbanization around the world in many seismic zones. This underlines the need to promote the mainstreaming of disaster risk assessments into land-use policy development and implementation, including urban planning, building codes and investing in earthquake-resistant infrastructure, notably housing, schools, health facilities and work places. The private sector, and the construction industry in particular, need to be partners in this endeavour;

- While better data is needed on overall disaster mortality, particularly in relation to weather- and climate-related hazards in low-income and lower-middle-income countries, it is clear that there needs to be more focus on alleviating the impact of climate change on countries which contribute least to greenhouse gas emissions but which suffer disproportionate losses of life because of extreme weather events exacerbated by rising sea levels and the warming of the land and sea;

BOX | 1

The Hyogo years

The last decade saw a concerted worldwide effort to reduce disaster losses following the adoption of the Hyogo Framework for Action 2005-2015: Building the Resilience of Nations and Communities to Disasters.

UNISDR's assessment of progress during that decade is that advances have been made in strengthening disaster preparedness, response and early warning capacities but there is ample room for improvement. Progress has been limited in most countries when it comes to managing the underlying risks such as poverty, environmental degradation, shortcomings in disaster risk governance, rapid urbanization, climate change and population growth in hazard-exposed areas.

From 2006 to 2015, there was further evidence of the rising human cost of weather- and climate-related disasters, with 48.7% of all lives lost to natural hazards in that period due to storms, extreme temperatures, flood, drought, landslides and wildfires, up from 39.6% between 1996 and 2005.

Storms became the second most deadly type of natural disaster in the past decade after earthquakes, due mainly to 138,000 deaths in Cyclone Nargis which struck a largely unprepared Myanmar in 2008. In total, storms killed 174,000 people between 2006 and 2015. This was nearly one quarter of all deaths from natural hazards during that decade and far higher than the 65,000 storm deaths recorded in 1996-2005. However, Cyclone Nargis obscured an underlying downward trend in storm deaths across most countries despite population growth in hazard-exposed areas.

Record-breaking heatwaves made extreme temperatures the third most lethal type of disaster in the past decade. In 2006-2015, a sharp increase in mortality in Russia was offset by declines in heatwave deaths in Western Europe, resulting in a fall in reported global fatalities in this category from 87,000 (1996-2005) to 79,000 (2006-2015). However, heatwave deaths are widely underestimated so the true figures for both decades were doubtlessly much higher.

Floods remained the most common type of disaster during the Hyogo decade, accounting for 47% of all disasters in 2006-2015, up from 40% in 1996-2005. Flood mortality fell to 57,000 lives lost between 2006 and 2015 from 93,000 in the previous decade. This fall reflected a sharp drop in flood deaths in Venezuela, where a single catastrophe – the Vargas landslides and floods - cost more than 30,000 lives in 1999. Flood mortality has also declined in China. Further progress on reducing flood mortality continues to be a challenge.

Overall, natural hazards were both more frequent and more deadly decade-on-decade. Earthquakes caused increasing numbers of deaths per disaster. With the exception of Cyclone Nargis, the average numbers dying in storms declined decade-on-decade and the average number of deaths per flood also fell markedly. If Cyclone Nargis is excluded then the average numbers of deaths from both storms and floods declined.

In 2009, UNISDR published its first biennial Global Assessment Report: on Disaster Risk Reduction: Risk and poverty in a changing climate. One of its conclusions was that data limitations combined with the unpredictable and unique nature of hazards mean that much uncertainty remains in the understanding of disaster risk. Nonetheless, it found that "relative mortality risk is approximately 200 times higher in low-income countries than in OECD countries and approximately 30 times greater in low human development countries than in high human development countries." This present report provides further evidence of this stark inequality between rich and poor.

- Overall, there is much higher exposure to disasters and the risk of death in low- and middle-income countries which needs to be addressed through improved early warning systems, better preparedness, weather forecasting and greater investment in resilient infrastructure;

- The continuing loss of life in high-income countries underlines how, even in the absence of a megadisaster, countries continue to be vulnerable to new emerging risk scenarios as evidenced by the triple nuclear, earthquake and tsunami disaster which overtook Japan in 2011, also Hurricane Katrina in New Orleans in 2005, and the 2003 heatwaves which claimed 70,000 lives in Europe. Policies and practices for disaster risk management should be based on an understanding of disaster risk in all its dimensions and must be factored into both public and private sector investment decisions. Particular attention must be paid to vulnerable groups. A disproportionately high number of older people died in Hurricane Katrina and the 2003 heatwaves, for example;

- The three megadisasters (more than 100,000 fatalities) which marked the last 20 years demonstrate the truth of the statement that the worst disasters which could happen have not happened yet. The Indian Ocean Tsunami, Cyclone Nargis and the Haitian earthquake all underline the importance of preparing for worst-case scenarios where the evidence demonstrates that such events are predictable, and require strong disaster risk governance at the local, national, regional and global levels.

Chapter 1

Trends in global mortality from natural disasters

Average mortality for all types of natural disasters increased to 69,800 per year in the decade 2006-2015, up from 64,900 between 1996 and 2005. Average deaths per disaster also rose, up to 194 from 187. These increases in averages reflect the impacts of two megadisasters in the most recent decade (Cyclone Nargis in 2008 and the 2010 Haitian earthquake) up from one megadisaster in 1996-2005: the 2004 Indian Ocean Tsunami. A megadisaster is defined as a single event which kills more than 100,000 people.

BOX | 2

Classifying natural hazards

Natural hazards are classified by their root cause, hence tsunamis are a sub-type of earthquake because they are caused by seismic activity. There are two major classifications in natural hazards: geophysical (earthquakes, volcanic activity & dry mass land movements) and climate- or weather-related disasters. The latter group includes hydrological disasters such as floods and landslides, meteorological disasters such as storms and extreme temperatures, and climatological disasters, including droughts and wildfires. In this report, the latter group are collectively termed weather- and climate-related disasters.

Climate-related disasters accounted for the majority of deaths in 15 out of the past 20 years (Figure 1). High earthquake mortality and heavy tolls from climate-related events combined to create the spike in deaths in 2010 and also contributed to high global mortality in 2008. The 2004 peak was due overwhelmingly to the Indian Ocean Tsunami.

Figure 1

Annual deaths by major disaster category (climate-related & geophysical), 1996-2015

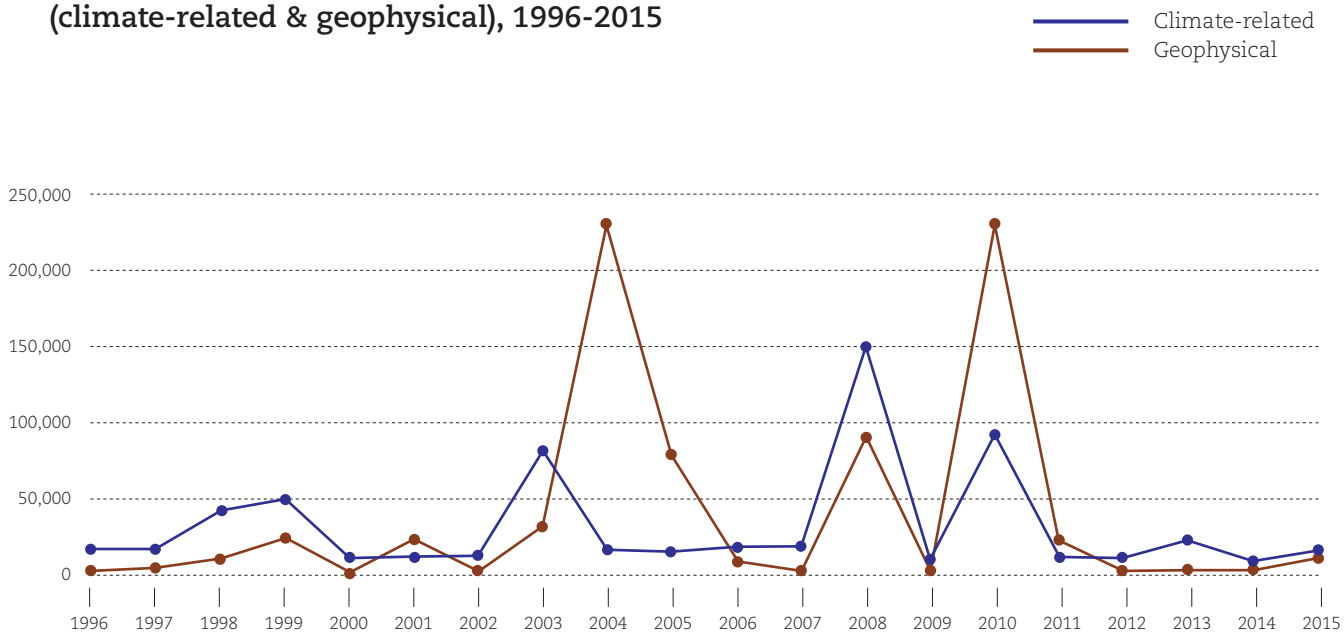
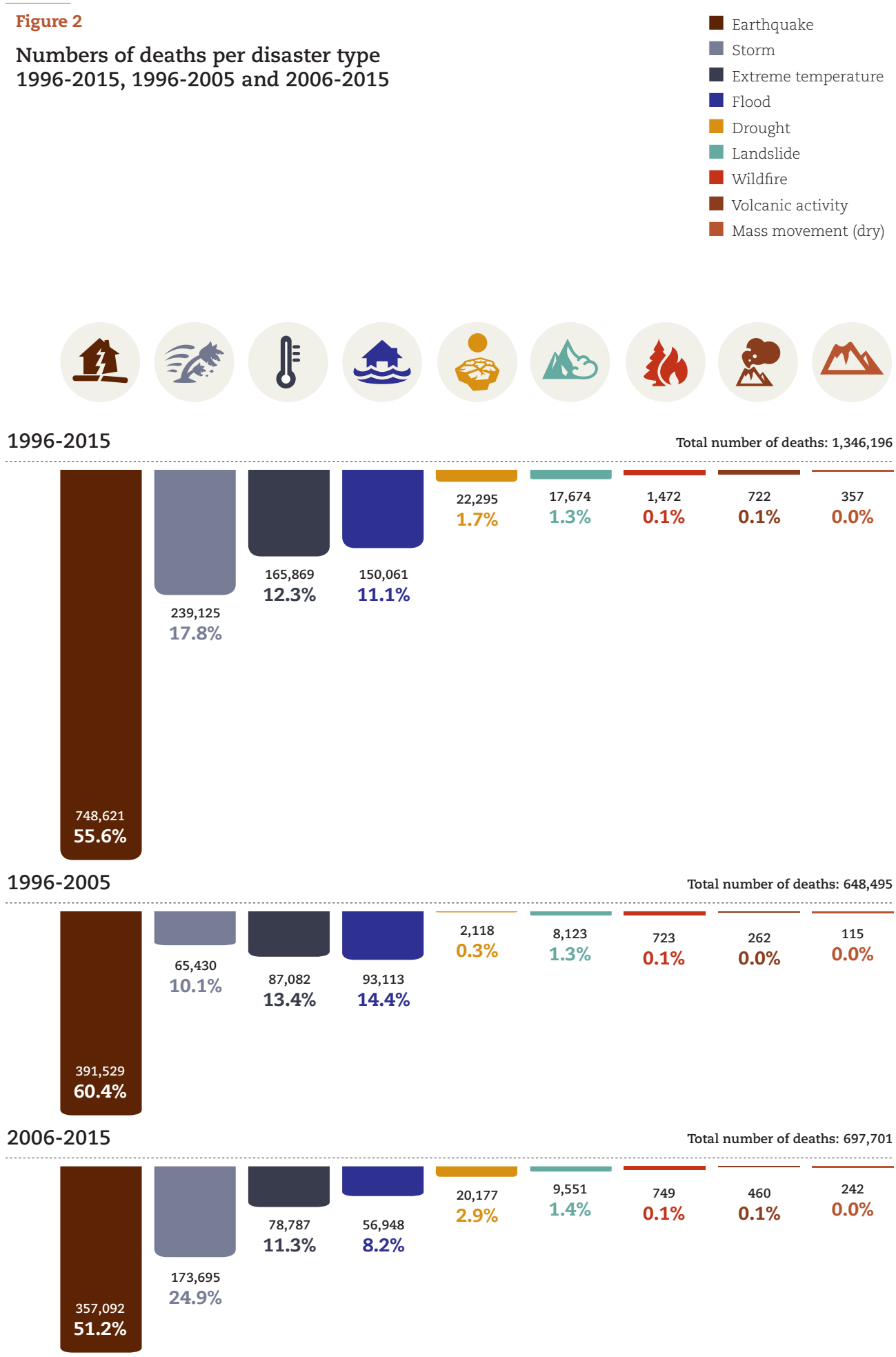


Figure 2

Numbers of deaths per disaster type 1996-2015, 1996-2005 and 2006-2015



Trends in geophysical disasters

In the past two decades, earthquakes accounted for more deaths than all other natural hazards combined, causing nearly 56% of total global disaster mortality between 1996 and 2015 **(Figure 2)**. The gap between mortality from earthquakes and climate-related disasters narrowed in 2006-2015, when 51.2% of global deaths were caused by earthquakes, down from 60.4% in 1996-2005. Nevertheless, a fall in the number of earthquakes (down to 248 from 299) meant that the death toll per earthquake increased to an average of 1,440 lives lost, up from 1,310 in the previous decade.

Tsunamis were on average 16 times more deadly than ground movement earthquakes in terms of the proportion of victims killed. Over the past 20 years, an average of 65 people died per 1,000 victims in tsunamis, against four deaths per 1,000 victims in ground movement earthquakes **(Table 1)**. This chilling statistic underlines why 2016 will see the inauguration of World Tsunami Awareness Day on 5 November. The affected includes injured survivors, people left homeless and displaced, and those who needed emergency assistance. Victims include all affected people plus the dead.

Incidences of volcanic activity and mass dry land movements both rose decade-on-decade in the past 20 years, but collectively these types of geophysical disasters remained far less significant than earthquakes, accounting for just 1.7% of all disasters in 1996-2015. A total of 55 volcanic eruptions claimed 460 lives in 2006-2015, up from 262 deaths in 51 events in 1996-2005. Mass dry land movements cost 357 lives in 11 events over the full 20-year period.

Table 1

Earthquake victims and deaths from ground movements & tsunamis, 1996-2015

	Total no. victims (affected + dead)	Total no. deaths	Deaths per 1,000 victims
Ground movement	125,796,060	498,394	4
Tsunami	3,829,825	250,149	65

Trends in climate-related disasters

The incidence of storms resulting in fatalities declined decade-on-decade over the past 20 years. Of the 1,985 storms resulting in lost lives between 1996 and 2015, the majority (1,019) occurred in 1996-2005. Storms also fell as a percentage of all recorded natural hazards, down to 26.9% in 2006-2015 from 29.4% the previous decade. This last decade was marked by a decrease in activity notably during the Atlantic hurricane seasons of 2014-2015 due to El Niño.

By contrast, the deadliness of storms jumped from an average of 64 deaths per event in 1996-2005 to 180 in 2006-2015, although this average is grossly inflated by Cyclone Nargis in Myanmar in 2008. The reality is that, as with floods, disaster risk management is having an impact on reducing death tolls from climate- and weather-related hazards in countries with efficient risk governance in place.

Extreme temperatures (primarily heatwaves) killed at least 166,000 people in the past 20 years, accounting for 12.3% of all reported disaster deaths in that period. In 2006-2015, extreme temperatures overtook flooding to become the third highest cause of global disaster mortality. The incidence of extreme temperature events also increased, rising to 219 events in 2006-2015 (6.1% of all natural hazards) up from 177 the previous decade (5.1%).

Despite these statistics (and record-breaking temperatures in recent years) recorded deaths from extreme temperatures fell in the past 10 years, due mainly to lower mortality in Western Europe which introduced health-impact based weather forecasting following the 2003 heatwaves, an example which has been followed this year by India for the first time. Success in reducing these mortality figures is largely due to improved heatwave management and closer collaboration between national meteorological services, ministries of health and first responders with a particular focus on the elderly and the young.

However, the global numbers for deaths due to heatwaves are considerably under-reported. While Western Europe may have increased public awareness, and made better provision for emergency hospital admissions, countries in the tropical south lag far behind on many fronts. Since exact death tolls from heatwaves are unlikely to be recorded in the near future, one way forward would be to gather systematic evidence of hospital admissions during very hot weather, and to generate modelled estimates of the expected death tolls.

The declining trend in mortality from flooding was accentuated in the past 10 years by markedly fewer flood deaths in Venezuela and China. In all, floods caused just 8.2% of global disaster deaths in 2006-2015, down from 14.4% in 1996-2005. This was particularly striking at a time when the number of floods rose significantly.

Chapter 2

Patterns of global mortality from natural hazards

Patterns of global mortality from natural hazards depend on the dataset used. Absolute numbers give a sense of the scale of mortality for individual countries, while standardizing national data to show deaths per 100,000 inhabitants gives a better indication of the relative impact of disaster deaths on countries of different sizes. For example, the loss of 10,000 lives is a human tragedy wherever it occurs, but this number of deaths will have a far greater impact on the social and economic well-being of a small island state of 100,000 people than, say, in a vast Asian nation like China or India, or in the United States of America. This section of the report also analyses patterns of mortality by economic income brackets in order to highlight the relative impacts of disaster mortality from natural hazards on low-income, middle-income & high-income countries. It focuses on three disaster types (earthquakes, storms and floods) for which EM-DAT has the most comprehensive data.

Mortality patterns by income group

Analysis of EM-DAT shows that natural hazards strike countries regardless of national income, but the severity of the impacts are directly related to income and development levels. This is particularly evident for disaster mortality. Put simply, the poorer the country, the higher the number of disaster deaths there are likely to be. It is also striking that none of the high-income countries which appear on the 2015 top ten list for economic losses from disasters (such as the USA, Japan, the UK, Australia and Chile) appear among the countries suffering the highest disaster mortality.

In absolute terms, middle-income countries bore the brunt of disaster mortality between 1996 and 2015 **(Figure 3)**. In terms of lives lost per disaster, however, low-income countries experienced by far the highest rate of mortality **(Figure 4)**. On average, 327 people died per disaster in low-income countries in the past 20 years, almost five times more than the average toll in high-income countries. There is also a stark upward progression in the number of deaths per 100,000 inhabitants in poorer nations, with low-income countries suffering more than five times the number of disaster deaths by this measure than high-income countries **(Figure 4)**. Great disparities are also evident between upper-middle-income and lower-middle-income countries. Today some 613 million people live in 31 low-income countries. Many of these countries are either in post-conflict or conflict situations and lack the resources to account adequately for their disaster losses or to reduce their vulnerability to disasters. Thus disaster mortality in low-income countries is probably even higher than indicated in the EM-DAT database.

Figure 3

Number of deaths per income group for all natural hazards, 1996-2015

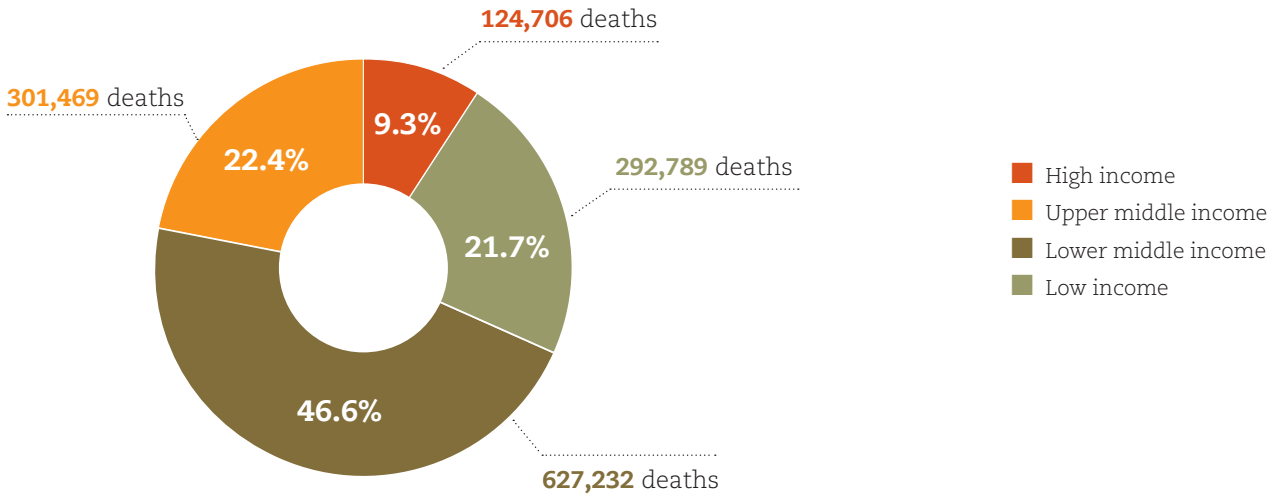
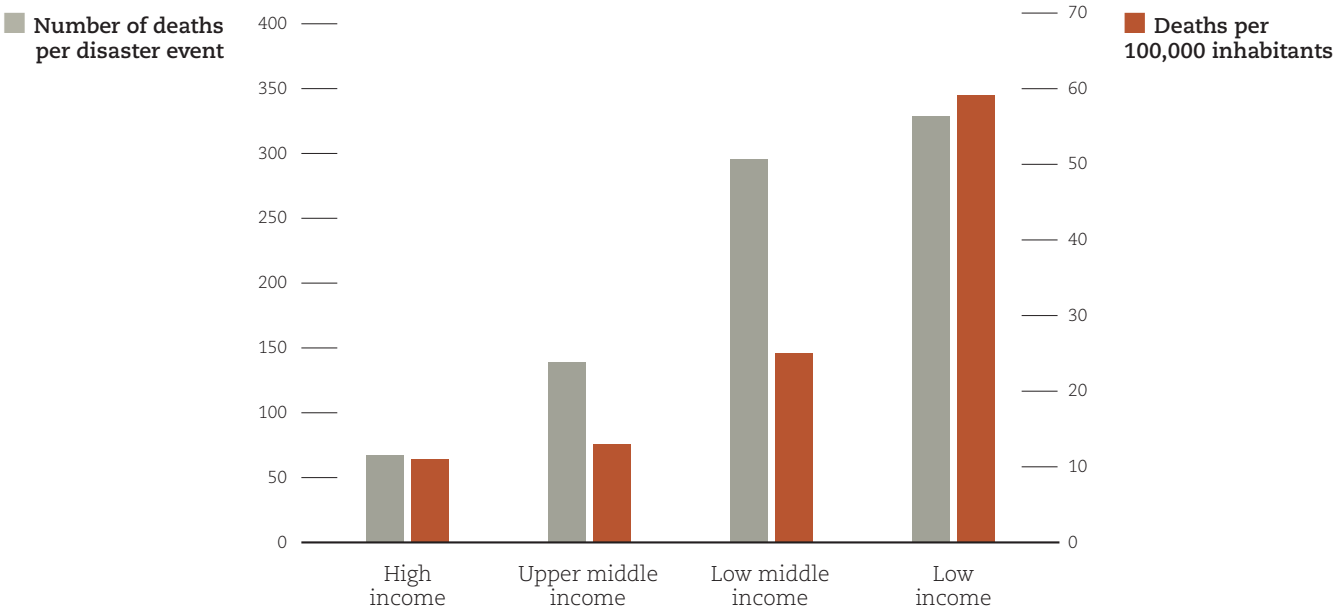


Figure 4

Number of deaths per disaster event compared to the number of deaths per 100,000 inhabitants per income group, 1996-2015



Mortality patterns by country

Over the past 20 years, Haiti lost more lives to natural hazards than any other country in the world both in absolute terms and relative to the size of its population. This was due principally to the enormous death toll of the 2010 earthquake, but also because of high flood and storm mortality. Nearly 230,000 Haitians died from all types of natural disaster between 1996 and 2015 **(Figure 5)**. Based on an average population size at 2006, that is the equivalent of 2,460 deaths per 100,000 inhabitants.

A key lesson of the 2010 Haitian earthquake is that many countries, particularly low- and middle-income countries, struggle to reduce rare but intensive risks. Such events can often be unexpected, either without historical precedent or beyond living memory. In the absence of frequent major earthquakes, governments are less likely to find political incentives to invest in protective measures to reduce the risk. There may also be a trade-off between investing in reducing disaster risk and social expenditures on areas such as education and public health. Elaborate technologically-based solutions to disaster risk are often unaffordable for such countries, so, low-cost solutions have to be found. Many simple houses built to earthquake-resistant standards in Nepal and India have withstood severe seismic tests of their structural soundness.

Figure 5

Top 10 countries for disaster deaths in absolute numbers, 1996-2015

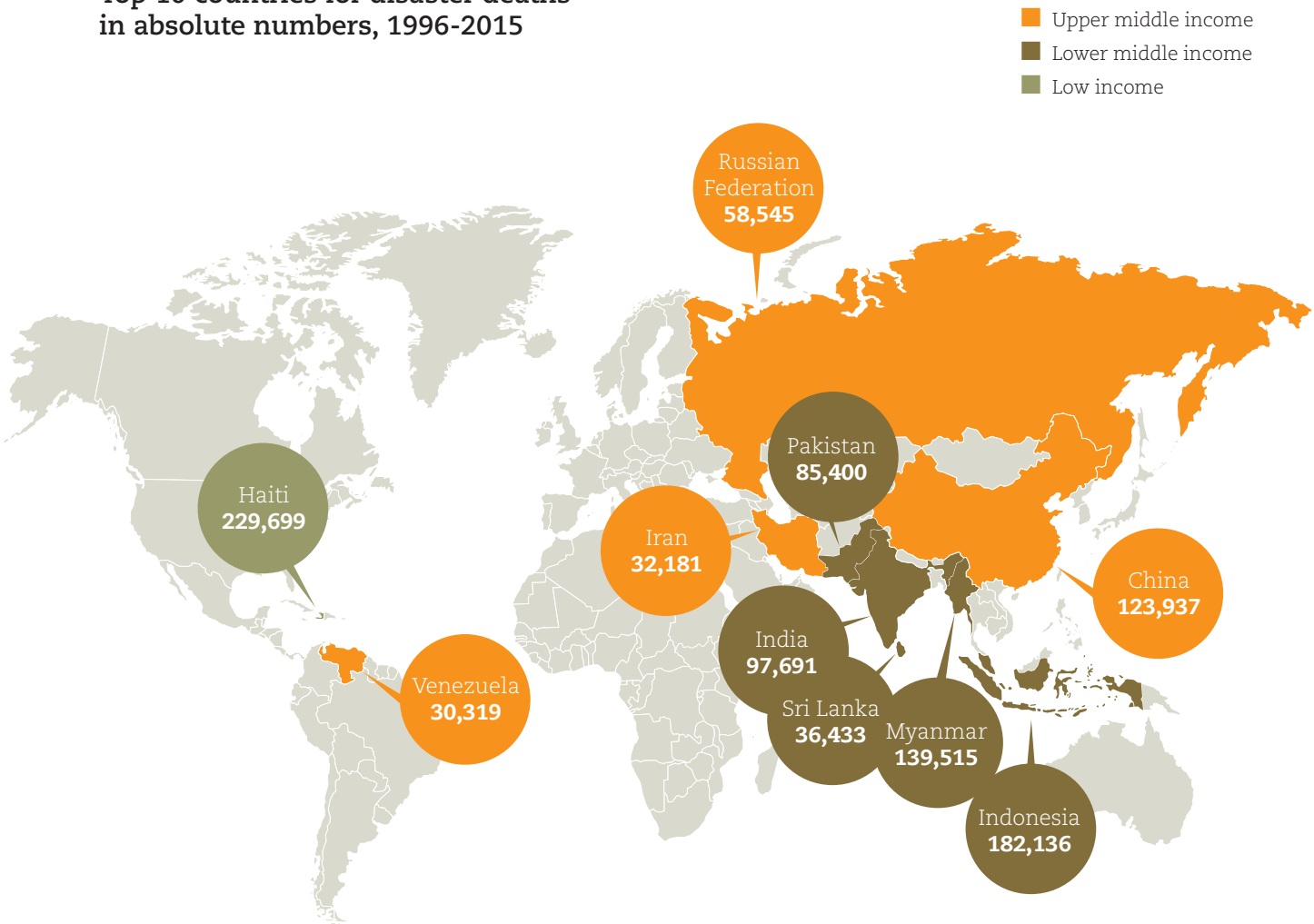


Figure 5 also illustrates the impact of two other megadisasters on global patterns of mortality: Indonesia's second-place ranking behind Haiti reflects the terrible toll of the 2004 Indian Ocean Tsunami, while Myanmar's third place is explained by the huge number of lives lost to Cyclone Nargis in 2008. (Both these cases also illustrate how a major tragedy can spur improvements in disaster risk management. In the case of Indonesia, disaster risk reduction became embedded in the country's development strategy following the tsunami. Similarly, two years after Cyclone Nargis, Myanmar committed to a national disaster risk reduction plan and to implementing the Hyogo Framework for Action.) It is not until fourth-placed China that the size of the country, and the frequency of occurrence of natural hazards, become significant factors in explaining its ranking in the world's top 10.

In total, China experienced 554 disasters during 1996-2015, including 182 floods, 179 storms and 102 earthquakes. Between the two decades disasters became more frequent (248 in 1996-2005, rising to 306 in 2006-2015) due mostly to an increased number of floods and storms.

Despite this increased frequency, China reduced flood deaths dramatically decade-on-decade, reporting just 6,600 flood deaths in 2006-2015, down from 14,400 in 1996-2005. Yet a huge toll from earthquakes in 2006-2015 (91,700 lives) pushed China into the top 10 countries for the total number of disaster deaths worldwide, as well as into the top 10 countries for earthquake deaths per 100,000 inhabitants.

Earthquakes also accounted for the greatest number of disaster deaths in Pakistan and Iran, making these neighbours the two highest middle-income countries for earthquake deaths per 100,000 population in the world.

Like China, India saw a sharp rise in the number of floods decade-on-decade, but unlike China, India's flood mortality increased, with 90 floods claiming 15,860 lives in 2006-2015, up from 13,660 lives lost in 67 floods the previous decade. If India could emulate China in terms of reducing flood deaths, the declining global trend in flood mortality seen over the past decade could perhaps be extended.

Elsewhere, the 2010 heatwave in Russia pushed its recorded deaths from extreme temperatures to 56,100 in 2006-2015 (the majority of deaths worldwide for this type of disaster) up from 1,500 in 1996-2005. As noted above, this rise in Russian heatwave deaths contrasted with sharp declines in heatwave mortality in Western Europe. Spain, for example, reported 15,100 lives lost to extreme temperatures in 1996-2005 but only 21 in 2006-2015. Similarly, over those two decades, Italy cut its toll from more than 20,000 to 61 and France from 19,521 to 4,700.

Mortality patterns calculated per 100,000 inhabitants

There is considerable overlap between countries suffering the highest number of disaster deaths in absolute terms **(Figure 5)** and those ranking among the top 10 nations for deaths per 100,000 inhabitants **(Figure 6)**. Disaster mortality in Haiti and Myanmar has already been discussed above.

Somalia's third placed ranking per 100,000 population was predominantly due to the 20,000 lives lost to drought in 2006-2015 as well as high flood mortality in 1996-2005. More than one billion people were affected worldwide by drought over the last 20 years and there is currently acute food insecurity across regions such as southern Africa because of prolonged drought. Indirect drought-related deaths are difficult to quantify given poor record-keeping in many affected countries.

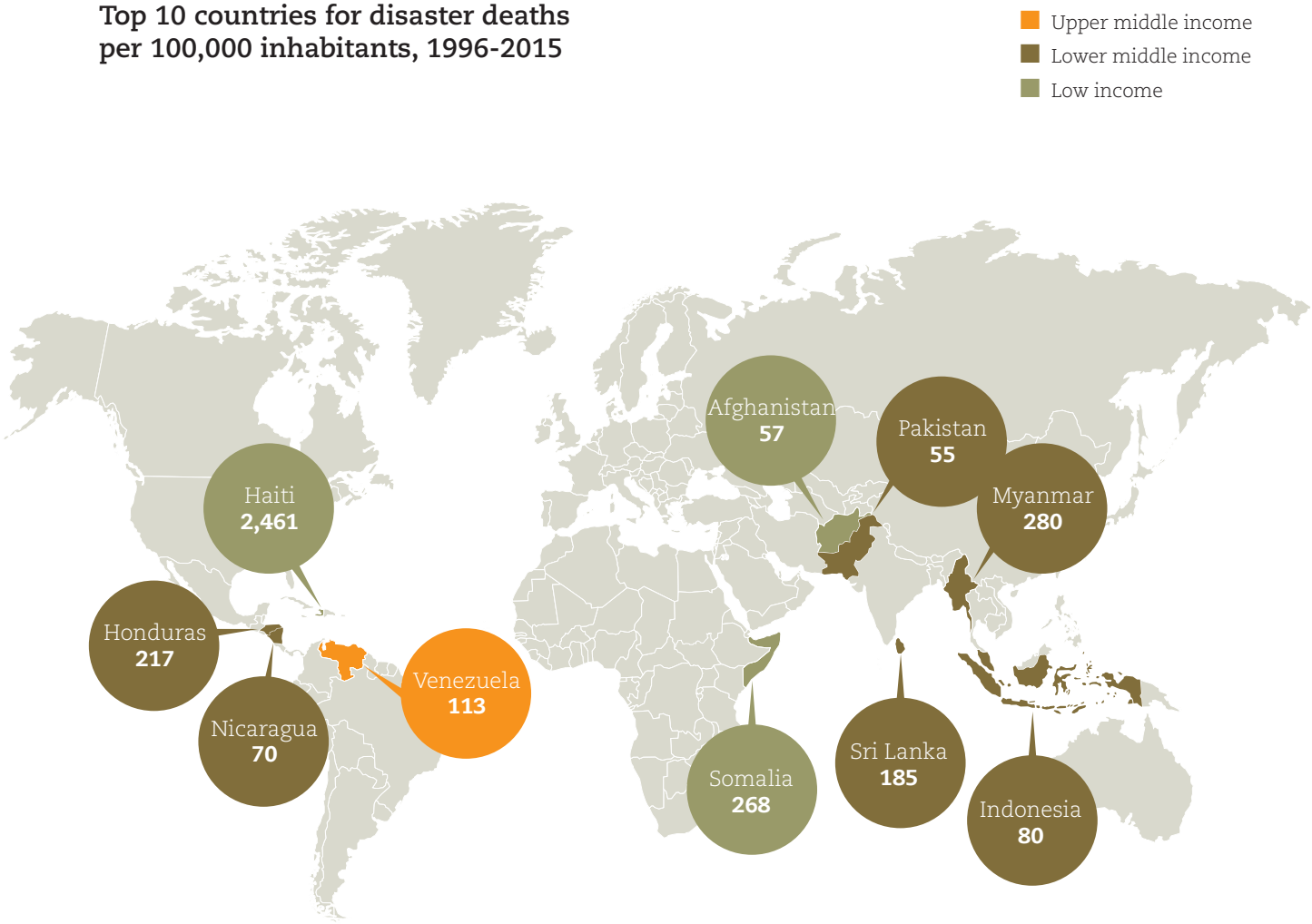
Like Indonesia, Sri Lanka's inclusion in both Figures 5 and 6 reflects the impact of the 2004 Indian Ocean Tsunami on their coastal populations. In total, earthquakes killed 35,000 Sri Lankans and 167,000 Indonesians between 1996 and 2005.

Hurricane Mitch was the second most deadly Atlantic hurricane in recorded history, claiming more than 19,000 lives across Central America. Honduras and Nicaragua were the countries hardest hit, with this one event the reason why both nations rank among the top 10 countries for mortality per 100,000 over the period 1996-2015 **(Figure 6)**. The random nature of such singular events is illustrated by the fact that in 2006-2015, Honduras recorded just 23 storm deaths, down from 14,700 in 1996-2005, while Nicaragua reported 206 deaths in the past decade, down from 3,400 in 1996-2005.

The incidence of floods also halved in Venezuela decade-on-decade (from 16 to eight events) but the number of lives lost fell far more dramatically (to just 66 flood deaths in 2006-2015 from 30,100 in 1996-2005). These earlier deaths were almost entirely due to a single event in December 1999, when heavy and prolonged rain led to flooding, mudslides and a catastrophic loss of life in Vargas State.

Figure 6

Top 10 countries for disaster deaths per 100,000 inhabitants, 1996-2015



Mortality patterns by disaster type

Earthquakes

Extreme hazards are translated into risk through exposure and vulnerability. The high death toll in the earthquake which struck Haiti on 12 January 2010 reflected the exposure of large numbers of people in a context devoid of meaningful disaster risk governance. Vulnerability factors such as extreme poverty, corruption, a fragile democracy, a lack of earthquake experience and inadequately engineered building stock all played their part in this tragedy.

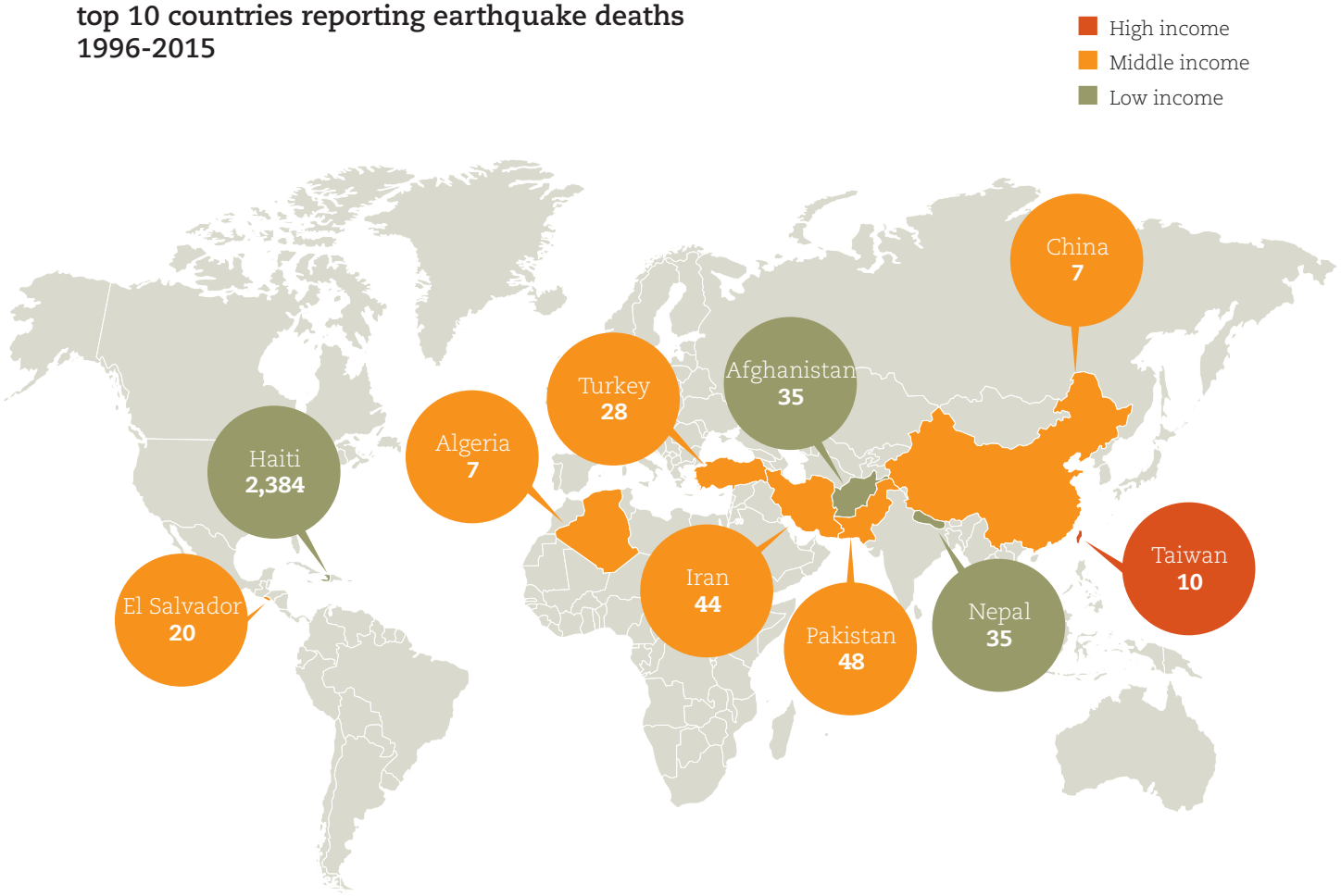
By contrast, similar levels of mortality were avoided in two high-income countries which were also hit by earthquakes in the same year as Haiti. On 27 February 2010, Chile was struck by a quake that released 500 times more energy than the Haitian event, but the Chile event only killed 562 people. The earthquake that struck New Zealand in September 2010, produced the same intensity on the Modified Mercalli scale as the Haitian earthquake but no lives at all were lost. A second New Zealand earthquake in February 2011 caused 181 deaths, but the low casualty rates in both events was a tribute to the country's strong building codes. It also has to be recognised that both Chile and New Zealand have a great deal more experience than Haiti in dealing with earthquakes.

Globally, earthquakes present a special distribution pattern as they are concentrated in specific seismic zones. Thus many countries are excluded from any analysis of earthquake mortality by virtue of being outside a seismic area. The 20-year period under review is far too short to cover earthquake 'return periods', therefore a low national mortality rate is no reason for complacency: every country in a seismic zone needs to invest in building codes and ensure compliance with them. It is critically important to focus on earthquake-resistant housing, schools, health facilities and work places.

In terms of earthquake deaths per 100,000 inhabitants, Haiti far outstripped the next two worst-hit countries: middle-income Pakistan and Iran, and also low-income Nepal and Afghanistan **(Figure 7)**. Pakistan's high relative mortality reflected the country's 73,500 earthquake deaths in 1996-2005. By 2006-2015, such deaths had fallen to 913, behind extreme temperatures and flooding as the major causes of national disaster deaths. Iran, too, saw a huge reduction in earthquake mortality, down from 30,500 in 1996-2005 to 438 in the following decade. In the case of Iran this can be partly attributed to a massive investment programme, particularly in safe schools.

Figure 7

Mortality per 100,000 inhabitants for top 10 countries reporting earthquake deaths 1996-2015



Storms

The picture that emerges when you standardize storm deaths per 100,000 inhabitants over the past 20 years **(Figure 8)** once again demonstrates how major disasters which incur a high loss of life influence global patterns of mortality. The high death tolls from Hurricane Mitch (discussed above) and storms such as Typhoon Haiyan, which claimed 6,300 lives in the Philippines in 2013, explain the concentration of storm deaths in Central America, the Caribbean and South-East Asia.

There has been no recurrence of a Mitch-type event in the intervening years which, together with improved early warning systems and better preparedness, accounts for the fact that there has been a significant reduction in storm deaths in the Americas over the last ten years. The recent El Niño weather phenomenon contributed to below-average Atlantic hurricane season activity in 2014 and 2015. Though memories are still fresh of Superstorm Sandy, the USA went ten years without a major hurricane making landfall since 2005 when it was hit by four in one year.

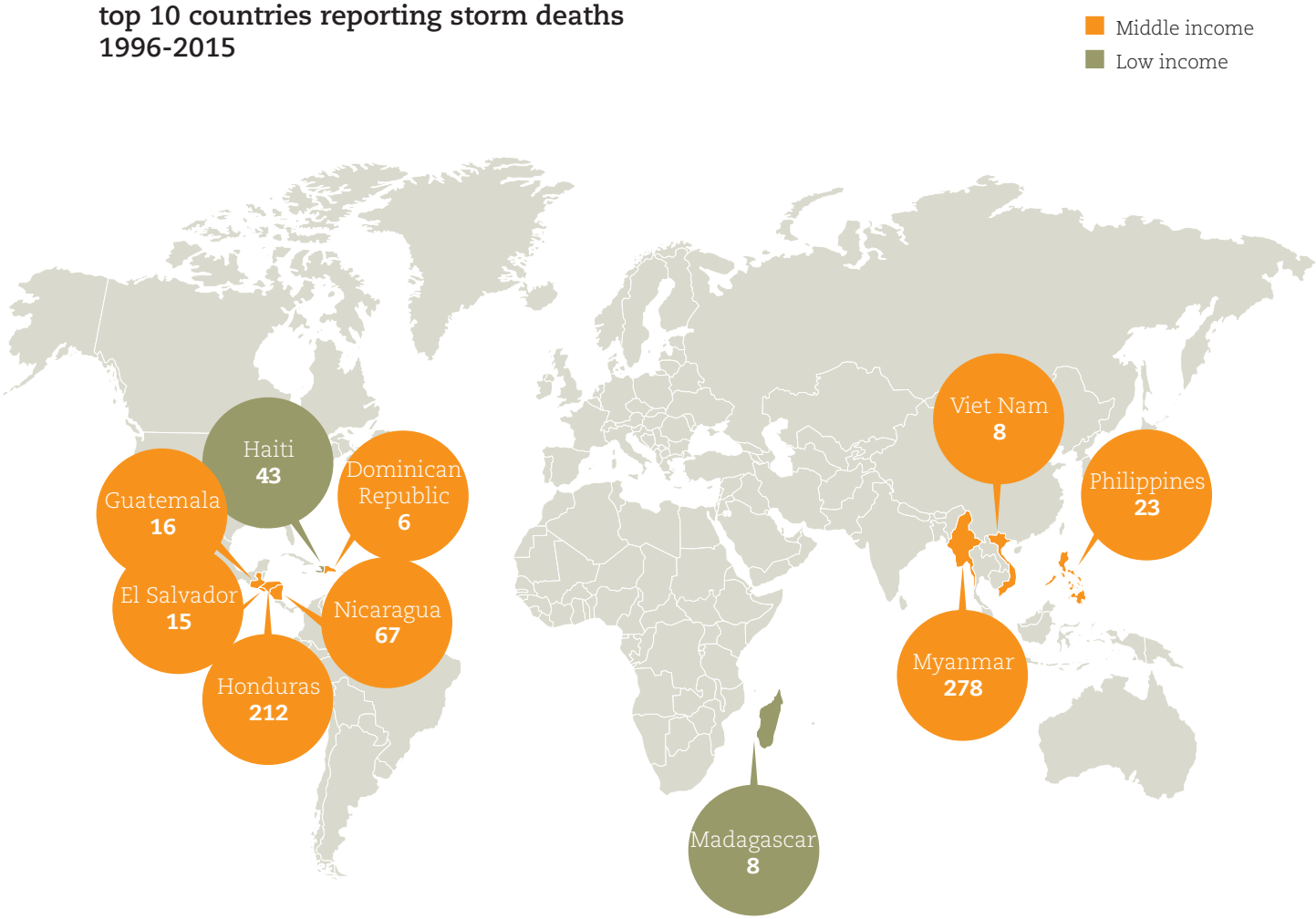
In South East Asia, the pattern is different. Cyclone Nargis battered Myanmar in 2008. Storm deaths soared in the Philippines to 15,880 in 2006-2015 from 3,970 in the previous decade. Even in high-income Taiwan, storm deaths rose to 770 from 530. Among South East Asian middle-income nations in the top 10, only Vietnam saw a fall in storm mortality, down to 1,270 in 2006-2015 from 5,120 in 1996-2005.

Despite being hit by major storms such as Cyclone Phailin and Cyclone Hudhud in 2013 and 2014 respectively, India has had significant success in reducing storm deaths thanks to improved early warning systems and effective evacuation management, notably in Odisha and Andhra Pradesh on the Bay of Bengal. Bangladesh also continues to perform well in reducing potential loss of life from cyclones.

While China has managed to reduce flood deaths, progress on storm deaths has been more challenging, with the country recording 2,800 storm deaths in 2006-2015, little changed from the 2,861 Chinese lives lost to storms in the previous decade.

Figure 8

Mortality per 100,000 inhabitants for top 10 countries reporting storm deaths 1996-2015



BOX | 3

Storms and Small States

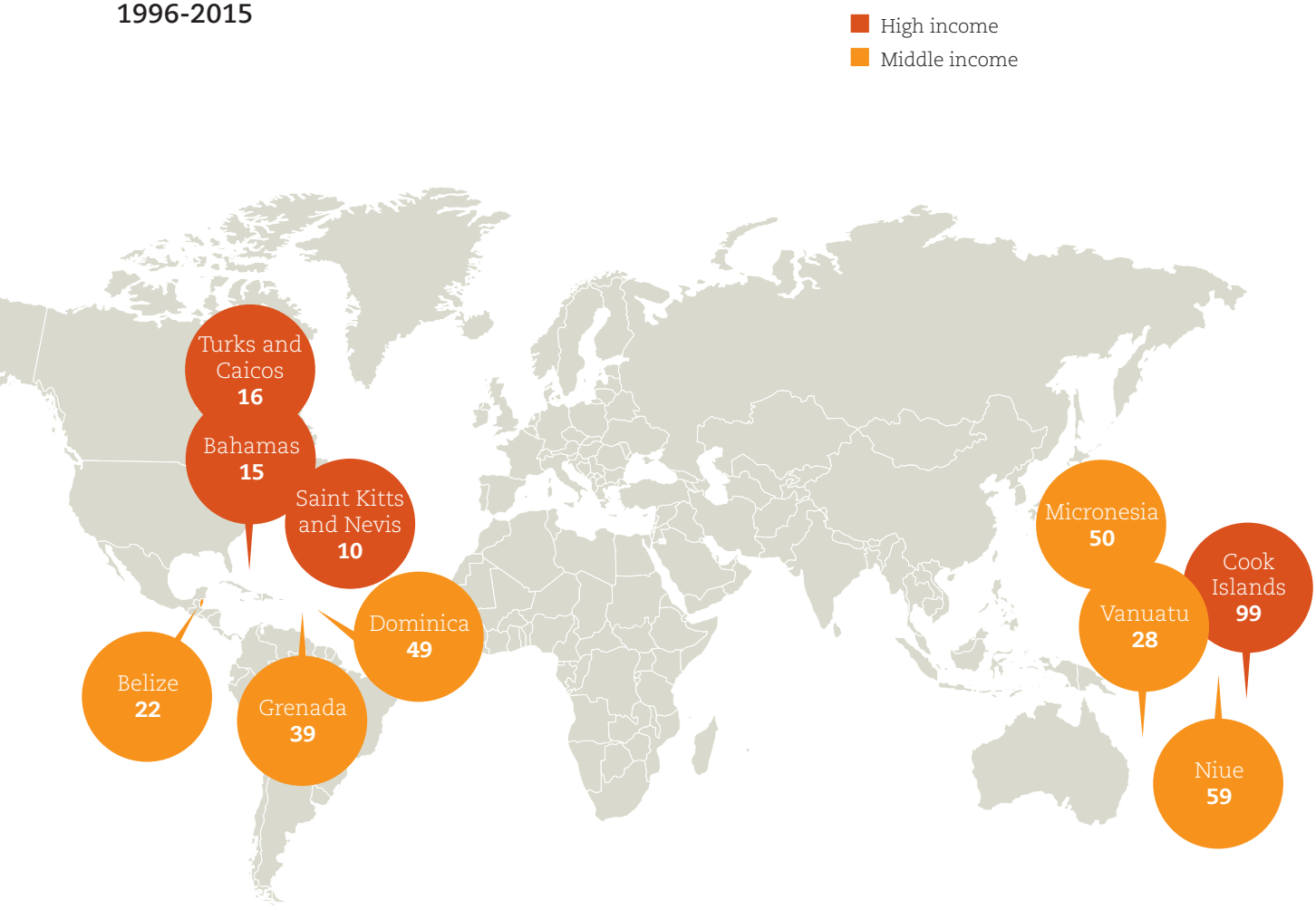
A study carried out for the UNISDR's 2013 Global Assessment Report on Disaster Risk Reduction shows that, in relative terms, smaller countries can be expected to lose a very high proportion of their economic assets when struck by major hurricanes, tropical cyclones and other intense storms. This high level of risk also applies to potential losses of life, particularly for vulnerable small island states. This risk is illustrated by Figure 9 which lists storm mortality rates for Small States standardized to reflect deaths per 100,000 head of population.

Among the top 10 small countries for storm deaths per 100,000 inhabitants are three high-income Caribbean countries plus the Cook Islands, also a high-income state. The others are all middle-income countries, including Belize, the only mainland small state within this top 10. It should be noted that the total numbers of deaths in small states were low in absolute terms compared to storm mortality in larger nations over the past 20 years.

The variation in mortality from tropical cyclones is affected by a combination of factors including the severity of the cyclone, the number of people exposed, and GNI per capita. A high-income country like Australia is better prepared to meet the threat of a Mitch-like event than a low- or middle-income country or a Small Island Developing State (SIDS). This was borne out by Australia's management of Cyclone Yasi in February 2011. It was a Category 5 cyclone which caused economic losses of US$3.6 billion but no loss of life. The implication is that if a country can reduce its vulnerability and exposure, it can significantly reduce the mortality risk associated with a disaster event.

Figure 9

Mortality per 100,000 inhabitants for top 10 Small States reporting storm deaths, 1996-2015



Floods

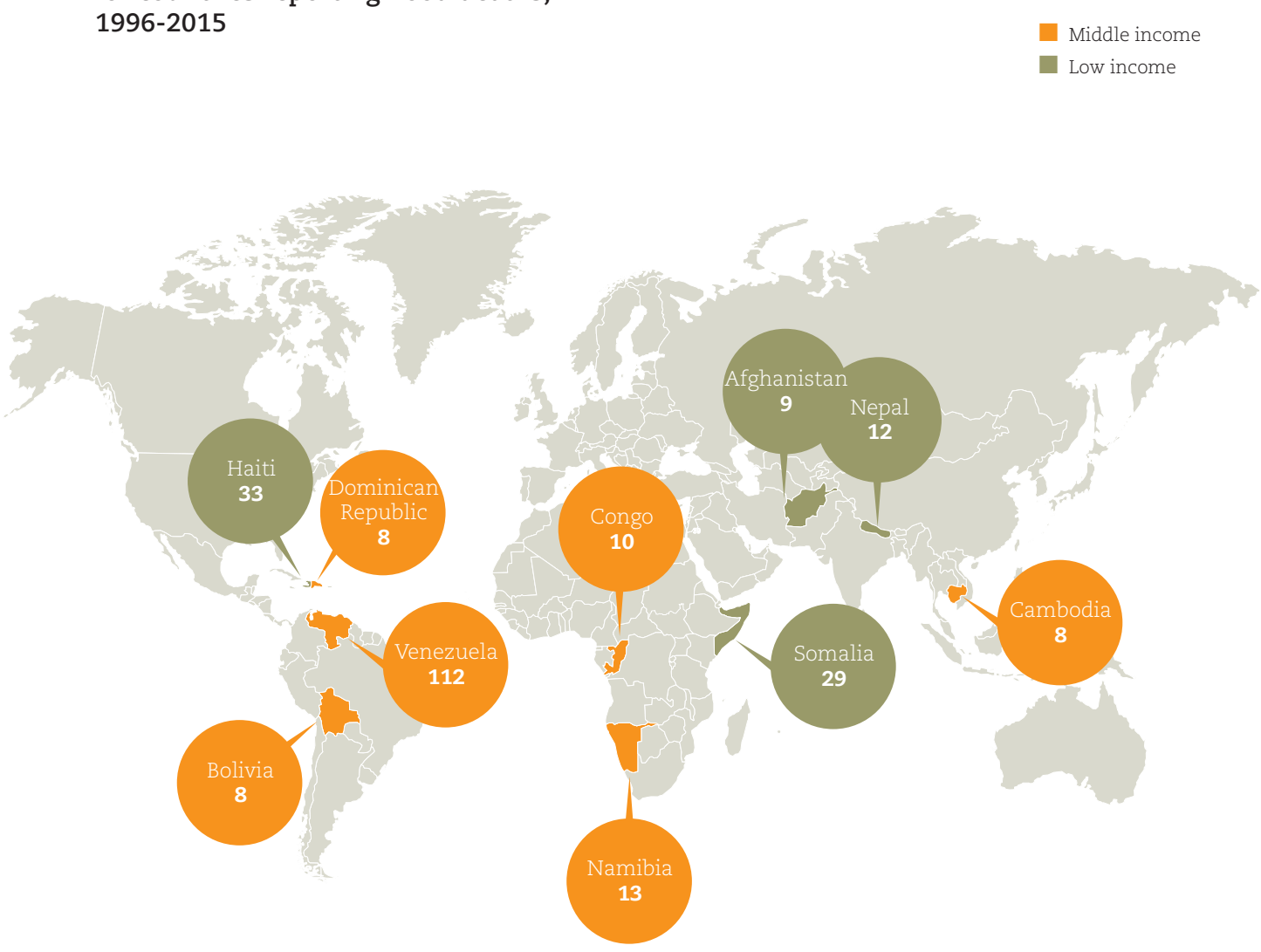
Floods affected more countries more often than any other disaster type recorded by EM-DAT. Flood mortality is highly variable between nations, but heavily concentrated in middle-income countries, which accounted for 84.5% of the global total of flood deaths over the past 20 years. Low-income countries recorded 13% of global flood deaths, although this may well be an underestimate. High-income nations recorded just 2.5% of global flood mortality in 1996-2015, a lower percentage than for storms or earthquakes.

Overall, flood mortality declined during the past 20 years, both in absolute numbers and as a percentage of the global total, falling to 8.2% of all disaster deaths in 2006-2015 from 14.4% in 1996-2005. The past decade also saw the number of people killed per flood halving to an average of 34, down from an average of 68 deaths per flood in 1996-2005. Apart from the impact of lower flood mortality in Venezuela and China (discussed above) this drop in average death rates can be attributed to both a rise in the overall number of floods (which increased to 1,672 in 2006-2015 from 1,368 in 1996-2005) and also to improved performance in disaster preparedness and responses in many countries.

Among nations showing marked reductions in flood deaths between the two decades were Algeria, Bangladesh, Haiti, Iran, Mexico, Nepal and Somalia. But significant increases were recorded in India, Brazil, Indonesia and the Democratic People's Republic of Korea. In Pakistan, more than 5,100 people died in floods in 2006-2015, up from 2,470 in 1996-2005, placing Pakistan in third place for flood mortality behind India and China in the past decade.

Figure 10

Mortality per 100,000 inhabitants for countries reporting flood deaths, 1996-2015



The Sendai Framework for Disaster Risk Reduction 2015-2030

The Third UN World Conference on Disaster Risk Reduction, held in Sendai, Japan, in March 2015, resulted in the adoption of the Sendai Framework for Disaster Risk Reduction 2015-2030, which maps out a broad, people-centred approach to disaster risk reduction and applies to small-scale and large-scale disasters caused by natural or man-made hazards as well as related environmental, technological and biological hazards and risks. The inclusion of man-made disasters amounts to a major expansion of the remit of disaster risk reduction.

The UN Office for Disaster Risk Reduction (UNISDR) has been tasked with supporting the implementation and the Sendai Framework aims to achieve: *"The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries"*

It places strong emphasis on the prevention of new, and reducing existing disaster risk, a key learning from the previous decade and an acknowledgement of the fact that some 60% of the area expected to be urbanized by 2030 remains to be built and much of this growth will occur in countries with weak capacities to ensure risk-sensitive urban development.

The Sendai Framework was unanimously endorsed by the UN General Assembly and disaster risk reduction is seen as a key area of focus for the overall achievement of the 2030 Development Agenda including the Addis Ababa Action Agenda, the Sustainable Development Goals and the Paris Agreement on climate.

To support the assessment of global progress in achieving the outcome and goal of this framework, seven global targets have been agreed. These targets will be measured at the global level. National targets and indicators will contribute to the achievement of the outcome and goal of this framework and an intergovernmental expert working group is developing indicators to measure global progress on the Framework's seven agreed targets.

The seven global targets are:

1. Substantially reduce global disaster mortality by 2030, aiming to lower average per 100,000 global mortality between 2020-2030 compared to 2005-2015.
2. Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 between 2020-2030 compared to 2005-2015.
3. Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030.
4. Substantially reduce disaster damage to critical infrastruc-ture and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030.
5. Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020.
6. Substantially enhance international cooperation to develo-ping countries through adequate and sustainable support to complement their national actions for implementation of this framework by 2030.
7. Substantially increase the availability of, and access to, multi-hazard early warning systems and disaster risk infor-mation and assessments to the people by 2030.

The Sendai Framework also identifies four priorities for action which are quickly becoming the focus for action by governments around the world, including the Government of India which has based its first National Disaster Management Plan on these four priorities which call for focused action within and across sectors by States at local, national, regional and global levels in the following four priority areas:

1. Understanding disaster risk

Disaster risk management needs to be based on an understanding of disaster risk in all its dimensions of vulnerability, capacity, exposure of persons and assets, hazard characteristics and the environment.

2. Strengthening disaster risk governance to manage disaster risk

Disaster risk governance at the national, regional and global levels is vital to the management of disaster risk. This requires integrating DRR in all sectors, both public and private.

3. Investing in disaster risk reduction for resilience

Public and private investment in disaster risk reduction through structural and non-structural measures are essential to building resilience to disasters and can result in co-benefits such as economic growth and job creation.

4. Enhancing disaster preparedness for effective response, and to "Build Back Better" in recovery, rehabilitation and reconstruction

Experience indicates that disaster preparedness needs to be strengthened for more effective response. Disasters have also demonstrated that the recovery, rehabilitation and reconstruction phase, which needs to be prepared ahead of the disaster, is an opportunity to build back better through integrating DRR measures.

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Contact

CRED

- **Mail:**
  Alizée Vanderveken:
  alizee.vanderveken@uclouvain.be

  Regina Below:
  regina.below@uclouvain.be

- **Phone:**
  +32 2 764 3327

- **Postal Address:**
  School of Public Health
  Institute of Health and Society (IRSS)
  Université catholique de Louvain
  Clos Chapelle-aux-Champs, Bte B1.30.15
  1200 Brussels, BELGIUM

UNISDR

- **Mail:**
  Denis McClean:
  mccleand@un.org

- **Phone:**
  +41 22 917 8897

- **Postal Address:**
  9-11 Rue de Varembé
  CH 1202, Geneva
  SWITZERLAND

design: www.mardi.be

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The contents of this report remain the responsibility of the authors alone.