Czech Republic	IHD	Stroke	Lung C	Colorectal C	Cirrhosis	Self harm	Alzheimer's	COPD	LRI	Other cardio
Hungary	IHD	Stroke	Lung C	Cirrhosis	Colorectal C	Self harm	COPD	Alzheimer's	HTN HD	Breast C
Macedonia	Stroke	IHD	Lung C	Diabetes	HTN HD	Colorectal C	COPD	Stomach C	Alzheimer's	Road injuries
Montenegro	IHD	Stroke	Lung C	Self harm	Road injuries	CMP	Breast C	Diabetes	Alzheimer's	Colorectal C
Poland	IHD	Stroke	Lung C	Self harm	COPD	Cirrhosis	Road injuries	Colorectal C	Alzheimer's	LRI
Romania	IHD	Stroke	Cirrhosis	Lung C	LRI	HTN HD	Alzheimer's	CMP	COPD	Colorectal C
Serbia	IHD	Stroke	CMP	Lung C	Self harm	Colorectal C	COPD	Alzheimer's	Diabetes	Breast C
Slovakia	IHD	Stroke	Lung C	Cirrhosis	Colorectal C	LRI	Self harm	Alzheimer's	Road injuries	Other cardio
Slovenia	IHD	Stroke	Lung C	Self harm	Cirrhosis	Colorectal C	Alzheimer's	COPD	CMP	Road injuries
Eastern Europe	IHD	Stroke	Self harm	CMP	Cirrhosis	Lung C	Road injuries	LRI	Violence	Alcohol
Belarus	IHD	Stroke	Self harm	Lung C	Road injuries	Cirrhosis	Stomach C	COPD	CMP	Alcohol
Estonia	IHD	Stroke	Lung C	Self harm	HTN HD	Alzheimer's	Cirrhosis	Alcohol	Colorectal C	CMP
Latvia	IHD	Stroke	CMP	Lung C	Self harm	Alzheimer's	Colorectal C	Cirrhosis	Stomach C	Road injuries
Lithuania	IHD	Stroke	Self harm	Lung C	Cirrhosis	Alzheimer's	Road injuries	Colorectal C	CMP	Stomach C
Moldova	IHD	Stroke	Cirrhosis	LRI	Self harm	Lung C	Road injuries	COPD	Colorectal C	Congenital
Russia	IHD	Stroke	CMP	Self harm	Cirrhosis	Lung C	Road injuries	LRI	Violence	Alcohol
Ukraine	IHD	Stroke	Cirrhosis	Self harm	HIV/AIDS	Lung C	Road injuries	Colorectal C	Alzheimer's	CMP
Latin America and Caribbean	IHD	Violence	Road injuries	Stroke	LRI	Congenital	Diabetes	Cirrhosis	NN preterm	CKD
Andean Latin America	LRI	Road injuries	IHD	Congenital	NN preterm	Stroke	F Body Asp	Cirrhosis	NN encephalitis	CKD
Bolivia	LRI	F Body Asp	Road injuries	NN preterm	IHD	Congenital	NN encephalitis	Stroke	Cirrhosis	NN sepsis
Ecuador	LRI	Road injuries	IHD	Congenital	Violence	Stroke	CKD	NN preterm	Self harm	Cirrhosis
Peru	LRI	IHD	Road injuries	Congenital	Stroke	NN preterm	Cirrhosis	F Body Asp	NN encephalitis	NN sepsis
Caribbean	IHD	Stroke	LRI	HIV/AIDS	Road injuries	Diarrhoea	Diabetes	NN preterm	Congenital	NN sepsis
Antigua and Barbuda	IHD	Stroke	Diabetes	LRI	Road injuries	HIV/AIDS	NN preterm	Violence	CKD	Congenital
Barbados	IHD	Diabetes	Stroke	LRI	CKD	Road injuries	Violence	HTN HD	Breast C	HIV/AIDS
Belize	IHD	Diabetes	Violence	Stroke	Road injuries	NN preterm	Congenital	LRI	HIV/AIDS	Self harm
Cuba	IHD	Stroke	Lung C	LRI	Self harm	COPD	Road injuries	Colorectal C	Alzheimer's	CKD
Dominica	IHD	Stroke	Diabetes	LRI	Road injuries	Violence	NN preterm	CKD	Congenital	HTN HD
Dominican Republic	IHD	Road injuries	Stroke	NN preterm	Congenital	LRI	Violence	NN sepsis	Diabetes	CKD
Grenada	IHD	Stroke	Diabetes	LRI	Road injuries	HIV/AIDS	Violence	CKD	Self harm	Congenital
Guyana	IHD	Stroke	HIV/AIDS	Diabetes	Road injuries	LRI	Congenital	Self harm	Violence	NN preterm
Haiti	HIV/AIDS	LRI	Diarrhoea	Stroke	PEM	NN sepsis	IHD	NN preterm	Congenital	NN encephalitis
Jamaica	Stroke	Diabetes	Violence	IHD	NN preterm	CKD	LRI	Congenital	HIV/AIDS	Alzheimer's
Saint Lucia	IHD	Stroke	Diabetes	LRI	Violence	Road injuries	HIV/AIDS	NN preterm	CKD	Congenital
VCT	IHD	Stroke	Diabetes	NN preterm	Violence	HIV/AIDS	LRI	Road injuries	Congenital	CKD
Suriname	IHD	Stroke	NN preterm	Congenital	Diabetes	LRI	Road injuries	HIV/AIDS	Self harm	CKD
The Bahamas	IHD	Stroke	Diabetes	HIV/AIDS	Violence	Road injuries	CKD	LRI	HTN HD	NN preterm
TTO	IHD	Diabetes	Stroke	Violence	Road injuries	HIV/AIDS	LRI	CKD	Congenital	Self harm
Central Latin America	Violence	IHD	Road injuries	CKD	Congenital	LRI	Diabetes	Cirrhosis	Stroke	NN preterm
Colombia	Violence	IHD	Road injuries	Stroke	Congenital	LRI	COPD	NN preterm	Diabetes	Self harm
Costa Rica	IHD	Road injuries	Congenital	CKD	Stroke	Cirrhosis	Violence	Self harm	Stomach C	COPD
El Salvador	Violence	IHD	Road injuries	CKD	LRI	Congenital	Alcohol	Cirrhosis	Diabetes	Stroke
Guatemala	LRI	Violence	Diarrhoea	NN preterm	IHD	PEM	Congenital	Cirrhosis	Diabetes	Road injuries
Honduras	IHD	Violence	Congenital	NN preterm	Stroke	COPD	Diarrhoea	LRI	Road injuries	Cirrhosis
Mexico	IHD	CKD	Diabetes	Cirrhosis	Violence	Road injuries	Congenital	LRI	Stroke	NN preterm
Nicaragua	Congenital	LRI	CKD	IHD	NN preterm	Road injuries	Stroke	Cirrhosis	Violence	Diabetes
Panama	IHD	Violence	Congenital	Road injuries	Stroke	LRI	CKD	Diabetes	NN preterm	HIV/AIDS
Venezuela	Violence	IHD	Road injuries	Stroke	Congenital	Diabetes	CKD	LRI	Self harm	NN preterm
Tropical Latin America	IHD	Violence	Stroke	Road injuries	LRI	Congenital	Diabetes	NN preterm	Cirrhosis	COPD
Brazil	IHD	Violence	Stroke	Road injuries	LRI	Congenital	Diabetes	Cirrhosis	NN preterm	COPD
Paraguay	IHD	Road injuries	Stroke	Congenital	NN preterm	LRI	Violence	Diabetes	CKD	NN encephalitis
Southeast and east Asia and Oceania	Stroke	IHD	Road injuries	COPD	Lung C	LRI	Liver C	Congenital	Cirrhosis	Stomach C
East Asia	Stroke	IHD	Road injuries	COPD	Lung C	Liver C	Stomach C	Congenital	LRI	Cirrhosis
China	Stroke	IHD	Road injuries	COPD	Lung C	Liver C	Stomach C	Congenital	LRI	Cirrhosis
North Korea	Stroke	IHD	Lung C	COPD	Road injuries	Liver C	Stomach C	Self harm	LRI	Congenital
Taiwan (province of China)	IHD	Stroke	Liver C	Lung C	Diabetes	Cirrhosis	Self harm	Road injuries	LRI	Colorectal C
Oceania	LRI	IHD	Diabetes	Diarrhoea	Congenital	Malaria	NN preterm	Stroke	Road injuries	Asthma
FSM	IHD	Diabetes	Stroke	LRI	Road injuries	Congenital	Asthma	Self harm	CKD	COPD
Fiji	IHD	Diabetes	Stroke	LRI	Congenital	NN preterm	CKD	Road injuries	Breast C	COPD
Kiribati	Stroke	Diabetes	IHD	LRI	Congenital	Road injuries	Diarrhoea	Asthma	Self harm	NN preterm
Marshall Islands	IHD	Diabetes	LRI	Stroke	Congenital	NN preterm	Road injuries	CKD	Diarrhoea	Self harm
PNG	LRI	IHD	Diarrhoea	Diabetes	Malaria	NN preterm	Congenital	Road injuries	HIV/AIDS	Asthma
Samoa	Diabetes	IHD	Stroke	LRI	Congenital	Road injuries	CKD	Violence	Asthma	Self harm

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Solomon Islands	IHD	Diabetes	Stroke	LRI	Diarrhoea	Congenital	NN preterm	Asthma	TB	Road injuries
Tonga	IHD	Diabetes	LRI	Stroke	NN preterm	Congenital	Road injuries	Lung C	Breast C	Meningitis
Vanuatu	IHD	LRI	Diabetes	Stroke	NN preterm	Congenital	Road injuries	Diarrhoea	Asthma	TB
Southeast Asia	Stroke	IHD	LRI	Road injuries	TB	NN preterm	Diabetes	Congenital	Cirrhosis	NN encephalitis
Cambodia	IHD	LRI	NN preterm	Stroke	Congenital	Road injuries	NN encephalitis	TB	Diarrhoea	Self harm
Indonesia	Stroke	IHD	LRI	TB	Road injuries	NN encephalitis	Diabetes	Diarrhoea	NN preterm	Cirrhosis
Laos	LRI	NN preterm	IHD	Stroke	Diarrhoea	Road injuries	Congenital	NN encephalitis	TB	Drowning
Malaysia	IHD	Road injuries	Stroke	LRI	Lung C	Congenital	COPD	Diabetes	HIV/AIDS	CKD
Maldives	IHD	Stroke	Congenital	NN encephalitis	NN preterm	Drowning	COPD	Road injuries	CKD	LRI
Myanmar	Stroke	LRI	Cirrhosis	TB	IHD	Malaria	NN preterm	Road injuries	Lung C	NN encephalitis
Philippines	IHD	LRI	Stroke	TB	NN preterm	Congenital	Diabetes	Violence	Road injuries	NN encephalitis
Sri Lanka	IHD	Self harm	Stroke	Diabetes	COPD	Road injuries	Cirrhosis	LRI	Congenital	Violence
Thailand	IHD	Road injuries	Stroke	LRI	Liver C	Cirrhosis	CKD	HIV/AIDS	Self harm	Diabetes
Timor-Leste	LRI	NN preterm	Congenital	Diarrhoea	IHD	Stroke	NN encephalitis	Road injuries	Drowning	Maternal
Vietnam	Stroke	Road injuries	LRI	Liver C	NN preterm	IHD	Drowning	Cirrhosis	Congenital	Lung C
South Asia	IHD	LRI	NN encephalitis	NN preterm	Diarrhoea	TB	Stroke	COPD	Road injuries	Self harm
Afghanistan	LRI	NN preterm	IHD	Diarrhoea	Congenital	Road injuries	Stroke	Meningitis	Maternal	TB
Bangladesh	Stroke	IHD	NN encephalitis	LRI	NN preterm	Drowning	NN sepsis	Cirrhosis	Self harm	Congenital
Bhutan	IHD	LRI	NN encephalitis	Stroke	NN preterm	Road injuries	Congenital	Cirrhosis	COPD	NN sepsis
India	IHD	LRI	TB	NN encephalitis	NN preterm	Diarrhoea	Stroke	COPD	Self harm	Road injuries
Nepal	LRI	IHD	NN encephalitis	Stroke	Diarrhoea	Self harm	TB	NN preterm	NN sepsis	COPD
Pakistan	LRI	NN encephalitis	Diarrhoea	IHD	NN preterm	NN sepsis	Stroke	Meningitis	Congenital	TB
North Africa and Middle East	IHD	NN preterm	Congenital	Stroke	Road injuries	LRI	Cirrhosis	COPD	Diabetes	Diarrhoea
Algeria	NN preterm	IHD	Stroke	Congenital	Road injuries	Diabetes	LRI	NN encephalitis	CKD	NN sepsis
Bahrain	IHD	Road injuries	Diabetes	Self harm	Congenital	Stroke	NN preterm	Drugs	CKD	Breast C
Egypt	IHD	Stroke	Cirrhosis	Congenital	LRI	COPD	Other cardio	NN preterm	CKD	Road injuries
Iran	IHD	NN preterm	Congenital	Road injuries	Stroke	LRI	Other cardio	HTN HD	COPD	Self harm
Iraq	NN preterm	IHD	Congenital	Stroke	LRI	CKD	Road injuries	Violence	Diabetes	Diarrhoea
Jordan	Congenital	IHD	NN preterm	LRI	Stroke	Road injuries	Drowning	Diabetes	CKD	NN encephalitis
Kuwait	IHD	Congenital	Road injuries	NN preterm	Stroke	LRI	CKD	HTN HD	Diabetes	Cirrhosis
Lebanon	IHD	Congenital	Stroke	Lung C	Road injuries	Diabetes	Breast C	NN preterm	COPD	CKD
Libya	IHD	Stroke	Congenital	Road injuries	NN preterm	Diabetes	LRI	CKD	COPD	Lung C
Morocco	NN preterm	IHD	Diabetes	Stroke	LRI	Road injuries	Congenital	NN encephalitis	Drugs	NN sepsis
Oman	Road injuries	IHD	Stroke	Diabetes	Congenital	LRI	Other cardio	NN preterm	Drowning	CKD
Palestine	Congenital	IHD	Stroke	LRI	NN preterm	Road injuries	CKD	Diabetes	Violence	Drugs
Qatar	Road injuries	Congenital	IHD	NN preterm	Self harm	Stroke	Diabetes	Falls	Oth mech	Drowning
Saudi Arabia	Road injuries	IHD	Congenital	NN preterm	Stroke	CKD	LRI	Falls	NN sepsis	Drugs
Sudan	NN preterm	IHD	Congenital	Diarrhoea	LRI	Stroke	Road injuries	Malaria	HIV/AIDS	Vis Leish
Syria	War	IHD	Stroke	Congenital	Road injuries	COPD	NN preterm	LRI	Endocrine	Typhoid
Tunisia	IHD	Road injuries	Stroke	Congenital	NN preterm	Lung C	LRI	COPD	Diabetes	CKD
Turkey	IHD	Stroke	Lung C	Congenital	COPD	Road injuries	NN preterm	Diabetes	LRI	Stomach C
UAE	Road injuries	IHD	Congenital	Stroke	Self harm	LRI	Drugs	NN preterm	Falls	Diabetes
Yemen	NN preterm	IHD	Diarrhoea	Congenital	LRI	Stroke	Malaria	Road injuries	Maternal	COPD
Sub-Saharan Africa	HIV/AIDS	Malaria	LRI	Diarrhoea	NN preterm	NN encephalitis	PEM	Congenital	NN sepsis	TB
Central sub-Saharan Africa	LRI	Diarrhoea	Malaria	PEM	HIV/AIDS	NN preterm	Congenital	TB	NN encephalitis	Meningitis
Angola	LRI	Diarrhoea	HIV/AIDS	Malaria	Congenital	PEM	NN preterm	NN encephalitis	TB	Road injuries
CAR	HIV/AIDS	LRI	Diarrhoea	Malaria	TB	NN preterm	PEM	NN encephalitis	Syphilis	Meningitis
Republic of Congo	HIV/AIDS	LRI	Malaria	Congenital	Stroke	NN preterm	Diarrhoea	Measles	NN encephalitis	TB
DR Congo	Diarrhoea	LRI	PEM	Malaria	NN preterm	HIV/AIDS	Congenital	TB	NN encephalitis	Meningitis
Equator Guinea	HIV/AIDS	LRI	Malaria	Congenital	Road injuries	Diarrhoea	Stroke	PEM	NN preterm	NN encephalitis
Gabon	HIV/AIDS	LRI	Malaria	Stroke	Road injuries	Congenital	NN encephalitis	TB	IHD	NN preterm
Eastern sub-Saharan Africa	HIV/AIDS	LRI	Malaria	Diarrhoea	TB	NN preterm	NN encephalitis	PEM	NN sepsis	Congenital
Burundi	Malaria	LRI	Diarrhoea	TB	HIV/AIDS	NN preterm	PEM	NN encephalitis	NN sepsis	Congenital
Comoros	LRI	TB	Diarrhoea	NN preterm	Malaria	NN encephalitis	NN sepsis	Stroke	Road injuries	Congenital
Djibouti	HIV/AIDS	LRI	Malaria	Diarrhoea	TB	Stroke	NN encephalitis	PEM	NN preterm	Congenital
Eritrea	Diarrhoea	LRI	TB	HIV/AIDS	Malaria	NN preterm	PEM	Maternal	NN encephalitis	NN sepsis
Ethiopia	LRI	Diarrhoea	HIV/AIDS	TB	NN preterm	NN encephalitis	Malaria	NN sepsis	Congenital	Stroke
Kenya	HIV/AIDS	LRI	Diarrhoea	TB	NN preterm	NN encephalitis	Malaria	Congenital	NN sepsis	PEM
Madagascar	LRI	Diarrhoea	Stroke	NN preterm	PEM	Syphilis	Malaria	NN sepsis	Congenital	Meningitis
Malawi	HIV/AIDS	LRI	Diarrhoea	PEM	TB	NN preterm	Malaria	Congenital	NN encephalitis	Meningitis
Mauritius	Diabetes	IHD	Stroke	CKD	Cirrhosis	LRI	Road injuries	Self harm	HTN HD	Congenital
Mozambique	HIV/AIDS	Malaria	LRI	Diarrhoea	TB	NN sepsis	NN encephalitis	Syphilis	NN preterm	Road injuries

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Rwanda	LRI	HIV/AIDS	Malaria	Diarrhoea	NN preterm	NN encephalitis	NN sepsis	TB	Road injuries	PEM
Seychelles	IHD	Stroke	LRI	HTN HD	Cirrhosis	Drowning	Road injuries	Self harm	Congenital	CKD
Somalia	Diarrhoea	LRI	Malaria	TB	PEM	NN preterm	Meningitis	NN encephalitis	Tetanus	NN sepsis
South Sudan	LRI	Diarrhoea	HIV/AIDS	TB	PEM	Syphilis	Meningitis	Maternal	Malaria	NN preterm
Tanzania	HIV/AIDS	LRI	Malaria	Diarrhoea	TB	Congenital	PEM	NN encephalitis	Syphilis	NN sepsis
Uganda	HIV/AIDS	Malaria	LRI	Diarrhoea	NN preterm	NN encephalitis	NN sepsis	TB	PEM	Road injuries
Zambia	HIV/AIDS	Malaria	LRI	Diarrhoea	PEM	TB	NN encephalitis	NN sepsis	Congenital	Meningitis
Southern sub-Saharan Africa	HIV/AIDS	LRI	Diarrhoea	TB	Violence	Stroke	NN preterm	Road injuries	IHD	NN encephalitis
Botswana	HIV/AIDS	TB	LRI	Diarrhoea	Road injuries	Self harm	NN preterm	NN encephalitis	Maternal	Violence
Lesotho	HIV/AIDS	TB	Diarrhoea	LRI	NN preterm	Violence	NN encephalitis	Self harm	Stroke	Road injuries
Namibia	HIV/AIDS	TB	LRI	Diarrhoea	Stroke	Self harm	Road injuries	NN preterm	IHD	Violence
South Africa	HIV/AIDS	LRI	TB	Diarrhoea	Violence	Stroke	Road injuries	IHD	Diabetes	NN preterm
Swaziland	HIV/AIDS	LRI	Diarrhoea	TB	Road injuries	NN preterm	Self harm	Violence	Stroke	NN encephalitis
Zimbabwe	HIV/AIDS	LRI	Diarrhoea	TB	NN preterm	NN encephalitis	Stroke	PEM	Malaria	Meningitis
Western sub-Saharan Africa	Malaria	LRI	HIV/AIDS	Diarrhoea	NN preterm	NN encephalitis	Sickle	Road injuries	PEM	NN sepsis
Benin	Malaria	LRI	HIV/AIDS	Diarrhoea	NN preterm	NN encephalitis	Congenital	NN sepsis	Road injuries	PEM
Burkina Faso	Malaria	LRI	Diarrhoea	NN preterm	Congenital	Meningitis	NN encephalitis	NN sepsis	Road injuries	HIV/AIDS
Cameroon	HIV/AIDS	LRI	Malaria	Diarrhoea	Road injuries	NN preterm	NN encephalitis	Congenital	PEM	NN sepsis
Cape Verde	Stroke	IHD	Congenital	LRI	Stomach C	NN encephalitis	Liver C	Violence	COPD	NN preterm
Chad	Diarrhoea	LRI	Malaria	HIV/AIDS	PEM	NN preterm	NN encephalitis	Meningitis	Tetanus	Congenital
Côte d'Ivoire	LRI	HIV/AIDS	Malaria	Diarrhoea	NN preterm	NN encephalitis	NN sepsis	Road injuries	Congenital	PEM
Ghana	Malaria	LRI	HIV/AIDS	NN sepsis	NN preterm	PEM	NN encephalitis	Stroke	Road injuries	Congenital
Guinea	Malaria	LRI	Diarrhoea	HIV/AIDS	NN preterm	NN encephalitis	PEM	NN sepsis	Meningitis	Congenital
Guinea-Bissau	Malaria	HIV/AIDS	LRI	Diarrhoea	NN preterm	PEM	NN encephalitis	Meningitis	Road injuries	NN sepsis
Liberia	Malaria	LRI	Diarrhoea	HIV/AIDS	NN preterm	NN encephalitis	NN sepsis	PEM	Congenital	Stroke
Mali	Malaria	Diarrhoea	LRI	PEM	NN preterm	NN encephalitis	NN sepsis	Meningitis	Congenital	HIV/AIDS
Mauritania	LRI	Malaria	Diarrhoea	NN encephalitis	NN preterm	Road injuries	NN sepsis	Congenital	Stroke	Maternal
Niger	Malaria	Diarrhoea	LRI	PEM	NN preterm	Meningitis	NN encephalitis	Congenital	NN sepsis	TB
Nigeria	Malaria	LRI	HIV/AIDS	Sickle	Road injuries	NN preterm	NN encephalitis	Diarrhoea	PEM	NN sepsis
São Tomé and Príncipe	LRI	Malaria	Stroke	NN preterm	NN encephalitis	NN sepsis	Congenital	PEM	Diarrhoea	IHD
Senegal	Malaria	LRI	Diarrhoea	NN preterm	NN encephalitis	NN sepsis	HIV/AIDS	Congenital	Road injuries	PEM
Sierra Leone	Malaria	LRI	HIV/AIDS	PEM	NN preterm	Diarrhoea	NN encephalitis	Congenital	NN sepsis	Meningitis
The Gambia	Malaria	LRI	Diarrhoea	Congenital	NN preterm	HIV/AIDS	NN sepsis	NN encephalitis	Road injuries	PEM
Togo	Malaria	LRI	HIV/AIDS	Diarrhoea	NN preterm	NN encephalitis	Congenital	PEM	NN sepsis	Road injuries

Figure 12: **Top ten causes in 2013 of years of life lost by location**

The top 15 global causes of years of life lost are coloured. VCT=Saint Vincent and the Grenadines. TTO=Trinidad and Tobago. FSM=Federated States of Micronesia. PNG=Papua New Guinea. UAE=United Arab Emirates. CAR=Central African Republic. STP=São Tomé and Príncipe. IHD=ischaemic heart disease. LRI=lower respiratory infections. Road inj=road injuries. NN Preterm=preterm birth complications. NN enceph=neonatal encephalitis. Congenital=congenital disorders. C=cancer. COPD=chronic obstructive pulmonary disease. CKD=chronic kidney disease. CMP=cardiomyopathies. Other cardio=other cardiovascular disease. Drugs=drug use disorders. Alcohol=alcohol use disorders. Violence=interpersonal violence. HTN HD=hypertensive heart disease. F body asp=pulmonary aspiration and foreign body in airway. NN sepsis=neonatal sepsis. PEM=protein–energy malnutrition. TB=tuberculosis. Vis leish=visceral leishmaniasis. Other mech=other mechanical forces. Endocrine=endocrine, metabolic, blood, and immune disorders. Maternal=maternal disorders. Sickle=sickle cell disorders.

cause of YLLs in South Korea, Alzheimer's disease and other dementias as the third highest cause in Canada, Finland, and Israel, and lower respiratory infections as the second cause in Singapore and the third highest cause in Argentina and Japan. Cirrhosis was the third highest cause in Chile. Colorectal cancer was a top five cause in 13 high-income countries and diabetes was in three high-income countries.

In central Europe, eastern Europe, and central Asia, ischaemic heart disease and stroke dominated but in Bosnia and Herzegovina, Serbia, Latvia, and Russia cardiomyopathies were also in the top five. As a result of higher child mortality in these regions, Azerbaijan, Kyrgyzstan, Mongolia, Tajikistan, Turkmenistan, and Uzbekistan had preterm, or neonatal encephalopathy, in the top five causes. In eastern Europe, five causes (ischaemic heart disease, stroke, self-harm, cirrhosis, and road injury) made up 49·7% of YLLs (95% UI 48·5–51·3; or 29·3 million [28·5–30·2]). In Latin America and Caribbean, more variation exists in the leading cause of YLLs. Lower respiratory infections were the leading cause in Bolivia, Peru, Guatemala, and Ecuador; HIV/AIDS was in Haiti; interpersonal violence was in Colombia, El Salvador, and Venezuela; stroke was in Jamaica; congenital anomalies were in Nicaragua, and ischaemic heart disease was in the rest. Road injury was in the top five for 17 of 29 countries. Diabetes was also in the top five for 13 countries. Chronic kidney disease was in the top five for Barbados, Costa Rica, El Salvador, Mexico, and Nicaragua. Perhaps most unusually, interpersonal violence was in the top five causes in 15 countries in the region, but only one country outside Latin America and Caribbean, namely South Africa.

In east Asia, the top five causes of YLLs, in order, were stroke, ischaemic heart disease, road injury, chronic obstructive pulmonary disorder, and lung cancer. These are

almost the same top five causes as in USA: the only difference is Alzheimer's disease and other dementias, which was fourth and road injury was sixth, providing evidence of epidemiological convergence between east Asian countries and some high-income countries. In Oceania, ischaemic heart disease, lower respiratory infections, diabetes, and diarrhoea were important. In Papua New Guinea, malaria was also a top five cause. Southeast Asia as a whole, Indonesia, Myanmar, and Philippines have tuberculosis as a top five cause of YLLs. Road injury was a top five cause in Indonesia, Malaysia, Thailand, and Vietnam. Cirrhosis was in the top five in Myanmar and liver cancer in Thailand and Vietnam. Among the countries of south Asia, the leading causes are a mix of neonatal causes and ischaemic heart disease, lower respiratory infections, and stroke in most countries. Tuberculosis was the third highest cause in India.

In north Africa and Middle East, ischaemic heart disease and stroke, preterm birth complications, congenital anomalies, and road injury were prominent leading causes of YLLs. In four countries—Oman, Qatar, Saudi Arabia, and United Arab Emirates—road injury was the leading cause of YLLs. Cirrhosis was the third highest cause of YLLs in Egypt. Self-harm was in the top five in Bahrain, Qatar, and United Arab Emirates. The profile of leading causes of YLLs in sub-Saharan Africa was greatly different from the rest of the world with the exception of Cape Verde, Mauritius, and Seychelles. HIV/AIDS was the leading cause in 18 countries. Malaria was the leading cause in 14 countries. Lower respiratory infection was the leading cause in Angola, Comoros, Ethiopia, Madagascar, Rwanda, South Sudan, Côte d'Ivoire, Mauritania, and São Tomé and Princípe. Diarrhoea was the leading cause in D R Congo, Eritrea, Somalia, and Chad. Tuberculosis was in the top five causes in 18 countries. Violence was the fifth highest cause in South Africa. Road injury was the fifth highest cause in Equatorial Guinea, Gabon, Botswana, Swaziland, Cameroon, and Nigeria.

Discussion

Main findings

The GBD 2013 incorporates many new datasets for cause of death, particularly from China, and new data for 155 other countries. Compared with the GBD 2010, it provides the most comprehensive and up-to-date assessment of causes of death. The results for the GBD 2013 are based on re-estimation of all causes from 1990 to 2013, and thus supersede all previously published GBD time series (panel). Publication of country-level results provides many opportunities for comparing a country's performance with that of its peers.

On the broadest level, our analysis of 240 causes of death for 188 countries confirms that global life expectancy at birth has continued to improve over the past 23 years and these improvements are driven largely by falls in diarrhoea, lower respiratory infections, and neonatal causes in low-income countries, and decreases in cardiovascular diseases and some cancers in middle-income and high-income countries. HIV/AIDS has had a large enough effect to negate progress made in other causes contributing to decreases in life expectancy, particularly in southern sub-Saharan Africa.

This general progress masks enormous heterogeneity across countries and age groups. Even within regions, substantially different mortality, leading causes of death, and trends exist. Outside sub-Saharan Africa, premature mortality is dominated by relatively few causes including ischaemic heart disease, stroke, lower respiratory infections, road injury, diarrhoea, preterm birth complications, neonatal encephalopathy, congenital anomalies, tuberculosis, chronic obstructive pulmonary disease, cirrhosis, self-harm, and lung cancer. In addition to these common causes, great regional and country variation exists, such as the dominant role of interpersonal violence in most countries of central Latin America and Brazil.

Our study points to extraordinary epidemiological progress: global age-standardised death rates fell significantly for 157 of 240 causes from 1990 to 2013. The largest decreases were for some of the major communicable diseases including diarrhoeal diseases, lower respiratory infections, tuberculosis, and measles. Age-standardised rates for many non-communicable causes are also falling. At the same time, numbers of deaths from 115 of these 240 causes, have increased, driven by both growth in population and shifts in the population age-structure towards older ages. For a further 58 causes, changes in the age-standardised death rate over the 23 year period were not statistically different from no change. For some of these causes, sparse data might have contributed to wide UIs and in other cases uncertainty might have arisen from inconsistent coding across countries. However, eight specific causes account for more than 100 000 deaths and their age-standardised death rates have increased significantly since 1990: HIV/AIDS, liver cancer caused by hepatitis C, pancreatic cancer, atrial fibrillation and flutter, drug use disorders, diabetes, chronic kidney disease, and sickle cell disorders. Of these causes, three (HIV/AIDS, diabetes, and chronic kidney disease) account for more than a half a million deaths each. HIV/AIDS, however, has been decreasing as a cause of death since 2005. These causes, which run counter to an extraordinary global trend towards lower age-standardised death rates, deserve special attention.

The rise and subsequent fall of HIV/AIDS is well known as is the rise in diabetes. Increases for atrial fibrillation and flutter, pancreatic cancer, drug use disorders, and chronic kidney disease have received far less global attention. Drug use disorders and chronic kidney diseases cause many more deaths in some regions and countries than in others. Nevertheless, they are important emerging global

challenges that show the potential adverse effects of some behaviours and socioeconomic developments. In view of the important behavioural component for some of these causes, there is potentially an important role for public health policy and resources to modify these causes of death. These diseases, particularly HIV/AIDS and drug use disorders are also subject to social stigmatisation, which adds an important challenge for effective policy interventions. Although global age-standardised death rates have increased for very few causes, there is remarkable and important variation in trends across countries such that causes with falling global age-standardised rates are increasing in some countries—for example, ischaemic heart disease in China.

Convergence or divergence?

Ambitious goals have been set for maternal and child mortality,[84–86] such as the end of preventable maternal and child death in a generation. *The Lancet* Commission *Global health 2035: a world converging within a generation* has argued that a grand convergence in health is possible between high-income, middle-income, and low-income countries.[24] Trends in the past 23 years provide an important starting point for framing how great a challenge achieving these aspirations will be and the political will and financial resources required. Part of the answer depends on how the goals are framed—for example, what does convergence mean? In the development literature on economic convergence,[87–89] convergence has been framed in terms of poverty rates or in terms of income inequality measured by the Gini coefficient or other measures of inequality. Work on convergence in life expectancy has tended to focus on measures of absolute difference[90–92] rather than relative difference.[93] We found unequivocal divergence in mortality rates for women aged 25–39 years and older than 80 years and for men aged 20–44 years and 65 years and older, similar to previous estimates of divergence of life expectancy at birth since the 1980s.[94] In these age groups, both the Gini coefficient and the mean absolute difference in death rates are rising. In all other age groups, except girls aged 10–14 years, relative inequality is increasing but the absolute gap is narrowing. Framing a grand convergence as simply achieving a reduction in the differences in mortality rates across countries might not be sufficiently ambitious to meet the goals of many national policy makers. If mortality decreases in all countries by the same percent per year, absolute difference will decrease and relative differences will stay constant. For age groups in which global relative and absolute differences in death rates are diverging, extraordinary efforts will be needed to achieve laudable goals such as a grand convergence. If convergence includes reducing the ratio of the highest to lowest death rates, even for under-5 mortality, major new efforts will be needed to have faster percent decreases in countries with higher mortality.

***Panel:* Research in context**

Systematic review

The GBD 2013 assessment of causes of death is a major improvement in the evidence base compared with GBD 2010 through the inclusion of new data from vital registration systems, verbal autopsy studies, maternal mortality surveillance, injury surveillance and other sources. Through the inclusion of sub-national data on China, Mexico, and UK the evidence base for causes of death has been greatly expanded. Redistribution algorithms for ill-defined causes of death used to enhance the comparability of data were based on new statistical models. GBD 2013 also benefits from several improvements in the methods used to estimate all-cause mortality and specific causes of death such as HIV/AIDS. GBD 2013 provides a more up-to-date and comprehensive assessment of causes of death than do other studies of cause of death in particular age groups (CHERG), for particular causes (GLOBOCAN),[83] and previous GBD analyses (GBD 2010).[2–8]

Interpretation

This study provides a comprehensive description of mortality levels and patterns worldwide, and provides the evidence to assess progress of global development goals, including control of non-communicable diseases, and priorities for further global health and development debates. Because the study provides a complete re-analysis of trends for each cause from 1990 to 2013, it supersedes the results of the GBD 2010 study. This is the first time that country-specific results for all 188 countries with populations of more than 50 000 people have been comprehensively published. Country-specific data provide the opportunity to examine the extent to which epidemiological convergence is occurring across countries.

For **CHERG estimates** see http://cherg.org/main.html

Arguments that convergence is technically and financially feasible are grounded on the rapid improvements of some countries.[24] For example, from 1990 to 2013, 13 countries (all low-income), achieved increases in life expectancy greater than 10 years (appendix pp 141–151). The real challenge is whether the strategies to decrease mortality used by these countries are generalisable or transferable to those countries who are making the least progress. *The Lancet* Commission on global health 2035 drew attention to the four Cs (Cuba, Costa Rica, Chile, and China). Life expectancy has improved faster than the global aggregate trend in China and Chile in the past 23 years.

The good news is that some countries that were low-income in 1990 have achieved remarkable progress in the past 23 years—for example, in Nepal, life expectancy has increased by 12·16 years since 1990, reaching 70·64 years in 2013 for both sexes combined (appendix pp 141–151). Other examples of improvements greater than 12 years for both sexes combined include Rwanda, Ethiopia, Niger, Maldives, Timor-Leste, and Iran. Because

the Rwandan genocide occurred after 1990, the progress from the peak of mortality during the genocide until 2013 is even larger, 49·63 years. Studies have already assessed progress in Bangladesh, Ethiopia, and Niger, particularly in reducing child mortality.[95] Further study of these countries might provide insights about how to achieve low mortality, including the role of development assistance for health, rapid economic growth, and addressing chronic challenges such as famines. Simple assessments built up from individual technology analyses, such as the Disease Control Priorities-2,[96] assume a high-level of health system efficiency and contextual factors that enable technology to be delivered such as levels of maternal education. Plans to achieve a grand convergence in the face of diverging mortality will need to take into account low levels of health system efficiency and low levels of health system resourcing in some countries and the greater efforts needed to achieve high intervention coverage in low-income countries with inadequate primary health-care systems and low levels of educational attainment. The challenge of improving health system management, particularly locally, is a crucial component of the future plans.

The analysis of average relative difference between countries and average absolute difference between countries by cause (data not shown) shows the general pattern that many communicable, maternal, and neonatal causes, along with war and natural disasters, are highly unequal across countries; almost all have average relative differences of more than 50%. Among the non-communicable disease categories, mental and substance use disorders is the only cause with a mean relative difference greater than 40%. Following the more stringent criteria for convergence—in which global rates and the Gini coefficient are both falling—only neoplasms and chronic respiratory diseases are converging. As more countries go through the epidemiological transition, it seems likely that cross-country inequalities or relative differences for communicable causes will rise and inequalities for non-communicable causes will narrow. Narrowing inequalities across countries will not necessarily narrow inequalities for non-communicable disease within countries. Because mortality exponentially rises with age, at least after age 50 years, relative differences at older ages, when mortality becomes concentrated, tend to be small. Causes such as diabetes, chronic kidney disease, and alcohol and drug use disorders—for which global death rates are rising and inequality is increasing—are exceptions to this general pattern.

Non-communicable diseases

For the **age-standardised death rates by cause for each country** see http://vizhub.healthdata.org/cod

Age-standardised death rates for cardiovascular and circulatory diseases have fallen in high-income and many middle-income countries since 1990. Rapid falls have occurred in some countries. For example, five countries (Israel, Denmark, Norway, South Korea, and UK), had at least a 65% decrease in age-standardised death rates for ischaemic heart disease. Many other countries have had decreases of 40–65%. Age-adjusted death rates caused by haemorrhagic stroke fell by three-quarters in South Korea.

The ageing and growth of populations has led to an increase in the total number of cardiovascular deaths, accounting for almost a third of all deaths globally in 2013. Ischaemic heart disease, ischaemic stroke, and haemorrhagic stroke continue to cause most cardiovascular and circulatory deaths in almost all countries. Some Balkan countries are an exception; cardiomyopathy was a leading cause of death, possibly as a result of alcohol exposure or local patterns of garbage codes.[97] Additional studies are needed to establish whether this finding is driven by medical certification practices or is related to alcohol or some other factor.[97] Age-standardised death rates for atrial fibrillation and flutter and peripheral vascular disease have increased, possibly because of increased awareness of these conditions or better survival from cardiovascular diseases that share the same risk factors. Much uncertainty remains for trends in mortality caused by rheumatic heart disease, partly because endemic populations are concentrated within poorer subnational regions where data collection is limited and rheumatic heart disease might not always be coded as the underlying cause of death.[98] Efforts to benchmark changes in cardiovascular and circulatory diseases will benefit from increasing access to verbal autopsy in India and sub-Saharan Africa, household surveys focused on chronic diseases, and improvements in electronic health records.

Generally, cancer deaths are increasing but age-standardised cancer death rates are falling. Some cancer-related risk factors, such as tobacco consumption, have decreased, but others, such as obesity, have increased. The substantial general fall in cancers require further explanation. Death rates for five cancers increased (non-Hodgkin lymphoma, mesothelioma, kidney cancer, pancreatic cancer, and multiple myeloma); some explanations, such as the potential link between the rise of diabetes and pancreatic cancer might account for some of these reversals. Because of different rates of decrease for other sites, the mix of cancers is steadily changing, particularly in low-income regions, such as the relative importance of breast cancer compared with cervical cancer. These local changes have important implications for the development of cancer care programmes and training. Because of the strong relation between cancer mortality and age, ageing of the world's population is the most important driver of the rising number of cancer deaths in most countries. Most countries can expect to have to deal with more patients who need diagnosis, treatment, and palliation in coming years.

Alzheimer's disease and other dementias

We used a substantially different approach to estimate Alzheimer's disease and other dementia mortality in the GBD 2013 by focusing on studies of prevalence and

using data from countries with the highest death to prevalence ratios in 2013 to estimate mortality in other regions and back in time. This change greatly lowers the increase compared with GBD 2010 in the age-standardised death rate for dementia although the numbers of dementia deaths nevertheless increased. Lower increases in the age-standardised rate were because the meta-regression of prevalence studies did not show a rapidly rising trend; one study, reported decreases in age-specific rates, although our overall assessment suggests a slight increase in age-specific rates.[99] Even in high-income countries with complete medical certification of causes of death, we argue that dementia was systematically underestimated as a cause of death in earlier periods. Other studies, such as the National Mortality Followback Study in USA, support this idea.[100] Dementia deaths might have been misclassified into categories such as senility. Our garbage code redistribution algorithms for this broad category might have under-allocated dementia deaths in earlier periods. For future research, we may want to more carefully trace to which garbage codes dementia deaths might have been assigned using hospital linkage or other approaches.

The other effect of using this approach is that we estimated considerably more dementia deaths in middle-income countries than in the GBD 2010. Prevalence studies suggest dementia occurs in these countries although it is rarely recorded on a death certificate as a cause of death. Our overall conclusion is that dementia is more common worldwide and that numbers are increasing because of population ageing with only a small component of the increase caused by rising age-specific rates. The analysis of dementia will benefit from further population-based prevalence surveys, especially with repeated measurement over time using standardised definitions and methods. As further studies of this type become available and incorporated into the GBD, our estimates of dementia burden might be substantially revised. Trends in the category Alzheimer's disease and other dementias might mask upward trends in Alzheimer's and downward trends in vascular dementia; however, these disorders are difficult to tell apart in population-based prevalence studies and cause of death data. Nevertheless, our finding that the number of dementia deaths is increasing implies that governments should remain concerned about the rising demands for care that will come with population ageing even if future rates do not increase substantially.

Diarrhoea and lower respiratory infections

We report that the distribution of the causes of diarrhoea is different around the world. The distribution of pathogens has also changed significantly since 1990—for example, almost 50% (20 343 [9054–41 216] deaths) of all cholera deaths in children occur in sub-Saharan Africa. Because we used GEMS data to estimate relative risks, it is perhaps not surprising that our results are comparable to their findings.[57] The population attributable fraction for pathogens such as *Campylobacter*, *Shigella*, and *Salmonella* were not significant in some countries and some ages. Because of the nature of case notification data, we had to estimate all types of cholera and were unable to breakdown cholera into O1, non-O1, and O-139.

In high-income countries, *C difficile* is an important threat that has increased during the past two decades. 65% (744 413 deaths) of unexplained diarrhoea in people older than 5 years is an important knowledge gap. Although the new counterfactual approach is successful for estimating attributable death empirically and adjusts for the overall pathogen load in the country, it still suffers from limitations such as the potential low sensitivity of diagnostic tests. Some pathogens are more prevalent in controls than in cases, which might present a distorted causal picture because of continuous shedding of pathogen long after the acute phase.[101–105] These findings could also suggest a protective effect of infection from one or more pathogens against other pathogens or could be simply caused by a differential decrease in the sensitivity of diagnostic tests (for other pathogens) where diarrhoea presents assuming a single pathogen caused the diarrhoea. More sensitive diagnostic tests help to improve sensitivity but at the price of decreased specificity because of contamination and post-diarrhoea pathogen excretion. Follow-up studies with multiple measurements of pathogens in children during healthy and diarrhoea periods could help to elucidate the true causal associations. Better case definition and more strict criteria for pathogens such as excluding recent cases of diarrhoea could decrease exposure misclassifications.

Our estimates of the fraction of under-5 lower respiratory infection deaths attributable to the four causes of pneumonia (pneumococcus, *H influenzae* B, respiratory syncytial virus, and influenza) are much the same as previous estimates, with pneumococcus and *H influenzae* B the predominant causes.[63,64,106–108] The large fraction of lower respiratory infection attributable to pneumococcus and *H influenzae* B, particularly in low-income regions where the absolute burden is highest, shows the potential benefit of continuing to scale up pneumococcal conjugate and *H influenzae* B vaccination. We calculated the contribution of each cause with a counterfactual approach. This approach means that they do not add up to 100% but also that there might be overlap; for example, death from lower respiratory infection might involve viral and bacterial co-infection. These results should also be interpreted with caution because of the data used to generate these estimates. Data for cause are sparse and prone to several biases, which is shown in the large UIs.

Estimates of the mortality burden of pneumococcal pneumonia in children rely on data from vaccine probe studies, which showed that disease in infants fell after

pneumococcal conjugate vaccination; there are no sensitive diagnostic tests to detect non-bacteraemic pneumococcal pneumonia in children. To calculate burden in the absence of a diagnostic assay, the pneumococcal conjugate vaccination probe studies assumed a vaccine efficacy against non-bacteraemic pneumonia caused by vaccine types equal to that of protection from vaccine type bacteraemia (75%). Data from a large randomised trial of pneumococcal conjugate vaccination in adults confirmed efficacy against bacteraemic pneumonia of 75%, but efficacy against non-bacteraemic pneumonia was only 45%.[109] If similar efficacy estimates are applied to infants, then the contribution of the pneumococcus to pneumonia mortality in infants could be as high as 63% (166 324 deaths). Because data were sparse, we did not estimate the fraction of deaths caused by *H influenzae* B among people aged 5 years and older. The before-and-after vaccine efficacy studies used to estimate the burden of pneumococcus were limited to high-income settings. These types of studies might also be biased because of underlying temporal trends in hospital admissions for lower respiratory infection. Furthermore, the only variation included for pneumococcus and *H influenzae* B is a result of differences in vaccination coverage.

The observational studies used for respiratory syncytial virus and influenza were based on case series data from predominantly tertiary-level hospitals, which might not be representative of the underlying population and are prone to varying case-definitions and diagnostic methods. Finally, hospital discharge data for the relative differences in case-fatality for respiratory syncytial virus and influenza compared with pneumococcus and *H influenzae* B were limited to high-income and middle-income countries. Several of these shortcomings are being addressed by the Pneumonia Etiological Research for Child Health project.[110]

Injuries

Most global road traffic deaths occur in low-income and middle-income countries and are rapidly increasing because of the growth in motorisation. Mortality rates caused by traffic-related injuries are increasing in low-income and middle-income countries. Pedestrians are most often affected, followed by car occupants and motorcyclists. Conversely, traffic deaths are decreasing in high-income countries. We noted a similar divergence between low-income and high-income countries for occupational injuries: they generally fell in high-income countries (with the exception of deaths resulting from asbestos-related mesotheliomas), whereas occupational injury deaths have increased in low-income countries (data not shown).

Suicide continues to be a major public health problem in many regions. Half of all suicide deaths occur in China and India alone. However, the trends are in opposite directions, decreasing rapidly in China but rising in India between 1990 and 2013. Both countries have undergone economic growth and urbanisation, a key factor in limiting access to lethal pesticides, a common method of suicide by poisoning in both countries.[111] Therefore, as yet unexplained reasons must exist for the divergence between the two countries.

We recorded several sharp increases in mortality caused by war and disaster. Particularly, the 2010 Haiti earthquake, conflict in Syria over the past several years, the 2011 Tōhoku earthquake and tsunami in Japan, and conflict in Libya in 2011 have caused considerable loss of life. The war in Syria led to an estimated 29 947 deaths (19 392–54 903) in 2013, and about 10 504 deaths and 21 422 deaths in each of the preceding 2 years. Uncertainty around these estimates is large because several different estimates exist. These estimates are of the direct deaths attributable to armed conflicts and natural disasters and do not account for the full effects of mechanisms such as the breakdown of health systems or critical infrastructure. For example, the conflict in Syria has had a substantial effect on routine immunisation for polio, with coverage now as low as 50% in some areas.[112] The estimation of direct deaths caused by war and natural disasters is one of the most challenging components of the GBD measurement. We depend on the work of various groups to collate combatant reports, newspaper reports, humanitarian agency assessments, and other direct accounts to approximate the number of deaths. Vital registration systems often do not function in war or conflict but might be more useful in countries with natural disasters as a way of measuring the number of deaths. More work is needed to better measure shock mortality.

India

India accounts for 19% of the world's deaths in 2013. Estimations of cause of death for India are important both for health policy in India and for global understanding of causes of death. India has had remarkable progress in reducing both child and adult mortality over the past 23 years. Average yearly rates of decline were 1·3% per year for adults and 3·7% for children.

Unfortunately, less cause of death data were available for 2013 than for 1990 or 2000. The Medical Certification of Causes of Death system provided ongoing information about patterns of urban mortality with better completeness in some states than in others. In rural areas, the Survey of Causes of Death (Rural) routinely reported causes of death from verbal autopsy from 1980 to 1998. This survey was replaced with a verbal autopsy sample collected by the Registrar-General of India based on the ongoing Sample Registration Scheme. Data for 2002–04 have been reported but not in full detail—results were released in a series of articles spanning 2008–14 but even these have not provided the standard tabulation of deaths by International Classification of Diseases cause, age, and sex used by most countries. Verbal autopsies were collected after 2004 but no data have been analysed or released. Attempts to

add verbal autopsy to other major data collection efforts of the Government of India, such as the Annual Health Survey and the latest round of the District Level Household Survey, have so far been unsuccessful. Small community studies continue to be published but there is a major gap in knowledge of rural cause of death.

In view of the rapid change in India, including decreases in child mortality and adult mortality, simple predictions based on the 2002–04 data are inadequate. Our modelling strategy takes into account trends for key covariates that explain some changes in age-specific rates for many causes; nevertheless, more recent national data would be helpful to develop more precise estimates of causes of death for India. Epidemics such as Chikungunya, dengue, and H1N1 influenza also point to the need for better ongoing surveillance of causes of death in India that does not suffer from long time lags.[113–116]

Comparing different global health estimates

Comparison of the GBD 2013 results with GBD 2010 for 1990 or 2010 shows some important differences. The overall correlation coefficient of age-sex-country-cause rates was 0·998 in both 1990 and 2010 but some causes have changed substantially at the global level. The ten causes in terms of the largest change in the number of global deaths were Alzheimer's disease and other dementias, ischaemic heart disease, interstitial lung disease and pulmonary sarcoidosis, cerebrovascular disease, neonatal encephalopathy caused by birth asphyxia and trauma, lower respiratory infections, other cardiovascular and circulatory diseases, cirrhosis, malaria, and chronic kidney disease. These changes might be because of new data, modifications of garbage coding algorithms, and revised modelling strategies (appendix). Generally, the data used has substantially increased: from 8967 site-years to 14 244 site-years.

Some specific changes are worth noting. First, data for China has greatly increased. Given China's population, the incorporation of large amounts of new data for cause of death led to large changes in China and these affected even global estimates. The five largest changes for China in 2013 compared with the GBD 2010 were ischaemic heart disease, Alzheimer's disease and other dementias, cerebrovascular disease, interstitial lung disease and pulmonary sarcoidosis, and chronic obstructive pulmonary disease. Second, more detailed cause of death data covering 189 causes instead of 98 causes were available for Russia for the GBD 2013. This affected several smaller causes, such as those related to alcohol. Third, we included new vital registration data for Turkey for 2010–12. Fourth, we modelled India in two components, urban and rural, which enabled us to make much more use of some data sources such as the Survey of Causes of Death (Rural) for rural India. Because India is large, these changes have a global effect. Fifth, for cancers, we incorporated 1145 registry-years of new data, including 128 from the Cancer Incidence in Five Continents Volume X.[48] Sixth, the change to use of a Bayesian noise reduction algorithm for smoothing has reduced the number of outliers, particularly in small verbal autopsy studies, some of which were included in the GBD 2010. Seventh, changes to garbage code redistribution algorithms, particularly the use of statistically derived algorithms that vary by region and country, has had effects on injuries, cancers, and cardiovascular diseases. Other changes included treating unspecified anaemia as a garbage code whereas in the GBD 2010 it was mapped to iron-deficiency anaemia, moving abdominal hernia from other digestive diseases to hernia, as well as moving deaths related to specific procedures to the category of adverse effects of medical treatment. In the GBD 2010, we included abdominal hernia, including umbilical hernia, ventral hernia, and diaphragmatic hernia in the category "other digestive diseases". In the GBD 2013, we combined these with inguinal hernia and femoral hernia into one cause named "hernia". Additionally, we moved some ill-defined causes from the other digestive diseases category to more specific causes, thereby reducing the number of deaths in other digestive and changing the distribution of all digestive deaths among its more disaggregated causes. Seventh, the assessment of all-cause mortality in the GBD 2013 benefited from both new data and improved approaches for assessment of the age pattern of mortality in the model life-table system. Finally, the more detailed analysis of HIV/AIDS led to major changes both for HIV/AIDS (particularly in countries with concentrated epidemics) and for other causes, particularly in the people of reproductive age and in countries with moderate-to-large epidemics.

The International Agency for Research on Cancer produces cancer estimates by country, age, sex, and cancer site for 2008 and 2012 (GLOBOCAN). Our definitions and the GLOBOCAN definitions are compatible for 25 sites. For these cancer sites, the total estimated prevalence from GLOBOCAN was 6 848 204 cases in 2008 and 7 483 018 cases in 2012. By comparison, the GBD estimates were 6 930 377 for 2008, and 7 437 018 for 2012. Worldwide, the largest variation in estimates occurs for thyroid cancer, testicular cancer, and other pharynx cancers, with differences of 20–30%. The rough similarity of results at worldwide masks substantial national variation. Comparing age-standardised death rates for 2012, the correlation ranges from 0·94 for tracheal, bronchus, and lung cancer, to 0·20 for thyroid cancer. Five cancers have correlations below 0·5 (ovarian, non-Hodgkin lymphoma, testicular, Hodgkin lymphoma, and thyroid). A further six cancers have correlations of 0·5–0·7 (uterine, nasopharynx, lip and oral cavity, breast, leukaemia, and multiple myeloma).

Because both GLOBOCAN and our estimates used population-based cancer registry data and vital registration data as inputs, the wide variation in results requires explanation. As with all comparisons of global health estimates, the differences stem from data, data processing,

	CHERG	GBD 2013
Neonates aged 0–27 days		
Congenital abnormalities	270 (207–366)	251 (221–291)
Diarrhoea	50 (17–151)	52 (44–61)
Pneumonia	325 (209–470)	213 (186–242)
Intrapartum-related complications*	717 (610–876)	657 (532–770)
Sepsis or meningitis	393 (252–552)	369 (237–504)
Tetanus	58 (20–276)	34 (16–48)
Other neonatal disorders	181 (115–284)	470 (411–557)
All causes	3072†	2807 (2719–2898)
Children aged 1–59 months		
Injury	354 (274–429)	350 (310–394)
Diarrhoea	751 (538–1031)	536 (461–607)
AIDS	159 (131–185)	102 (95–111)
Pneumonia	1071 (977–1176)	772 (693–850)
Malaria	564 (432–709)	699 (576–855)
Measles	114 (92–176)	95 (52–166)
Meningitis	180 (136–237)	129 (98–163)
Other disorders	1356 (1112–1581)	1355 (1211–1524)
All causes	4550†	4039 (3883–4207)

Data are thousands of deaths (95% uncertainty interval). GBD=Global Burden of Disease Study. CHERG=Child Health Epidemiology Reference Group. *Compares GBD cause "Neonatal encephalopathy (birth asphyxia/trauma)" with CHERG cause "intrapartum-related complications". †CHERG did not report uncertainty estimates for all-cause mortality in children.

Table 5: **Comparison of GBD and CHERG estimated child deaths for select causes in 2010**

and model development. We included a wider range of registries than did GLOBOCAN, particularly in China, and we used of a broader database of vital registration data. Our redistribution of cancer of unknown primary was based on a statistical model. The most important differences, however, probably stem from the modelling strategy. For all cancer sites in all countries, we used CODEm. GLOBOCAN used nine different methods to estimate cancer mortality depending on the country.[83,117] The choice of method can lead to surprising differences in estimated rates for neighbouring countries without data. For example, the age-standardised death rate for male thyroid cancer in Timor Leste is 250% higher than that for Indonesia; age-standardised death rates for testicular cancer differ by 1300% between Mali and Mauritania. The GLOBOCAN estimates have a substantial subjective component in the choice of which modelling strategy to use and do not provide any estimate of uncertainty. Empirical assessment of the validity of the GLOBOCAN methods—for example, through cross-validation—would help to understand the strength of the approach.

For the **INDEPTH Network** see http:// www.indepth-network.org/

Understanding causes of death begins with assessment of all-cause mortality. There are some notable differences between our assessment of global age-specific deaths and those produced by the United Nations Population Division in their World Population Prospects 2012 revision (WPP2012). For the three periods (1995–2000, 2000–05, and 2005–10) as defined in WPP2012, the total numbers of deaths were 2·4–3·6% higher (6·1 million–9·1 million deaths) than estimated by us. These differentials translate into a difference of 7·8 million deaths for the 5-year period between 2005 and 2010. The difference is greatest for younger age groups. For 2005–10, estimated under-5 deaths from WPP2012 are 10·7% higher (3·9 million more deaths) than for the GBD 2013.

The WPP2012 global under-5 death estimates were also higher than those of UNICEF; part of this difference might be a result of the agencies releasing their estimates at different times. The biggest relative difference was for the adolescent age group (age 5–14 years). For 2005–10, the estimated deaths in adolescents from WPP2012 were 45·1% higher than in the GBD 2013, even though the absolute difference was about 2·2 million for a 5-year period, less than 1% (2·17 million of 264·7 million) of the total deaths for the same period. The differences are even greater at the GBD regional level. For 2005–10, the relative difference between WPP2012 and GBD 2013 ranged from 26·7% (122 800) lower in WPP2012 in Oceania, to 36·0% (1·9 million) higher in WPP2012 in central sub-Saharan Africa. WPP2012 tends to have high estimates of adolescent mortality compared with the GBD 2013 for all regions in sub-Saharan Africa, Andean Latin America, north Africa and Middle East, and southeast Asia. Overall, we find more differences in estimates for sub-Saharan Africa across all age group in both relative and absolute terms.

Such discrepancy originates from different assessments of child mortality rates and the difference in model life-table systems, both of which used child mortality rate to generate age-specific mortality rates. Estimating mortality for the adolescent age group is important.[118–120] As part of the background research for the GBD 2013, we assessed the Demographic Health Surveys complete birth history data for age groups 5–9 years and 10–14 years and compared this data in countries with almost complete vital registration or sample registration systems, such as India. We also systematically assessed estimates of adolescent mortality from sites of the health and demographic surveillance systems, a network known as INDEPTH. When we assessed the ratio of ${}_5q_5$ (probability of death from age 5 years to age 10 years) and ${}_5q_{10}$ (probability of death from age 10 years to age 15 years) to under-5 mortality, conflicting pictures arise: our GBD 2013 estimates are sometimes higher than one source and lower than the other. Further analysis is warranted to validate our approaches for estimating adolescent mortality in low-income and middle-income countries without working vital registration systems. In addition, efforts are needed to improve both data collection and method development to better estimate mortality for adolescents.

As in the GBD 2010, we noted differences for causes of child death compared with those produced by the Child Health Epidemiology Reference Group (CHERG; table 5). Given the complexity of both approaches, it is