	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
All causes	**53 618·5 (53 139·8 to 54 075·8)**	**55 792·9 (54 984·1 to 56 640·3)**	**4·1 (2·6 to 5·6)**	**1024·0 (1015·1 to 1032·6)**	**850·1 (838·3 to 862·4)**	**–17·0 (–18·1 to –15·8)**
Communicable, maternal, neonatal, and nutritional diseases (Group 1 causes)	**14 023·9 (13 734·8 to 14 335·3)**	**11 263·6 (10 922·7 to 11 594·5)**	**–19·7 (–21·6 to –17·8)**	**226·2 (221·3 to 231·6)**	**159·3 (154·4 to 163·9)**	**–29·6 (–31·3 to –27·9)**
HIV/AIDS and tuberculosis	3139·5 (2938·6 to 3469·8)	2305·2 (2092·7 to 2578·0)	–26·6 (–30·1 to –23·0)	51·6 (48·0 to 57·4)	31·9 (28·8 to 35·9)	–38·2 (–41·2 to –35·2)
Tuberculosis	1347·6 (1152·9 to 1658·7)	1112·6 (909·8 to 1392·8)	–17·4 (–24·4 to –11·3)	24·2 (20·8 to 29·9)	16·0 (13·1 to 20·1)	–33·8 (–39·6 to –28·7)
HIV/AIDS	1791·9 (1703·8 to 1886·6)	1192·6 (1130·8 to 1270·3)	–33·4 (–36·2 to –30·0)	27·4 (26·0 to 28·8)	15·8 (15·0 to 16·9)	–42·1 (–44·6 to –39·1)
HIV/AIDS—tuberculosis	351·8 (281·7 to 400·4)	211·7 (161·9 to 245·0)	–39·8 (–44·3 to –34·4)	5·4 (4·4 to 6·2)	2·8 (2·2 to 3·3)	–48·2 (–52·1 to –43·5)
HIV/AIDS resulting in other diseases	1440·1 (1349·6 to 1546·7)	980·8 (914·7 to 1063·6)	–31·9 (–35·6 to –27·7)	21·9 (20·5 to 23·6)	13·0 (12·1 to 14·1)	–40·6 (–43·8 to –36·9)
Diarrhoea, lower respiratory, and other common infectious diseases	**5773·1 (5548·3 to 6004·8)**	**4959·8 (4711·6 to 5179·4)**	**–14·1 (–17·1 to –11·0)**	**99·3 (95·5 to 103·1)**	**73·2 (69·5 to 76·4)**	**–26·3 (–28·7 to –23·8)**
Diarrhoeal diseases	1657·2 (1565·0 to 1756·1)	1312·1 (1233·6 to 1391·3)	–20·8 (–26·1 to –15·4)	28·1 (26·7 to 29·6)	19·1 (18·0 to 20·2)	–32·2 (–36·5 to –27·7)
Intestinal infectious diseases	208·6 (118·0 to 344·1)	178·5 (100·9 to 293·7)	–14·4 (–20·7 to –8·7)	3·0 (1·7 to 5·0)	2·4 (1·4 to 4·0)	–20·3 (–26·1 to –15·0)
Typhoid fever	172·9 (94·6 to 293·2)	148·8 (81·9 to 249·7)	–14·0 (–20·6 to –8·1)	2·5 (1·4 to 4·3)	2·0 (1·1 to 3·4)	–19·8 (–25·7 to –14·0)
Paratyphoid fever	33·9 (15·6 to 65·1)	29·2 (13·7 to 56·3)	–14·1 (–21·8 to –6·2)	0·5 (0·2 to 0·9)	0·4 (0·2 to 0·8)	–20·3 (–27·4 to –13·2)
Other intestinal infectious diseases	1·8 (0·6 to 3·3)	0·6 (0·3 to 1·2)	–64·0 (–75·5 to –43·9)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–67·7 (–77·7 to –51·2)
Lower respiratory infections	2828·5 (2628·6 to 2965·8)	2736·7 (2500·3 to 2860·8)	–3·2 (–6·9 to 0·4)	51·7 (47·9 to 54·1)	41·6 (38·0 to 43·5)	–19·5 (–22·3 to –16·9)
Upper respiratory infections	3·8 (3·3 to 4·2)	3·1 (2·8 to 3·5)	–18·0 (–28·5 to –5·2)	0·1 (0·1 to 0·1)	0·0 (0·0 to 0·1)	–32·2 (–40·4 to –22·0)
Otitis media	3·9 (3·5 to 4·3)	3·2 (2·9 to 3·7)	–17·7 (–27·3 to –4·5)	0·1 (0·1 to 0·1)	0·0 (0·0 to 0·1)	–27·8 (–38·5 to –14·5)
Meningitis	407·7 (351·1 to 457·1)	379·2 (322·7 to 444·7)	–7·0 (–15·4 to 5·2)	6·3 (5·5 to 7·1)	5·2 (4·5 to 6·1)	–17·2 (–24·3 to –6·7)
Pneumococcal meningitis	112·1 (93·3 to 135·2)	112·9 (93·4 to 141·8)	0·7 (–8·7 to 13·8)	1·7 (1·5 to 2·1)	1·6 (1·3 to 1·9)	–10·8 (–18·4 to 0·7)
Haemophilus influenzae type b meningitis	110·6 (88·3 to 135·8)	71·5 (56·7 to 91·8)	–35·4 (–43·6 to –24·7)	1·7 (1·3 to 2·0)	1·0 (0·8 to 1·3)	–41·1 (–48·3 to –31·4)
Meningococcal meningitis	74·3 (58·7 to 91·8)	73·3 (58·0 to 93·2)	–1·3 (–13·1 to 15·4)	1·1 (0·9 to 1·4)	1·0 (0·8 to 1·3)	–11·6 (–21·8 to 3·0)
Other meningitis	110·6 (94·9 to 128·6)	121·5 (101·8 to 144·2)	9·8 (1·1 to 22·0)	1·8 (1·5 to 2·1)	1·7 (1·4 to 2·0)	–4·6 (–11·8 to 5·9)
Encephalitis	147·0 (135·3 to 163·0)	149·5 (137·6 to 167·0)	1·7 (–4·7 to 8·1)	2·4 (2·2 to 2·7)	2·1 (1·9 to 2·4)	–11·7 (–17·1 to –6·4)
Diphtheria	5·6 (3·0 to 11·0)	2·1 (1·1 to 4·7)	–61·3 (–85·0 to –2·0)	0·1 (0·0 to 0·2)	0·0 (0·0 to 0·1)	–64·2 (–86·2 to –9·2)
Whooping cough	99·6 (36·8 to 226·3)	58·7 (20·3 to 126·6)	–41·0 (–77·9 to 65·1)	1·4 (0·5 to 3·3)	0·8 (0·3 to 1·7)	–45·1 (–79·4 to 53·8)
Tetanus	108·0 (90·9 to 151·1)	56·7 (48·2 to 80·0)	–47·5 (–54·6 to –39·0)	1·7 (1·4 to 2·4)	0·8 (0·7 to 1·1)	–53·2 (–59·7 to –45·9)
Measles	293·7 (110·6 to 611·4)	73·4 (26·1 to 161·4)	–75·0 (–84·5 to –58·8)	4·2 (1·6 to 8·8)	1·0 (0·4 to 2·2)	–76·7 (–85·5 to –61·6)
Varicella and herpes zoster	9·6 (8·5 to 11·0)	6·4 (5·4 to 7·8)	–33·5 (–44·4 to –19·2)	0·2 (0·2 to 0·2)	0·1 (0·1 to 0·1)	–45·8 (–54·7 to –34·7)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Neglected tropical diseases and malaria	**1298·5 (1082·7 to 1509·1)**	**843·1 (669·9 to 1019·7)**	**–35·1 (–43·6 to –26·7)**	**19·5 (16·3 to 22·6)**	**11·5 (9·1 to 13·9)**	**–41·3 (–48·9 to –33·8)**
Malaria	1167·0 (952·1 to 1378·1)	730·5 (555·8 to 904·0)	–37·4 (–47·0 to –27·8)	17·4 (14·2 to 20·6)	9·9 (7·5 to 12·3)	–43·1 (–51·8 to –34·7)
Chagas disease	7·5 (7·2 to 7·8)	8·0 (7·5 to 8·6)	7·7 (0·1 to 15·9)	0·1 (0·1 to 0·2)	0·1 (0·1 to 0·1)	–16·5 (–22·4 to –10·3)
Leishmaniasis	23·1 (14·8 to 33·2)	24·2 (17·1 to 32·5)	4·9 (–8·5 to 21·5)	0·3 (0·2 to 0·5)	0·3 (0·2 to 0·4)	–7·2 (–18·7 to 7·1)
Visceral leishmaniasis	23·1 (14·8 to 33·2)	24·2 (17·1 to 32·5)	4·9 (–8·5 to 21·5)	0·3 (0·2 to 0·5)	0·3 (0·2 to 0·4)	–7·2 (–18·7 to 7·1)
African trypanosomiasis	14·2 (7·6 to 23·1)	3·5 (1·8 to 5·7)	–75·3 (–81·4 to –67·9)	0·2 (0·1 to 0·4)	0·0 (0·0 to 0·1)	–78·4 (–83·7 to –72·0)
Schistosomiasis	7·8 (7·0 to 8·9)	4·4 (3·8 to 4·9)	–44·2 (–52·7 to –35·6)	0·1 (0·1 to 0·2)	0·1 (0·1 to 0·1)	–55·8 (–62·7 to –48·8)
Cysticercosis	0·6 (0·5 to 0·7)	0·4 (0·3 to 0·5)	–37·0 (–43·5 to –28·0)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–47·7 (–53·1 to –40·2)
Cystic echinococcosis	1·8 (1·7 to 1·9)	1·2 (1·1 to 1·3)	–32·6 (–35·7 to –29·4)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–44·6 (–47·0 to –42·1)
Dengue	12·3 (8·6 to 15·1)	18·4 (11·8 to 22·7)	48·7 (15·1 to 90·9)	0·2 (0·1 to 0·2)	0·3 (0·2 to 0·3)	34·0 (4·4 to 70·9)
Yellow fever	6·3 (1·3 to 16·9)	5·1 (1·1 to 14·2)	–18·8 (–33·5 to –0·8)	0·1 (0·0 to 0·2)	0·1 (0·0 to 0·2)	–25·7 (–39·2 to –9·4)
Rabies	32·1 (28·0 to 36·1)	17·4 (14·8 to 20·6)	–45·8 (–52·2 to –39·0)	0·5 (0·4 to 0·6)	0·2 (0·2 to 0·3)	–52·9 (–58·4 to –47·3)
Intestinal nematode infections	3·8 (3·3 to 4·3)	2·7 (2·4 to 3·1)	–28·5 (–36·9 to –19·7)	0·1 (0·1 to 0·1)	0·0 (0·0 to 0·0)	–34·7 (–42·3 to –26·7)
Ascariasis	3·8 (3·3 to 4·3)	2·7 (2·4 to 3·1)	–28·5 (–36·9 to –19·7)	0·1 (0·1 to 0·1)	0·0 (0·0 to 0·0)	–34·7 (–42·3 to –26·7)
Ebola virus disease	0·0 (0·0 to 0·0)	5·5 (4·4 to 6·6)	32 659·1 (32 659·1 to 32 659·1)	0·0 (0·0 to 0·0)	0·1 (0·1 to 0·1)	28 636·1 (28 636·1 to 28 636·1)
Other neglected tropical diseases	21·9 (14·0 to 27·7)	21·8 (12·7 to 27·6)	–0·6 (–14·5 to 15·9)	0·4 (0·2 to 0·4)	0·3 (0·2 to 0·4)	–13·0 (–24·9 to 1·1)
Maternal disorders	**350·8 (327·9 to 376·6)**	**275·3 (243·8 to 315·5)**	**–21·5 (–30·3 to –10·7)**	**5·1 (4·7 to 5·5)**	**3·6 (3·2 to 4·1)**	**–29·1 (–37·1 to –19·3)**
Maternal haemorrhage	99·7 (87·6 to 113·0)	83·1 (67·0 to 101·5)	–16·6 (–28·8 to –3·2)	1·4 (1·3 to 1·6)	1·1 (0·9 to 1·3)	–25·0 (–35·9 to –12·9)
Maternal sepsis and other maternal infections	24·7 (20·4 to 29·9)	17·9 (13·4 to 23·9)	–27·7 (–41·7 to –10·8)	0·4 (0·3 to 0·4)	0·2 (0·2 to 0·3)	–35·0 (–47·6 to –19·8)
Maternal hypertensive disorders	63·7 (54·9 to 74·3)	46·9 (37·1 to 59·6)	–26·4 (–36·7 to –13·1)	0·9 (0·8 to 1·1)	0·6 (0·5 to 0·8)	–32·9 (–42·5 to –20·9)
Maternal obstructed labour and uterine rupture	26·9 (22·1 to 32·0)	23·1 (17·2 to 30·0)	–13·9 (–27·4 to 1·5)	0·4 (0·3 to 0·5)	0·3 (0·2 to 0·4)	–22·5 (–34·5 to –8·5)
Maternal abortion, miscarriage, and ectopic pregnancy	41·2 (34·7 to 49·6)	31·7 (24·6 to 39·7)	–23·1 (–33·9 to –11·1)	0·6 (0·5 to 0·7)	0·4 (0·3 to 0·5)	–30·7 (–40·4 to –19·8)
Indirect maternal deaths	38·2 (31·6 to 45·4)	30·8 (23·1 to 40·5)	–19·4 (–32·4 to –1·9)	0·6 (0·5 to 0·7)	0·4 (0·3 to 0·5)	–27·1 (–38·8 to –11·1)
Late maternal deaths	7·9 (5·3 to 11·5)	6·7 (4·3 to 10·0)	–15·1 (–26·2 to –1·1)	0·1 (0·1 to 0·2)	0·1 (0·1 to 0·1)	–23·3 (–33·3 to –10·6)
Maternal deaths aggravated by HIV/AIDS	2·8 (1·8 to 3·8)	2·3 (1·4 to 3·3)	–15·8 (–33·1 to 8·0)	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	–24·8 (–40·4 to –3·7)
Other maternal disorders	45·7 (39·0 to 53·9)	32·7 (26·3 to 40·5)	–28·4 (–37·1 to –18·3)	0·7 (0·6 to 0·8)	0·4 (0·3 to 0·5)	–35·3 (–43·3 to –26·2)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Neonatal disorders	**2653·5 (2583·4 to 2728·1)**	**2163·2 (2095·1 to 2232·5)**	**–18·5 (–20·4 to –16·4)**	**37·3 (36·4 to 38·4)**	**28·8 (27·9 to 29·7)**	**–22·8 (–24·6 to –20·9)**
Neonatal preterm birth complications	1088·0 (1010·9 to 1217·7)	805·8 (736·2 to 898·6)	–25·9 (–31·3 to –20·6)	15·3 (14·2 to 17·1)	10·7 (9·8 to 12·0)	–29·8 (–34·9 to –24·8)
Neonatal encephalopathy (birth asphyxia and trauma)	882·8 (800·7 to 974·3)	740·4 (667·6 to 829·2)	–16·1 (–23·8 to –8·0)	12·4 (11·3 to 13·7)	9·9 (8·9 to 11·0)	–20·5 (–27·8 to –12·8)
Neonatal sepsis and other neonatal infections	352·3 (252·0 to 465·7)	351·7 (249·2 to 459·1)	–0·2 (–16·2 to 20·3)	5·0 (3·5 to 6·6)	4·7 (3·3 to 6·1)	–5·5 (–20·6 to 13·9)
Haemolytic disease and other neonatal jaundice	68·3 (42·9 to 106·1)	45·1 (30·1 to 67·3)	–34·0 (–47·9 to –17·1)	1·0 (0·6 to 1·5)	0·6 (0·4 to 0·9)	–37·6 (–50·6 to –21·6)
Other neonatal disorders	262·0 (190·3 to 343·0)	220·2 (167·6 to 276·8)	–16·0 (–34·1 to 5·6)	3·7 (2·7 to 4·8)	2·9 (2·2 to 3·7)	–20·5 (–37·7 to –0·1)
Nutritional deficiencies	460·8 (380·3 to 541·6)	405·7 (331·7 to 495·6)	–11·9 (–22·9 to 0·6)	7·8 (6·5 to 9·0)	5·9 (4·8 to 7·2)	–24·3 (–32·9 to –14·3)
Protein-energy malnutrition	379·7 (314·3 to 457·1)	323·2 (264·9 to 400·8)	–14·9 (–27·3 to –0·2)	6·4 (5·3 to 7·6)	4·7 (3·9 to 5·8)	–26·3 (–35·8 to –14·5)
Iodine deficiency	2·1 (1·6 to 2·9)	2·0 (1·5 to 2·7)	–3·1 (–31·4 to 40·7)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–18·4 (–41·6 to 15·7)
Iron-deficiency anaemia	48·4 (31·9 to 63·1)	54·2 (35·1 to 72·9)	12·1 (–2·1 to 28·0)	0·8 (0·5 to 1·1)	0·8 (0·5 to 1·0)	–5·1 (–16·8 to 7·8)
Other nutritional deficiencies	30·7 (21·7 to 43·7)	26·3 (20·7 to 33·6)	–14·1 (–33·1 to 1·1)	0·6 (0·4 to 0·8)	0·4 (0·3 to 0·5)	–30·0 (–45·1 to –18·7)
Other communicable, maternal, neonatal, and nutritional diseases	**347·7 (291·2 to 419·8)**	**311·3 (257·9 to 372·7)**	**–10·5 (–15·6 to –4·6)**	**5·6 (4·7 to 6·6)**	**4·4 (3·6 to 5·2)**	**–21·5 (–26·0 to –16·6)**
Sexually transmitted diseases excluding HIV	135·5 (81·2 to 207·2)	108·0 (64·6 to 165·7)	–20·3 (–28·3 to –12·4)	2·0 (1·2 to 3·0)	1·5 (0·9 to 2·2)	–26·1 (–33·7 to –19·0)
Syphilis	134·1 (79·9 to 205·7)	106·8 (63·4 to 164·6)	–20·3 (–28·5 to –12·4)	1·9 (1·2 to 3·0)	1·4 (0·9 to 2·2)	–26·1 (–33·8 to –18·8)
Chlamydial infection	0·2 (0·1 to 0·2)	0·2 (0·1 to 0·2)	–5·3 (–17·0 to 10·6)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–23·5 (–32·9 to –11·3)
Gonococcal infection	0·8 (0·7 to 0·9)	0·7 (0·5 to 0·8)	–15·7 (–26·7 to –4·7)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–31·3 (–40·1 to –22·6)
Other sexually transmitted diseases	0·4 (0·3 to 0·4)	0·3 (0·2 to 0·4)	–16·8 (–27·6 to –6·1)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–31·7 (–40·3 to –23·0)
Hepatitis	123·0 (118·6 to 127·6)	105·8 (100·7 to 110·8)	–14·0 (–17·9 to –10·0)	2·1 (2·0 to 2·2)	1·5 (1·4 to 1·6)	–28·0 (–31·1 to –24·7)
Acute hepatitis A	16·9 (10·9 to 23·1)	11·2 (6·9 to 15·9)	–34·0 (–43·5 to –24·2)	0·2 (0·2 to 0·3)	0·2 (0·1 to 0·2)	–39·4 (–47·9 to –30·4)
Hepatitis B	71·4 (62·0 to 80·1)	65·4 (56·4 to 73·7)	–8·4 (–14·1 to –2·2)	1·3 (1·1 to 1·4)	0·9 (0·8 to 1·1)	–26·4 (–30·9 to –21·6)
Hepatitis C	2·8 (0·6 to 6·4)	2·5 (0·5 to 5·9)	–9·8 (–24·4 to 8·6)	0·1 (0·0 to 0·1)	0·0 (0·0 to 0·1)	–29·6 (–41·0 to –15·1)
Acute hepatitis E	31·9 (23·0 to 42·3)	26·7 (18·5 to 36·6)	–16·4 (–26·1 to –6·6)	0·5 (0·4 to 0·7)	0·4 (0·3 to 0·5)	–26·3 (–34·3 to –17·9)
Other infectious diseases	89·1 (61·3 to 102·3)	97·5 (61·3 to 112·9)	9·4 (–2·3 to 23·2)	1·5 (1·1 to 1·7)	1·4 (0·9 to 1·6)	–6·4 (–16·8 to 5·2)
Non-communicable diseases	**34 835·6 (34 441·3 to 35 277·1)**	**39 804·2 (39 210·8 to 40 452·2)**	**14·3 (12·6 to 16·0)**	**719·1 (711·9 to 727·3)**	**624·7 (615·8 to 634·5)**	**–13·1 (–14·3 to –11·9)**
Neoplasms	7492·8 (7378·4 to 7616·5)	8764·6 (8591·1 to 8945·6)	17·0 (14·8 to 19·3)	149·2 (147·1 to 151·7)	134·3 (131·6 to 137·0)	–10·0 (–11·6 to –8·3)
Lip and oral cavity cancer	110·2 (107·6 to 112·9)	146·0 (141·6 to 150·6)	32·5 (28·5 to 37·0)	2·2 (2·1 to 2·2)	2·2 (2·1 to 2·3)	1·4 (–1·6 to 4·8)
Nasopharynx cancer	55·8 (45·9 to 58·8)	63·0 (51·1 to 67·0)	12·8 (5·1 to 19·4)	1·0 (0·8 to 1·1)	0·9 (0·7 to 1·0)	–10·9 (–16·8 to –5·7)
Other pharynx cancer	51·9 (50·5 to 53·2)	64·4 (61·6 to 67·1)	24·1 (18·4 to 29·7)	1·0 (1·0 to 1·0)	1·0 (0·9 to 1·0)	–5·0 (–9·3 to –0·6)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Oesophageal cancer	459·3 (445·1 to 474·2)	439·0 (422·6 to 456·9)	–4·4 (–9·0 to 0·7)	9·2 (8·9 to 9·5)	6·7 (6·5 to 7·0)	–26·8 (–30·3 to –22·9)
Stomach cancer	824·5 (806·8 to 843·0)	818·9 (795·5 to 843·7)	–0·7 (–3·7 to 2·6)	16·7 (16·3 to 17·0)	12·7 (12·4 to 13·1)	–23·8 (–26·0 to –21·4)
Colon and rectum cancer	675·5 (664·9 to 688·2)	832·0 (811·7 to 854·5)	23·2 (20·6 to 26·0)	14·0 (13·8 to 14·2)	13·0 (12·7 to 13·4)	–6·7 (–8·7 to –4·6)
Liver cancer	726·7 (636·0 to 762·2)	810·5 (749·7 to 862·8)	11·5 (5·9 to 20·4)	13·9 (12·3 to 14·6)	12·1 (11·2 to 12·9)	–13·1 (–17·4 to –6·7)
Liver cancer due to hepatitis B	263·1 (224·4 to 282·5)	265·3 (241·0 to 290·5)	0·8 (–5·6 to 12·5)	4·8 (4·1 to 5·1)	3·8 (3·5 to 4·2)	–20·2 (–25·2 to –11·5)
Liver cancer due to hepatitis C	137·8 (126·1 to 146·3)	167·1 (153·9 to 177·9)	21·3 (17·3 to 26·2)	2·8 (2·6 to 3·0)	2·6 (2·4 to 2·8)	–7·4 (–10·4 to –3·8)
Liver cancer due to alcohol use	194·5 (168·8 to 208·3)	245·2 (225·1 to 266·6)	26·1 (18·5 to 37·1)	3·8 (3·3 to 4·1)	3·7 (3·4 to 4·0)	–3·1 (–8·6 to 4·8)
Liver cancer due to other causes	131·3 (114·1 to 141·6)	132·9 (119·8 to 144·4)	1·2 (–4·2 to 9·7)	2·5 (2·2 to 2·7)	2·0 (1·8 to 2·2)	–21·1 (–25·2 to –15·0)
Gallbladder and biliary tract cancer	124·5 (120·8 to 127·8)	140·5 (131·4 to 147·2)	12·9 (7·3 to 18·2)	2·6 (2·5 to 2·7)	2·2 (2·1 to 2·3)	–14·7 (–19·0 to –10·6)
Pancreatic cancer	314·6 (310·1 to 319·0)	411·6 (403·6 to 420·7)	30·8 (28·3 to 33·6)	6·5 (6·4 to 6·6)	6·4 (6·3 to 6·6)	–0·9 (–2·8 to 1·2)
Larynx cancer	93·1 (90·9 to 95·7)	105·9 (102·7 to 109·5)	13·8 (10·5 to 17·5)	1·8 (1·8 to 1·9)	1·6 (1·6 to 1·7)	–12·8 (–15·3 to –10·0)
Tracheal, bronchus, and lung cancer	1434·5 (1406·5 to 1463·5)	1722·5 (1673·7 to 1772·7)	20·1 (16·7 to 24·0)	29·0 (28·5 to 29·6)	26·6 (25·9 to 27·4)	–8·1 (–10·7 to –5·2)
Malignant skin melanoma	47·0 (38·7 to 58·6)	59·8 (47·6 to 72·7)	27·2 (20·0 to 32·6)	0·9 (0·8 to 1·1)	0·9 (0·7 to 1·1)	–1·8 (–7·1 to 2·4)
Non-melanoma skin cancer	36·3 (35·4 to 37·1)	51·9 (49·9 to 53·8)	42·9 (37·4 to 47·8)	0·8 (0·7 to 0·8)	0·8 (0·8 to 0·9)	7·6 (3·4 to 11·1)
Squamous-cell carcinoma	36·3 (35·4 to 37·1)	51·9 (49·9 to 53·8)	42·9 (37·4 to 47·8)	0·8 (0·7 to 0·8)	0·8 (0·8 to 0·9)	7·6 (3·4 to 11·1)
Breast cancer	439·8 (418·8 to 461·9)	533·6 (502·2 to 553·1)	21·3 (14·9 to 27·2)	8·5 (8·1 to 8·9)	7·9 (7·5 to 8·2)	–6·8 (–11·5 to –2·5)
Cervical cancer	225·4 (213·9 to 237·8)	238·6 (225·3 to 252·4)	5·8 (–0·5 to 13·8)	4·2 (4·0 to 4·4)	3·5 (3·3 to 3·7)	–17·7 (–22·5 to –11·5)
Uterine cancer	81·8 (78·5 to 85·4)	89·9 (86·1 to 94·3)	10·0 (3·8 to 17·4)	1·6 (1·6 to 1·7)	1·4 (1·3 to 1·4)	–16·1 (–20·8 to –10·7)
Ovarian cancer	133·8 (130·8 to 138·6)	161·1 (156·5 to 166·5)	20·4 (16·5 to 24·4)	2·6 (2·6 to 2·7)	2·4 (2·3 to 2·5)	–7·9 (–10·8 to –4·9)
Prostate cancer	277·4 (230·8 to 348·9)	365·9 (303·5 to 459·6)	31·9 (28·2 to 35·4)	6·1 (5·1 to 7·7)	6·0 (5·0 to 7·6)	–1·7 (–4·5 to 0·8)
Testicular cancer	8·6 (8·3 to 9·1)	9·4 (8·8 to 9·9)	8·4 (1·3 to 14·4)	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·1)	–8·9 (–14·7 to –3·9)
Kidney cancer	104·5 (102·4 to 106·9)	136·9 (133·0 to 141·3)	31·0 (27·0 to 34·6)	2·1 (2·1 to 2·1)	2·1 (2·0 to 2·2)	0·4 (–2·6 to 3·2)
Bladder cancer	150·6 (147·9 to 153·2)	188·0 (182·8 to 192·7)	24·8 (21·4 to 28·3)	3·2 (3·2 to 3·3)	3·0 (2·9 to 3·1)	–6·4 (–9·0 to –3·8)
Brain and nervous system cancer	190·4 (173·3 to 201·2)	228·8 (209·5 to 244·7)	20·1 (12·7 to 27·2)	3·5 (3·2 to 3·6)	3·3 (3·0 to 3·6)	–3·6 (–9·3 to 1·8)
Thyroid cancer	25·5 (24·4 to 27·6)	31·9 (28·9 to 33·2)	24·8 (14·8 to 31·0)	0·5 (0·5 to 0·6)	0·5 (0·5 to 0·5)	–4·8 (–12·2 to 0·0)
Mesothelioma	23·2 (22·7 to 23·8)	32·4 (31·2 to 33·4)	39·6 (34·4 to 44·3)	0·5 (0·5 to 0·5)	0·5 (0·5 to 0·5)	7·8 (3·6 to 11·6)
Hodgkin lymphoma	25·4 (22·7 to 29·7)	23·9 (21·8 to 29·0)	–6·0 (–10·6 to –1·3)	0·5 (0·4 to 0·5)	0·3 (0·3 to 0·4)	–23·9 (–27·7 to –20·1)
Non-Hodgkin's lymphoma	179·3 (160·6 to 191·6)	231·4 (195·7 to 243·8)	29·0 (18·1 to 35·2)	3·5 (3·1 to 3·7)	3·5 (3·0 to 3·7)	0·0 (–8·0 to 4·4)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Multiple myeloma	77·5 (75·6 to 79·7)	101·1 (97·7 to 104·1)	30·5 (26·3 to 34·5)	1·6 (1·6 to 1·6)	1·6 (1·5 to 1·6)	–1·3 (–4·4 to 1·7)
Leukaemia	303·5 (297·3 to 311·8)	353·5 (344·6 to 363·1)	16·5 (13·5 to 19·6)	5·6 (5·5 to 5·7)	5·3 (5·1 to 5·4)	–5·7 (–7·9 to –3·3)
Acute lymphoid leukaemia	97·5 (90·4 to 108·0)	110·5 (101·2 to 118·4)	13·3 (7·1 to 19·0)	1·6 (1·5 to 1·8)	1·6 (1·4 to 1·7)	–3·0 (–8·1 to 1·7)
Chronic lymphoid leukaemia	51·5 (49·3 to 53·9)	60·7 (57·9 to 64·6)	17·9 (12·5 to 23·4)	1·1 (1·0 to 1·1)	1·0 (0·9 to 1·0)	–10·1 (–14·0 to –6·1)
Acute myeloid leukaemia	119·0 (110·5 to 126·7)	147·1 (137·3 to 157·0)	23·5 (19·3 to 27·8)	2·2 (2·1 to 2·3)	2·2 (2·1 to 2·3)	–0·4 (–3·5 to 2·7)
Chronic myeloid leukaemia	35·4 (33·4 to 38·2)	35·2 (33·4 to 37·7)	–0·7 (–4·8 to 3·8)	0·7 (0·6 to 0·7)	0·5 (0·5 to 0·6)	–22·0 (–25·3 to –18·5)
Other neoplasms	292·1 (270·9 to 302·6)	372·2 (335·9 to 392·1)	27·4 (21·4 to 32·6)	5·5 (5·1 to 5·7)	5·5 (5·0 to 5·8)	1·2 (–3·6 to 5·3)
Cardiovascular diseases	15 933·7 (15 732·1 to 16 161·6)	17 921·0 (17 590·5 to 18 276·8)	12·5 (10·6 to 14·4)	338·1 (333·8 to 342·9)	285·5 (280·2 to 291·2)	–15·6 (–16·9 to –14·2)
Rheumatic heart disease	333·2 (313·1 to 349·5)	319·4 (297·3 to 337·3)	–4·1 (–8·2 to –0·1)	6·4 (6·0 to 6·7)	4·8 (4·5 to 5·1)	–24·7 (–27·9 to –21·6)
Ischaemic heart disease	7648·4 (7551·5 to 7774·3)	8917·0 (8751·6 to 9108·8)	16·6 (14·6 to 18·6)	163·1 (160·8 to 165·6)	142·1 (139·5 to 145·2)	–12·8 (–14·2 to –11·4)
Cerebrovascular disease	6020·9 (5920·2 to 6127·1)	6326·1 (6175·2 to 6492·9)	5·1 (2·7 to 7·5)	127·9 (125·8 to 130·1)	101·0 (98·6 to 103·6)	–21·0 (–22·8 to –19·2)
Ischaemic stroke	2760·8 (2682·7 to 2837·5)	2978·0 (2880·8 to 3068·8)	7·9 (5·2 to 10·6)	61·3 (59·5 to 62·9)	48·9 (47·3 to 50·4)	–20·2 (–22·1 to –18·1)
Haemorrhagic stroke	3260·1 (3169·2 to 3359·8)	3348·2 (3240·9 to 3500·1)	2·7 (–0·6 to 6·4)	66·7 (64·9 to 68·7)	52·1 (50·4 to 54·5)	–21·9 (–24·3 to –19·0)
Hypertensive heart disease	760·5 (711·9 to 823·7)	962·4 (873·6 to 1024·5)	26·5 (17·5 to 32·3)	16·2 (15·2 to 17·5)	15·4 (13·9 to 16·4)	–4·9 (–11·9 to –0·6)
Cardiomyopathy and myocarditis	328·8 (315·8 to 338·8)	353·7 (339·5 to 370·6)	7·6 (3·8 to 11·4)	6·4 (6·2 to 6·6)	5·4 (5·2 to 5·7)	–16·1 (–18·9 to –13·2)
Atrial fibrillation and flutter	142·8 (117·3 to 172·0)	195·3 (159·5 to 236·2)	36·8 (34·0 to 39·6)	3·4 (2·8 to 4·1)	3·3 (2·7 to 4·0)	–3·4 (–4·9 to –1·9)
Aortic aneurysm	134·8 (131·7 to 138·3)	168·2 (163·6 to 172·8)	24·8 (19·5 to 28·5)	2·9 (2·8 to 3·0)	2·7 (2·6 to 2·8)	–6·6 (–10·4 to –3·8)
Peripheral vascular disease	38·1 (36·7 to 39·6)	52·5 (49·7 to 55·7)	37·7 (30·1 to 46·5)	0·9 (0·8 to 0·9)	0·9 (0·8 to 0·9)	–0·3 (–5·9 to 6·3)
Endocarditis	68·8 (60·4 to 74·7)	84·9 (74·7 to 93·0)	23·4 (18·5 to 28·2)	1·4 (1·2 to 1·5)	1·3 (1·2 to 1·4)	–4·6 (–8·1 to –1·1)
Other cardiovascular and circulatory diseases	457·4 (446·7 to 470·6)	541·4 (521·7 to 561·2)	18·4 (14·0 to 22·5)	9·6 (9·3 to 9·8)	8·6 (8·3 to 8·9)	–10·3 (–13·5 to –7·4)
Chronic respiratory diseases	3709·1 (3631·6 to 3796·0)	3795·5 (3683·9 to 3910·4)	2·3 (–0·8 to 5·4)	79·0 (77·3 to 80·9)	61·0 (59·3 to 62·8)	–22·8 (–25·1 to –20·4)
Chronic obstructive pulmonary disease	3100·5 (2997·7 to 3194·9)	3188·3 (3083·8 to 3292·5)	2·8 (–0·6 to 6·9)	67·0 (64·8 to 69·0)	51·7 (50·0 to 53·4)	–22·9 (–25·4 to –20·0)
Pneumoconiosis	31·9 (28·4 to 36·3)	36·1 (31·5 to 40·7)	13·2 (6·4 to 22·4)	0·7 (0·6 to 0·8)	0·6 (0·5 to 0·7)	–14·4 (–19·5 to –7·7)
Silicosis	10·2 (9·4 to 11·4)	10·4 (9·4 to 11·7)	2·0 (–9·0 to 15·4)	0·2 (0·2 to 0·2)	0·2 (0·1 to 0·2)	–21·8 (–30·2 to –11·8)
Asbestosis	2·8 (2·0 to 3·2)	3·6 (2·5 to 4·2)	28·4 (17·6 to 39·5)	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·1)	–2·1 (–10·2 to 6·2)
Coal workers pneumoconiosis	2·7 (2·4 to 3·0)	2·5 (2·2 to 2·9)	–7·3 (–21·5 to 6·4)	0·1 (0·1 to 0·1)	0·0 (0·0 to 0·0)	–29·9 (–40·4 to –19·6)
Other pneumoconiosis	16·1 (13·3 to 19·7)	19·5 (15·8 to 23·2)	21·2 (11·0 to 33·5)	0·3 (0·3 to 0·4)	0·3 (0·3 to 0·4)	–9·4 (–16·9 to –0·2)
Asthma	449·9 (362·1 to 518·0)	397·1 (363·0 to 438·7)	–11·7 (–21·2 to 3·4)	8·8 (7·1 to 10·2)	6·1 (5·6 to 6·7)	–31·3 (–38·9 to –19·4)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Interstitial lung disease and pulmonary sarcoidosis	80·4 (61·2 to 92·8)	121·8 (94·1 to 135·2)	51·5 (37·9 to 60·5)	1·7 (1·3 to 2·0)	2·0 (1·5 to 2·2)	14·1 (4·1 to 20·9)
Other chronic respiratory diseases	46·4 (33·9 to 55·6)	52·1 (38·0 to 61·0)	12·2 (1·4 to 23·0)	0·8 (0·6 to 1·0)	0·8 (0·6 to 0·9)	–5·9 (–13·8 to 2·5)
Cirrhosis and other chronic liver diseases	1171·7 (1131·9 to 1236·7)	1292·1 (1239·9 to 1371·7)	10·3 (7·0 to 13·7)	21·6 (20·9 to 22·8)	18·8 (18·0 to 19·9)	–13·1 (–15·6 to –10·5)
Cirrhosis and other chronic liver diseases due to hepatitis B	341·4 (316·2 to 374·1)	371·1 (341·6 to 410·0)	8·7 (4·7 to 12·7)	6·3 (5·9 to 6·9)	5·4 (5·0 to 6·0)	–14·6 (–17·5 to –11·6)
Cirrhosis and other chronic liver diseases due to hepatitis C	287·4 (268·1 to 307·8)	325·6 (301·8 to 349·9)	13·3 (10·4 to 16·5)	5·4 (5·0 to 5·8)	4·8 (4·4 to 5·1)	–11·7 (–13·9 to –9·3)
Cirrhosis and other chronic liver diseases due to alcohol use	310·1 (289·4 to 333·4)	347·9 (322·7 to 374·6)	12·2 (8·4 to 16·7)	5·6 (5·2 to 6·0)	5·0 (4·6 to 5·3)	–11·6 (–14·5 to –8·2)
Cirrhosis and other chronic liver diseases due to other causes	232·8 (217·6 to 254·6)	247·5 (230·3 to 272·2)	6·3 (3·4 to 9·8)	4·3 (4·0 to 4·7)	3·6 (3·4 to 4·0)	–14·8 (–17·1 to –12·2)
Digestive diseases	1113·2 (1081·1 to 1186·7)	1203·0 (1150·5 to 1270·0)	8·1 (3·7 to 12·6)	22·0 (21·4 to 23·4)	18·5 (17·7 to 19·5)	–16·1 (–19·3 to –12·7)
Peptic ulcer disease	294·3 (278·0 to 322·0)	267·5 (249·4 to 290·0)	–9·1 (–15·3 to 0·0)	5·8 (5·5 to 6·3)	4·1 (3·8 to 4·4)	–29·3 (–34·1 to –22·1)
Gastritis and duodenitis	49·9 (40·2 to 60·9)	49·7 (41·8 to 60·1)	–0·5 (–10·9 to 12·4)	1·0 (0·8 to 1·2)	0·8 (0·6 to 0·9)	–23·0 (–31·0 to –12·9)
Appendicitis	49·9 (42·9 to 56·4)	50·1 (41·2 to 56·0)	0·5 (–9·0 to 10·7)	0·9 (0·8 to 1·0)	0·7 (0·6 to 0·8)	–17·0 (–24·5 to –9·0)
Paralytic ileus and intestinal obstruction	233·4 (210·7 to 272·0)	264·3 (242·4 to 307·4)	13·2 (7·7 to 19·7)	4·6 (4·1 to 5·3)	4·0 (3·7 to 4·7)	–11·4 (–15·5 to –6·6)
Inguinal, femoral, and abdominal hernia	56·6 (40·0 to 63·8)	59·8 (41·1 to 69·2)	5·8 (–3·1 to 16·8)	1·1 (0·8 to 1·3)	0·9 (0·6 to 1·1)	–18·1 (–25·2 to –9·3)
Inflammatory bowel disease	42·6 (38·3 to 47·3)	47·4 (43·5 to 51·7)	11·2 (2·9 to 18·8)	0·9 (0·8 to 0·9)	0·7 (0·7 to 0·8)	–14·6 (–20·4 to –9·1)
Vascular intestinal disorders	84·3 (79·0 to 91·2)	105·8 (99·0 to 114·3)	25·6 (20·4 to 30·5)	1·8 (1·7 to 2·0)	1·7 (1·6 to 1·8)	–6·1 (–10·0 to –2·7)
Gallbladder and biliary diseases	96·4 (91·1 to 103·1)	111·7 (105·3 to 120·0)	15·9 (10·2 to 21·3)	2·0 (1·9 to 2·1)	1·8 (1·7 to 1·9)	–11·7 (–15·8 to –7·7)
Pancreatitis	109·6 (103·0 to 117·2)	132·7 (122·9 to 144·0)	21·1 (14·3 to 28·1)	2·0 (1·9 to 2·2)	1·9 (1·8 to 2·1)	–3·9 (–9·2 to 1·5)
Other digestive diseases	96·3 (86·5 to 116·2)	114·0 (101·9 to 131·1)	18·3 (8·1 to 28·9)	2·0 (1·8 to 2·4)	1·8 (1·6 to 2·0)	–9·5 (–16·6 to –2·1)
Neurological disorders	1671·0 (1445·9 to 1889·8)	2258·9 (1937·8 to 2574·4)	35·2 (33·2 to 37·2)	38·7 (33·1 to 44·1)	37·6 (32·2 to 43·0)	–2·7 (–3·7 to –1·6)
Alzheimer's disease and other dementias	1380·8 (1152·7 to 1599·4)	1908·2 (1586·7 to 2229·1)	38·2 (36·2 to 40·1)	33·2 (27·6 to 38·7)	32·3 (26·9 to 37·8)	–2·7 (–3·7 to –1·7)
Parkinson's disease	82·4 (80·0 to 85·6)	117·4 (113·9 to 121·3)	42·4 (37·3 to 46·9)	1·9 (1·8 to 2·0)	2·0 (1·9 to 2·0)	4·2 (0·5 to 7·6)
Epilepsy	119·0 (111·9 to 127·6)	124·9 (119·3 to 131·0)	5·0 (–2·1 to 12·3)	1·9 (1·8 to 2·0)	1·7 (1·6 to 1·8)	–9·2 (–15·1 to –3·3)
Multiple sclerosis	16·5 (14·9 to 18·1)	18·9 (17·3 to 20·0)	14·8 (7·2 to 20·7)	0·3 (0·3 to 0·3)	0·3 (0·2 to 0·3)	–9·7 (–15·3 to –5·1)
Motor neuron disease	27·6 (26·8 to 28·8)	35·2 (33·9 to 36·7)	27·6 (20·6 to 31·1)	0·5 (0·5 to 0·6)	0·5 (0·5 to 0·6)	–1·2 (–6·5 to 1·6)
Other neurological disorders	44·8 (43·6 to 47·8)	54·3 (53·0 to 57·5)	21·3 (17·5 to 24·5)	0·8 (0·8 to 0·8)	0·8 (0·8 to 0·8)	–1·0 (–4·1 to 1·7)
Mental and substance use disorders	305·9 (293·5 to 314·9)	324·9 (308·6 to 337·4)	6·2 (1·9 to 10·4)	5·1 (4·9 to 5·3)	4·5 (4·3 to 4·7)	–12·6 (–16·0 to –9·2)
Schizophrenia	19·1 (17·9 to 20·0)	16·9 (15·9 to 18·0)	–11·4 (–18·8 to –2·9)	0·3 (0·3 to 0·4)	0·2 (0·2 to 0·3)	–29·2 (–34·9 to –22·9)
Alcohol use disorders	157·4 (147·4 to 163·3)	137·5 (131·5 to 144·0)	–12·6 (–16·7 to –7·0)	2·7 (2·5 to 2·8)	1·9 (1·8 to 2·0)	–29·2 (–32·4 to –24·7)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Drug use disorders	128·8 (124·0 to 133·6)	169·9 (152·1 to 179·2)	31·8 (20·4 to 39·4)	2·1 (2·0 to 2·2)	2·3 (2·1 to 2·5)	11·5 (2·0 to 17·7)
Opioid use disorders	94·2 (90·5 to 99·7)	122·1 (109·5 to 129·7)	29·6 (18·2 to 37·2)	1·5 (1·5 to 1·6)	1·7 (1·5 to 1·8)	10·0 (0·5 to 16·5)
Cocaine use disorders	7·4 (5·0 to 7·9)	11·1 (8·5 to 12·2)	49·7 (33·6 to 75·4)	0·1 (0·1 to 0·1)	0·1 (0·1 to 0·2)	26·4 (12·9 to 48·0)
Amphetamine use disorders	7·3 (4·3 to 8·2)	12·2 (8·4 to 14·2)	67·5 (25·6 to 118·9)	0·1 (0·1 to 0·1)	0·2 (0·1 to 0·2)	42·3 (7·2 to 85·6)
Other drug use disorders	19·9 (18·6 to 22·8)	24·5 (22·7 to 27·3)	23·0 (12·7 to 32·1)	0·3 (0·3 to 0·4)	0·3 (0·3 to 0·4)	2·6 (–5·6 to 9·5)
Eating disorders	0·6 (0·4 to 0·8)	0·7 (0·5 to 0·9)	7·7 (0·8 to 17·3)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–4·4 (–10·2 to 3·5)
Anorexia nervosa	0·6 (0·4 to 0·7)	0·6 (0·4 to 0·8)	5·6 (–1·2 to 14·1)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–6·0 (–11·8 to 1·1)
Bulimia nervosa	0·0 (0·0 to 0·1)	0·1 (0·0 to 0·1)	33·2 (19·1 to 58·1)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	14·6 (3·3 to 34·2)
Diabetes, urogenital, blood, and endocrine diseases	2635·3 (2534·5 to 2716·0)	3409·3 (3287·5 to 3516·5)	29·4 (26·1 to 32·7)	52·9 (51·0 to 54·3)	52·9 (51·0 to 54·5)	–0·1 (–2·3 to 2·3)
Diabetes mellitus	1150·2 (1120·9 to 1176·8)	1519·0 (1470·3 to 1576·0)	32·1 (27·7 to 36·3)	23·6 (23·0 to 24·2)	23·7 (23·0 to 24·6)	0·4 (–2·7 to 3·6)
Acute glomerulonephritis	12·7 (9·9 to 14·4)	11·8 (7·8 to 13·3)	–6·9 (–23·8 to 2·0)	0·2 (0·2 to 0·3)	0·2 (0·1 to 0·2)	–25·3 (–38·9 to –18·2)
Chronic kidney disease	937·7 (866·2 to 970·8)	1234·9 (1131·7 to 1282·4)	31·7 (27·7 to 35·6)	19·0 (17·7 to 19·7)	19·2 (17·7 to 20·0)	1·2 (–1·9 to 4·0)
Chronic kidney disease due to diabetes mellitus	299·4 (278·7 to 314·2)	417·8 (388·7 to 441·4)	39·5 (35·4 to 43·5)	6·1 (5·7 to 6·4)	6·5 (6·1 to 6·9)	6·4 (3·3 to 9·3)
Chronic kidney disease due to hypertension	408·5 (377·1 to 427·6)	549·5 (501·6 to 575·6)	34·5 (30·0 to 38·7)	8·4 (7·8 to 8·8)	8·7 (7·9 to 9·1)	2·4 (–0·9 to 5·5)
Chronic kidney disease due to glomerulonephritis	205·6 (184·9 to 217·9)	237·7 (212·6 to 255·9)	15·6 (10·9 to 20·2)	4·0 (3·6 to 4·2)	3·6 (3·3 to 3·9)	–9·0 (–12·6 to –5·4)
Chronic kidney disease due to other causes	24·2 (20·2 to 28·6)	30·0 (25·0 to 35·2)	23·9 (17·8 to 30·2)	0·5 (0·4 to 0·6)	0·5 (0·4 to 0·5)	–2·2 (–6·9 to 2·5)
Urinary diseases and male infertility	201·1 (188·2 to 215·7)	261·7 (243·2 to 277·6)	30·1 (23·7 to 36·6)	4·2 (3·9 to 4·5)	4·1 (3·8 to 4·4)	–1·3 (–6·1 to 3·6)
Interstitial nephritis and urinary tract infections	149·8 (139·3 to 160·9)	196·4 (181·5 to 211·0)	31·1 (25·3 to 37·3)	3·2 (2·9 to 3·4)	3·1 (2·9 to 3·4)	–1·1 (–5·5 to 3·7)
Urolithiasis	14·9 (12·5 to 18·1)	16·1 (14·0 to 20·3)	7·8 (0·0 to 21·2)	0·3 (0·3 to 0·4)	0·2 (0·2 to 0·3)	–16·5 (–22·6 to –5·8)
Other urinary diseases	36·4 (30·8 to 42·7)	49·2 (41·2 to 55·4)	35·1 (20·4 to 49·9)	0·7 (0·6 to 0·9)	0·8 (0·6 to 0·9)	4·2 (–7·1 to 15·3)
Gynaecological diseases	7·6 (6·1 to 8·6)	7·9 (5·9 to 9·2)	2·9 (–10·1 to 24·5)	0·1 (0·1 to 0·2)	0·1 (0·1 to 0·1)	–17·4 (–28·0 to –1·0)
Uterine fibroids	2·1 (1·2 to 2·7)	2·3 (1·2 to 3·0)	9·5 (–12·5 to 34·7)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–13·3 (–30·5 to 5·8)
Polycystic ovarian syndrome	0·7 (0·2 to 1·3)	0·6 (0·2 to 1·0)	–17·9 (–37·0 to 10·1)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–30·9 (–47·0 to –7·9)
Endometriosis	0·0 (0·0 to 0·1)	0·1 (0·0 to 0·1)	24·2 (–0·6 to 59·4)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	5·7 (–15·2 to 35·4)
Genital prolapse	1·1 (0·6 to 1·8)	0·9 (0·6 to 1·5)	–19·5 (–36·0 to 12·9)	0·0 (0·0 to 0·0)	0·0 (0·0 to 0·0)	–39·0 (–51·1 to –15·9)
Other gynaecological diseases	3·6 (2·7 to 4·5)	4·0 (3·0 to 4·8)	9·9 (–5·8 to 34·4)	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·1)	–10·0 (–23·1 to 9·9)
Haemoglobinopathies and haemolytic anaemias	215·5 (173·5 to 274·0)	226·9 (177·2 to 306·2)	5·3 (–9·4 to 24·1)	3·6 (2·9 to 4·5)	3·2 (2·5 to 4·3)	–9·8 (–21·2 to 5·1)
Thalassaemias	19·7 (16·5 to 23·3)	16·8 (13·9 to 20·2)	–14·5 (–27·7 to 2·9)	0·3 (0·3 to 0·4)	0·2 (0·2 to 0·3)	–23·6 (–34·1 to –10·3)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Sickle cell disorders	108·3 (78·5 to 159·8)	114·8 (78·3 to 183·2)	6·0 (–20·1 to 40·4)	1·6 (1·2 to 2·3)	1·6 (1·1 to 2·5)	–2·7 (–26·0 to 28·3)
Glucose-6-phosphate dehydrogenase deficiency	27·5 (23·5 to 32·1)	33·0 (28·0 to 38·9)	19·9 (11·6 to 29·2)	0·4 (0·4 to 0·5)	0·5 (0·4 to 0·5)	1·2 (–5·9 to 8·7)
Other haemoglobinopathies and haemolytic anaemias	60·0 (53·2 to 66·5)	62·3 (54·7 to 71·1)	3·9 (–3·4 to 10·2)	1·2 (1·1 to 1·3)	1·0 (0·9 to 1·1)	–19·6 (–25·6 to –15·0)
Endocrine, metabolic, blood, and immune disorders	110·5 (108·1 to 113·5)	147·3 (142·5 to 151·7)	33·2 (28·0 to 37·2)	2·1 (2·1 to 2·2)	2·2 (2·2 to 2·3)	5·6 (1·7 to 8·7)
Musculoskeletal disorders	76·2 (69·2 to 80·5)	90·1 (82·5 to 94·6)	18·2 (10·8 to 24·3)	1·5 (1·4 to 1·6)	1·4 (1·3 to 1·5)	–8·3 (–13·5 to –3·8)
Rheumatoid arthritis	26·5 (23·2 to 29·3)	30·0 (27·0 to 34·6)	13·2 (5·0 to 23·5)	0·6 (0·5 to 0·6)	0·5 (0·4 to 0·5)	–14·0 (–20·0 to –6·4)
Other musculoskeletal disorders	49·7 (45·5 to 53·1)	60·1 (53·1 to 63·5)	20·9 (11·5 to 27·0)	1·0 (0·9 to 1·0)	0·9 (0·8 to 1·0)	–5·0 (–11·5 to –0·5)
Other non-communicable diseases	726·6 (626·8 to 869·3)	744·6 (667·8 to 811·6)	2·5 (–10·6 to 11·7)	10·9 (9·4 to 13·0)	10·2 (9·2 to 11·1)	–6·5 (–17·7 to 1·5)
Congenital anomalies	634·2 (535·9 to 773·4)	627·8 (567·3 to 694·4)	–1·0 (–15·4 to 9·0)	9·2 (7·8 to 11·2)	8·4 (7·6 to 9·3)	–8·0 (–21·1 to 1·1)
Neural tube defects	76·5 (56·7 to 107·0)	64·6 (47·9 to 83·4)	–15·5 (–34·9 to 4·4)	1·1 (0·8 to 1·5)	0·9 (0·6 to 1·1)	–20·5 (–38·8 to –1·7)
Congenital heart anomalies	319·0 (267·4 to 378·1)	303·3 (268·8 to 335·4)	–4·9 (–18·9 to 6·5)	4·6 (3·9 to 5·4)	4·1 (3·6 to 4·5)	–11·4 (–24·4 to –0·9)
Cleft lip and cleft palate	3·3 (2·6 to 3·8)	1·3 (1·1 to 1·7)	–59·0 (–66·4 to –50·1)	0·0 (0·0 to 0·1)	0·0 (0·0 to 0·0)	–61·3 (–68·3 to –52·9)
Down's syndrome	26·6 (17·9 to 42·7)	26·5 (19·1 to 36·9)	–0·2 (–25·0 to 30·6)	0·4 (0·3 to 0·6)	0·4 (0·3 to 0·5)	–10·1 (–31·7 to 16·9)
Other chromosomal abnormalities	20·6 (9·8 to 49·3)	22·7 (12·9 to 40·5)	10·3 (–21·8 to 41·0)	0·3 (0·1 to 0·7)	0·3 (0·2 to 0·5)	3·3 (–26·6 to 31·3)
Other congenital anomalies	188·3 (158·7 to 231·9)	209·4 (188·9 to 241·3)	11·2 (–3·7 to 24·5)	2·8 (2·3 to 3·4)	2·8 (2·6 to 3·3)	2·7 (–10·6 to 14·6)
Skin and subcutaneous diseases	71·6 (48·1 to 90·4)	97·6 (66·6 to 128·8)	36·2 (29·5 to 46·4)	1·5 (1·0 to 1·8)	1·5 (1·0 to 2·0)	3·7 (–1·6 to 12·5)
Cellulitis	12·6 (7·8 to 17·4)	16·9 (10·4 to 23·0)	34·2 (22·2 to 48·2)	0·3 (0·2 to 0·3)	0·3 (0·2 to 0·3)	3·5 (–5·5 to 14·1)
Pyoderma	30·9 (21·3 to 43·5)	44·1 (31·1 to 62·8)	42·7 (33·0 to 53·3)	0·6 (0·4 to 0·8)	0·7 (0·5 to 1·0)	12·5 (4·7 to 21·4)
Decubitus ulcer	25·1 (14·5 to 30·7)	32·4 (19·3 to 40·0)	29·3 (20·4 to 42·4)	0·6 (0·3 to 0·7)	0·5 (0·3 to 0·7)	–5·7 (–12·6 to 4·4)
Other skin and subcutaneous diseases	3·1 (2·2 to 4·2)	4·2 (3·0 to 5·8)	35·4 (26·9 to 46·0)	0·1 (0·0 to 0·1)	0·1 (0·0 to 0·1)	5·7 (–1·2 to 14·2)
Sudden infant death syndrome	20·8 (16·9 to 33·7)	19·2 (15·9 to 27·5)	–7·9 (–23·0 to 8·9)	0·3 (0·2 to 0·5)	0·3 (0·2 to 0·4)	–13·5 (–27·7 to 2·3)
Injuries	**4759·0 (4451·4 to 4893·1)**	**4725·1 (4398·5 to 4905·2)**	**–0·7 (–4·3 to 3·5)**	**78·6 (73·5 to 80·8)**	**66·2 (61·5 to 68·7)**	**–15·8 (–18·7 to –12·4)**
Transport injuries	1494·1 (1444·8 to 1550·6)	1466·6 (1394·8 to 1536·5)	–1·8 (–7·4 to 3·3)	24·2 (23·4 to 25·0)	20·2 (19·3 to 21·2)	–16·2 (–20·8 to –11·8)
Road injuries	1392·5 (1341·0 to 1446·0)	1361·7 (1294·0 to 1428·1)	–2·2 (–7·8 to 2·6)	22·5 (21·7 to 23·3)	18·8 (17·9 to 19·7)	–16·4 (–21·1 to –12·3)
Pedestrian road injuries	581·4 (546·3 to 631·3)	560·6 (525·8 to 617·1)	–3·6 (–10·7 to 2·8)	9·6 (9·1 to 10·5)	7·8 (7·4 to 8·6)	–18·6 (–24·6 to –13·2)
Cyclist road injuries	63·4 (58·7 to 68·9)	58·7 (54·4 to 64·4)	–7·5 (–15·2 to 1·2)	1·0 (1·0 to 1·1)	0·8 (0·8 to 0·9)	–21·9 (–28·5 to –14·6)
Motorcyclist road injuries	245·7 (215·2 to 263·8)	257·1 (230·6 to 290·9)	4·6 (–4·7 to 16·5)	3·8 (3·4 to 4·1)	3·5 (3·1 to 3·9)	–8·9 (–17·0 to 1·6)
Motor vehicle road injuries	483·1 (445·9 to 536·6)	464·2 (417·8 to 508·3)	–3·9 (–9·3 to 2·1)	7·7 (7·1 to 8·5)	6·4 (5·7 to 7·0)	–17·2 (–21·8 to –12·1)

(Table 5 continues on next page)

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Other road injuries	18·9 (13·1 to 22·5)	21·1 (14·0 to 24·8)	11·3 (–5·4 to 34·9)	0·3 (0·2 to 0·4)	0·3 (0·2 to 0·3)	–4·5 (–18·7 to 14·7)
Other transport injuries	101·5 (93·2 to 114·0)	104·9 (90·5 to 127·2)	3·3 (–6·4 to 14·7)	1·7 (1·5 to 1·9)	1·4 (1·2 to 1·8)	–12·6 (–20·7 to –3·2)
Unintentional injuries	1887·3 (1701·0 to 1969·6)	1838·7 (1634·6 to 1939·1)	–2·6 (–5·7 to 3·2)	32·3 (29·1 to 33·6)	26·5 (23·6 to 28·0)	–17·8 (–20·4 to –13·4)
Falls	436·1 (402·3 to 451·2)	527·2 (467·8 to 554·5)	20·9 (14·6 to 27·2)	8·6 (7·9 to 8·9)	8·1 (7·2 to 8·5)	–5·5 (–10·1 to –0·8)
Drowning	403·1 (349·2 to 424·7)	323·8 (285·8 to 347·5)	–19·7 (–23·6 to –14·2)	6·3 (5·4 to 6·6)	4·5 (4·0 to 4·8)	–28·5 (–31·8 to –23·8)
Fire, heat, and hot substances	195·2 (161·4 to 209·0)	176·0 (145·1 to 189·6)	–9·9 (–14·8 to –2·5)	3·3 (2·7 to 3·5)	2·5 (2·1 to 2·7)	–23·5 (–27·7 to –17·7)
Poisonings	100·8 (71·4 to 117·4)	86·4 (58·6 to 101·0)	–14·3 (–24·1 to –1·1)	1·6 (1·2 to 1·9)	1·2 (0·8 to 1·4)	–26·7 (–34·3 to –16·2)
Exposure to mechanical forces	202·6 (175·4 to 214·0)	200·6 (157·6 to 216·7)	–1·0 (–11·7 to 7·0)	3·3 (2·8 to 3·5)	2·8 (2·2 to 3·0)	–15·1 (–24·1 to –8·9)
Unintentional firearm injuries	32·7 (23·8 to 35·6)	32·0 (23·3 to 35·1)	–2·1 (–7·1 to 3·3)	0·5 (0·4 to 0·6)	0·5 (0·3 to 0·5)	–17·0 (–20·9 to –12·7)
Unintentional suffocation	34·9 (27·1 to 39·4)	35·6 (25·6 to 40·3)	2·0 (–11·6 to 15·8)	0·6 (0·4 to 0·6)	0·5 (0·4 to 0·6)	–9·2 (–21·2 to 2·5)
Other exposure to mechanical forces	135·0 (113·9 to 144·3)	133·0 (101·1 to 145·1)	–1·5 (–13·6 to 8·5)	2·2 (1·9 to 2·3)	1·9 (1·4 to 2·0)	–16·2 (–26·2 to –8·3)
Adverse effects of medical treatment	97·3 (74·1 to 107·8)	99·8 (77·3 to 109·0)	2·5 (–2·6 to 9·3)	1·7 (1·4 to 1·9)	1·5 (1·1 to 1·6)	–15·6 (–19·2 to –11·4)
Animal contact	104·4 (67·1 to 114·9)	94·0 (55·8 to 132·3)	–9·9 (–19·7 to 18·4)	1·7 (1·1 to 1·9)	1·3 (0·8 to 1·8)	–22·5 (–31·0 to 1·6)
Venomous animal contact	88·2 (54·1 to 98·6)	79·6 (44·2 to 115·9)	–9·8 (–21·0 to 20·5)	1·4 (0·9 to 1·6)	1·1 (0·6 to 1·6)	–22·3 (–32·1 to 3·7)
Non-venomous animal contact	16·2 (13·1 to 18·7)	14·4 (11·4 to 16·4)	–10·8 (–19·7 to 10·9)	0·3 (0·2 to 0·3)	0·2 (0·2 to 0·2)	–23·5 (–30·6 to –5·8)

(Table 5 continues on next page)

Injuries

In 2015, transport injuries caused 1·5 million deaths (95% UI 1·4 million to 1·5 million), unintentional injuries resulted in 1·8 million (1·6 million to 1·9 million), and intentional injuries, including self-harm and interpersonal violence, led to 1·2 million (1·1 million to 1·3 million). Although total deaths did not significantly change between 2005 and 2015, age-standardised death rates fell by 16·2% (11·8–20·8) for transport injuries, 17·8% (13·4–20·4) for unintentional injuries, and 16·3% (12·6–20·1) for intentional injuries. Age-standardised death rates for road injuries and most types of road injuries, including pedestrian, cyclist, and motor vehicle injuries, significantly decreased from 2005 to 2015. Notably, deaths due to falls increased by 20·9% (14·6–27·2) between 2005 and 2015 (to 527 000 deaths, 468 000–555 000), which probably reflects global shifts in ageing rather than a rise in injury risk given that age-standardised death rates fell by 5·5% (0·8–10·1). For drowning, there were significant reductions in both total deaths (decreased by 19·7% [14·2–23·6], to 324 000 deaths [286 000–347 000]) and age-standardised death rates (decreased by 28·5%, 23·8–31·8). Total deaths due to self-harm and interpersonal violence remained relatively unchanged since 2005, but age-standardised deaths fell by 16·3% (11·2–21·5) and 16·4% (13·1–19·1), respectively. Assault by firearms, which accounted for 42·4% (40·4–43·9) of all interpersonal violence deaths, claimed 173 100 lives (149 300–183 200) in 2015, and in contrast with all other causes of interpersonal violence, total deaths significantly increased since 2005 (rose by 6·3%, 2·4–11·0).

Mortality trends due to natural disasters and war were highly irregular (figure 11). By decade, the numbers of war deaths were higher in the 1970s and 1980s, then fell in the 1990s and in the first decade of the 21st century. Conversely, between 2010 and 2015, mortality due to war (collective violence and legal intervention) increased, rising to 171 300 (88 100–251 100) in 2015. More than 40·6% (34·8–45·1) of these deaths occurred in Syria and Yemen (70 000 deaths, 33 000–107 000). These numbers of war fatalities remain much lower than those recorded in 1993 and 1994, when more than 626 000 lives were lost to the Rwandan genocide, the Iraq civil war, ongoing armed conflict in Bosnia and Herzegovina, and other

	All age deaths (thousands)			Age-standardised mortality rate (per 100 000)		
	2005	2015	Percentage change, 2005–15	2005	2015	Percentage change, 2005–15
(Continued from previous page)						
Foreign body	145·7 (118·7 to 175·9)	151·6 (132·6 to 169·8)	4·1 (–4·7 to 13·6)	2·5 (2·1 to 3·0)	2·2 (1·9 to 2·4)	–12·3 (–18·4 to –6·1)
Pulmonary aspiration and foreign body in airway	116·6 (93·0 to 148·1)	124·0 (105·5 to 143·2)	6·3 (–4·9 to 15·7)	2·0 (1·7 to 2·5)	1·8 (1·5 to 2·1)	–10·8 (–18·5 to –4·6)
Foreign body in other body part	29·0 (18·1 to 43·2)	27·6 (20·3 to 34·4)	–5·0 (–22·7 to 11·2)	0·5 (0·3 to 0·7)	0·4 (0·3 to 0·5)	–18·8 (–34·3 to –6·2)
Environmental heat and cold exposure	53·4 (39·9 to 57·2)	45·2 (33·5 to 49·5)	–15·4 (–21·1 to –9·1)	0·9 (0·7 to 1·0)	0·7 (0·5 to 0·7)	–31·3 (–35·8 to –26·6)
Other unintentional injuries	148·8 (141·4 to 157·7)	134·2 (124·8 to 147·8)	–9·8 (–16·7 to –1·6)	2·4 (2·3 to 2·5)	1·9 (1·7 to 2·0)	–22·3 (–28·2 to –15·4)
Self-harm and interpersonal violence	1253·0 (1125·6 to 1288·8)	1236·7 (1130·1 to 1287·9)	–1·3 (–5·7 to 3·0)	20·3 (18·2 to 20·9)	17·0 (15·5 to 17·7)	–16·3 (–20·1 to –12·6)
Self-harm	827·6 (725·4 to 855·5)	828·1 (745·8 to 868·7)	0·1 (–6·2 to 6·1)	13·7 (12·0 to 14·2)	11·5 (10·3 to 12·1)	–16·3 (–21·5 to –11·2)
Interpersonal violence	425·3 (388·7 to 439·6)	408·6 (370·5 to 431·5)	–3·9 (–7·0 to –0·1)	6·5 (6·0 to 6·8)	5·5 (5·0 to 5·8)	–16·4 (–19·1 to –13·1)
Assault by firearm	162·9 (142·8 to 168·8)	173·1 (149·3 to 183·2)	6·3 (2·4 to 11·0)	2·4 (2·1 to 2·5)	2·3 (2·0 to 2·4)	–6·0 (–9·4 to –1·8)
Assault by sharp object	104·4 (97·5 to 110·7)	89·5 (83·3 to 97·3)	–14·3 (–18·8 to –9·1)	1·6 (1·5 to 1·7)	1·2 (1·1 to 1·3)	–25·6 (–29·4 to –21·2)
Assault by other means	158·0 (143·1 to 167·5)	145·9 (129·6 to 159·7)	–7·6 (–12·6 to –1·5)	2·5 (2·3 to 2·6)	2·0 (1·8 to 2·2)	–20·6 (–24·8 to –15·4)
Forces of nature, war, and legal intervention	124·7 (82·5 to 166·5)	183·1 (100·0 to 263·8)	46·8 (–14·2 to 120·5)	1·9 (1·3 to 2·6)	2·4 (1·3 to 3·5)	27·4 (–25·5 to 90·7)
Exposure to forces of nature	90·8 (53·0 to 128·0)	11·8 (7·2 to 16·4)	–87·0 (–87·9 to –86·1)	1·4 (0·8 to 2·0)	0·2 (0·1 to 0·2)	–88·5 (–89·3 to –87·6)
Collective violence and legal intervention	33·8 (25·5 to 43·0)	171·3 (88·1 to 251·1)	406·0 (236·0 to 524·5)	0·5 (0·4 to 0·7)	2·3 (1·2 to 3·3)	347·5 (192·4 to 455·8)

Data in parentheses are 95% uncertainty intervals.

Table 5: **Global deaths in 2005 and 2015 for all ages and both sexes combined and age-standardised death rates, with percentage change between 2005 and 2015 for 249 causes**

occurrences of collective violence; nonetheless, the rising number of casualties in the Middle East represents the largest increase in war deaths since 1995. Because of deaths in Afghanistan, Iraq, Syria, and Yemen, war deaths have increased during 2014–15. Between 2004 and 2010, natural disasters claimed thousands of lives, including 226 000 from the Indonesian earthquake and tsunami in 2004; 74 700 from earthquakes in India and Pakistan, as well as 1870 from Hurricane Katrina in the USA in 2005; 87 900 from an earthquake in China and 138 000 from a cyclone in Myanmar in 2008; and 223 000 from the earthquake in Haiti in 2010. In 2015, natural disasters caused 11 800 deaths (7160–16 400), mainly due to the Nepal earthquake and floods in India.

In general, age-standardised death rates for males and females by cause are highly correlated at the global level (figure 12). For most causes, male age-standardised death rates are higher than for females. Death rates are notably higher in males for many cancers including tracheal, bronchus, and lung, liver, oesophageal, bladder, and larynx cancer, and mesothelioma. Male age-standardised death rates are also higher for many injuries including road injuries, self-harm, falls, and interpersonal violence. For a small number of causes, female age-standardised rates are higher than for males, including breast cancer, rheumatic heart disease, gallbladder and biliary cancer, whooping cough, rheumatoid arthritis, thyroid cancer, and multiple sclerosis, and other musculoskeletal disorders.

Decomposition analysis of changes in global mortality

Drivers of global changes in mortality—population growth, ageing, and changes to age-standardised rates of cause-specific mortality—varied substantially by cause from 2005 to 2015 (figure 13). Among the leading 30 causes of death worldwide, changes in total death tolls ranged from a reduction of 37·4% (95% UI 27·8–47·0) for malaria to an increase of 38·2% (36·2–40·1) for Alzheimer's disease and other dementias. Population growth accounted for increases in numbers of deaths across all 30 causes, but its contribution ranged from less than 9% for several types of cancer, including lung cancer and liver cancer, to 22·9% for malaria. In fact, for malaria, as well as a subset of other Group 1 causes (ie, preterm birth complications, neonatal

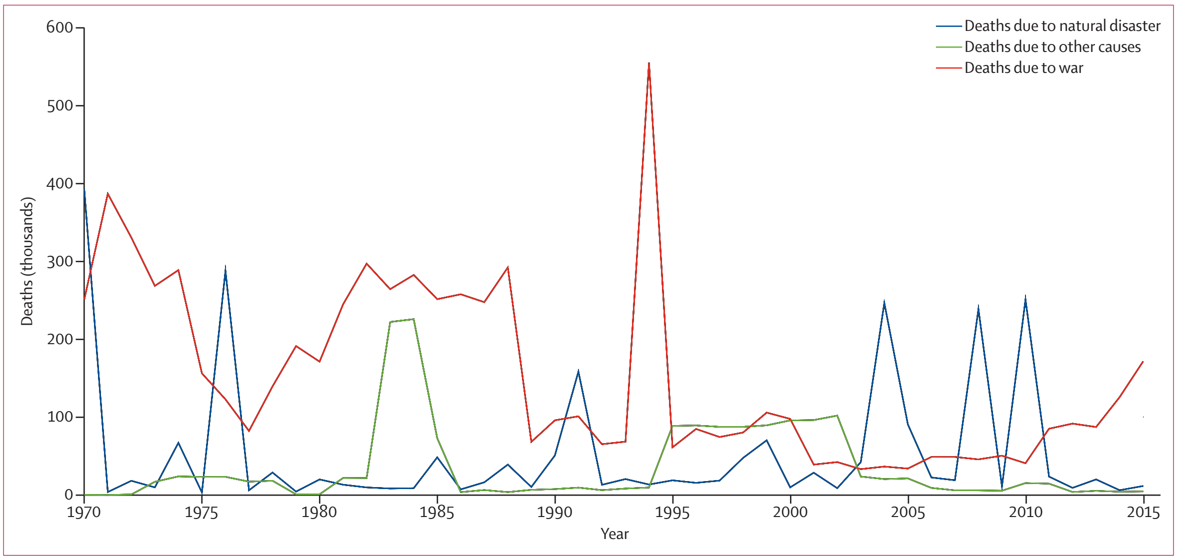


Figure 11: **Global deaths due to fatal discontinuities by cause group for each year, 1980–2015**
Numbers shown are total deaths. Fatal discontinuities are events that lead to abrupt changes in deaths in a geography. The causes for these fatal discontinuities include wars, natural disasters, industrial accidents, large transport accidents, epidemics, famines, or other injuries.

encephalopathy, and meningitis), population growth was the only factor that hindered further reductions in mortality. Population ageing led to increasing mortality for most causes, but its relative contribution ranged from less than 4% for interpersonal violence and diarrhoeal diseases to 29·6% for Alzheimer's disease and other dementias. Shifts in population age structures also accounted for more than 23% of increased mortality due to cardiovascular disease (ischaemic heart disease and stroke), 24·2% for COPD, and at least 20% for several types of cancer (eg, pancreatic cancer and oesophageal cancer). Conversely, for some causes, namely neonatal conditions and causes that largely affect children, such as malaria, population ageing contributed to decreasing levels of mortality. Except for pancreatic cancer, changes in age-specific and cause-specific rates of death drove reductions in deaths due to the 28 other leading causes. Declines attributable to changes in age-specific and cause-specific mortality rates markedly differed, with several causes experiencing reductions of more than 40% (eg, malaria [58·2%], HIV/AIDS [54·8%], tuberculosis [41·9%], and diarrhoeal diseases [41·0%]) and others showing much smaller decreases (eg, chronic kidney disease [2·4%] and diabetes [3·1%]). Notably, patterns were less distinct for most injuries because population growth and shifts in age-specific and cause-specific mortality rates had relatively similar contributions to changes in deaths due to road injuries, self-harm, and interpersonal violence. Falls were the exception, with a combination of population growth and ageing mainly driving its rising death toll.

Global YLLs

From 2005 to 2015, changes in the relative ranks of YLLs, emphasised the increasing complexity of global mortality patterns (figure 14). The top three causes of YLLs—ischaemic heart disease, stroke (which includes both ischaemic and haemorrhagic stroke), and lower respiratory infections—all saw reductions in age-standardised rates between 2005 and 2015, but changed minimally in rankings. In 2005, the causes ranked fourth to eighth were all communicable diseases (HIV/AIDS [fourth], diarrhoeal diseases [sixth], and malaria [seventh]) or neonatal disorders (preterm birth complications [fifth] and neonatal encephalopathy [eighth]). By 2015, both total and age-standardised rates of YLLs had significantly decreased for all of these causes, but their relative rankings did not substantially change; the exceptions were HIV/AIDS, which fell to seventh, and malaria, which dropped to ninth. Road injuries, COPD, and congenital anomalies, ranked as ninth, tenth, and 11th leading causes of YLLs in 2005, remained largely the same in terms of ranks in 2015, with only road injuries moving up by one spot to rank eighth. YLLs due to road injuries fell significantly between 2005 and 2015, both in terms of total YLLs, which decreased by 8·1% (95% UI 3·3–13·3), and age-standardised rates, which decreased by 18·5% (14·3–23·1). Among the top ten leading causes, premature mortality due to malaria decreased the most, with total YLLs falling by 40·1% (29·4–50·2) and age-standardised rates dropping 44·7% (34·9–54·1).

More pronounced shifts in YLL ranks and percentage changes between 2005 and 2015 occurred beyond the leading 11 causes, particularly for several NCDs. Total YLLs due to diabetes rose 25·4% (95% UI 20·4–30·0) and diabetes advanced from being ranked 18th to 15th. Similar increases occurred for chronic kidney disease (18·4% [13·8–23·1] for total YLLs and rising from 21st to

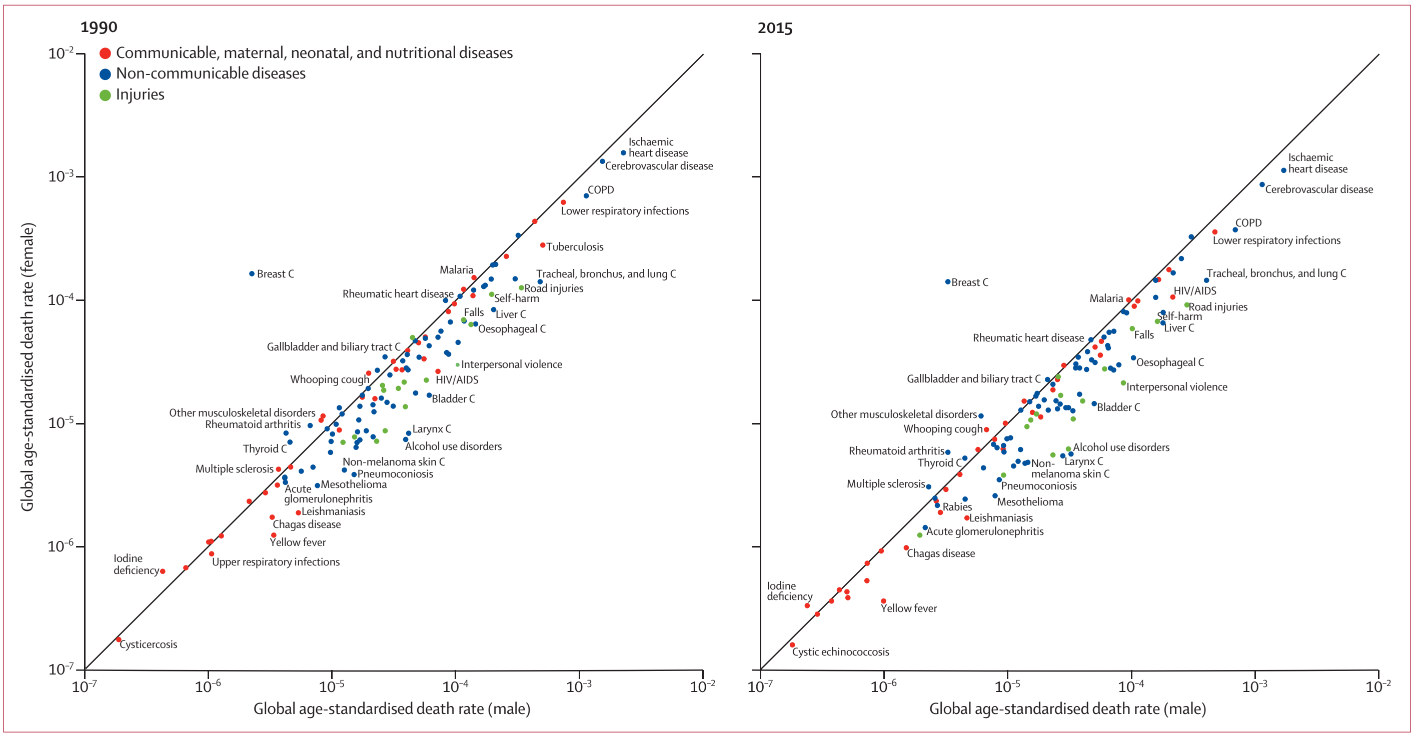


***Figure 12*: Global age-standardised death rates for males versus females, by GBD cause Level 3, 1990 and 2015**

The y-axis and x-axis are shown on a log scale to enable comparisons between males and females spanning a wide range of values. Black lines show where death rates are identical for males and females. Causes that only affect one sex, including maternal disorders, chlamydia, cervical, uterine, ovarian, prostate, testicular cancers, and gynaecological diseases are not shown. GBD=Global Burden of Disease. COPD=chronic obstructive pulmonary disease. C=cancer.

17th) and Alzheimer's disease and other dementias (30·5% [28·6–32·4] for total YLLs and increasing from 30th to 25th). Several types of cancer, including colon and rectum cancer, breast cancer, pancreatic cancer, and brain cancer, showed significant increases in total YLLs and relative ranks by 2015; however, none of these cancers had significant increases in age-standardised rates of YLLs. Among NCDs, only asthma (ranked 32nd in 2005 and 37th in 2015) and rheumatic heart disease (ranked 41st in 2005 and 43rd in 2015) had significant reductions for both total YLLs and age-standardised rates. By contrast, larger declines for total YLLs and age-standardised rates occurred for several leading Group 1 causes, including tuberculosis (20·5% [14·9–26·0] and 33·7% [29·1–38·3], respectively); protein-energy malnutrition (22·9% [4·8–38·1] and 29·4% [13·0–43·0], respectively); and most notably, measles (75·0% [58·9–84·4] and 76·7% [61·8–85·5], respectively). In general, changes in total YLLs and age-standardised rates due to injuries suggested reduced levels of premature mortality; the main exception was early deaths due to war, which climbed from the 92nd leading cause of YLLs in 2005 to 38th in 2015, and increased more than 350% for total YLLs and age-standardised rates of early death. Additional comparisons for changes in YLLs across different years between 1990 and 2015 can be explored online.

Causes of child death

Globally, under-5 deaths decreased by 27·2% (95% UI 25·2–29·0) between 2005 and 2015, reaching 5·8 million deaths (95% UI 5·6 million to 6·0 million). Group 1 causes, which include communicable, maternal, neonatal, and nutritional conditions, led to 80·8% (79·5–82·3; 4·7 million deaths, 4·6 million to 4·8 million) of under-5 deaths, NCDs caused 13·8% (12·6–14·9; 804 000 deaths, 733 000–868 000), and injuries accounted for 5·4% (4·6–6·0; 313 000 deaths, 265 000–348 000) of deaths. Of the selected causes shown in table 6, neonatal disorders, which can affect children beyond the neonatal period (ie, infants younger than 1 month), caused 37·2% (36·0–38·3) of under-5 deaths, equating to 2·2 million deaths (2·1 million to 2·2 million) in 2015; these causes included preterm birth complications, neonatal encephalopathy, neonatal sepsis, and other neonatal disorders. 62 Group 1 causes of under-5 deaths were lower respiratory infections (12·1% [11·2–13·1], 703 000 deaths [651 000–763 000]); diarrhoeal diseases (8·5% [7·7–9·5], 499 000 deaths [447 000–558 000]); malaria (8·1% [5·7–10·7], 474 000 deaths [333 000–624 000]); nutritional deficiencies (3·3% [2·6–4·3], 193 000 deaths [147 000–248 000]); and meningitis (3·0% [2·3–3·9], 173 000 deaths [137 000–229 000]). Congenital anomalies, which include congenital heart anomalies, led to 8·5% (7·7–9·5) of under-5 deaths in 2015 (497 000 deaths,

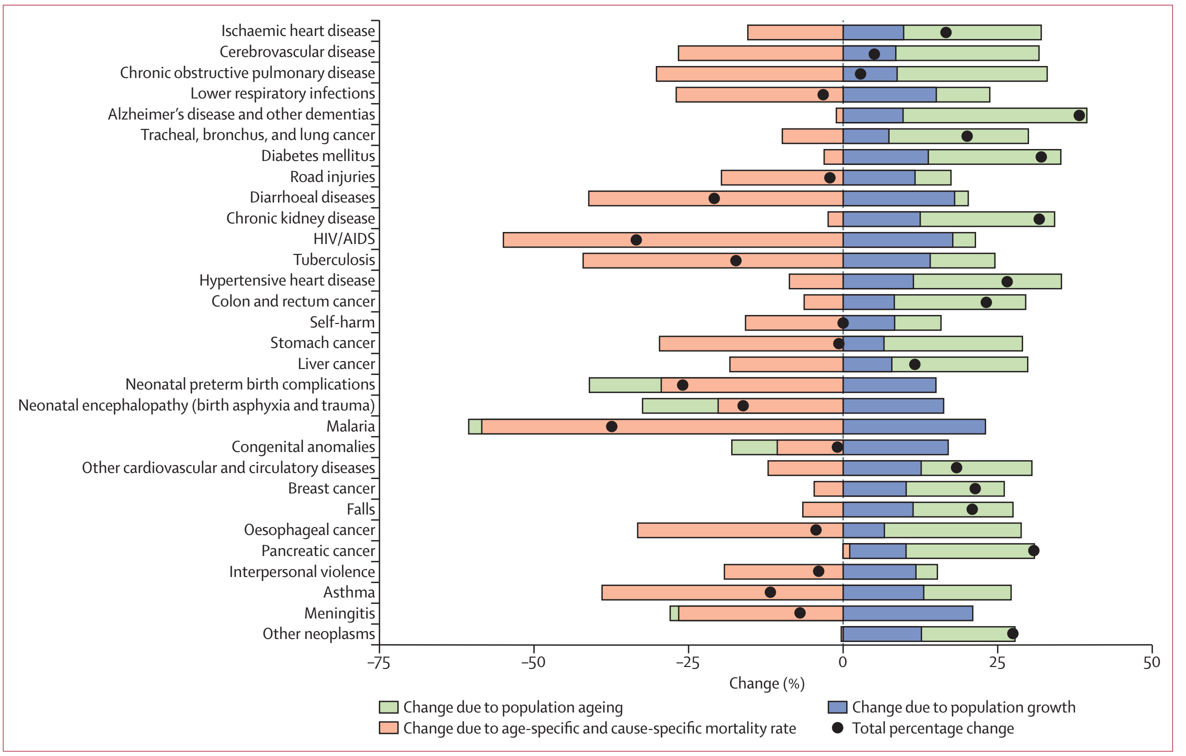


***Figure 13:* Global decomposition of changes in leading 30 causes of death, 2005 to 2015**

Changes due to population growth, population ageing, and changes in age-specific mortality rates are shown. Causes are reported in descending order by total number of deaths for all ages and both sexes combined in 2015. The black circle shows the overall median percentage change in global deaths from 2005 to 2015. Causes with increases in overall death rates have a circle to the right of the zero, whereas a circle to the left of the zero denotes causes with decreases in overall death rates. The contributions of population growth, ageing, and change in age-specific death rates sum to the total change in numbers of deaths.

444 000–555 000), and other NCDs, such as sudden infant death syndrome, accounted for 9·0% (8·1–9·9) of under-5 deaths that year (522 000 deaths, 470 000–580 000).

Neonatal deaths, which accounted for 45·0% (44·9–45·2) of total under-5 deaths in 2015, decreased by 20·3% (95% UI 18·7–21·8), falling from 3·3 million (3·2 million to 3·3 million) in 2005 to 2·6 million (2·6 million to 2·7 million) in 2015. Neonatal causes, mainly preterm complications and neonatal encephalopathy, accounted for 77·5% (76·0–79·5) of deaths among neonates (766 000 deaths, 700 000–854 000), followed by neonatal sepsis, congenital anomalies, and lower respiratory infections. Tetanus had the largest reduction in neonatal deaths between 2005 and 2015, falling 57·7% (50·0–64·2) to 19 900 deaths (17 000–23 400), followed by malaria, which fell by 55·9% (41·1–67·8) to 13 900 deaths (8 930–19 800). Smaller improvements were achieved in the reduction of neonatal deaths from sepsis and congenital anomalies.

Among children aged 1–59 months, total deaths fell by 32·1% (95% UI 29·7–34·2) from 2005 to 2015, with 1·5 million (1·2 million to 1·8 million) fewer children in this age group dying in 2015. Lower respiratory infections, diarrhoeal diseases, and malaria caused 57·0% (49·7–64·6) of deaths among children aged 1–59 months, leading to a total of 1·8 million deaths (1·6 million to 2·1 million). Other leading causes of death for this age group included congenital anomalies (254 000 deaths, 224 000–297 000), nutritional deficiencies (193 000 deaths, 147 000–248 000), and meningitis (147 000 deaths, 117 000–196 000). Deaths due to measles fell by 75·1% (59·6–84·5), the largest reduction among this age group, to 62 600 deaths (22 400–136 000), followed by tetanus, which fell by 55·2% (39·3–66·4) to 5560 deaths (4140–7760), and HIV/AIDS, which fell by 51·9% (49·6–54·2), to 88 900 deaths (84 300–93 700). Nearly all of these leading causes of death showed some form of reduction from 2005 to 2015; neonatal sepsis and congenital anomalies were exceptions, both of which had, albeit not significant, increases in deaths since 2005.

Lower respiratory infections and diarrhoea by pathogens

In 2015, we estimated that 1·3 million deaths (95% UI 1·2 million to 1·4 million) were caused by diarrhoeal diseases, including 499 000 (447 000–558 000) in children younger than 5 years, representing 8·6% (7·7–9·5) of all deaths in this age group. Reductions in under-5 deaths due to diarrhoeal diseases exceeded the rate of change for all other age groups. Rotaviral enteritis (rotavirus) was the leading cause of diarrhoeal death in children younger than 5 years globally (29·3% [24·6–35·9%], 146 500 deaths

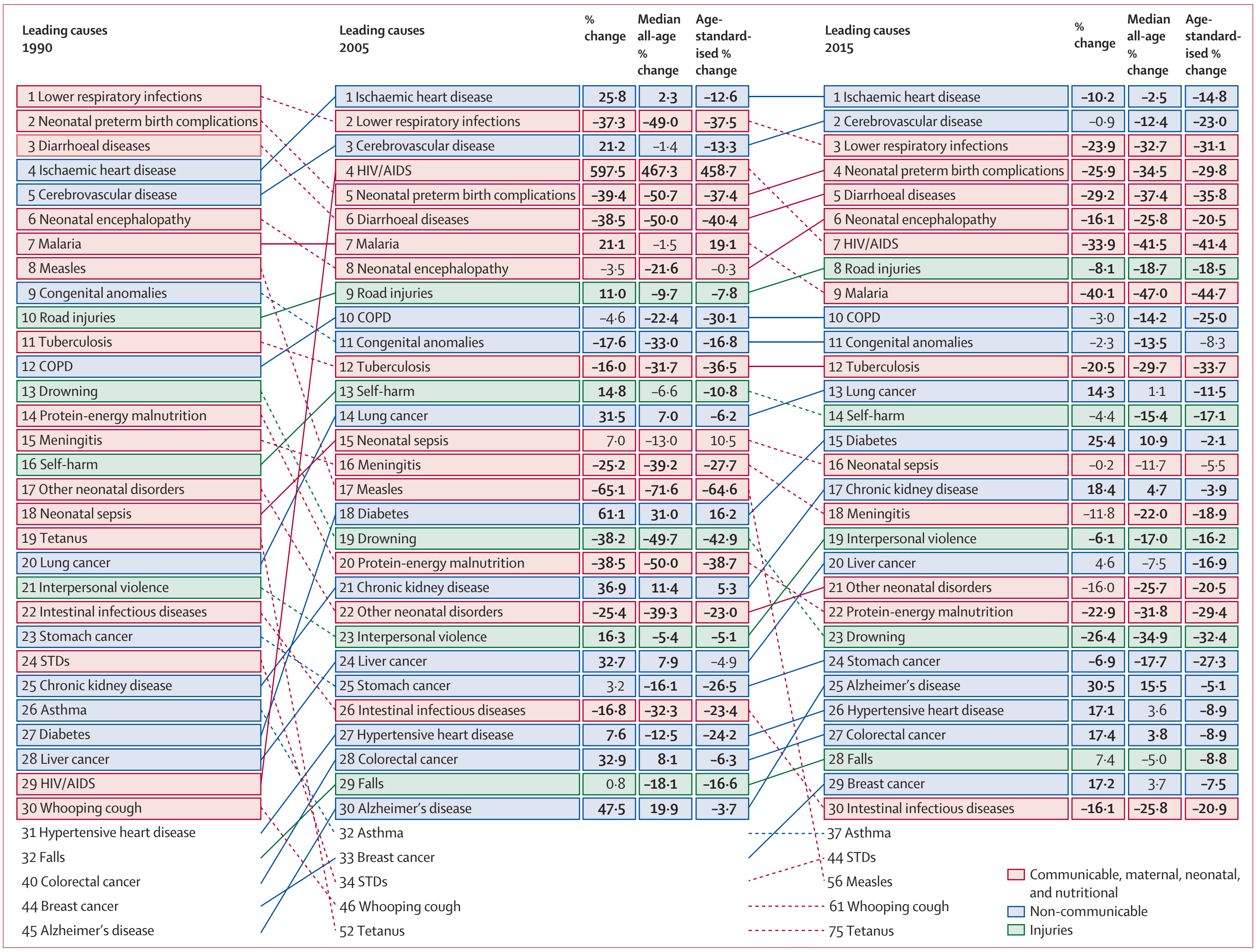


***Figure 14:* Leading 30 Level 3 causes of global YLLs for both sexes combined for 1990, 2005, and 2015, with percent change in number of YLLs, and all-age and age-standardised rates**
Causes are connected by lines between time periods. For the time periods 1990 to 2005 and 2005 to 2015, three measures of change are shown: percent change in the number of YLLs, percent change in the all-age YLL rate, and percent change in the age-standardised YLL rate. Statistically significant changes are shown in bold. YLLs=years of life lost. COPD=chronic obstructive pulmonary disease. STDs=sexually transmitted diseases excluding HIV. An interactive version of this figure is available online at http://vizhub.healthdata.org/gbd-compare.

[118 000–183 500]) in 2015 followed by cryptosporidiosis (*Cryptosporidium*; 12·1% [2·8–26·9], 60 400 deaths [13 700–134 500]) and shigellosis (*Shigella*; 11·0% [5·5–18·7], 54 900 deaths [27 000–94 700]). Rotavirus was also the leading cause of mortality due to diarrhoea in all ages (15·2% [12·9–18·1], 199 200 deaths [165 500–241 200]), followed by *Shigella* (12·5% [6·4–21·2], 164 300 deaths [85 000–278 700]) and other *Salmonella* infections (6·9% [2·7–13·9], 90 300 deaths [34 100–183 100]; table 7). Adenovirus was an important cause of mortality due to diarrhoea in children younger than 5 years, accounting for nearly 10% of such deaths in this age group (9·2 [3·3–19·7], 46 000 deaths [16 200–97 700]). Mortality due to *Clostridium difficile* was the lowest among all diarrhoea causes, but was a major cause of diarrhoea mortality in high-income countries. Moreover, it was the only cause for which the attributable fraction increased from 2005 to 2015 (increased by 36·3%, 11·3–65·6). During this same time period, the only attributable fraction to significantly decrease was for rotavirus (decreased by 14·1%, 6·3–20·5; table 7).

We estimated that 2·7 million (95% UI 2·5 million to 2·9 million) deaths occurred in 2015 due to lower respiratory infections, of which 704 000 (651 000–763 000) occurred among children younger than 5 years, representing 12·1% of deaths in this age group. From 2005 to 2015, the number of deaths due to lower respiratory infections decreased by 3·25% (–0·45 to 6·94) globally in all age groups, but decreased by 36·9% (31·6–42·0) in children younger than 5 years. Pneumococcal pneumonia and *H influenzae* type b together accounted for nearly 65% of deaths due to lower respiratory infections in children

	Neonates age <1 month		Children age 1–59 months		Under-5 totals	
	2015 (thousands)	Percentage change, 2005–15	2015 (thousands)	Percentage change, 2005–15	2015 (thousands)	Percentage change, 2005–15
All causes	2621·5 (2562·0–2680·8)	–20·3 (–21·8 to –18·7)	3199·4 (3093·9–3309·8)	–32·1 (–34·2 to –29·7)	5820·9 (5673·0–5965·2)	–27·2 (–29·0 to –25·2)
Communicable, maternal, neonatal, and nutritional diseases	2331·6 (2272·8–2394·0)	–21·6 (–23·2 to –19·9)	2371·7 (2267·7–2473·5)	–37·1 (–39·9 to –34·4)	4703·4 (4569·9–4845·5)	–30·3 (–32·4 to –28·1)
HIV/AIDS	..	..	88·9 (84·3–93·7)	–51·9 (–54·2 to –49·6)	88·9 (84·3–93·7)	–51·9 (–54·2 to –49·6)
Diarrhoeal diseases	44·0 (38·6–50·6)	–38·5 (–46·3 to –29·1)	454·9 (404·4–510·2)	–33·9 (–42·4 to –23·4)	498·9 (447·5–557·6)	–34·3 (–42·3 to –24·9)
Intestinal infectious diseases	..	..	42·2 (22·5–73·2)	–20·0 (–29·8 to –8·9)	42·2 (22·5–73·2)	–20·0 (–29·8 to –8·9)
Lower respiratory infections	152·9 (140·4–166·6)	–35·9 (–40·8 to –30·7)	551·0 (502·2–600·5)	–37·1 (–43·0 to –30·9)	703·9 (651·4–763·0)	–36·9 (–42·0 to –31·6)
Meningitis	25·8 (18·3–35·9)	–15·6 (–31·9 to 9·3)	147·3 (117·1–196·0)	–17·9 (–32·0 to 4·9)	173·1 (137·1–228·9)	–17·6 (–31·0 to 4·0)
Whooping cough	..	..	54·5 (18·8–117·0)	–41·0 (–77·8 to 63·5)	54·5 (18·8–117·0)	–41·0 (–77·8 to 63·5)
Tetanus	19·9 (17·0–23·5)	–57·7 (–64·2 to –50·0)	5·6 (4·1–7·8)	–55·2 (–66·4 to –39·3)	25·5 (21·8–30·9)	–57·2 (–63·8 to –49·1)
Measles	..	..	62·6 (22·4–135·8)	–75·1 (–84·5 to –59·6)	62·6 (22·4–135·8)	–75·1 (–84·5 to –59·6)
Malaria	13·9 (8·9–19·8)	–55·9 (–67·8 to –41·1)	460·2 (324·1–604·9)	–42·3 (–54·1 to –29·0)	474·1 (333·3–623·7)	–42·8 (–54·6 to –29·4)
Neonatal preterm birth complications	765·9 (700·0–854·3)	–25·9 (–31·5 to –20·5)	39·9 (32·7–48·3)	–25·9 (–39·3 to –8·4)	805·8 (736·2–898·6)	–25·9 (–31·3 to –20·6)
Neonatal encephalopathy (birth asphyxia and trauma)	707·8 (638·4–789·7)	–16·3 (–23·8 to –8·0)	32·6 (24·8–43·0)	–11·9 (–34·0 to 16·4)	740·4 (667·6–829·2)	–16·1 (–23·8 to –8·0)
Neonatal sepsis and other neonatal infections	336·3 (237·4–441·5)	–0·5 (–16·9 to 20·7)	15·4 (10·0–20·6)	7·8 (–18·0 to 40·6)	351·7 (249·2–459·1)	–0·2 (–16·2 to 20·3)
Other neonatal disorders	180·0 (133·9–229·4)	–16·4 (–35·1 to 6·2)	40·3 (29·2–52·3)	–14·1 (–39·2 to 19·9)	220·2 (167·6–276·8)	–16·0 (–34·1 to 5·6)
Nutritional deficiencies	..	..	192·8 (147·2–248·1)	–24·3 (–40·4 to –4·1)	192·8 (147·2–248·1)	–24·3 (–40·4 to –4·1)
Syphilis	31·5 (17·5–49·2)	–28·4 (–34·5 to –21·5)	59·0 (32·9–95·7)	–16·5 (–28·7 to –5·4)	90·5 (50·6–144·5)	–21·1 (–30·4 to –12·5)
Other communicable diseases	53·6 (39·3–75·5)	–30·9 (–44·1 to –16·4)	124·7 (108·2–141·5)	–21·7 (–30·2 to –10·3)	178·3 (151·7–211·3)	–24·7 (–32·3 to –16·2)
Non-communicable diseases	267·4 (234·3–290·8)	–7·1 (–18·4 to 0·8)	537·2 (488·1–592·6)	–8·0 (–18·0 to 2·9)	804·5 (733·8–868·9)	–7·7 (–17·3 to 1·0)
Congenital anomalies	242·6 (213·6–263·6)	–6·0 (–18·4 to 2·5)	254·0 (223·6–297·4)	–0·4 (–17·2 to 13·7)	496·6 (444·4–554·6)	–3·2 (–17·8 to 7·6)
Sudden infant death syndrome	1·9 (1·6–2·6)	–9·7 (–25·5 to 4·9)	17·3 (14·2–24·9)	–7·7 (–23·1 to 9·7)	19·2 (15·9–27·5)	–7·9 (–23·0 to 8·9)
Other non-communicable diseases	22·9 (17·3–37·3)	–17·3 (–29·3 to 3·8)	265·9 (232·7–315·0)	–14·3 (–25·5 to 1·6)	288·8 (251·6–348·9)	–14·6 (–25·3 to –0·1)
Injuries	22·5 (17·0–25·9)	–13·9 (–23·1 to –2·7)	290·5 (247·2–323·4)	–17·5 (–25·9 to –5·0)	313·0 (265·2–348·4)	–17·3 (–25·3 to –5·2)
Road injuries	2·4 (1·7–3·4)	–27·8 (–49·9 to 2·4)	47·1 (40·9–54·2)	–16·0 (–30·0 to 4·1)	49·5 (43·0–56·8)	–16·7 (–30·1 to 2·5)
Drowning	1·4 (0·9–1·9)	–20·3 (–44·4 to 16·9)	54·7 (43·4–64·3)	–37·1 (–47·0 to –23·9)	56·1 (44·4–65·7)	–36·8 (–46·6 to –23·8)
Other injuries	18·7 (14·0–21·7)	–11·2 (–20·8 to 1·6)	188·7 (155·8–216·0)	–9·8 (–20·2 to 6·2)	207·4 (170·2–236·6)	–9·9 (–19·9 to 5·3)

Data in parenthesis are 95% uncertainty intervals. The selected causes are the major causes of death within each Level 1 group that accounted for deaths in children younger than 5 years. Neonates were defined as children younger than 1 month. Childhood was defined as ages 1–59 months.

Table 6: Selected causes of global child deaths for both sexes combined in 2005 and 2015, with percentage change between 2005 and 2015

younger than 5 years (table 7). The attributable fraction of deaths due to lower respiratory infection caused by pneumococcal pneumonia was highest in children younger than 5 years (55·8%, 32·5–75·0) and all ages (55·4%, 31·5–79·1). The percentage of under-5 deaths due to *H influenzae* type b decreased by 60·7% (56·8–65·7), from 13·4% (–0·8 to 24·7) in 2005 to 8·3% (–0·5 to 15·9) in 2015, with 58 700 deaths (–3130 to 115 000) recorded in 2015. Respiratory syncytial virus (5·2% [2·9–8·6], 36 400 deaths [20 400–61 500]) and influenza (1·4% [0·8–2·4], 10 200 deaths [5700–16 800]) together accounted for less than 10% of deaths due to lower respiratory infections in children younger than 5 years, and the remaining 29% of such deaths in this age group remain unattributed.

Expected changes in disease profile with higher SDI

Figure 15 shows the changes in patterns of premature mortality as they relate to age-standardised rates of YLLs, population age structure, and total YLLs per 100 000 population. With increasing SDI, age-standardised YLL rates narrowed (figure 15A), from a total of 98 742 YLLs per 100 000 for males and 96 381 YLLs per 100 000 for females at low SDI, to a low of 9172 YLLs per 100 000 and 6239 YLLs per 100 000, respectively, at high SDI. The cause composition of YLLs substantially shifted as well. At lower SDI, premature mortality was largely due to communicable diseases that disproportionately affect children, such as diarrhoeal disease and lower respiratory infections, measles, and meningitis, but with increasing SDI, YLLs due to these causes markedly decreased. Age-standardised YLL rates due to HIV/AIDS and tuberculosis, neglected tropical diseases and malaria, neonatal disorders, and maternal disorders also rapidly decreased as SDI increased. Nonetheless, the gains achieved for neglected tropical diseases and malaria with rising SDI were somewhat attenuated because the rates of premature mortality due to dengue and Chagas disease increased. For a subset of NCDs, several causes had reductions in age-standardised YLL rates amid improving SDI, including chronic respiratory diseases; digestive diseases; diabetes, urogenital, blood, and endocrine diseases; and unintentional injuries. However, for other causes, the relationship between increasing SDI and premature mortality was less obvious. Age-standardised YLL rates due to cardiovascular disease gradually increased for both sexes until SDI reached 0·40, after which rates declined slowly until an SDI of 0·7, and more rapidly thereafter. For cancers, age-standardised rates of YLLs rose steadily between SDI levels of 0·60 and 0·72, and then largely plateaued. Notably, changes in age-standardised YLL rates and SDI affected the relative ratio of early death by sex for a subset of causes. Cancers, for example, began to exact a larger toll for males than females at SDI levels of about 0·40; this was mainly associated with rising mortality due to lung cancer. A similar trend occurred for cardiovascular disease, with the age-standardised YLL rates of males exceeding those of females beyond an SDI of 0·27. Injuries generally caused higher rates of age-standardised YLLs among males than females across all levels of SDI, but the largest imbalance occurred between SDI levels of 0·35 and 0·72.

Increases in SDI had sizeable implications for population age structure (figure 15B), and in combination with age-standardised rates of cause-specific YLLs, these factors shape the magnitude—and types—of early deaths worldwide (figure 15C). At the lowest levels of SDI (where SDI equals 1), 49·8% of the population was younger than 15 years and 0·23% was older than 80 years, whereas 11·3% were younger than 15 years and 9·3% were older than 80 years at the highest levels of SDI (where SDI equals 100). Differences by sex with increasing SDI were minimal, except for in the oldest age groups starting from SDI of 0·40. At highest SDI, the 80 years and older age group consisted of far more females (10·9%) than males (6·2%). Below an SDI of 0·50, Group 1 causes, especially infectious diseases such as diarrhoeal diseases and lower respiratory infections, accounted for most premature mortality (as much as 72·5%, or roughly 141 513 YLLs per 100 000). Between SDI levels of 0·32 and 0·58, premature mortality from communicable causes, nutritional deficiencies, and maternal disorders sharply decreased, whereas YLLs per 100 000 due to NCDs and injuries remained relatively unchanged or slowly increased; notably, as SDI increased, early death due to neonatal disorders decreased at a much slower pace than did other Group 1 causes. At SDI of 0·50 and above, NCDs and injuries accounted for a larger portion of total YLLs per 100 000 than did communicable, maternal, neonatal, and nutritional causes. With further improvements in SDI, YLLs per 100 000 generally plateaued—or even increased for some causes—as population age structures began to shift faster than the falls in age-standardised rates of death. The stark contrast between the absolute and relative causes of YLLs per 100 000 for SDI levels lower than 0·40 and higher than 0·60 accentuates the complex disease profile of the remaining levels of SDI: relatively high levels of premature mortality due to a broad mixture of causes, ranging from neonatal disorders to cardiovascular disease.

Attribution of change in life expectancy to changes in major causes of death

Figure 16 shows changes in life expectancy from 2005 to 2015, as attributable to changes in Level 2 causes of death, for each country, territory, and subnational geography. In 2015, Andorra had the highest life expectancy at birth for males (81·2 years, 95% UI 80·8–81·6) and females (88·4 years, 88·1–88·7), whereas Lesotho experienced the lowest life expectancy at birth for both sexes (44·1 years, 38·6–51·8 for males and 50·4 years, 43·6–58·5 for

	Children younger than 5 years					All ages				
	2005		2015		Percentage change, 2005–15	2005		2015		Percentage change, 2005–15
	Deaths (thousands)	Population attributable fractions (%)	Deaths (thousands)	Population attributable fractions (%)		Deaths (thousands)	Population attributable fractions (%)	Deaths (thousands)	Population attributable fractions (%)	
Diarrhoea										
Cholera	46·8 (32·2 to 64·5)	6·2 (4·3 to 8·4)	28·8 (20·6 to 39·7)	5·8 (4·1 to 7·9)	–38·4 (–49·9 to –24·3)	98·7 (70·7 to 130·3)	6·0 (4·3 to 7·7)	68·4 (50·4 to 87·1)	5·2 (3·8 to 6·6)	–30·7 (–38·9 to –21·1)
Other *Salmonella* infections	60·1 (18·6 to 131·3)	7·9 (2·5 to 17·6)	38·5 (12·2 to 84·2)	7·7 (2·5 to 16·6)	–35·9 (–76·9 to 76·3)	116·8 (44·3 to 241·9)	7·0 (2·7 to 14·5)	90·3 (34·1 to 183·1)	6·9 (2·7 to 13·9)	–22·7 (–71·8 to 116·1)
Shigellosis	83·0 (42·8 to 147·3)	10·9 (5·7 to 18·9)	54·9 (27·0 to 94·7)	11·0 (5·5 to 18·7)	–33·8 (–68·3 to 40·9)	195·4 (101·5 to 328·5)	11·8 (6·2 to 19·6)	164·3 (85·0 to 278·7)	12·5 (6·4 to 21·2)	–15·9 (–59·2 to 77·4)
Enteropathogenic *Escherichia coli* infection	15·2 (0·7 to 41·7)	2·0 (0·1 to 5·4)	11·3 (0·7 to 32·0)	2·3 (0·1 to 6·2)	–26·0 (–85·5 to 283·4)	16·0 (0·6 to 44·6)	1·0 (0·0 to 2·6)	12·0 (0·6 to 34·1)	0·9 (0·0 to 2·6)	–25·1 (–83·8 to 249·8)
Enterotoxigenic *Escherichia coli* infection	38·2 (15·7 to 72·5)	5·0 (2·1 to 9·3)	23·6 (9·6 to 44·3)	4·7 (2·0 to 8·9)	–38·1 (–74·0 to 42·7)	91·8 (40·3 to 167·0)	5·5 (2·5 to 10·1)	74·1 (29·9 to 137·9)	5·6 (2·3 to 10·4)	–19·3 (–66·5 to 91·2)
Campylobacter enteritis	46·1 (10·5 to 94·1)	6·1 (1·4 to 12·4)	30·9 (8·3 to 62·5)	6·2 (1·7 to 12·5)	–32·9 (–68·2 to 48·8)	52·7 (11·1 to 111·0)	3·2 (0·7 to 6·8)	37·5 (6·3 to 81·6)	2·9 (0·5 to 6·2)	–28·9 (–69·8 to 67·0)
Amoebiasis	26·1 (–37·8 to 173·9)	3·4 (–4·9 to 22·3)	15·5 (–32·4 to 102·4)	3·1 (–6·3 to 20·7)	–40·8 (–467·1 to 881·9	79·7 (4·9 to 316·8)	4·8 (0·3 to 18·8)	67·9 (5·6 to 236·7)	5·2 (0·4 to 18·1)	–14·8 (–90·9 to 837·6)
Cryptosporidiosis	78·7 (21·2 to 179·0)	10·3 (2·9 to 22·8)	60·4 (13·7 to 134·5)	12·1 (2·8 to 26·9)	–23·2 (–80·6 to 188·8)	83·0 (14·5 to 201·5)	5·0 (0·9 to 11·8)	64·8 (11·1 to 154·2)	4·9 (0·8 to 11·6)	–21·9 (–81·6 to 208·8)
Rotaviral enteritis	259·7 (211·2 to 323·5)	34·2 (29·3 to 41·5)	146·5 (118·0 to 183·5)	29·3 (24·6 to 35·9)	–43·6 (–52·1 to –33·0)	336·1 (281·3 to 403·7)	20·3 (17·4 to 24·0)	199·2 (165·5 to 241·2)	15·2 (12·9 to 18·1)	–40·7 (–48·0 to –32·3)
Aeromonas	11·8 (–72·2 to 90·6)	1·5 (–9·5 to 11·8)	7·3 (–48·3 to 59·1)	1·4 (–9·7 to 12·0)	–37·9 (–96·0 to 287·7)	67·8 (–10·4 to 189·9)	4·1 (–0·6 to 11·4)	56·8 (–4·0 to 151·3)	4·3 (–0·3 to 11·6)	–16·2 (–112·7 to 475·3)
Clostridium difficile	0·9 (0·8 to 1·1)	0·1 (0·1 to 0·1)	0·8 (0·7 to 0·9)	0·2 (0·1 to 0·2)	–10·5 (–24·0 to 2·3	6·7 (5·9 to 7·7)	0·4 (0·3 to 0·5)	9·4 (7·9 to 11·5)	0·7 (0·6 to 0·9)	40·1 (29·6 to 49·9)
Norovirus	20·7 (5·0 to 46·3)	2·7 (0·7 to 6·3)	14·8 (4·2 to 33·7)	3·0 (0·8 to 6·7)	–28·5 (–71·9 to 86·3)	36·3 (5·6 to 82·5)	2·2 (0·3 to 5·0)	29·7 (4·8 to 67·6)	2·3 (0·4 to 5·2)	–18·3 (–70·8 to 131·3)
Adenovirus	68·5 (24·8 to 141·9)	9·0 (3·3 to 18·6)	46·0 (16·2 to 97·7)	9·2 (3·3 to 19·7)	–32·8 (–77·2 to 90·1)	95·2 (35·4 to 191·4)	5·7 (2·1 to 11·6)	70·2 (25·4 to 145·4)	5·4 (2·0 to 10·9)	–26·2 (–74·5 to 110·8)
Lower respiratory infections										
Influenza	16·3 (9·6 to 26·0)	1·5 (0·8 to 2·4)	10·2 (5·7 to 16·8)	1·4 (0·8 to 2·4)	–37·8 (–44·2 to –31·7)	81·3 (56·3 to 116·8)	2·9 (1·9 to 4·2)	83·1 (55·7 to 122·1)	3·0 (2·0 to 4·4)	2·3 (–4·4 to 8·7)
Pneumococcal pneumonia	642·0 (386·2 to 848·6)	57·6 (35·5 to 74·1)	393·0 (228·4 to 532·3)	55·8 (32·5 to 75·0)	–38·8 (–45·7 to –32·1)	1692·3 (1061·1 to 2245·6)	59·8 (37·7 to 79·2)	1517·4 (857·9 to 2183·8)	55·4 (31·5 to 79·1)	–10·3 (–22·4 to –0·8)
Haemophilus influenzae type b	149·5 (–8·9 to 277·9)	13·4 (–0·8 to 24·7)	58·7 (–3·1 to 114·5)	8·3 (–0·5 to 15·9)	–60·7 (–65·7 to –56·8)	149·5 (–8·9 to 277·9)	5·3 (–0·3 to 9·9)	58·7 (–3·1 to 114·5)	2·1 (–0·1 to 4·2)	–60·7 (–65·7 to –56·8)
Respiratory syncytial virus	58·4 (33·2 to 97·6)	5·2 (3·0 to 8·7)	36·4 (20·4 to 61·5)	5·2 (2·9 to 8·6)	–37·8 (–44·4 to –30·6)	95·8 (61·5 to 142·6)	3·4 (2·2 to 5·1)	82·0 (53·9 to 117·6)	3·0 (2·0 to 4·3)	–14·3 (–23·1 to –5·2)

Data in parentheses are 95% uncertainty intervals. Numbers for each cause represent the reduction in deaths that is estimated to occur if a pathogen were eliminated. Numbers should not be summed across pathogens because of interactions between pathogens.

Table 7: **Global counterfactual deaths and population attributable fractions for diarrhoea and lower respiratory infection pathogens for 2005 and 2015, with percentage change between 2005 and 2015**

females). Overall, several countries in sub-Saharan Africa had the largest gains in longevity since 2005. By 2015, Zimbabwe had the fastest progress for both sexes, with life expectancy increasing by 11·7 years (5·5–18·3) to 56·3 years (51·1–62·6) for males and 17·0 years (10·1–23·3) to 62·5 years (56·3–68·3) for females. Furthermore, female life expectancy increased by more than 10 years for eight countries in sub-Saharan Africa (South Africa, Ethiopia, Botswana, Zambia, Swaziland, Namibia, Zimbabwe, and Malawi); this progress was largely attributable to marked reductions in mortality from HIV/AIDS. Death rates due to HIV/AIDs peaked from 2003 to 2005 for many of these countries, after which sizeable gains in prolonged life occurred through to 2015. For some countries, including Laos, decreases in death rates from various communicable diseases, such as diarrhoeal diseases and lower respiratory infections, were related to improved life expectancy, whereas several countries in central and eastern Europe

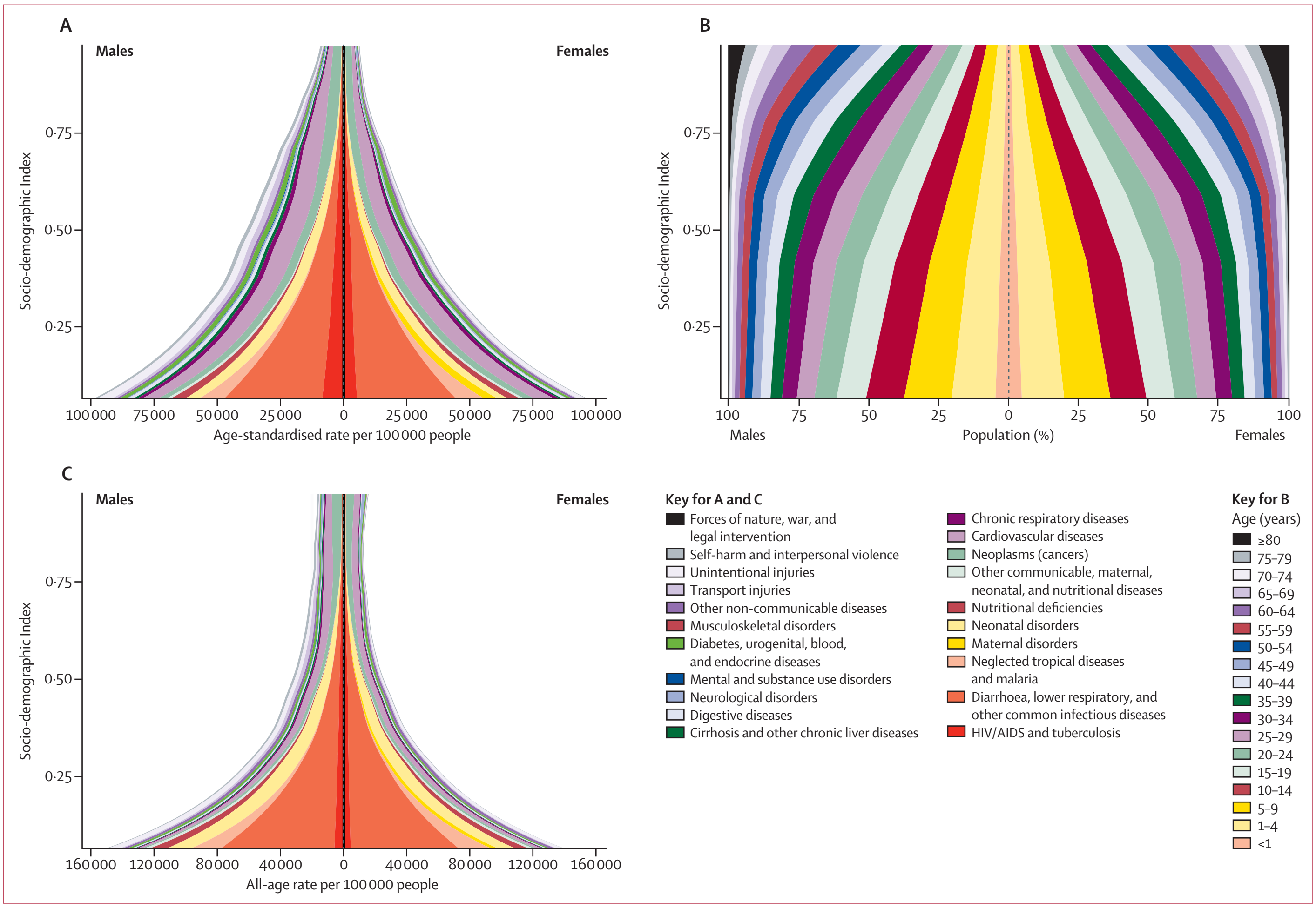


***Figure 15:* Expected relationship between age-standardised YLL rates per 100 000 people for the 21 GBD Level 2 causes and SDI (A), the expected relationship between population and SDI (B), and the expected relationship between all-age YLL rates per 100 000 people for the 21 GBD Level 2 causes and SDI (C), by sex**

The stacked curves in A and C represent the average relationship between SDI and each cause of YLLs observed across all geographies over the time period 1980 to 2015. In each figure, the y-axis spans from the lowest SDI up to the highest SDI. To the left of the midline are male rates, and the female rates are to the right; higher rates are further from the midline. GBD=Global Burden of Disease. SDI=Socio-demographic Index. YLL=years of life lost.

recorded gains in longevity that were mainly associated with relative reductions in cardiovascular disease deaths.

Nonetheless, seven countries and territories had higher life expectancies for both sexes combined (nine for males only, four for females only) in 2005 than in 2015 and many others had minimal progress due to rising numbers of war-related causalities. By 2015, average life expectancy for both sexes fell by 1·3 years (–0·3 to 2·8) in Libya, 1·1 years (–0·2 to 2·4) in Dominica, and 7·3 years (1·8–12·1) in Syria; however, these reductions were far more pronounced among males in these countries, with male life expectancy reduced by 11·3 years (3·7–17·4) in Syria, 2·5 years (0·2–4·9) in Libya, and 1·6 years (–0·3 to 3·6) in Dominica. For Syria and Libya, rising mortality due to war was the main driver of such losses in longevity, whereas NCDs, including cancers and cardiovascular disease, led to reduced male life expectancy in Dominica. Six other geographies also had decreases in male life expectancy since 2005, with losses of 0·9 years (–0·6 to 2·5) in Jamaica, 1·6 years (–1·2 to 4·2) in Guam, 0·5 years (–2·4 to 3·2) in Palestine, 0·4 years (–1·3 to 2·0) in the Northern Mariana Islands, 0·6 years (–0·7 to 2·0) in the Virgin Islands, and 0·5 years (–1·2 to 2·1) in Venezuela. Increased mortality from cancers, cardiovascular disease, diabetes, and chronic kidney disease was associated with reduced life expectancy among males in Jamaica and Guam, whereas increased death rates due to interpersonal violence largely contributed to reduced longevity for males in Venezuela. For several countries and territories, overall life expectancy increased from 2005 to 2015, but heightened mortality due to natural disasters, interpersonal violence, and war offset gains achieved against other causes of death since 2005. In Yemen, for example, male and female life expectancy rose by 1·0 years and 1·9 years, respectively, yet rising war-related deaths resulted in reductions in life expectancy of 1·5 years for males and 1·0 years for females, attenuating further improvement in life expectancy. Similar results emerged for other countries in which war has claimed increasingly more lives, including Afghanistan, Iraq, Somalia, and South Sudan. The 2015 earthquake in Nepal largely contributed to the 0·7 years lost for females and 0·8 years for males; nonetheless, overall life expectancy improved by 2·1 years (–0·4 to 4·6) and 2·4 years (0·0–4·6) for males and females in Nepal, respectively—gains mainly attributable to reductions in mortality from diarrhoeal diseases and lower respiratory infections.

Inequalities in life expectancy by sex generally increased over time. In 2005, the difference between male and female life expectancy was 5·0 years (65·7 years, 95% UI 65·5–65·9 for males and 70·7 years, 70·5–71·0 for females), which widened to 5·8 years in 2015 (69·0 years, 68·3–69·4 for males and 74·8 years, 74·4–75·2 for females). For several countries, including Russia, Estonia, and Latvia, differences between male and female life expectancy narrowed more rapidly; these gains could be attributed to reduced mortality due to cardiovascular diseases, cancer, and injuries. Yet, inequalities in life expectancy grew in many countries and territories, often driven by uneven progress in health by sex and increasing male deaths due to a subset of NCDs. For example, Georgia recorded a widening gap between male and female life expectancy, rising from 8·6 years (7·7–9·6) in 2005 to 10·2 years (8·9–11·4) in 2015. In other places (eg, Syria), rising mortality from interpersonal violence or war disproportionately affected males.

Leading causes of YLLs and deviations from expected levels based on SDI

Distinct, yet notably varied, patterns emerged across and within GBD regions when we compared observed YLLs due to leading causes with the levels of premature mortality expected on the basis of SDI. Figure 17 shows the ratios of observed and expected YLLs for the ten leading causes by geography in 2015, colour coded by the magnitude of differences between observed and expected YLLs.

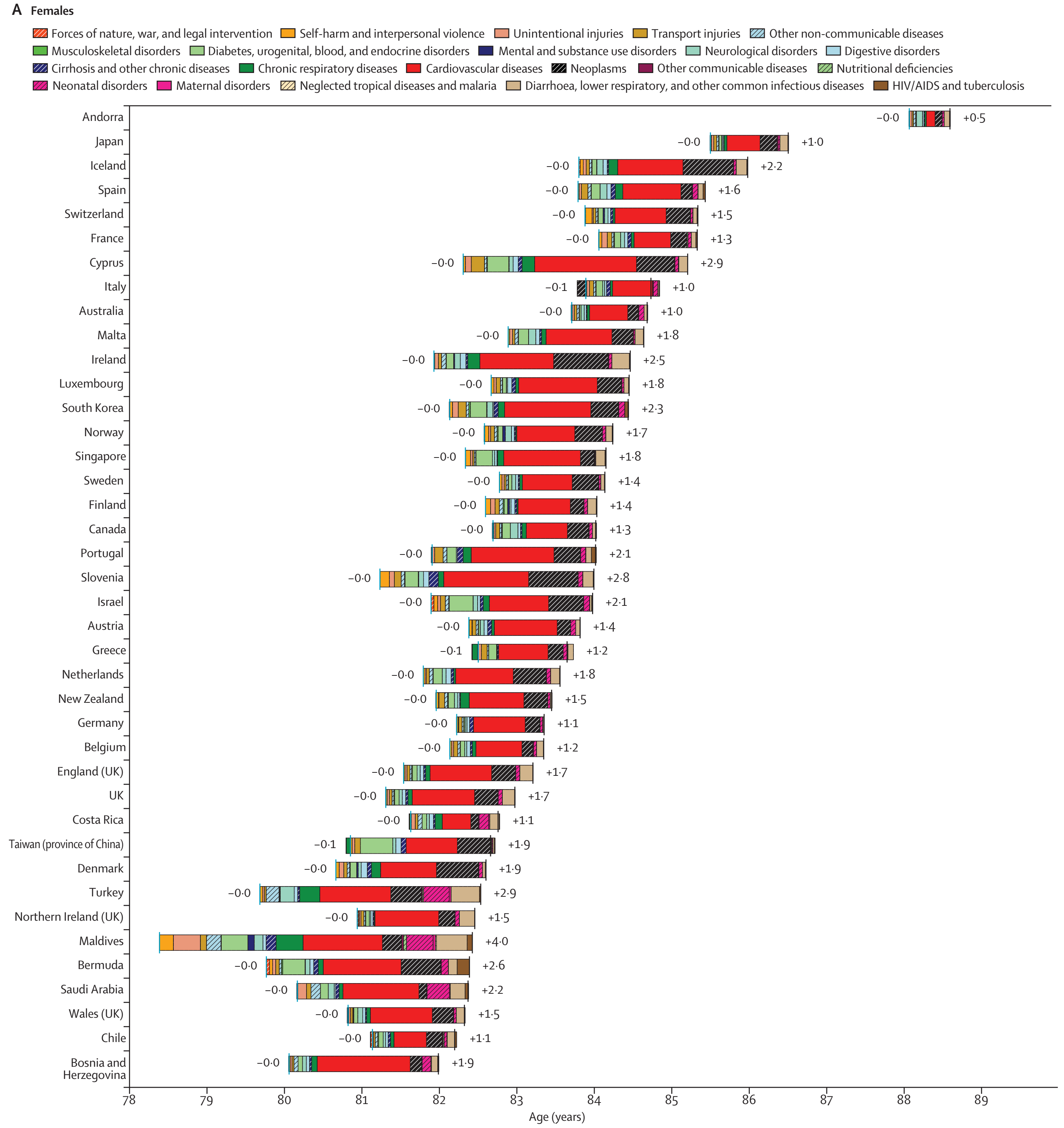
Globally, ischaemic heart disease and stroke were the leading two causes of premature mortality in 2015; 119 countries and territories also had ischaemic heart disease or stroke as the leading cause of YLLs that year. Three geographical regions featured countries that largely diverged from this trend: Latin America and the Caribbean, where interpersonal violence or lower respiratory infections frequently accounted for the most YLLs; north Africa and the Middle East, where war was the primary cause of early death in several countries; and sub-Saharan Africa, where HIV/AIDS or malaria was the leading cause of YLLs in 28 countries. Furthermore, lung cancer consistently ranked among the top three causes of YLLs in high-income countries; road injuries were a major cause of early death in Latin American countries; and neonatal disorders were frequently among leading five causes of YLLs in south Asia and sub-Saharan Africa.

Of the ten leading causes of premature mortality globally, lower respiratory infections resulted in the most countries (122) recording observed YLLs lower than those expected on the basis of SDI. This finding was particularly prevalent in east Asia, where China and North Korea had YLL ratios less than 0·40. Other leading causes for which observed YLLs were much lower than expected included stroke in Andean Latin America and neonatal preterm birth complications in Oceania. By contrast, HIV/AIDS led to the highest discrepancies for observed and expected YLLs, particularly affecting southern sub-Saharan Africa. Diarrhoeal diseases, particularly in southern sub-Saharan Africa, and neonatal encephalopathy due to birth asphyxia and trauma, particularly in southern Asia, also resulted in large differences for observed and expected YLLs.

Regional, country, territory, and selected subnational results

For many high-income countries, observed YLLs due to stroke—a cause consistently among the leading three causes of early death—fell below the levels expected on the basis of SDI in 2015. Spain, France, Malta, and Israel had particularly low ratios for observed versus expected YLLs from stroke, all falling below 0·45; 26 countries, including Portugal, Argentina, and Uruguay had ratios lower than 0·80. A subset of countries, including Japan, South Korea, and Chile, also had lower observed YLLs from ischaemic heart disease than expected on the basis of SDI. Early death due to drug use disorders exceeded expected levels in the USA (5·71), Scotland (5·08), and Norway (3·44), and a similar pattern was found for YLLs due to alcohol use disorders in Denmark (10·50) and Finland (9·61). Within the GBD high-income super-region, Brunei, Greenland, and the USA had some of the largest deviations between observed and expected YLLs across causes. Within the UK, observed YLLs from self-harm and stroke were often substantially lower than expected for most regions, whereas observed levels of premature mortality due to COPD were higher than expected.

Throughout Latin America and the Caribbean, observed YLLs due to interpersonal violence far exceeded those expected on the basis of SDI, with 19 countries and territories recording ratios higher than 3·00. Furthermore, interpersonal violence ranked as the first or second leading cause of early death for seven of 11 countries in central and Tropical Latin America. For these two geographical regions, discrepancies between observed and expected YLLs from interpersonal violence were highest in Venezuela (9·91) and Brazil (4·88), respectively. Observed YLLs were also higher than expected for diabetes, especially in the Caribbean;



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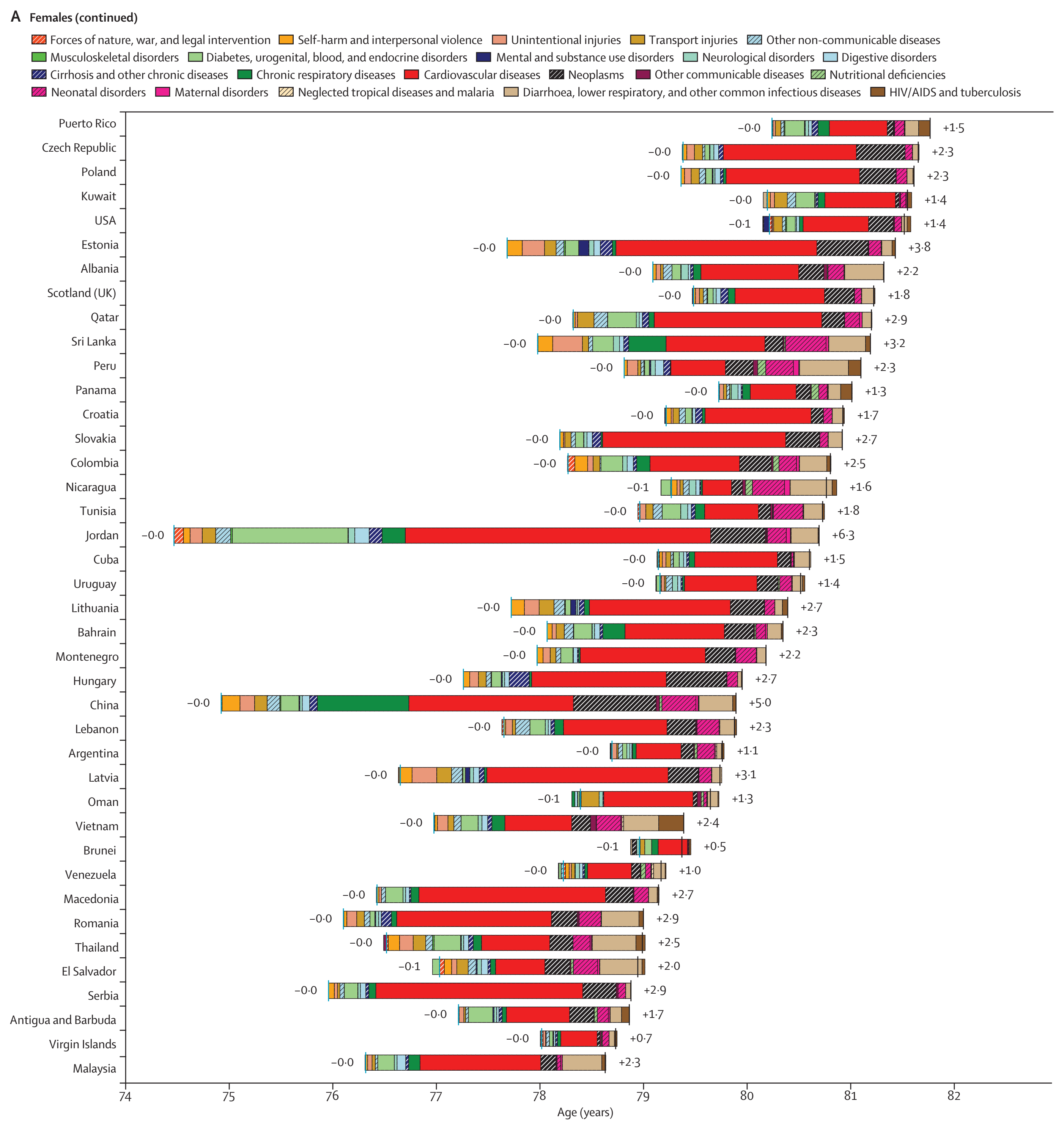

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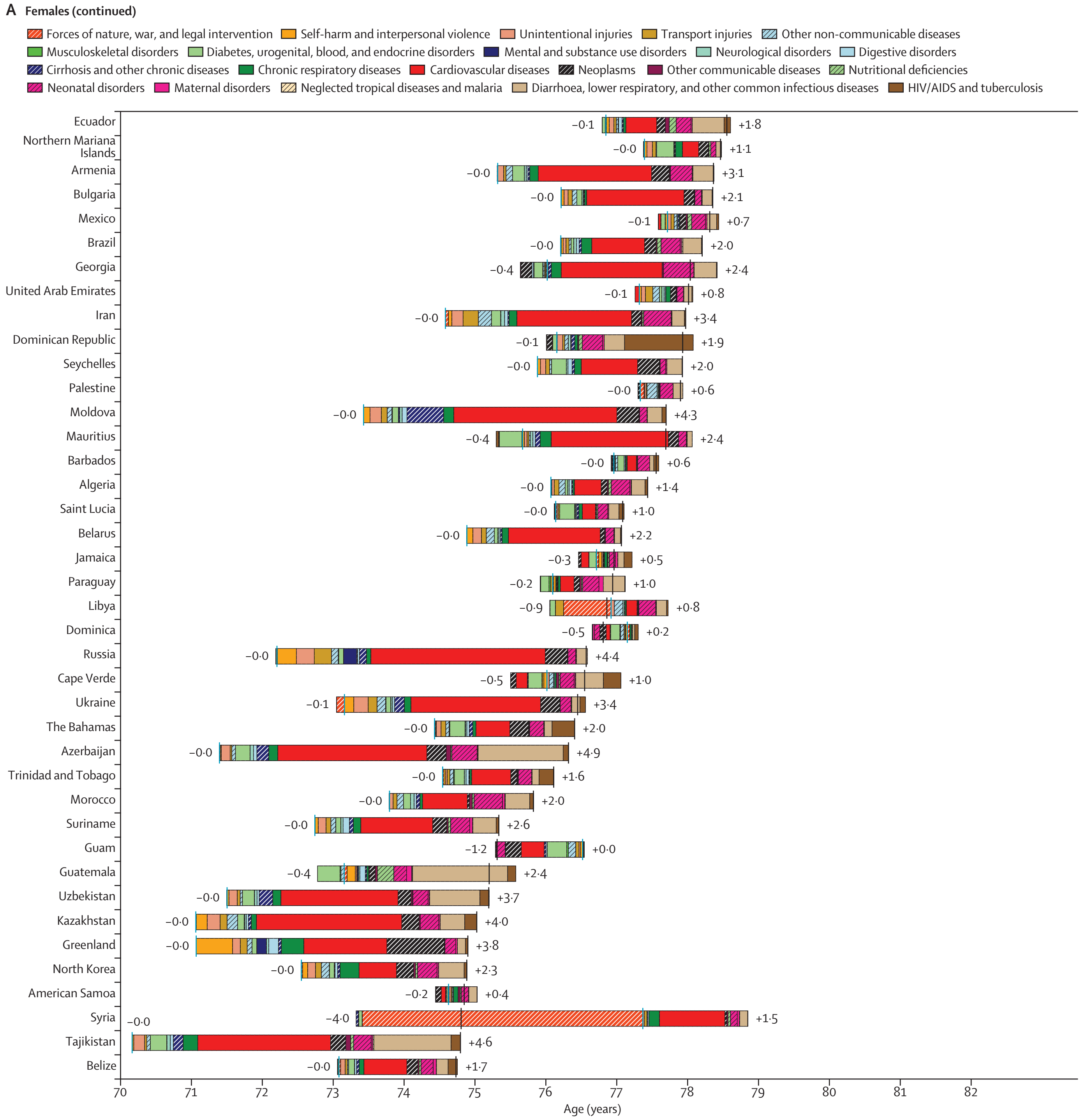

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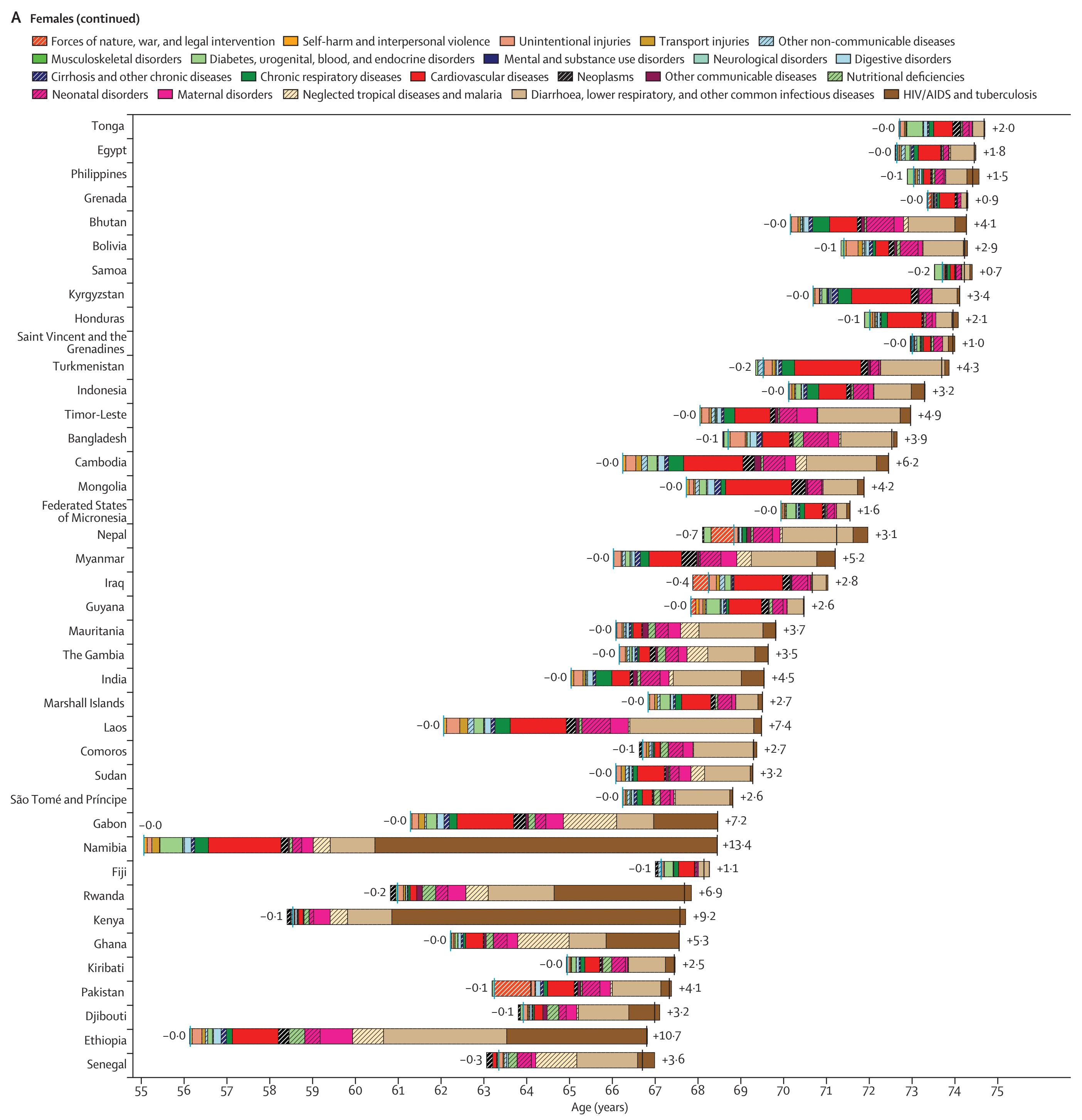

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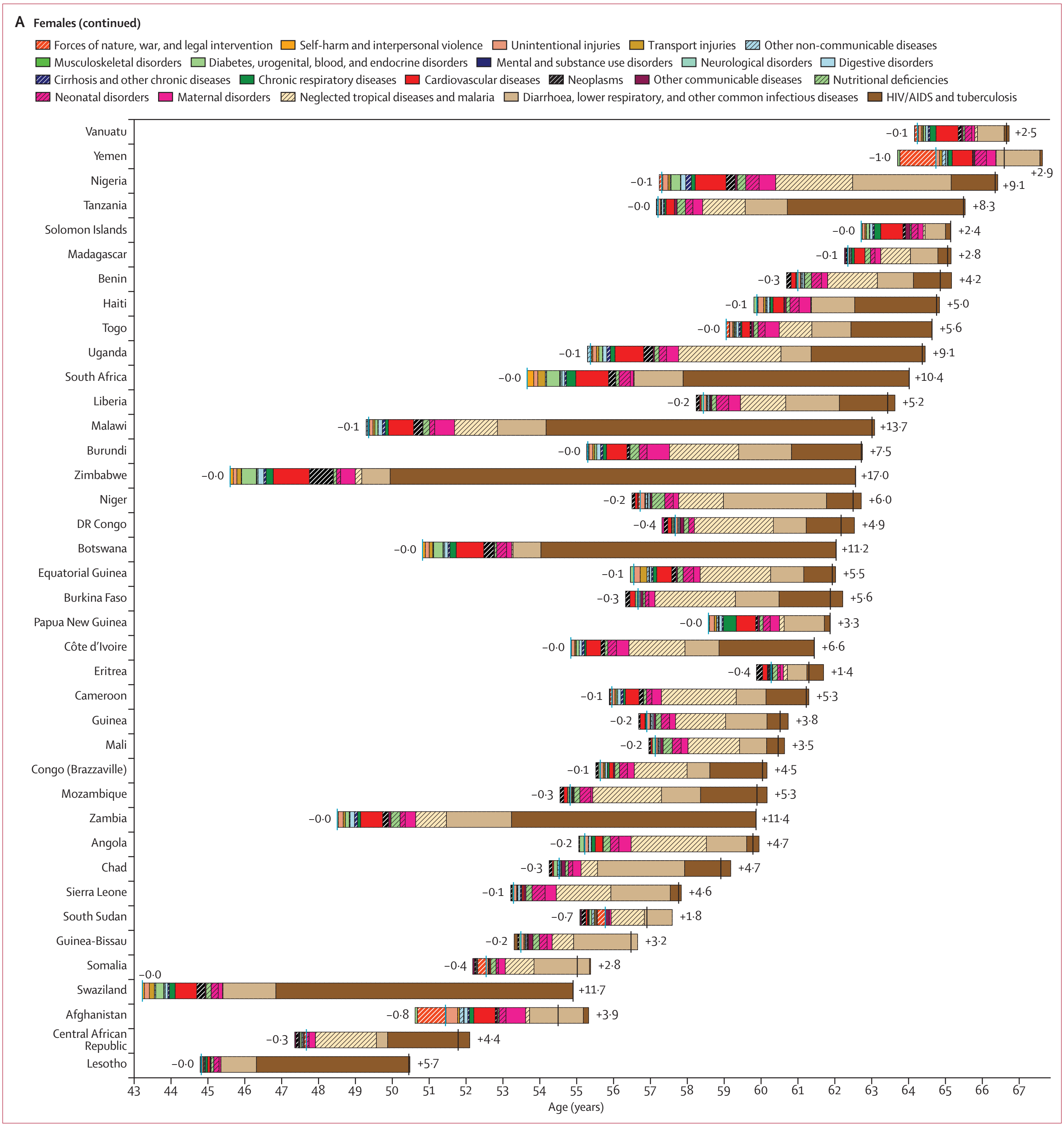

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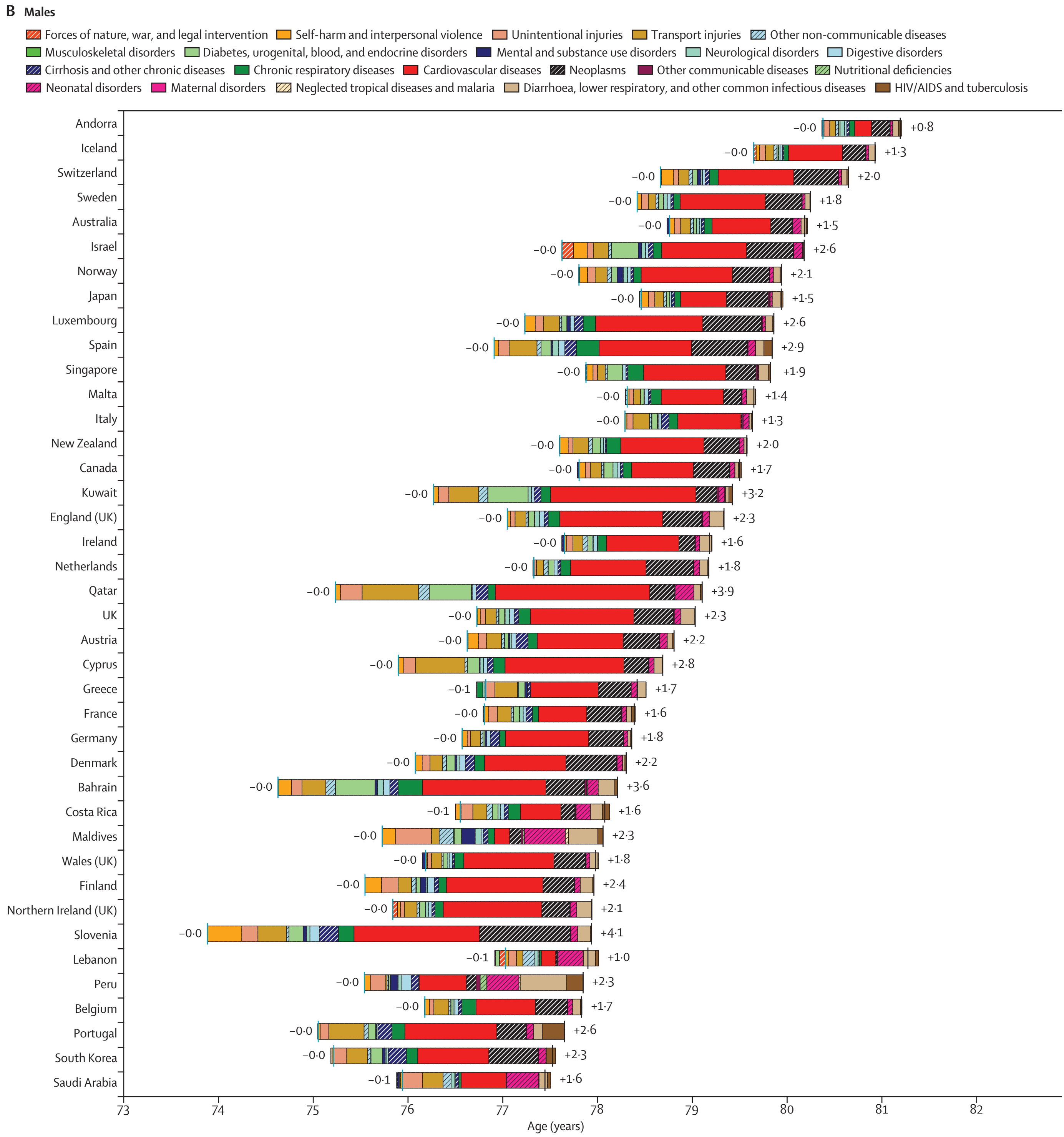

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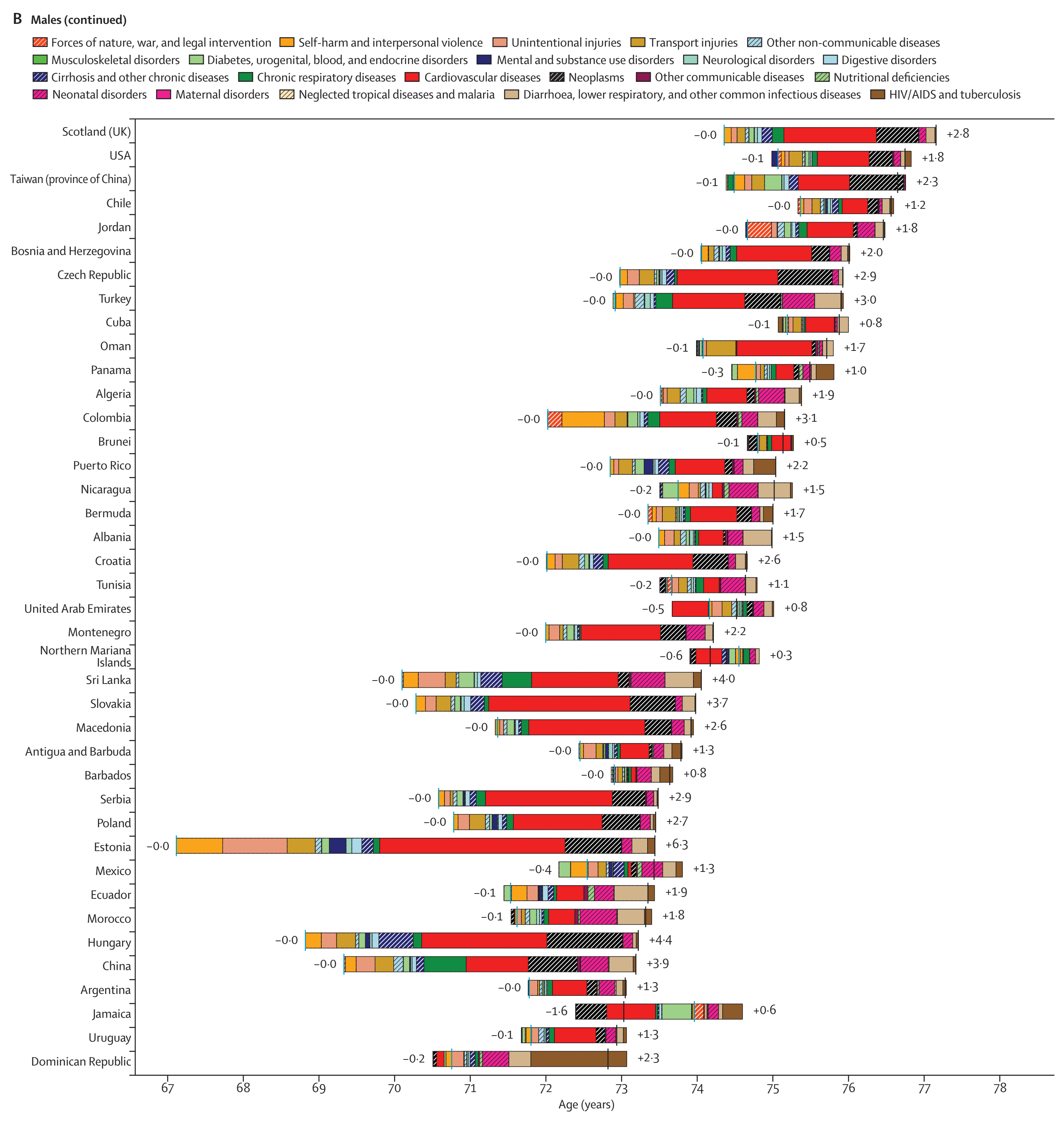

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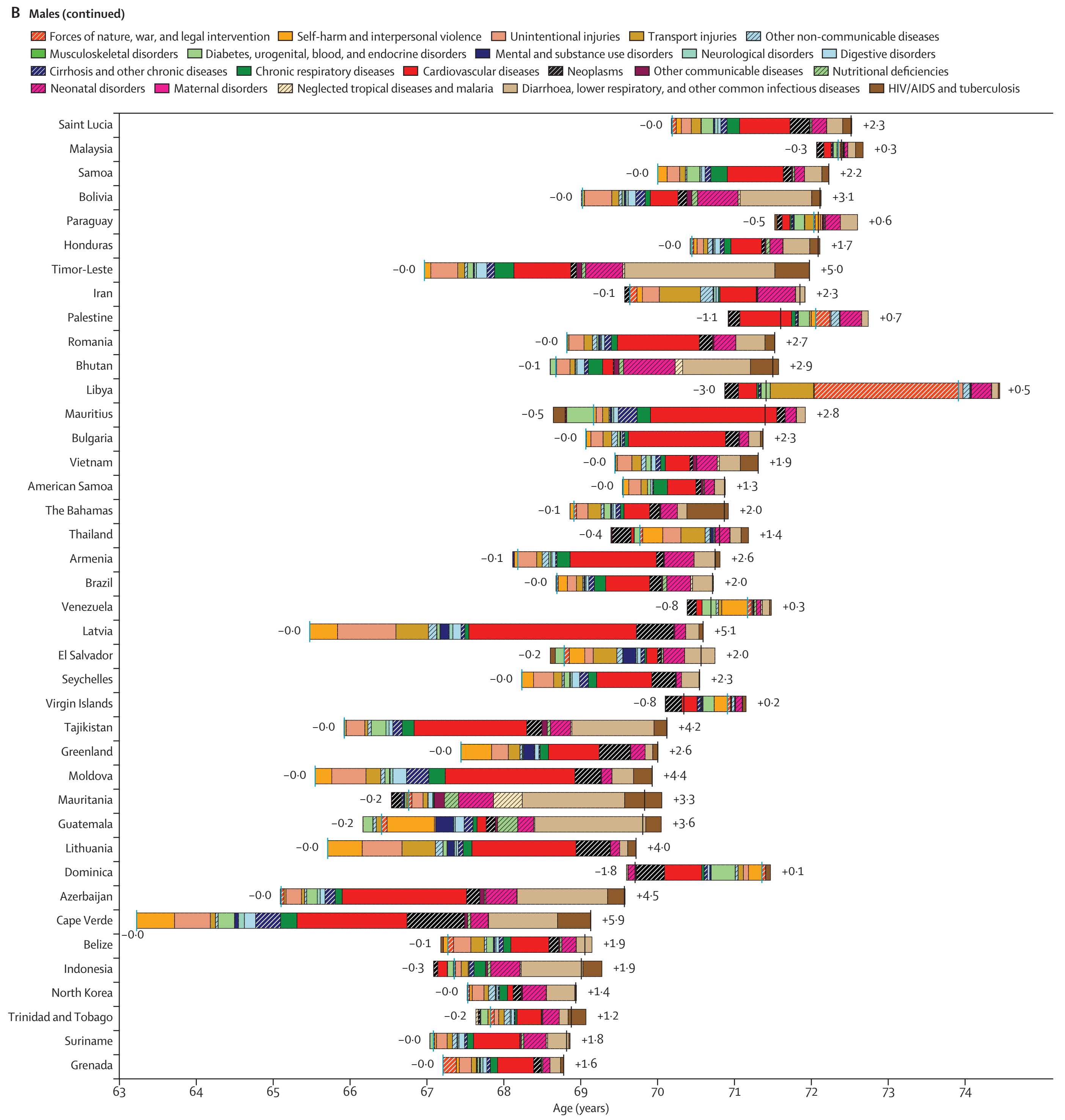

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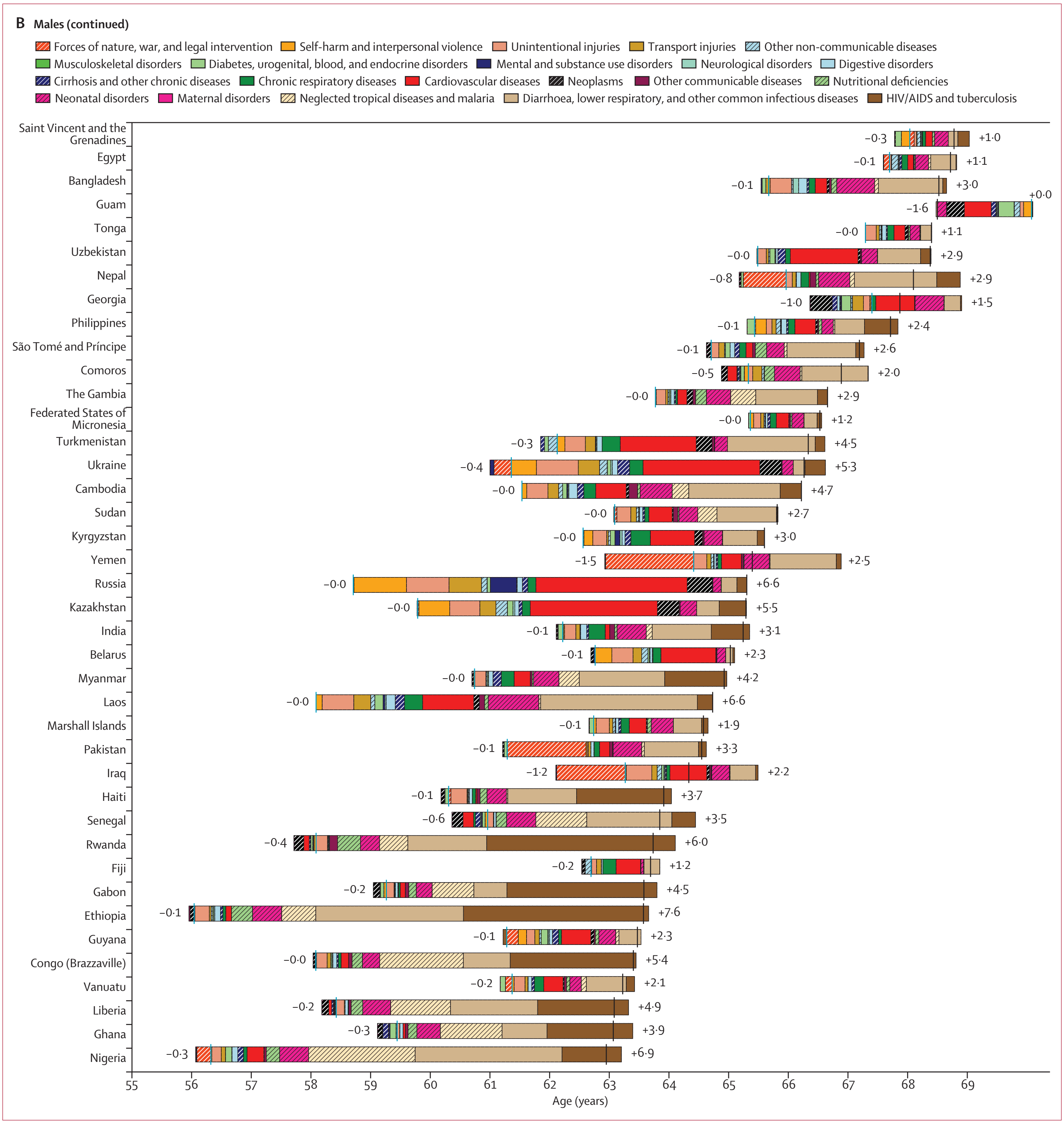

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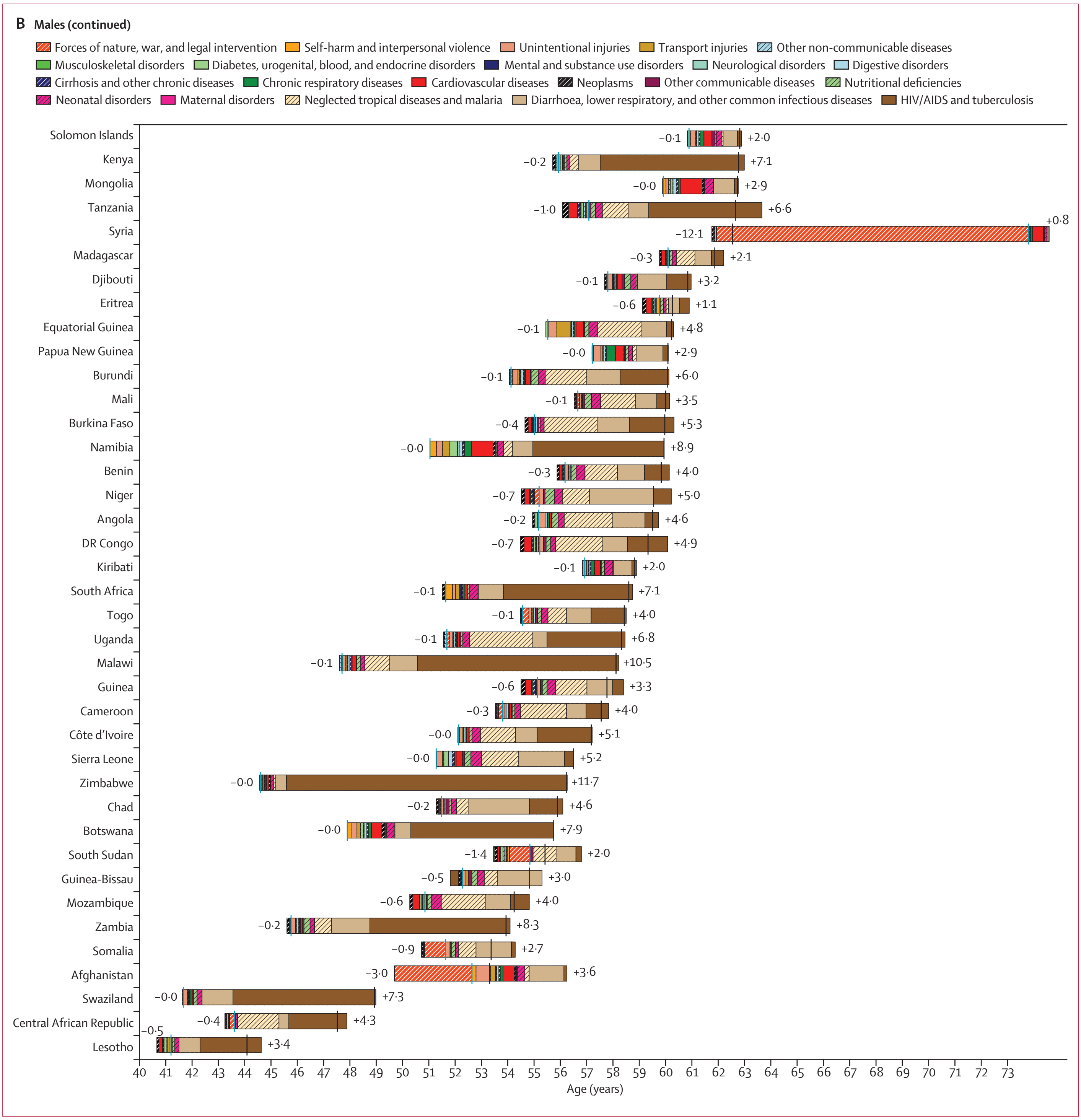

***Figure 16*: Attribution of changes in life expectancy at birth to changes in major groups of causes of death, 2005 to 2015**

Changes are shown for countries and territories (and subnational units in the UK) for females (A) and males (B). Locations are ordered by decreasing life expectancy at birth in 2015. Blue lines show life expectancy at birth in 2005 and black lines show life expectancy at birth in 2015. Causes to the left of the 2005 life expectancy values reflect causes that contributed to reductions in life expectancy from 2005 to 2015. Causes to the right of the 2005 life expectancy values contributed to increases in life expectancy from 2005 to 2015.

chronic kidney disease, particularly in Mexico (3·22); and prostate cancer for several Caribbean islands and territories. Although ischaemic heart disease was a leading cause of early death for many Latin American countries, several had ratios of observed and expected YLLs lower than 0·60, including Peru (0·33), Panama (0·50), and Colombia (0·51). Similar results were found for stroke (eg, a ratio of 0·26 for Costa Rica); road injuries (eg, Honduras [0·37] and Cuba [0·48]); and for preterm birth complications (Haiti [0·43] and Guatemala [0·32]).

In 2015, leading causes of early death, as well as their observed and expected levels, were markedly heterogeneous in southeast and east Asia and Oceania. For many countries and territories, lower respiratory infections ranked among the ten leading causes of premature mortality, but observed YLLs fell below the levels expected on the basis of SDI (eg, 0·22 in the Maldives, 0·34 in China, and 0·46 in the Solomon Islands). For others, such as Malaysia and Laos, observed YLLs due to lower respiratory infections were higher than expected. Within the region, 18 countries and territories had ischaemic heart disease as their leading cause of YLLs in 2015, but their ratios of observed versus expected YLLs ranged from less than 0·50 in Thailand to more than 4·00 in Guam. Particularly in Oceania, observed levels of YLLs due to diabetes and chronic kidney disease consistently exceeded expected YLLs, and premature mortality due to liver cancer was higher than expected in Taiwan (province of China), Thailand, China, North Korea, Vietnam, and Tonga. Observed YLLs due to communicable diseases were at least twice as high as expected for some countries, including measles in Papua New Guinea (3·61) and tuberculosis in Indonesia (6·53) and the Philippines (4·11). At the same time, several countries and territories recorded cause-specific YLLs that were substantially lower than expected, such as preterm birth complications in Papua New Guinea (0·35); road injuries in Sri Lanka (0·47) and Samoa (0·31); and self-harm in Malaysia (0·52) and China (0·51).

Patterns of early death in south Asia reflect the region's diversity of countries and their relative stages of development. Although lower respiratory infections, diarrhoeal diseases, and congenital anomalies remained among the leading causes of premature mortality throughout south Asia, observed levels of YLLs were generally lower than those expected on the basis of SDI. However, for most countries in south Asia, observed YLLs due to neonatal encephalopathy were more than twice as high as expected (eg, 2·94 in Pakistan and 2·13 in India). Notably, observed YLLs from intestinal infections, such as typhoid fever, were above expected levels in Bangladesh (6·07). Observed levels of YLLs exceeded expected levels for a subset of NCDs, including ischaemic heart disease in Pakistan (1·81), and COPD in India (2·44). In 2015, an earthquake claimed more than 8700 lives in Nepal, and since the occurrence of earthquakes has minimal linkages to SDI, the ratio for observed and expected YLLs was extremely high for natural disasters. At the same time, Nepal and Bangladesh had substantially fewer than expected YLLs due to preterm birth complications (0·25 and 0·40, respectively). Observed levels of early death from stroke were also lower than expected in Bhutan (0·49) and Nepal (0·49).

In central Europe, eastern Europe, and central Asia, except for a subset of causes and countries, observed YLLs generally met or exceeded the levels expected on the basis of SDI. YLL ratios due to ischaemic heart disease and hypertensive heart disease were more than 2·00 for 17 countries, and observed premature mortality due to cardiomyopathy and myocarditis was at least three times higher than expected levels in Russia (10·86), Latvia (7·93), and Bosnia and Herzegovina (5·65). Alcohol and drug use disorders were among the ten leading causes of early death throughout the region, and observed levels often exceeded expected YLLs (eg, 24·53 for drug use disorders in the Ukraine and 17·95 for alcohol use disorders in Russia). Early death from cirrhosis due to alcohol use was more common than expected in several countries, including Moldova (4·24) and Hungary (3·40), whereas levels of YLLs due to interpersonal violence far exceeded expected levels in Russia (12·78) and Kazakhstan (5·65). Group 1 causes often led to higher levels of observed YLLs than expected in central Asia, such as neonatal encephalopathy in Azerbaijan (8·26) and lower respiratory infections in Turkmenistan (6·81). Notably, several countries had much lower than expected observed YLLs due to road injuries, including Albania (0·38) and Macedonia (0·47).

In north Africa and the Middle East, large discrepancies occurred between observed YLLs and those expected on the basis of SDI, underscoring the region's rapid development and inequalities in wealth. Furthermore, because of the region's escalating rates of war-related mortality, which is not strictly related to SDI, ratios of observed versus expected YLLs from war were extremely high. The United Arab Emirates (UAE) and Afghanistan had the most causes for which observed levels of YLLs exceeded expected YLLs; these causes ranged from ischaemic heart disease to interpersonal violence for Afghanistan, and included chronic kidney disease, COPD, diabetes, and road injuries for the UAE. Many countries in the region recorded substantially lower YLLs than expected for several causes: 13 had ratios less than 0·60 for lower respiratory infections, including Iraq (0·40) and Palestine (0·25); eight countries had ratios less than 0·60 for stroke, including Lebanon (0·45) and Turkey (0·42); and six had ratios less than 0·60 for preterm birth complications, including Egypt (0·47) and Syria (0·19).

For every country in sub-Saharan Africa, the leading cause of early death was one of four communicable diseases—HIV/AIDS, malaria, lower respiratory infection, or diarrhoeal diseases—yet patterns in observed and expected levels of YLLs strikingly differed within the continent. In southern sub-Saharan Africa,

	1	2	3	4	5	6	7	8	9	10
Global	IHD (0·98)	Stroke (0·98)	LRI (0·67)	NN preterm (0·72)	Diarrhoea (0·74)	NN encephalitis (1·18)	HIV (0·63)	Road injuries (0·78)	Malaria (4·98)	COPD (1·34)
High SDI	IHD (1·58)	Stroke (1·09)	Lung C (1·08)	Self-harm (0·94)	Alzheimer's (0·98)	LRI (0·81)	Colorect C (0·86)	COPD (1·46)	Road injuries (1·47)	Breast C (1·06)
High-middle SDI	IHD (0·88)	Stroke (0·92)	Road injuries (0·9)	Lung C (0·93)	LRI (0·81)	HIV (0·51)	COPD (1·12)	Congenital (0·78)	Self-harm (0·6)	Diabetes (0·93)
Middle SDI	IHD (0·8)	Stroke (1·15)	Road injuries (0·73)	COPD (1·37)	LRI (0·6)	NN preterm (0·7)	Congenital (0·74)	NN encephalitis (1·08)	Diabetes (0·74)	TB (1·77)
Low-middle SDI	LRI (0·77)	NN encephalitis (1·5)	Diarrhoea (1·02)	NN preterm (0·79)	IHD (1·02)	HIV (0·71)	Malaria (15·93)	Stroke (0·83)	Congenital (0·81)	COPD (1·62)
Low SDI	LRI (0·53)	Malaria (2·96)	Diarrhoea (0·45)	HIV (1·62)	NN preterm (0·51)	NN encephalitis (0·68)	Congenital (0·93)	NN sepsis (1·6)	Meningitis (0·87)	PEM (0·9)
High income	IHD (1·08)	Lung C (1·05)	Stroke (0·7)	Alzheimer's (1·04)	Self-harm (0·81)	COPD (1·46)	LRI (0·75)	Colorect C (0·83)	Road injuries (1·18)	Breast C (1·08)
High-income North America	IHD (2·15)	Lung C (1·42)	Alzheimer's (1·39)	COPD (2·92)	Stroke (0·85)	Self-harm (0·85)	Road injuries (2·76)	Drugs (5·32)	Colorect C (0·89)	LRI (0·82)
Canada	IHD (1·59)	Lung C (1·32)	Alzheimer's (1·29)	Self-harm (0·75)	Stroke (0·67)	Colorect C (0·84)	COPD (1·75)	Breast C (1·22)	Road injuries (1·71)	Diabetes (2·64)
Greenland	Self-harm (4·7)	Lung C (2·65)	IHD (0·75)	NN preterm (1·66)	Stroke (0·82)	Congenital (0·74)	Colorect C (1·52)	COPD (1·83)	Violence (2·69)	Alcohol (9·11)
USA	IHD (2·22)	Lung C (1·43)	COPD (3·06)	Alzheimer's (1·4)	Stroke (0·87)	Self-harm (0·86)	Road injuries (2·87)	Drugs (5·71)	Colorect C (0·9)	LRI (0·85)
Australasia	IHD (1·22)	Lung C (0·85)	Stroke (0·68)	Self-harm (0·7)	Colorect C (0·87)	COPD (1·65)	Alzheimer's (0·74)	Road injuries (1·36)	Breast C (1·12)	Diabetes (1·85)
Australia	IHD (1·23)	Lung C (0·85)	Stroke (0·69)	Self-harm (0·7)	Colorect C (0·84)	COPD (1·62)	Alzheimer's (0·73)	Road injuries (1·39)	Breast C (1·09)	Diabetes (1·98)
New Zealand	IHD (1·16)	Lung C (0·85)	Stroke (0·62)	Self-harm (0·75)	Colorect C (1·03)	COPD (1·77)	Breast C (1·29)	Road injuries (1·22)	Alzheimer's (0·79)	Congenital (1·1)
High-income Asia Pacific	Stroke (0·91)	IHD (0·61)	Self-harm (1·27)	LRI (1·1)	Lung C (0·75)	Alzheimer's (0·86)	Stomach C (1·25)	Colorect C (0·81)	Liver C (1·43)	Pancreas C (0·87)
Brunei	IHD (2·35)	Diabetes (12·84)	Stroke (1·75)	Road injuries (2·78)	Lung C (1·03)	Congenital (1·95)	LRI (1·75)	COPD (3·56)	CKD (3·61)	Colorect C (1·15)
Japan	IHD (0·62)	Stroke (0·86)	LRI (1·2)	Lung C (0·72)	Self-harm (1·21)	Alzheimer's (0·87)	Stomach C (1·26)	Colorect C (0·85)	Liver C (1·14)	Pancreas C (0·91)
Singapore	IHD (1·07)	LRI (2·34)	Stroke (0·68)	Lung C (0·8)	Colorect C (0·88)	Self-harm (0·49)	CKD (1·53)	Alzheimer's (0·73)	Liver C (1·08)	Breast C (0·93)
South Korea	Self-harm (1·46)	Stroke (1·08)	IHD (0·5)	Lung C (0·88)	Liver C (2·5)	Stomach C (1·28)	Diabetes (2·92)	Road injuries (1·41)	Colorect C (0·69)	Alzheimer's (0·84)
Western Europe	IHD (0·88)	Lung C (1·0)	Stroke (0·58)	Alzheimer's (0·95)	COPD (1·21)	Colorect C (0·78)	Self-harm (0·6)	Breast C (1·2)	LRI (0·5)	Pancreas C (0·86)
Andorra	IHD (0·97)	Lung C (0·74)	Alzheimer's (0·9)	Stroke (0·56)	COPD (1·19)	Colorect C (0·63)	LRI (0·54)	Self-harm (0·45)	Breast C (0·83)	Pancreas C (0·65)
Austria	IHD (1·27)	Lung C (0·94)	Stroke (0·54)	Alzheimer's (0·9)	Self-harm (0·73)	COPD (1·21)	Colorect C (0·72)	Breast C (1·12)	Diabetes (1·69)	Pancreas C (0·96)
Belgium	IHD (1·01)	Lung C (1·33)	Stroke (0·66)	Alzheimer's (1·1)	Self-harm (1·03)	COPD (1·85)	LRI (0·79)	Colorect C (0·8)	Breast C (1·46)	Road injuries (1·25)
Cyprus	IHD (1·22)	Stroke (0·58)	Lung C (0·71)	Road injuries (1·43)	Diabetes (2·89)	Alzheimer's (0·86)	Breast C (1·0)	COPD (0·91)	Colorect C (0·5)	CKD (1·01)
Denmark	IHD (1·17)	Lung C (1·28)	Stroke (0·87)	COPD (2·84)	Alzheimer's (1·12)	Colorect C (0·97)	Self-harm (0·64)	Breast C (1·41)	LRI (0·71)	Alcohol (10·5)
Finland	IHD (1·57)	Stroke (0·78)	Alzheimer's (1·35)	Lung C (0·74)	Self-harm (1·01)	Colorect C (0·57)	Breast C (1·05)	Alcohol (9·61)	Pancreas C (0·93)	COPD (0·93)
France	IHD (0·52)	Lung C (1·09)	Stroke (0·4)	Self-harm (0·97)	Alzheimer's (0·92)	Colorect C (0·81)	Breast C (1·21)	LRI (0·42)	Other cardio (1·71)	Road injuries (0·67)
Germany	IHD (1·53)	Lung C (1·02)	Stroke (0·74)	COPD (1·5)	Colorect C (0·85)	Alzheimer's (0·75)	Self-harm (0·64)	Breast C (1·31)	LRI (0·56)	Other cardio (2·03)
Greece	IHD (1·06)	Stroke (0·8)	Lung C (1·07)	Alzheimer's (0·93)	COPD (0·93)	Road injuries (0·94)	Breast C (1·12)	Colorect C (0·55)	LRI (0·31)	Liver C (0·95)
Iceland	IHD (1·15)	Lung C (0·83)	Alzheimer's (1·05)	Stroke (0·49)	Self-harm (0·52)	LRI (0·58)	COPD (0·92)	Breast C (0·87)	Colorect C (0·5)	Pancreas C (0·74)
Ireland	IHD (1·21)	Lung C (0·92)	Stroke (0·55)	Self-harm (0·66)	COPD (1·56)	Colorect C (0·78)	LRI (0·73)	Alzheimer's (0·89)	Breast C (1·19)	Congenital (1·02)
Israel	IHD (0·61)	Lung C (0·72)	Stroke (0·43)	Diabetes (2·2)	Alzheimer's (0·92)	Breast C (1·32)	CKD (1·45)	Congenital (0·74)	Colorect C (0·71)	LRI (0·55)
Italy	IHD (0·75)	Stroke (0·6)	Lung C (0·89)	Alzheimer's (1·01)	Colorect C (0·75)	COPD (0·86)	Breast C (1·17)	Diabetes (1·46)	Road injuries (0·84)	Stomach C (0·55)
Luxembourg	IHD (1·08)	Lung C (1·04)	Stroke (0·71)	Alzheimer's (0·93)	Self-harm (0·53)	Colorect C (0·77)	COPD (1·51)	Breast C (1·16)	Other cardio (2·13)	Road injuries (1·06)
Malta	IHD (0·75)	Lung C (0·68)	Stroke (0·35)	Alzheimer's (0·92)	Breast C (1·12)	Colorect C (0·6)	Diabetes (0·96)	COPD (0·61)	LRI (0·4)	Pancreas C (0·88)
Netherlands	IHD (0·94)	Lung C (1·37)	Stroke (0·65)	Alzheimer's (1·21)	COPD (1·99)	LRI (0·75)	Breast C (1·38)	Self-harm (0·6)	Pancreas C (0·92)	Esophag C (1·53)

(Figure 17 continues on next page)

	1	2	3	4	5	6	7	8	9	10
Norway	IHD (1·45)	Lung C (0·98)	Stroke (0·84)	Alzheimer's (1·09)	COPD (2·32)	Colorect C (1·01)	Self-harm (0·65)	LRI (0·73)	Drugs (3·44)	Breast C (1·03)
Portugal	Stroke (0·56)	IHD (0·35)	Lung C (0·77)	LRI (0·73)	Colorect C (0·97)	Alzheimer's (0·88)	COPD (0·7)	Stomach C (0·69)	Diabetes (0·79)	Self-harm (0·64)
Spain	IHD (0·48)	Lung C (0·87)	Stroke (0·37)	Alzheimer's (1·13)	COPD (1·08)	Colorect C (0·81)	Breast C (0·89)	LRI (0·34)	Self-harm (0·37)	Road injuries (0·42)
Sweden	IHD (1·29)	Stroke (0·69)	Lung C (0·68)	Alzheimer's (0·98)	Self-harm (0·75)	Colorect C (0·82)	COPD (1·08)	Breast C (1·07)	Prostate C (1·92)	LRI (0·44)
Switzerland	IHD (1·17)	Lung C (0·9)	Alzheimer's (1·07)	Self-harm (0·76)	Stroke (0·55)	Colorect C (0·67)	Breast C (1·18)	COPD (1·22)	Pancreas C (0·78)	Falls (1·61)
UK	IHD (1·1)	Lung C (1·08)	Stroke (0·69)	COPD (2·04)	LRI (0·91)	Alzheimer's (0·99)	Colorect C (0·78)	Breast C (1·35)	Self-harm (0·49)	Other cardio (1·56)
England	IHD (1·05)	Lung C (1·03)	Stroke (0·66)	COPD (1·98)	LRI (0·89)	Alzheimer's (0·97)	Colorect C (0·75)	Breast C (1·34)	Self-harm (0·46)	Other cardio (1·58)
Northern Ireland	IHD (0·83)	Lung C (1·1)	Stroke (0·51)	COPD (1·56)	LRI (0·91)	Alzheimer's (1·05)	Colorect C (0·85)	Self-harm (0·59)	Breast C (1·26)	Congenital (0·86)
Scotland	IHD (1·73)	Lung C (1·53)	Stroke (1·09)	COPD (2·91)	LRI (1·05)	Alzheimer's (1·0)	Colorect C (0·94)	Self-harm (0·75)	Breast C (1·43)	Drugs (5·08)
Wales	IHD (1·25)	Lung C (1·13)	Stroke (0·74)	COPD (2·15)	Alzheimer's (1·14)	LRI (0·97)	Colorect C (0·88)	Breast C (1·4)	Self-harm (0·55)	Other cardio (1·74)
Southern Latin America	IHD (0·76)	Stroke (0·6)	LRI (1·36)	Road injuries (0·83)	Congenital (1·1)	Self-harm (0·83)	Lung C (0·79)	COPD (1·33)	CKD (1·33)	Diabetes (1·33)
Argentina	IHD (0·85)	LRI (1·66)	Stroke (0·58)	Road injuries (0·83)	Congenital (1·11)	Lung C (0·87)	COPD (1·48)	Self-harm (0·83)	NN preterm (1·32)	CKD (1·41)
Chile	IHD (0·55)	Stroke (0·65)	Self-harm (0·78)	Road injuries (0·85)	Stomach C (1·02)	LRI (0·71)	Congenital (1·12)	Lung C (0·52)	CKD (1·31)	COPD (0·94)
Uruguay	IHD (0·56)	Stroke (0·65)	Lung C (1·24)	COPD (1·26)	Self-harm (1·21)	LRI (0·83)	Road injuries (0·75)	Colorect C (1·23)	Congenital (0·88)	Breast C (1·39)
Central and eastern Europe and central Asia	IHD (2·72)	Stroke (1·92)	Self-harm (1·44)	LRI (1·2)	Lung C (1·09)	CMP (5·31)	Road injuries (1·17)	Colorect C (0·98)	COPD (1·18)	Violence (3·65)
Eastern Europe	IHD (3·66)	Stroke (2·41)	Self-harm (1·85)	CMP (8·27)	Lung C (1·02)	Road injuries (1·81)	LRI (1·11)	Violence (8·84)	HIV (1·5)	Drugs (14·16)
Belarus	IHD (4·64)	Stroke (2·25)	Self-harm (1·97)	Lung C (1·32)	Road injuries (2·09)	Stomach C (1·48)	Drugs (16·36)	COPD (1·72)	CMP (4·76)	Colorect C (1·08)
Estonia	IHD (2·2)	Stroke (1·05)	HTN HD (9·85)	Lung C (0·94)	Self-harm (0·84)	Alcohol (13·75)	Alzheimer's (0·7)	Colorect C (0·76)	Breast C (1·12)	CMP (3·26)
Latvia	IHD (2·92)	Stroke (2·04)	CMP (7·93)	Self-harm (1·21)	Lung C (1·0)	Colorect C (0·87)	Road injuries (1·24)	Alzheimer's (0·7)	Breast C (1·16)	LRI (0·58)
Lithuania	IHD (2·37)	Stroke (1·22)	Self-harm (2·07)	Lung C (0·94)	Road injuries (1·15)	Colorect C (0·83)	CMP (3·33)	Cirr alcohol (3·56)	LRI (0·57)	Alzheimer's (0·71)
Moldova	IHD (1·57)	Stroke (1·11)	Cirr alcohol (4·24)	Self-harm (1·06)	LRI (0·8)	Lung C (0·78)	Road injuries (0·46)	Other cirr (4·5)	COPD (0·69)	Colorect C (0·95)
Russia	IHD (3·71)	Stroke (2·86)	Self-harm (2·02)	CMP (10·86)	Road injuries (2·23)	Lung C (1·06)	LRI (1·39)	Violence (12·78)	Alcohol (17·95)	HIV (1·73)
Ukraine	IHD (3·77)	Stroke (1·69)	Self-harm (1·37)	Lung C (0·86)	Drugs (24·53)	HIV (1·54)	Road injuries (1·12)	Colorect C (0·93)	COPD (1·21)	CMP (3·49)
Central Europe	IHD (1·6)	Stroke (1·34)	Lung C (1·32)	Colorect C (1·09)	Self-harm (0·86)	COPD (1·06)	CMP (3·11)	LRI (0·6)	Road injuries (0·81)	Alzheimer's (0·74)
Albania	IHD (0·96)	Stroke (1·07)	Lung C (0·95)	LRI (0·57)	Congenital (0·76)	CMP (2·3)	Road injuries (0·38)	Other cardio (1·87)	Stomach C (0·69)	CKD (0·65)
Bosnia and Herzegovina	IHD (0·64)	Stroke (0·78)	Lung C (1·19)	CMP (5·65)	Diabetes (1·24)	Colorect C (0·94)	COPD (0·52)	Alzheimer's (0·71)	Breast C (0·72)	Brain C (1·8)
Bulgaria	IHD (1·92)	Stroke (1·77)	Lung C (1·15)	HTN HD (6·13)	Colorect C (1·1)	Other cardio (3·0)	COPD (1·13)	CMP (2·99)	LRI (0·56)	Alzheimer's (0·77)
Croatia	IHD (1·09)	Stroke (0·94)	Lung C (1·25)	Colorect C (1·18)	Self-harm (0·86)	COPD (0·87)	Alzheimer's (0·81)	Breast C (1·12)	Road injuries (0·58)	Stomach C (0·55)
Czech Republic	IHD (2·45)	Stroke (1·26)	Lung C (1·18)	Colorect C (1·24)	Self-harm (0·73)	LRI (0·74)	Alzheimer's (0·73)	COPD (1·25)	Pancreas C (1·11)	Other cardio (2·28)
Hungary	IHD (1·92)	Stroke (1·11)	Lung C (1·66)	Colorect C (1·4)	Self-harm (0·97)	COPD (1·72)	Breast C (1·36)	HTN HD (4·0)	Cirr alcohol (3·4)	Alzheimer's (0·66)
Macedonia	Stroke (1·66)	IHD (1·03)	Lung C (1·14)	CMP (3·87)	Diabetes (1·41)	Colorect C (0·84)	Road injuries (0·47)	Breast C (1·04)	Stomach C (0·7)	Self-harm (0·48)
Montenegro	IHD (1·28)	Stroke (1·83)	Lung C (1·47)	CMP (3·39)	Self-harm (0·69)	Road injuries (0·64)	Diabetes (1·27)	Breast C (1·06)	Colorect C (0·65)	Alzheimer's (0·77)
Poland	IHD (1·88)	Stroke (1·18)	Lung C (1·53)	Self-harm (1·07)	Colorect C (1·13)	Road injuries (1·29)	LRI (0·72)	CMP (3·74)	COPD (1·22)	Alzheimer's (0·74)
Romania	IHD (1·52)	Stroke (1·72)	Lung C (1·07)	HTN HD (4·28)	LRI (0·84)	CMP (3·6)	Colorect C (0·85)	COPD (0·98)	Self-harm (0·73)	Cirr alcohol (3·41)
Serbia	IHD (1·1)	Stroke (1·4)	Lung C (1·41)	Colorect C (1·17)	Self-harm (0·97)	Diabetes (1·33)	COPD (0·88)	Breast C (1·28)	Road injuries (0·62)	Alzheimer's (0·79)
Slovakia	IHD (2·29)	Stroke (1·17)	Lung C (1·06)	Colorect C (1·3)	LRI (0·98)	Self-harm (0·61)	Road injuries (0·9)	Breast C (1·01)	Alzheimer's (0·72)	Pancreas C (1·03)
Slovenia	IHD (0·83)	Stroke (0·72)	Lung C (0·91)	Self-harm (0·85)	Colorect C (0·92)	Alzheimer's (0·75)	CMP (3·29)	LRI (0·52)	Breast C (1·12)	COPD (0·8)

(Figure 17 continues on next page)

	1	2	3	4	5	6	7	8	9	10
Central Asia	IHD (2·08)	Stroke (1·53)	LRI (2·08)	NN encephalitis (2·25)	NN preterm (0·97)	Congenital (0·9)	Road injuries (0·69)	Self-harm (1·1)	HTN HD (3·58)	COPD (1·24)
Armenia	IHD (1·66)	Stroke (0·94)	Lung C (1·32)	Diabetes (2·26)	Congenital (1·32)	LRI (0·73)	Road injuries (0·63)	COPD (1·08)	Breast C (1·37)	Stomach C (0·79)
Azerbaijan	IHD (2·49)	LRI (3·63)	Stroke (1·33)	NN encephalitis (8·26)	NN preterm (2·45)	Congenital (1·22)	Lung C (0·84)	Diabetes (1·9)	Road injuries (0·52)	Stomach C (0·96)
Georgia	IHD (1·88)	Stroke (1·72)	Road injuries (1·08)	Lung C (0·97)	HTN HD (4·08)	COPD (1·25)	Diabetes (1·44)	LRI (0·57)	Stomach C (0·84)	Breast C (1·16)
Kazakhstan	IHD (2·96)	Stroke (2·33)	Self-harm (2·16)	Road injuries (1·55)	NN preterm (3·31)	LRI (1·88)	Congenital (1·38)	COPD (2·93)	Violence (5·65)	Lung C (1·08)
Kyrgyzstan	IHD (1·71)	Stroke (1·6)	LRI (1·21)	NN preterm (0·94)	NN encephalitis (1·64)	Congenital (0·92)	Road injuries (0·67)	Self-harm (1·11)	COPD (1·27)	Cirr hep B (5·14)
Mongolia	IHD (1·89)	Stroke (2·78)	Self-harm (3·03)	LRI (2·24)	Liver C (10·66)	NN encephalitis (3·5)	Road injuries (1·07)	Congenital (1·13)	NN preterm (0·9)	Violence (1·67)
Tajikistan	LRI (1·29)	IHD (1·24)	NN preterm (0·64)	Stroke (0·92)	Diarrhoea (1·04)	Congenital (0·7)	NN encephalitis (0·81)	Hemog (7·16)	Other NN (1·11)	Drowning (1·09)
Turkmenistan	IHD (3·18)	LRI (6·81)	Stroke (2·36)	Congenital (2·06)	NN preterm (2·99)	NN encephalitis (6·34)	Road injuries (0·66)	Self-harm (0·7)	Cirr hep B (8·71)	Other cirr (12·2)
Uzbekistan	IHD (1·82)	LRI (2·62)	Stroke (1·17)	NN encephalitis (2·74)	HTN HD (6·01)	Road injuries (0·59)	Self-harm (0·9)	Congenital (0·55)	NN preterm (0·43)	Drowning (1·6)
Latin America and Caribbean	IHD (0·66)	Violence (4·23)	Road injuries (0·84)	Stroke (0·59)	LRI (0·78)	Diabetes (1·34)	Congenital (0·85)	CKD (1·44)	NN preterm (0·56)	HIV (0·3)
Central Latin America	Violence (4·85)	IHD (0·62)	Road injuries (0·73)	CKD (2·16)	Congenital (0·96)	Diabetes (1·72)	LRI (0·71)	Stroke (0·43)	NN preterm (0·57)	Self-harm (0·57)
Colombia	Violence (6·01)	IHD (0·51)	Road injuries (0·6)	Congenital (0·88)	Stroke (0·37)	LRI (0·62)	COPD (0·79)	Self-harm (0·53)	NN preterm (0·47)	CKD (0·71)
Costa Rica	IHD (0·44)	Road injuries (0·65)	Congenital (0·91)	CKD (1·28)	Violence (1·61)	Stroke (0·26)	Self-harm (0·61)	Stomach C (0·77)	Alzheimer's (0·94)	COPD (0·56)
El Salvador	Violence (9·01)	IHD (0·61)	CKD (2·27)	Road injuries (0·78)	LRI (0·63)	Congenital (0·78)	Diabetes (0·86)	Alcohol (7·62)	Self-harm (0·95)	Stroke (0·3)
Guatemala	LRI (1·06)	Violence (4·74)	Diarrhoea (0·88)	IHD (0·49)	Congenital (0·65)	Road injuries (0·49)	Diabetes (1·33)	NN preterm (0·32)	CKD (1·44)	PEM (2·35)
Honduras	Violence (5·14)	IHD (1·02)	Stroke (0·89)	Congenital (1·02)	NN preterm (0·39)	LRI (0·32)	Road injuries (0·37)	Diarrhoea (0·62)	HIV (0·22)	Diabetes (0·61)
Mexico	IHD (0·62)	CKD (3·22)	Diabetes (2·7)	Violence (3·2)	Road injuries (0·78)	Congenital (1·09)	LRI (0·67)	Stroke (0·41)	NN preterm (0·69)	Cirr alcohol (3·0)
Nicaragua	CKD (1·92)	IHD (0·46)	LRI (0·38)	Congenital (0·65)	Road injuries (0·38)	Violence (1·23)	Stroke (0·35)	Diabetes (0·75)	NN preterm (0·28)	Self-harm (0·71)
Panama	IHD (0·5)	Violence (4·74)	Road injuries (0·86)	Congenital (1·05)	LRI (1·15)	Stroke (0·51)	HIV (0·63)	CKD (1·71)	Diabetes (1·56)	NN preterm (0·8)
Venezuela	Violence (9·91)	IHD (0·91)	Road injuries (1·19)	Stroke (0·58)	Congenital (0·94)	NN preterm (1·07)	LRI (0·91)	CKD (1·84)	Diabetes (1·65)	Self-harm (0·81)
Andean Latin America	LRI (1·37)	IHD (0·42)	Road injuries (0·68)	Stroke (0·42)	Congenital (0·66)	CKD (1·27)	NN preterm (0·51)	NN encephalitis (0·92)	NN sepsis (2·64)	Violence (1·11)
Bolivia	LRI (1·06)	IHD (0·55)	Stroke (0·66)	NN encephalitis (1·2)	Road injuries (0·6)	NN sepsis (3·07)	NN preterm (0·52)	CKD (1·41)	Congenital (0·57)	Self-harm (0·86)
Ecuador	LRI (1·24)	Road injuries (0·98)	IHD (0·48)	Violence (2·2)	CKD (1·8)	Congenital (0·78)	Stroke (0·46)	Diabetes (1·31)	NN preterm (0·6)	Self-harm (0·64)
Peru	LRI (1·68)	IHD (0·33)	Road injuries (0·56)	Congenital (0·63)	Stroke (0·31)	NN sepsis (3·21)	NN preterm (0·45)	CKD (0·9)	F Body (2·83)	NN encephalitis (0·94)
Caribbean	IHD (1·01)	Stroke (0·89)	LRI (0·84)	HIV (1·06)	Road injuries (0·88)	Congenital (1·1)	Diabetes (2·05)	NN preterm (0·68)	Diarrhoea (0·8)	Violence (2·2)
Antigua and Barbuda	IHD (1·15)	Stroke (1·33)	Diabetes (7·24)	LRI (1·68)	CKD (2·8)	NN preterm (3·6)	HIV (1·06)	Congenital (1·23)	Prostate C (4·63)	Violence (4·46)
The Bahamas	IHD (1·28)	Stroke (1·27)	Violence (14·42)	HIV (2·6)	Diabetes (4·85)	LRI (1·85)	HTN HD (11·61)	Road injuries (1·39)	CKD (2·89)	Breast C (1·81)
Barbados	IHD (0·65)	Diabetes (4·62)	Stroke (0·81)	LRI (1·4)	Breast C (1·72)	Prostate C (3·93)	CKD (1·63)	Colorect C (1·02)	Congenital (1·4)	Violence (4·33)
Belize	HIV (1·02)	Violence (3·66)	IHD (0·73)	LRI (0·96)	Road injuries (0·73)	Diabetes (2·44)	Stroke (0·7)	NN preterm (0·52)	Congenital (0·6)	CKD (1·62)
Bermuda	IHD (2·07)	Stroke (1·12)	Lung C (1·05)	HIV (2·67)	Diabetes (6·09)	Road injuries (2·17)	Colorect C (1·08)	Breast C (1·66)	LRI (0·96)	Prostate C (4·07)
Cuba	IHD (0·85)	Stroke (0·63)	Lung C (1·15)	LRI (0·95)	Self-harm (0·78)	Alzheimer's (1·12)	COPD (0·94)	Colorect C (0·75)	Road injuries (0·48)	CKD (0·93)
Dominica	IHD (0·71)	Diabetes (3·95)	Stroke (0·78)	LRI (1·51)	CKD (2·83)	Road injuries (0·85)	NN preterm (1·86)	Congenital (1·17)	Violence (3·48)	Prostate C (5·3)
Dominican Republic	IHD (0·89)	Stroke (0·74)	Road injuries (0·93)	NN preterm (1·13)	HIV (0·71)	Congenital (0·91)	LRI (0·83)	Violence (2·24)	NN sepsis (5·3)	Diabetes (1·0)
Grenada	IHD (0·98)	Stroke (1·26)	LRI (2·31)	Diabetes (5·05)	CKD (2·93)	Road injuries (0·78)	Congenital (0·89)	NN preterm (1·07)	Violence (2·38)	HIV (0·57)
Guyana	IHD (1·39)	HIV (2·21)	Stroke (1·56)	Diabetes (3·27)	Self-harm (2·37)	LRI (1·03)	Road injuries (0·82)	Violence (2·85)	NN preterm (0·89)	Congenital (0·81)
Haiti	HIV (1·51)	LRI (0·72)	IHD (1·19)	Diarrhoea (0·71)	Stroke (1·11)	Congenital (1·3)	Road injuries (1·01)	NN encephalitis (0·79)	NN preterm (0·43)	Other NN (1·73)

(Figure 17 continues on next page)

	1	2	3	4	5	6	7	8	9	10
Jamaica	Stroke (0·94)	Diabetes (3·41)	Violence (4·25)	IHD (0·45)	NN preterm (1·4)	CKD (1·57)	HIV (0·56)	Congenital (0·86)	LRI (0·7)	Lung C (0·72)
Puerto Rico	IHD (1·37)	Diabetes (8·54)	Violence (27·38)	LRI (1·32)	Stroke (0·71)	CKD (2·8)	Road injuries (1·62)	COPD (1·61)	Alzheimer's (0·84)	Colorect C (0·82)
Saint Lucia	Stroke (0·95)	IHD (0·59)	Diabetes (3·79)	LRI (1·28)	Violence (3·93)	CKD (1·71)	Road injuries (0·62)	Congenital (0·93)	NN preterm (1·26)	Prostate C (3·4)
Saint Vincent and the Grenadines	IHD (1·05)	Diabetes (5·78)	Stroke (1·07)	Violence (5·04)	LRI (1·43)	HIV (0·89)	NN preterm (1·93)	CKD (2·09)	Congenital (0·94)	Road injuries (0·55)
Suriname	IHD (0·79)	Stroke (1·16)	NN preterm (1·83)	Self-harm (1·98)	HIV (0·91)	Road injuries (0·91)	LRI (1·25)	Diabetes (2·07)	Congenital (1·16)	CKD (1·83)
Trinidad and Tobago	IHD (1·96)	Diabetes (14·95)	Stroke (1·43)	Violence (15·41)	Road injuries (1·56)	HIV (1·66)	Self-harm (0·92)	Congenital (2·15)	CKD (3·08)	LRI (1·33)
Virgin Islands	IHD (2·72)	Stroke (1·28)	Violence (34·9)	Diabetes (7·53)	Prostate C (5·43)	CKD (3·01)	Lung C (0·79)	Colorect C (1·25)	HTN HD (8·02)	LRI (0·96)
Tropical Latin America	IHD (0·69)	Violence (4·77)	Stroke (0·73)	Road injuries (0·99)	LRI (0·69)	Diabetes (1·04)	COPD (0·93)	Congenital (0·71)	HIV (0·32)	NN preterm (0·53)
Brazil	IHD (0·69)	Violence (4·88)	Stroke (0·73)	Road injuries (0·99)	LRI (0·7)	Diabetes (1·03)	COPD (0·95)	Congenital (0·7)	HIV (0·32)	NN preterm (0·52)
Paraguay	IHD (0·67)	Road injuries (0·94)	Stroke (0·8)	Congenital (0·82)	NN preterm (0·6)	Violence (1·95)	LRI (0·57)	Diabetes (1·34)	CKD (1·22)	NN encephalitis (0·58)
Southeast, east Asia, and Oceania	Stroke (1·22)	IHD (0·62)	Road injuries (0·79)	COPD (1·22)	Lung C (1·26)	Liver C (2·82)	LRI (0·55)	Congenital (0·66)	Stomach C (1·09)	Diabetes (0·59)
East Asia	Stroke (1·2)	IHD (0·56)	Road injuries (0·82)	COPD (1·34)	Lung C (1·38)	Liver C (3·21)	Stomach C (1·28)	LRI (0·34)	Congenital (0·65)	Self-harm (0·52)
China	Stroke (1·2)	IHD (0·55)	Road injuries (0·82)	Lung C (1·39)	COPD (1·34)	Liver C (3·18)	Stomach C (1·27)	LRI (0·34)	Congenital (0·65)	Self-harm (0·51)
North Korea	Stroke (1·58)	IHD (0·65)	COPD (1·67)	Road injuries (0·91)	Liver C (4·43)	Lung C (2·13)	Stomach C (2·46)	LRI (0·38)	Self-harm (1·04)	Congenital (0·78)
Taiwan (province of China)	IHD (0·69)	Liver C (3·67)	Stroke (0·86)	Lung C (0·93)	Diabetes (4·17)	Road injuries (1·57)	Self-harm (0·75)	LRI (0·97)	Colorect C (0·9)	CKD (1·39)
Southeast Asia	Stroke (1·28)	IHD (0·79)	LRI (0·91)	Road injuries (0·71)	TB (3·48)	Diabetes (1·33)	NN preterm (0·59)	Congenital (0·68)	CKD (1·14)	NN encephalitis (0·83)
Cambodia	IHD (1·08)	LRI (0·64)	Stroke (1·03)	NN preterm (0·63)	Road injuries (0·66)	Congenital (0·74)	HIV (0·36)	TB (1·03)	Self-harm (1·12)	NN encephalitis (0·46)
Indonesia	Stroke (1·76)	IHD (0·97)	TB (6·53)	Diabetes (1·91)	Road injuries (0·74)	NN preterm (0·74)	LRI (0·69)	Diarrhoea (3·13)	NN encephalitis (1·25)	Congenital (0·6)
Laos	LRI (1·35)	NN preterm (1·24)	IHD (1·17)	Stroke (1·11)	Congenital (1·12)	Road injuries (0·91)	Diarrhoea (0·79)	NN encephalitis (0·77)	Drowning (1·84)	Self-harm (1·31)
Malaysia	IHD (1·29)	LRI (2·41)	Stroke (0·98)	Road injuries (1·19)	Lung C (0·69)	Self-harm (0·52)	Diabetes (1·49)	HIV (0·42)	Congenital (0·57)	CKD (1·29)
Maldives	IHD (0·51)	Congenital (0·64)	Stroke (0·34)	Self-harm (0·69)	Drowning (1·14)	LRI (0·22)	CKD (0·59)	NN encephalitis (0·4)	Road injuries (0·17)	NN preterm (0·18)
Mauritius	IHD (0·99)	Diabetes (6·46)	CKD (4·29)	Stroke (0·79)	LRI (0·77)	Road injuries (0·53)	Self-harm (0·71)	HTN HD (2·41)	Congenital (0·84)	NN preterm (1·07)
Myanmar	Stroke (1·14)	LRI (0·83)	TB (2·11)	IHD (0·46)	NN encephalitis (1·08)	Road injuries (0·49)	NN preterm (0·46)	Congenital (0·8)	COPD (0·99)	HIV (0·33)
Philippines	IHD (1·15)	LRI (1·45)	Stroke (1·29)	Congenital (0·82)	NN preterm (0·56)	TB (4·11)	Violence (2·0)	NN sepsis (3·24)	CKD (1·61)	Diabetes (1·12)
Sri Lanka	IHD (0·76)	Self-harm (2·13)	Stroke (0·57)	Diabetes (1·55)	Asthma (4·93)	LRI (0·61)	Road injuries (0·47)	CKD (0·92)	Congenital (0·53)	COPD (0·64)
Seychelles	IHD (0·87)	LRI (2·33)	HTN HD (9·18)	Stroke (0·66)	CKD (3·07)	Road injuries (0·66)	Drowning (3·44)	Congenital (0·83)	Self-harm (0·55)	Diabetes (1·21)
Thailand	IHD (0·45)	Stroke (0·66)	LRI (1·73)	Road injuries (1·27)	Liver C (4·02)	HIV (0·67)	Lung C (1·1)	CKD (1·62)	Self-harm (1·14)	Diabetes (1·15)
Timor-Leste	LRI (0·58)	NN preterm (0·57)	Congenital (0·77)	IHD (0·7)	Stroke (0·65)	Measles (3·17)	NN encephalitis (0·43)	Diarrhoea (0·28)	Other NN (0·92)	Drowning (1·41)
Vietnam	Stroke (1·16)	IHD (0·42)	Road injuries (0·73)	Lung C (1·91)	LRI (0·46)	Congenital (0·76)	Diabetes (0·62)	Liver C (2·29)	TB (1·61)	Drowning (1·42)
Oceania	LRI (1·07)	IHD (2·14)	Stroke (1·86)	Diabetes (4·86)	COPD (3·62)	Road injuries (0·93)	NN preterm (0·39)	Asthma (5·21)	CKD (2·8)	Diarrhoea (0·44)
American Samoa	IHD (1·16)	Diabetes (4·56)	Stroke (0·98)	CKD (2·84)	LRI (0·84)	Congenital (0·36)	Endocrine (4·52)	COPD (1·51)	Drowning (1·56)	Road injuries (0·35)
Federated States of Micronesia	IHD (1·63)	Stroke (1·41)	Diabetes (3·03)	LRI (0·73)	CKD (2·24)	Self-harm (1·42)	Road injuries (0·46)	COPD (1·2)	Congenital (0·4)	Drowning (1·14)
Fiji	Diabetes (11·92)	IHD (2·05)	LRI (2·39)	Stroke (1·29)	CKD (4·0)	NN preterm (1·18)	Congenital (1·09)	Self-harm (1·21)	Asthma (7·61)	Other cardio (4·83)
Guam	IHD (4·42)	Stroke (2·08)	Self-harm (1·46)	Lung C (1·59)	Diabetes (7·7)	LRI (2·35)	CKD (4·92)	Road injuries (2·23)	Congenital (2·29)	COPD (2·56)
Kiribati	Stroke (2·23)	IHD (1·52)	LRI (0·68)	Diabetes (4·82)	NN preterm (0·51)	TB (2·13)	Violence (2·72)	NN encephalitis (0·75)	PEM (2·75)	Self-harm (1·87)
Marshall Islands	IHD (1·69)	Diabetes (3·81)	Stroke (1·49)	CKD (3·34)	LRI (0·78)	NN preterm (0·43)	Self-harm (1·41)	Road injuries (0·49)	Congenital (0·46)	Drowning (1·43)
Northern Mariana Islands	IHD (1·44)	Stroke (1·64)	Self-harm (0·64)	Road injuries (1·09)	Diabetes (6·08)	CKD (4·58)	Drowning (3·74)	LRI (1·83)	Lung C (1·17)	Violence (3·41)

(Figure 17 continues on next page)

	1	2	3	4	5	6	7	8	9	10
Papua New Guinea	LRI (1·03)	IHD (1·92)	Stroke (1·74)	COPD (3·83)	Diabetes (3·52)	Road injuries (0·96)	Diarrhoea (0·42)	Asthma (4·94)	NN preterm (0·35)	Measles (3·61)
Samoa	IHD (1·0)	Diabetes (2·72)	Stroke (0·87)	CKD (2·09)	LRI (0·54)	Self-harm (0·94)	Road injuries (0·31)	Congenital (0·35)	COPD (0·75)	Endocrine (2·64)
Solomon Islands	IHD (2·1)	Stroke (1·71)	Diabetes (4·38)	LRI (0·46)	CKD (3·1)	NN preterm (0·3)	COPD (1·67)	Road injuries (0·63)	Self-harm (1·64)	Drowning (1·6)
Tonga	IHD (0·97)	Diabetes (2·99)	LRI (0·74)	Stroke (0·77)	NN preterm (0·48)	Road injuries (0·46)	Congenital (0·47)	COPD (0·92)	Meningitis (2·29)	Liver C (3·27)
Vanuatu	IHD (1·97)	Stroke (1·85)	LRI (0·89)	Diabetes (3·2)	NN preterm (0·52)	Road injuries (0·62)	Self-harm (1·68)	CKD (1·94)	COPD (1·48)	Drowning (1·78)
North Africa and Middle East	IHD (1·2)	War (2001·28)	NN preterm (0·79)	Congenital (1·21)	Road injuries (0·98)	Stroke (0·87)	LRI (0·52)	Diabetes (0·97)	Diarrhoea (0·33)	CKD (1·02)
North Africa and Middle East	IHD (1·2)	War (2001·28)	NN preterm (0·79)	Congenital (1·21)	Road injuries (0·98)	Stroke (0·87)	LRI (0·52)	Diabetes (0·97)	Diarrhoea (0·33)	CKD (1·02)
Afghanistan	War (2145·26)	LRI (0·7)	IHD (4·49)	Congenital (1·6)	Stroke (2·22)	NN preterm (0·76)	Road injuries (2·41)	Oth Unint (11·93)	Diarrhoea (0·23)	Violence (4·04)
Algeria	IHD (0·67)	NN preterm (0·75)	Stroke (0·72)	Road injuries (0·68)	Congenital (0·91)	Diabetes (0·85)	LRI (0·31)	NN sepsis (1·57)	CKD (0·79)	NN encephalitis (0·49)
Bahrain	IHD (0·81)	Diabetes (4·21)	Road injuries (0·58)	Congenital (0·84)	Self-harm (0·37)	CKD (1·54)	Stroke (0·33)	LRI (0·57)	Breast C (0·98)	NN preterm (0·58)
Egypt	IHD (1·39)	Congenital (1·32)	Stroke (1·08)	LRI (0·78)	Cirr hep C (7·38)	NN preterm (0·47)	Road injuries (0·47)	CKD (1·29)	Diabetes (0·92)	CMP (4·07)
Iran	IHD (1·3)	Road injuries (1·75)	Stroke (0·78)	Congenital (1·05)	NN preterm (0·95)	HTN HD (3·19)	Other cardio (2·86)	LRI (0·55)	Self-harm (0·51)	Diabetes (0·87)
Iraq	War (5558·67)	IHD (1·92)	Congenital (1·23)	NN preterm (0·7)	Stroke (1·18)	NN sepsis (2·44)	Road injuries (0·67)	LRI (0·4)	Violence (2·27)	Diabetes (1·48)
Jordan	Congenital (1·1)	IHD (0·7)	Road injuries (0·68)	NN preterm (0·69)	LRI (0·58)	Stroke (0·45)	Diabetes (1·18)	CKD (1·07)	NN sepsis (1·72)	NN encephalitis (0·48)
Kuwait	IHD (1·98)	Congenital (2·02)	Road injuries (1·43)	NN preterm (2·89)	Stroke (0·77)	LRI (1·21)	Self-harm (0·17)	CKD (1·3)	Breast C (0·73)	Diabetes (1·4)
Lebanon	IHD (1·07)	Stroke (0·45)	Congenital (0·97)	Lung C (0·78)	Diabetes (1·39)	Road injuries (0·43)	Colorect C (0·85)	Alzheimer's (1·17)	Breast C (1·09)	CKD (0·84)
Libya	War (6283·28)	IHD (0·96)	Road injuries (0·83)	Congenital (1·08)	Stroke (0·75)	Other transport (11·51)	NN preterm (0·61)	LRI (0·38)	CKD (1·01)	Lung C (1·02)
Morocco	IHD (0·62)	NN preterm (0·56)	Stroke (0·51)	Diabetes (1·41)	Road injuries (0·6)	Congenital (0·75)	LRI (0·27)	NN encephalitis (0·42)	Lung C (1·48)	CKD (0·8)
Palestine	IHD (1·36)	NN preterm (0·68)	Congenital (0·84)	Road injuries (0·49)	Stroke (0·71)	LRI (0·26)	CKD (1·32)	NN sepsis (0·93)	NN encephalitis (0·29)	Violence (0·81)
Oman	Road injuries (1·65)	IHD (0·8)	Other cardio (5·29)	Congenital (0·67)	Diabetes (2·06)	LRI (0·79)	Stroke (0·47)	NN preterm (0·51)	Other NN (1·73)	Self-harm (0·21)
Qatar	Road injuries (1·58)	IHD (0·63)	Congenital (1·16)	Self-harm (0·27)	Diabetes (2·48)	NN preterm (1·59)	Stroke (0·45)	Falls (1·17)	Mech (1·21)	Breast C (1·17)
Saudi Arabia	IHD (0·85)	Road injuries (1·29)	Congenital (1·26)	NN preterm (1·08)	Stroke (0·57)	LRI (0·66)	CKD (1·42)	NN sepsis (3·78)	Self-harm (0·22)	Falls (1·04)
Sudan	NN preterm (1·22)	Congenital (1·59)	IHD (1·66)	LRI (0·52)	Road injuries (1·58)	Diarrhoea (0·51)	Stroke (1·08)	NN encephalitis (0·3)	Other NN (0·89)	HIV (0·26)
Syria	War (26105·82)	IHD (1·39)	Stroke (0·91)	Congenital (0·76)	LRI (0·33)	Road injuries (0·36)	NN preterm (0·19)	NN encephalitis (0·33)	Asthma (1·54)	Alzheimer's (1·33)
Tunisia	IHD (0·46)	Stroke (0·62)	Diabetes (1·33)	Road injuries (0·59)	Congenital (0·79)	Lung C (1·23)	NN preterm (0·59)	LRI (0·42)	CKD (0·72)	Alzheimer's (1·16)
Turkey	IHD (0·56)	Congenital (1·0)	Stroke (0·42)	Lung C (1·2)	NN preterm (0·85)	Road injuries (0·51)	COPD (0·79)	Alzheimer's (1·38)	Diabetes (0·65)	LRI (0·32)
United Arab Emirates	IHD (2·73)	Road injuries (3·54)	Stroke (2·25)	CKD (3·87)	COPD (4·24)	Diabetes (3·39)	Self-harm (0·22)	Falls (2·15)	Congenital (1·18)	Med treat (12·7)
Yemen	War (2398·83)	NN preterm (1·05)	IHD (2·11)	Congenital (1·37)	Road injuries (1·55)	LRI (0·38)	Stroke (1·19)	Diarrhoea (0·28)	Other NN (0·79)	NN encephalitis (0·25)
South Asia	IHD (1·23)	NN encephalitis (2·2)	NN preterm (1·09)	LRI (0·75)	Diarrhoea (1·07)	Stroke (0·84)	COPD (2·17)	TB (2·06)	Road injuries (0·65)	Congenital (0·65)
South Asia	IHD (1·23)	NN encephalitis (2·2)	NN preterm (1·09)	LRI (0·75)	Diarrhoea (1·07)	Stroke (0·84)	COPD (2·17)	TB (2·06)	Road injuries (0·65)	Congenital (0·65)
Bangladesh	Stroke (1·2)	IHD (0·95)	NN encephalitis (1·54)	LRI (0·52)	Drowning (2·59)	COPD (1·34)	NN preterm (0·4)	Road injuries (0·48)	Congenital (0·62)	Intestinal infect (6·07)
Bhutan	NN preterm (1·29)	IHD (0·77)	NN encephalitis (1·92)	LRI (0·52)	COPD (1·25)	Stroke (0·49)	TB (1·38)	Congenital (0·64)	Intestinal infect (13·13)	Diarrhoea (0·6)
India	IHD (1·2)	NN preterm (1·28)	NN encephalitis (2·13)	LRI (0·82)	COPD (2·44)	Diarrhoea (1·33)	Stroke (0·8)	TB (2·51)	Road injuries (0·69)	Self-harm (1·27)
Nepal	LRI (0·58)	IHD (0·92)	NN encephalitis (1·35)	Disaster (3932·26)	TB (1·39)	COPD (1·56)	Stroke (0·49)	Diarrhoea (0·38)	Road injuries (0·63)	NN preterm (0·25)
Pakistan	NN encephalitis (2·94)	IHD (1·81)	NN preterm (0·85)	LRI (0·62)	Diarrhoea (0·85)	Stroke (0·88)	TB (1·38)	Meningitis (1·44)	Congenital (0·59)	Other NN (1·46)
Sub-Saharan Africa	Malaria (5·39)	HIV (2·64)	LRI (0·65)	Diarrhoea (0·67)	NN sepsis (2·39)	NN encephalitis (0·83)	NN preterm (0·49)	Congenital (0·92)	PEM (1·26)	Meningitis (1·09)
Southern sub-Saharan Africa	HIV (13·33)	LRI (1·83)	TB (11·22)	Diarrhoea (4·01)	Road injuries (1·48)	Violence (4·96)	IHD (0·79)	Diabetes (3·41)	NN preterm (0·88)	Stroke (0·98)

(Figure 17 continues on next page)

	1	2	3	4	5	6	7	8	9	10
Botswana	HIV (12·98)	TB (15·84)	LRI (1·76)	IHD (0·96)	Road injuries (1·11)	Diarrhoea (4·35)	Diabetes (3·2)	Stroke (1·13)	Self-harm (1·96)	NN preterm (0·58)
Lesotho	HIV (18·72)	Diarrhoea (3·71)	LRI (1·88)	TB (10·58)	NN preterm (1·13)	Road injuries (1·77)	Other NN (5·18)	Violence (4·68)	IHD (1·27)	Stroke (1·39)
Namibia	HIV (7·97)	LRI (1·39)	Diarrhoea (3·74)	TB (8·54)	NN preterm (0·78)	Road injuries (1·0)	Other NN (3·71)	IHD (0·69)	NN encephalitis (1·11)	Stroke (0·72)
South Africa	HIV (15·18)	Violence (7·41)	LRI (2·66)	Road injuries (1·82)	TB (19·05)	IHD (0·81)	Diabetes (4·21)	Stroke (0·96)	Diarrhoea (10·14)	NN preterm (1·21)
Swaziland	HIV (19·98)	LRI (2·6)	Diarrhoea (7·38)	Road injuries (2·1)	TB (14·18)	IHD (1·22)	Stroke (1·46)	Other NN (3·85)	NN preterm (0·76)	Diabetes (3·58)
Zimbabwe	HIV (9·02)	Diarrhoea (2·49)	LRI (1·07)	NN encephalitis (1·58)	NN preterm (0·6)	TB (4·41)	NN sepsis (2·32)	PEM (3·89)	Road injuries (0·69)	Stroke (0·97)
Western sub-Saharan Africa	Malaria (9·36)	Diarrhoea (0·96)	LRI (0·73)	HIV (1·76)	NN sepsis (3·6)	NN encephalitis (0·98)	NN preterm (0·53)	Meningitis (1·45)	PEM (1·54)	Congenital (0·87)
Benin	Malaria (12·07)	LRI (0·7)	Diarrhoea (0·46)	NN sepsis (2·64)	NN preterm (0·53)	NN encephalitis (0·77)	Meningitis (1·21)	PEM (1·46)	Congenital (0·81)	Stroke (0·88)
Burkina Faso	Malaria (5·47)	LRI (0·52)	Diarrhoea (0·44)	NN sepsis (1·77)	Meningitis (1·0)	NN encephalitis (0·7)	PEM (0·86)	Congenital (0·88)	NN preterm (0·36)	TB (0·74)
Cameroon	HIV (3·79)	Malaria (76·49)	LRI (1·18)	NN sepsis (4·63)	Diarrhoea (1·07)	NN encephalitis (0·97)	NN preterm (0·54)	Congenital (1·07)	Meningitis (1·93)	PEM (2·89)
Cape Verde	LRI (0·64)	Stroke (0·88)	IHD (0·51)	HIV (0·5)	NN preterm (0·51)	Congenital (0·82)	Violence (1·74)	NN sepsis (2·48)	NN encephalitis (0·81)	Self-harm (1·11)
Chad	Diarrhoea (1·23)	LRI (0·95)	Malaria (4·11)	HIV (1·88)	NN sepsis (2·61)	PEM (1·7)	NN preterm (0·64)	Meningitis (1·48)	NN encephalitis (0·73)	Congenital (0·91)
Côte d'Ivoire	Malaria (34·35)	HIV (2·67)	LRI (0·93)	NN sepsis (4·37)	Diarrhoea (0·67)	NN preterm (0·69)	NN encephalitis (0·99)	Congenital (0·95)	Stroke (0·97)	Meningitis (1·16)
The Gambia	LRI (0·36)	NN sepsis (2·23)	Diarrhoea (0·28)	HIV (0·94)	NN preterm (0·38)	NN encephalitis (0·5)	Congenital (0·64)	Meningitis (0·66)	PEM (0·76)	Liver C (6·57)
Ghana	Malaria (78·2)	LRI (0·99)	NN sepsis (5·51)	HIV (1·16)	NN preterm (0·5)	Stroke (1·06)	Congenital (0·82)	IHD (0·78)	NN encephalitis (0·79)	PEM (3·46)
Guinea	Malaria (7·55)	LRI (0·69)	Diarrhoea (0·35)	NN sepsis (2·23)	NN preterm (0·62)	NN encephalitis (0·85)	HIV (1·09)	Meningitis (0·95)	Hemog (3·57)	PEM (0·88)
Guinea-Bissau	LRI (0·85)	Diarrhoea (0·89)	HIV (2·51)	Meningitis (1·82)	NN sepsis (2·87)	Malaria (2·72)	NN preterm (0·71)	PEM (1·82)	STD (3·53)	NN encephalitis (0·85)
Liberia	LRI (0·46)	Malaria (3·04)	Diarrhoea (0·42)	HIV (1·24)	NN sepsis (1·98)	NN preterm (0·48)	NN encephalitis (0·67)	TB (1·09)	Ebola (59835·47)	Meningitis (0·77)
Mali	Malaria (6·63)	Diarrhoea (0·39)	PEM (1·51)	NN preterm (0·87)	NN sepsis (2·49)	LRI (0·29)	NN encephalitis (0·92)	Meningitis (0·95)	HIV (1·08)	Congenital (0·82)
Mauritania	LRI (0·61)	NN sepsis (3·54)	Diarrhoea (0·51)	NN preterm (0·5)	NN encephalitis (0·78)	Congenital (0·89)	STD (2·35)	Meningitis (0·88)	Stroke (0·52)	PEM (1·27)
Niger	Malaria (1·4)	Diarrhoea (0·54)	LRI (0·39)	Meningitis (1·1)	PEM (0·52)	NN preterm (0·52)	NN sepsis (1·02)	NN encephalitis (0·53)	Congenital (0·59)	TB (0·56)
Nigeria	Malaria (108·21)	Diarrhoea (2·18)	HIV (2·08)	LRI (1·01)	NN sepsis (5·4)	NN encephalitis (1·25)	NN preterm (0·49)	Hemog (10·17)	Congenital (0·92)	Meningitis (2·2)
São Tomé Príncipe	LRI (0·68)	NN sepsis (2·33)	Stroke (1·01)	Congenital (0·81)	Diarrhoea (0·38)	NN encephalitis (0·57)	NN preterm (0·27)	IHD (0·66)	CKD (2·28)	PEM (1·52)
Senegal	Diarrhoea (0·51)	LRI (0·42)	NN sepsis (2·04)	NN preterm (0·38)	TB (1·24)	NN encephalitis (0·57)	Congenital (0·76)	Meningitis (0·95)	Malaria (1·89)	Stroke (0·81)
Sierra Leone	Malaria (15·38)	LRI (0·9)	Hemog (10·14)	Diarrhoea (0·6)	Ebola (98778·13)	NN sepsis (2·98)	NN preterm (0·66)	NN encephalitis (1·01)	Meningitis (1·62)	HIV (1·14)
Togo	Malaria (19·06)	HIV (2·17)	LRI (0·68)	Diarrhoea (0·52)	NN sepsis (3·19)	NN preterm (0·55)	NN encephalitis (0·86)	Congenital (0·8)	Hemog (4·09)	Stroke (0·84)
Eastern sub-Saharan Africa	HIV (2·51)	LRI (0·57)	Diarrhoea (0·52)	Malaria (2·32)	Congenital (1·04)	NN encephalitis (0·7)	NN preterm (0·42)	NN sepsis (1·49)	PEM (1·05)	Meningitis (0·89)
Burundi	LRI (0·43)	Diarrhoea (0·39)	Malaria (1·24)	NN preterm (0·54)	Congenital (1·01)	PEM (0·89)	NN encephalitis (0·6)	TB (0·98)	HIV (0·89)	NN sepsis (1·03)
Comoros	LRI (0·5)	Diarrhoea (0·4)	NN preterm (0·43)	Congenital (0·93)	NN encephalitis (0·61)	NN sepsis (1·53)	TB (0·88)	Stroke (0·61)	STD (1·7)	Meningitis (0·62)
Djibouti	LRI (1·11)	Diarrhoea (1·06)	HIV (1·01)	Congenital (1·28)	NN preterm (0·52)	Stroke (0·84)	IHD (0·7)	TB (1·62)	Measles (7·35)	PEM (2·99)
Eritrea	Diarrhoea (0·82)	LRI (0·67)	PEM (1·56)	Congenital (0·97)	TB (1·29)	NN preterm (0·43)	Meningitis (0·91)	NN encephalitis (0·54)	Stroke (0·98)	NN sepsis (1·25)
Ethiopia	LRI (0·43)	Diarrhoea (0·35)	TB (1·19)	Congenital (0·97)	NN encephalitis (0·68)	HIV (0·82)	NN preterm (0·36)	NN sepsis (1·42)	Meningitis (0·74)	STD (1·78)
Kenya	HIV (3·56)	Diarrhoea (1·08)	LRI (0·76)	NN encephalitis (0·91)	NN preterm (0·46)	Congenital (0·83)	Malaria (2·45)	Meningitis (1·05)	NN sepsis (1·24)	PEM (1·22)
Madagascar	LRI (0·71)	Diarrhoea (0·72)	NN preterm (0·52)	PEM (2·09)	Stroke (1·22)	Congenital (0·85)	Malaria (3·45)	NN sepsis (1·72)	IHD (0·88)	NN encephalitis (0·44)
Malawi	HIV (4·96)	Malaria (5·36)	LRI (0·6)	Diarrhoea (0·51)	NN preterm (0·49)	NN encephalitis (0·72)	Congenital (1·0)	PEM (1·14)	Meningitis (0·96)	NN sepsis (1·32)
Mozambique	HIV (7·75)	Malaria (4·38)	LRI (0·31)	Diarrhoea (0·28)	NN encephalitis (0·71)	Congenital (0·98)	NN sepsis (1·33)	NN preterm (0·37)	TB (0·93)	Stroke (0·85)
Rwanda	LRI (0·79)	HIV (1·11)	Congenital (1·25)	Diarrhoea (0·4)	NN preterm (0·5)	NN encephalitis (0·74)	NN sepsis (2·02)	PEM (1·78)	Road injuries (0·99)	Meningitis (1·06)

(Figure 17 continues on next page)

	1	2	3	4	5	6	7	8	9	10
Somalia	Diarrhoea (0·68)	LRI (0·65)	PEM (0·83)	TB (1·2)	NN preterm (0·64)	Malaria (0·33)	Meningitis (0·59)	Congenital (0·8)	War (329·44)	NN encephalitis (0·52)
South Sudan	Diarrhoea (0·92)	LRI (0·72)	HIV (1·94)	Malaria (2·24)	PEM (1·37)	Meningitis (1·18)	NN preterm (0·54)	TB (1·11)	Congenital (0·85)	War (441·01)
Tanzania	HIV (2·5)	LRI (0·79)	Congenital (1·42)	Malaria (11·54)	Diarrhoea (0·49)	NN encephalitis (0·68)	NN sepsis (2·06)	NN preterm (0·34)	PEM (1·87)	Meningitis (1·06)
Uganda	HIV (2·76)	LRI (0·6)	Malaria (9·44)	Diarrhoea (0·47)	NN encephalitis (0·87)	Congenital (1·13)	NN preterm (0·47)	Meningitis (1·46)	NN sepsis (1·87)	Hemog (4·48)
Zambia	HIV (6·21)	LRI (0·96)	Malaria (41·28)	Diarrhoea (1·18)	Congenital (1·06)	NN encephalitis (0·74)	Meningitis (1·95)	NN preterm (0·34)	NN sepsis (1·91)	IHD (1·05)
Central sub-Saharan Africa	Malaria (3·57)	LRI (0·55)	HIV (1·54)	Diarrhoea (0·33)	PEM (1·06)	NN preterm (0·46)	NN sepsis (1·62)	Congenital (0·89)	NN encephalitis (0·64)	TB (1·03)
Angola	LRI (0·96)	Malaria (27·12)	Diarrhoea (0·64)	HIV (1·32)	NN sepsis (2·85)	Congenital (1·1)	NN preterm (0·39)	PEM (2·66)	Road injuries (1·43)	Meningitis (1·63)
Central African Republic	Malaria (7·46)	HIV (4·28)	LRI (0·96)	Diarrhoea (0·68)	TB (1·87)	NN preterm (0·73)	Stroke (1·6)	PEM (1·74)	Road injuries (2·03)	NN sepsis (2·17)
Congo (Brazzaville)	HIV (3·26)	Malaria (108·62)	LRI (0·98)	Congenital (1·05)	NN sepsis (3·15)	Stroke (1·23)	IHD (0·89)	NN encephalitis (0·82)	NN preterm (0·43)	Diarrhoea (0·79)
DR Congo	Malaria (2·78)	LRI (0·46)	Diarrhoea (0·27)	HIV (1·3)	PEM (0·88)	NN preterm (0·47)	NN encephalitis (0·63)	NN sepsis (1·3)	Congenital (0·8)	TB (0·91)
Equatorial Guinea	Malaria (1084·28)	HIV (3·62)	LRI (1·88)	NN sepsis (6·1)	Congenital (1·45)	NN preterm (0·76)	Road injuries (1·06)	NN encephalitis (1·23)	Other NN (2·77)	Meningitis (4·35)
Gabon	HIV (2·69)	Malaria (879·85)	LRI (1·63)	Congenital (1·26)	NN sepsis (5·65)	Stroke (1·06)	IHD (0·66)	Road injuries (0·93)	NN preterm (0·66)	NN encephalitis (1·23)

Colour key

(0·0–0·56) (0·56–0·71) (0·71–0·84) (0·84–0·98) (0·98–1·17) (1·17–1·43) (1·43–2·01) (2·01–3·27) >3·27

***Figure 17:* Leading ten causes of YLLs with the ratio of observed YLLs to YLLs expected on the basis of SDI in 2015, by location**
The ratio of observed YLLs to YLLs expected based on SDI is provided in parentheses for each cause, and cells are colour coded by ratio ranges (calculated to place a roughly equal number of cells into each bin). Shades of blue represent much lower observed YLLs than expected levels based on SDI, whereas red shows that observed YLLs exceed expected levels. SDI=Socio-demographic Index. YLL=years of life lost. IHD=ischaemic heart disease. LRI=lower respiratory infection. NN enceph=neonatal encephalitis. COPD=chronic obstructive pulmonary disease. Congenital=congenital disorders. C=cancer. Alzheimer=Alzheimer's disease and other dementias. HTN HD=hypertensive heart disease. Cirr hepB=cirrhosis due to hepatitis B. NN preterm=neonatal preterm birth complications. CKD=chronic kidney disease. TB=tuberculosis. Intestinal infect=intestinal infectious disease. NN sepsis=neonatal sepsis. Endocrine=endocrine, metabolic, blood, and immune disorders. Other cardio=other cardiovascular diseases. CMP=cardiomyopathies. Haemog=haemoglobinopathies and haemolytic anaemias. Cirr alcohol=cirrhosis due to alcohol use. Violence=interpersonal violence. Alcohol=alcohol use disorders. Other cirr=cirrhosis due to other causes. Cirr hepC=cirrhosis due to hepatitis C. Drugs=drug use disorders. F Body=pulmonary aspiration and foreign body in airway. PEM=protein-energy malnutrition. Mech=exposure to mechanical forces. Other transport=other transport injuries. Med treat=adverse effects of medical treatment. Leish=leishmaniasis. Other NN=other neonatal disorders. Iron=iron-deficiency anaemia. Whooping=whooping cough.

HIV/AIDS was the leading cause of premature mortality and resulted in exceedingly more YLLs than expected given SDI; Namibia, with a YLL ratio for HIV/AIDS of 7·97, was the lowest among these countries, whereas Swaziland had the highest ratio (19·98). Early death due to tuberculosis also surpassed expected levels, especially in South Africa (19·05), as did observed YLLs due to violence (eg, 7·41 in South Africa). Observed YLLs due to preterm birth complications were somewhat lower than expected in southern sub-Saharan Africa (eg, 0·58 in Botswana), but such levels were largely surpassed by countries in western and eastern sub-Saharan Africa. In 2015, 13 countries in western sub-Saharan Africa and 14 countries in eastern sub-Saharan Africa had YLL ratios lower than 0·60 for preterm birth complications. In western sub-Saharan Africa, observed premature mortality due to malaria was at least twice as high as expected in 13 of 19 countries in the region, with the highest YLL ratios in Nigeria (108·21) and Ghana (78·2). Neonatal sepsis caused more YLLs than expected based on SDI in several western sub-Saharan African countries, including Ghana (5·51). Despite the fact that the Ebola virus disease epidemic claimed more lives in 2014 than in 2015, Ebola virus disease remained among the leading cause of YLLs in Sierra Leone and Liberia. Although still among the leading causes of early death in western sub-Saharan Africa, YLLs due to lower respiratory infections and diarrhoeal diseases were much lower than expected for most countries, with YLL ratios as low as 0·29 in Mali and 0·28 in The Gambia, respectively. Similar trends emerged for eastern sub-Saharan Africa, although the toll of HIV/AIDS was generally higher; observed levels of premature mortality due to HIV/AIDS were at least five times higher than expected in Zambia (6·21) and Mozambique (7·75). Within eastern sub-Saharan Africa, eight of 15 countries had YLL ratios less than 0·60 for YLLs due to diarrhoeal diseases (eg, Rwanda [0·40] and Uganda [0·47]), emphasising the region's rising SDI. Furthermore, every country in eastern sub-Saharan Africa had observed YLLs due to preterm birth complications that were below expected levels, including Ethiopia (0·36) and Kenya (0·46). Nonetheless, YLL ratios for malaria were quite high for several countries, particularly Zambia (41·28) and Tanzania (11·54). Among countries in central sub-Saharan Africa, malaria resulted in many more YLLs than expected based on SDI, with Angola, Congo (Brazzaville), Equatorial Guinea, and Gabon reporting ratios that exceeded 20·00. Neonatal sepsis consistently caused more early deaths than expected within the region. Observed YLLs due to preterm birth complications fell below expected levels in Angola (0·39), Congo (Brazzaville; 0·43), and the Democratic Republic of the Congo (0·47). Notably, the Democratic Republic of the Congo, which had the world's sixth-highest death toll due to diarrhoeal diseases in 2015, had far fewer YLLs due to diarrhoea than expected (0·27).

Discussion

Main findings

Over the past 35 years, global life expectancy, age-standardised death rates, and age-standardised YLL rates have all substantially improved year on year, with the single exception of 1994 (high mortality from the Rwandan genocide, the Iraq civil war, and ongoing armed conflict in Bosnia and Herzegovina that year was enough to change the trend in global life expectancy). During 2005–15, life expectancy increased in 188 of 195 countries and territories and those increases were faster than expected on the basis of SDI improvements in 120 countries and territories. Such gains were mainly driven by marked reductions in mortality due to HIV/AIDS, malaria, infectious diseases such as lower respiratory infections and diarrhoea, neonatal disorders, cardiovascular disease, and cancers. Running counter to the general improvement, age-standardised death rates for 13 causes increased significantly in the past decade. In addition to these causes with increases, for some leading causes of death such as diabetes and chronic kidney disease, age-standardised death rates have stagnated globally and increased in some countries. Since 2011, global deaths from war have risen massively due to conflicts in Syria, Yemen, and Libya. Furthermore, gains in life expectancy were reversed for a subset of countries, with Syrian men bearing the largest toll (a 12·1 year reduction in life expectancy from 2010 to 2015).

Our analysis of the average relationships between age, sex, and cause-specific mortality and SDI suggest that the epidemiological transition does not affect all causes uniformly. Not all causes of death or YLLs improve as SDI increases. In fact, some causes such as cardiovascular disease and a subset of cancer types, initially tend to increase with rising SDI and then decline. This inverted U pattern might be related to changes in risk factors that initially increase disease incidence and then, with rising SDI, risk factor management and disease treatment might act to reduce age-specific mortality. The change in death numbers and population rates with the epidemiological transition was driven by both expected changes in age-specific rates and the highly regular shifts in population age structure that occur with rising SDI. Previous attempts to characterise the shifts in disease pattern with development[56–58] have not been as comprehensive and have not been based on a comprehensive database such as that provided by GBD. Across causes and within geographical regions, we found huge country-level heterogeneities when observed levels of premature mortality were compared with those expected on the basis of SDI. The average patterns of age-specific mortality associated with a given level of SDI are a useful starting point for benchmarking a country's mortality pattern, but many other factors, including public health programmes, access to medical care, and inequalities could account for deviations from the pattern expected on the basis of SDI alone.

Nearly 40 years ago, Samuel Preston observed a shifting relationship between life expectancy and income per capita;[58] in a series of subsequent analyses, the crucial role of technological change has been supported by this changing relationship.[58–61] With global life expectancy or other mortality metrics improving faster than expected on the basis of SDI, this general trend was tempered by stagnant or increasing mortality rates due to a subset of causes such as diabetes, cardiovascular disease, and some types of cancer. The overall shift in life expectancy masked larger gains for children and minimal progress for older adults compared with that expected on the basis of SDI. In fact, figures 10C and 10D show that global progress has been much less impressive for the probability of death from ages 15–50 years than for children and that progress in reducing the probability of death from ages 50–70 years only seems to be noticeable at high levels of SDI. In the younger adult age groups, temporal patterns over the past 25 years were profoundly shaped by the unfolding of the HIV epidemic in eastern and southern sub-Saharan Africa and roll-out of ART and PMTCT and the rise and subsequent fall in adult mortality in eastern Europe and central Asia. This is an important difference from previous notions of the inevitability of technological shifts driving up levels of health faster than expected on the basis of income and education alone.[58–62] This finding comes at a time when two very different views of the future of health can be envisioned: rising threats such as climate change, food insecurity, water shortages, pandemics, human security, continued increases in obesity, or antimicrobial resistance that could undermine past health gains; and the realisation of the huge potential of new medical and public health breakthroughs driven by genomics, nanotechnology, and other technical developments.[63–68] Future health scenario construction will crucially depend on how the balance of these forces is played out.

The analysis of trends in numbers of global deaths by cause broken down into changes due to population growth, population ageing, and changes in age-standardised death rates highlights the critical importance of ageing in changing the mixture of causes of death and disease that health systems will have to manage. Likewise, the marked difference in patterns between age-standardised rates to crude rates of YLLs shows how ageing amplifies the speed of the shifts from communicable, maternal, neonatal, and nutritional diseases to NCDs. The combination of demographic and epidemiological change can also lead to extremely rapid changes in disease profiles in some countries. China is a clear example of having an accelerated change in disease profiles: from 1990 to 2015, the percentage of YLLs due to NCDs increased from 50·0% (48·5–53·0) to 77·3% (76·5–78·1). The potential rapidity of these changes presents challenges to many ministries of health in terms of human resources for health planning and policy formulation. Understanding where this potential is about to unfold will be aided by systematic demographic and epidemiological forecasts grounded in the patterns recorded in GBD.

Communicable diseases

Although our methods for the assessment of HIV/AIDS mortality changed substantially from GBD 2013, our general findings at the global level have remained similar across iterations of GBD.[11] With the global epidemic of HIV/AIDS mortality peaking in 2005, at 1·8 million deaths (95% UI 1·7 million to 1·9 million), deaths due to HIV/AIDS had decreased by 2015, dropping to 1·2 million (1·1 million to 1·3 million). Yet despite major progress, especially amid the scale-up of ART and PMTCT in sub-Saharan Africa, HIV/AIDS remains the leading cause of YLLs in 16 countries and among top five causes of mortality in 38 countries. Large numbers of individuals continue to die from HIV/AIDS each year in eastern and southern sub-Saharan Africa, where many countries still experience large-scale epidemics, even with the rapid scale-up of ART. We estimate that 17·8% (13·6–20·6) of these HIV/AIDS deaths in 2015 were due to tuberculosis in HIV-positive people, but little data exist for the immediate causes of other HIV/AIDS deaths. Continued high death rates in sub-Saharan Africa highlight the critical importance of improved quality of care and early initiation of therapy, irrespective of disease progression.[69] In the face of calls for the end of HIV/AIDS by 2030, more rapid progress is urgently needed.[70–73] Stagnating development assistance for health for HIV/AIDS programmes amplifies the challenge of reducing HIV/AIDS mortality.[74,75]

Our results suggest a notable decrease in malaria mortality in sub-Saharan Africa since 2003, consistent with documented reductions in incidence and prevalence, as well as observed increases in effective treatment and preventive interventions.[76] We found that malaria mortality peaked in 2003, which is slightly earlier than reported in previous GBD estimates. However, the timing of peak malaria mortality varied across countries (eg, 2005 in Angola and 2000 in Uganda), which might reflect a combination of factors. Estimates presented here for sub-Saharan Africa are based on an estimation method that maps from all untreated cases to mortality and will be refined in further iterations of GBD (eg, the introduction of an intermediate step of severe malaria).

The population attributable fraction of diarrhoeal aetiologies increased for most aetiologies compared with GBD 2013. This is mainly because of two factors. First, we used the new TAC diagnostic for the detection of pathogens in GEMS compared with the conventional laboratory diagnostic methods used in GBD 2013. The TAC method is more sensitive and specific than the conventional methods, such as bacterial culture or ELISA, which tends to increase the odds ratios used in the attributable fraction estimation by correcting for the pathogen misclassification.[77,78] Second, we used a correction factor to adjust for false negatives and false positives of the prevalence of pathogens in patients with diarrhoea and to make it comparable with the odds ratios from the TAC diagnostic method. We corrected our modelled prevalence estimates for the imperfect sensitivity and specificity of the laboratory diagnostic results compared with TAC because most studies reported diarrhoea based on previous diagnostics. Therefore, the correction for the prevalence of the pathogens widened our uncertainty of the final estimates. Although qPCR is a well established diagnostic for diarrhoeal pathogens, the application of TAC remains a novel approach and further testing of the appropriate cutoffs for continuous measures of pathogen presence is needed.

The attributable fractions for *Aeromonas,* amoebiasis (*Entamoeba histolytica*), and *H influenzae* type b were not significant in children younger than 5 years at the global level. Indeed, this is biologically implausible given that these pathogens do not have a protective effect against mortality. The odds ratios of diarrhoea given the presence of *Aeromonas* and amoebiasis were not significant in children aged 0–1 years and 1–2 years but were significant in the 2–5-year age group, highlighting that these pathogens might not be significant contributors across all age groups. The attributable fraction for *H influenzae* type b is based on a meta-analysis of randomised controlled trials of vaccine efficacy where the CI of the pooled estimate was not statistically significant. This is a potential limitation and future analyses could use alternative meta-analytical methods, such as log-log meta-analysis or imposition of a non-negative population attributable fraction prior, to prevent negative population attributable fraction estimates.

Our estimation of the fraction of deaths due to lower respiratory infection attributable to pneumococcal pneumonia relies on data from vaccine efficacy studies that show a decrease in all pneumonia and among invasive (bacteraemic) pneumococcal disease in children and adults. However, at least one study that used a urine antigen test in elderly adults found that the relative vaccine efficacy of pneumococcal conjugate vaccine against invasive pneumococcal disease was 66% greater than against pneumococcal pneumonia.[49] For GBD 2015, we corrected the estimated pneumococcal conjugate vaccine efficacy against invasive pneumococcal disease by this ratio in both child and adult age groups. This is a change in our GBD 2015 methods, although no studies have used this diagnostic test to detect non-invasive pneumococcal pneumonia in children. To reflect the uncertainty of this adjustment, we used a uniform distribution around the point estimate of the ratio. This adjustment contributed to an increase in our estimates of pneumococcal pneumonia mortality because the vaccine efficacy against pneumococcal pneumonia could be lower than has previously been estimated.[49] Given the much larger attributable fraction after the adjustment was made and wide uncertainty of the final estimates, further studies to confirm and precisely quantify the difference in vaccine efficacy between invasive and non-invasive disease are needed. Data availability limitations, particularly for vaccine efficacy data across age groups, hindered our ability to conduct pathogen attribution analyses for *H influenzae* type b among populations aged 5 years and older; a similar lack of data made estimating population attributable fractions and pathogen-specific mortality for neonates analytically infeasible.

While mortality rates from most infectious diseases fell, dengue emerged as a notable counterexample. The combination of new data and an improved dengue trend covariate (methods appendix p 82) enabled our model to better capture these trends. Compared with GBD 2013 estimates, our GBD 2015 dengue mortality estimates are higher for the most recent decade, yielding a pronounced upward trend that is more consistent with case reports, GBD 2013 incidence estimates, and expert consensus.[79] The increasing geographic range of dengue and, in some areas (eg, Latin America) increasing transmission intensity, contribute to growing concerns about other viruses that are transmitted by *Aedes* mosquitoes, including the chikungunya and Zika viruses.[80] Progress in dengue vaccine development, including the licensure of the CYD-TDV vaccine in 2015,[81] is promising, but the eventual impact of such vaccines remains unclear.

In GBD we follow the ICD principles of underlying cause of death. According to this principle, a single underlying cause is assigned to each death. In some cases, somewhat arbitrary rules are used to deal with interactions between pathogens or disease processes—eg, all deaths from opportunistic infections, such as fungal infections, in HIV-positive patients are assigned to HIV/AIDS as the underlying cause. Underlying cause assignment is distinct from the notion of excess mortality, whereby a condition or disease can be associated with increased risk of death from other pathophysiological processes. In some cases, the underlying cause of death rules embedded in the ICD could lead to lower death estimates for some neglected tropical diseases. For example, anaemia is a sequela of various different conditions, some of which are parasitic. Hookworm infections can cause iron-deficiency anaemia,[82] which is then recorded as the underlying cause of death. Similarly, infections by *Clonorchis* spp have been associated with increased risk of cholangiocarcinoma[83] and are classified as a Group 1 carcinogen by the International Agency for Research on Cancer (IARC);[84] however, the cause of death will be listed as cholangiocarcinoma and will be captured within the total cancer estimates. Alternative post-hoc analyses might be useful for some of these neglected tropical diseases to characterise the excess mortality that could be related to the disease.

Pandemics were incorporated into GBD as fatal discontinuities in the same way as armed conflicts and natural disasters.[7,85] In late 2013 an epidemic of Ebola virus disease started in west Africa. Slow national and international responses allowed the virus to spread throughout 2014 and to become a Public Health Emergency of International Concern,[86] which was eventually brought under control in 2015 after a sustained multilateral effort. These estimates of mortality are of the direct deaths attributable to Ebola virus disease and do not account for the full effects of mechanisms such as the breakdown of health systems or critical infrastructure and their subsequent potential health repercussions.[87,88] Previous estimates of mortality[86] combined with these destabilising effects on wider health-care provisioning within the three most affected countries have already resulted in appropriate introspection among the international community on the ability of institutions to cope with pandemic threats.[89] Correctly establishing the relative public health importance of pandemic preparedness investments is non-trivial, because even if there are no deaths in a year from a potential pandemic cause, such as pandemic influenza, substantial excess mortality risk remains.[90] The need for better surveillance and preparedness infrastructures to help to mitigate the risk posed by potential pandemic infectious diseases has been strongly advocated[91] and has been underscored again in 2016 with the rapid spread of Zika virus across the Americas and the declaration of another Public Health Emergency of International Concern.[92]

In GBD 2015, we have not estimated the burden of drug-resistant tuberculosis as a cause distinct from overall tuberculosis. Nor have we estimated deaths related to drug-resistant bacteria or malaria. The challenge that antimicrobial resistance poses both to current and future health-care systems is becoming increasingly documented and quantified,[93] with an estimated 3·3% of new tuberculosis cases and 20% of previously treated cases having multidrug resistance.[94] Incorporating the proportion of cases caused by pathogens with drug resistance therefore represents a significant, but increasingly important, objective for future estimates.[95] Within the GBD framework, drug resistance might be best assessed by examining antimicrobial resistance as a risk factor rather than estimation of subtypes of each pathogen.

Researchers have long foreseen health effects caused by changes in the environment, with a particular focus on climate change.[96] To date, our results do not show these trends being realised. Instead they show a substantial global trend of improvement in SDI and notable improvements in many of the infectious disease causes that would be most sensitive to climate change such as malaria,[76] in a process known as the environmentalist's paradox.[97] This lack of any association so far could be related to time lags between global environmental change and health outcomes and is widely hypothesised to be at the expense of degradation of ecosystem services.[98] It might also simply be much harder to detect changes against the backdrop of rapid improvements that are expected with SDI. The value expected from SDI might therefore help to identify which countries or subnational areas are improving at rates that are slower than expected.

Non-communicable diseases

From 2005 to 2015 age-standardised death rates due to most types of cancer decreased, a reflection of risk factor reduction, as well as improvements in some settings of health systems equipped for early diagnosis and effective treatment of cancers. With respect to YLLs due to cancer, lung cancer remains the leading cause globally and for most countries, with YLLs increasing by almost 15% over the past decade. Given that most cases of lung cancer can be prevented,[99] this observation stresses the importance of tobacco and air pollution control. For other types of cancer, the geographic pattern is more diverse and reflects the vast differences in risk factors, as well as health system capacity. Whereas colorectal, breast, and pancreatic cancer are the leading causes of cancer YLLs for most high-income countries, stomach, liver, and oesophageal cancer dominate in countries with low SDI. It is encouraging that global YLLs due to stomach cancer have decreased over the past decade, with the substantial decrease in age-specific death rates counterbalancing population growth and ageing. Oesophageal cancer is the other example for which YLLs decreased from 2005 to 2015, with the decrease in age-specific death rates offsetting the increase due to an ageing and growing population. Translating the observed changes in liver cancer mortality into public health planning and policy requires knowledge of the underlying aetiologies, as risk factors differ substantially between locations. This has become an even higher priority now that effective treatment for hepatitis C is available.[100] The increase in numbers of liver cancer deaths due to hepatitis B from 2005 to 2015 was not significant, which contrasted with the significant increases in deaths, often 20–30%, observed for many other types of cancer: this relative progress might be at least partly attributable to hepatitis B vaccination. A similar development for liver cancer due to hepatitis C can be achieved in the coming decades if hepatitis C treatment, which currently has high costs per patient,[100] becomes accessible in high prevalence populations.

Data newly available to GBD 2015 improved our understanding of global patterns of cardiovascular disease. High proportions of death due to cardiovascular disease have been observed in Oceania. Previously, very few data sources were available from Kiribati and Fiji,[101] but with additional data from Tonga, Guam, American Samoa, and the Northern Mariana Islands, it seems that 27–30% of deaths in this region were due to cardiovascular disease causes. Newly available data from India show that, similar to surveillance data previously available from Bangladesh, cardiovascular disease accounts for a large and increasing proportion of deaths. Updated data from China now show a clear trend toward decreasing risk of cardiovascular disease death in all age groups since 2010, when comprehensive vital registration became available. In GBD 2015 we examined age-standardised YLL rates by level of SDI. YLL rates for ischaemic heart disease were lowest in countries with the lowest SDI when country populations were examined by SDI, rising steadily at higher levels of SDI, and only reduced for populations in the quarter of countries with the highest SDI. This pattern was more pronounced among males than females and differs from that seen for stroke, where YLL rates decrease gradually at higher levels of SDI and then fall steeply for the highest SDI populations. The result is that for overall cardiovascular disease, YLL rates were lowest in both the lowest and highest sociodemographic groups with an increase for those in the middle of the sociodemographic rankings. One hypothesis is that medical care in the highest SDI populations might have increased life expectancy to the point where cardiovascular disease is most prevalent, while people in the lowest sociodemographic group are dying from other conditions before reaching an age where they would develop ischaemic heart disease and stroke.[102] In this scenario, people living in countries categorised in the middle range of the sociodemographic rankings are surviving long enough to develop ischaemic heart disease but might not have access to optimal medical or surgical treatment.

Deaths due to cirrhosis increased globally from 2005 to 2015, whereas age-standardised cirrhosis mortality rates fell during the same period. Underlying the global picture, though, are notably distinct regional trends, with substantial reductions in cirrhosis mortality in east Asia and central Europe, for example, and increases in cirrhosis mortality in central Asia and north Africa and the Middle East. These trends largely reflect changes in the major risk factors for the disease, with some cirrhosis risk factors, such as chronic hepatitis B infection, decreasing in the face of widespread vaccination, and other risk factors, such as alcohol consumption and chronic hepatitis C, increasing in some parts of the world.[103] The decades-long lag between hepatitis B infection and cirrhosis death, and the increasing use of the hepatitis B vaccine, suggest that the potential effect of vaccination on cirrhosis mortality is only beginning to become apparent, and hepatitis B-attributable cirrhosis deaths should continue to fall. Notably, with nearly a quarter of cirrhosis deaths being due to chronic hepatitis C infection, improvements in blood screening and new short-course oral treatments for hepatitis C have the potential to reduce cirrhosis mortality in the future.[103,104]

Globally, total deaths from Alzheimer's disease and other dementias increased by almost 40% from 2005 to 2015. This increase is due to population increases and ageing accompanied by a small but significant decrease in age-standardised death rates from Alzheimer's disease and other dementias, possibly reflecting the reduced burden of cardiovascular disease and the contribution of vascular brain injury to the dementia syndrome.[105] A small reduction in mortality rates is consistent with reports of a fall in the prevalence of dementia from two cross-sectional surveys a decade apart in the UK and a decline in incidence of dementia reported from the Framingham Cohort Study in the USA.[106,107] There is also evidence that increased education and healthier lifestyles can reduce disease incidence and delay disease onset,[105,107,108] partly reflecting the reduced burden of cardiovascular disease and the contribution of vascular brain injury to the dementia syndrome. Although the reductions in rates are welcome news, the substantial increase in the number of deaths from Alzheimer's disease and other dementias and the associated increase in prevalence present challenges for health systems and social support systems that need to address the needs of these patients and their families.

We estimate small numbers of death due to mental disorders as the underlying cause. We include schizophrenia as a cause of death because high-quality vital registration data every year show a stable, small number of deaths from this cause. Many more deaths occur in people with schizophrenia in excess of what would be expected on the basis of general population mortality rates. These deaths are certified and coded to other diseases and injuries as the underlying cause, such as self-harm, unintentional injuries, infectious diseases, substance use, cardiovascular disease, and cancers, for which excess mortality in people with schizophrenia has been reported.[109–111] Most deaths from self-harm can be attributed to underlying mental and substance disorders such as depression, anxiety disorders, schizophrenia, bipolar disorder, and alcohol and drug use disorders, as has been quantified based on GBD 2010 estimates.[112] In future iterations of GBD, it might be useful to more systematically and regularly quantify the excess mortality associated with several mental disorders.

The estimate of 1·5 million deaths (95% UI 1·5 million to 1·6 million) due to diabetes, plus 418 000 deaths (389 000–441 000) from chronic kidney disease due to diabetes mellitus, still underestimates the full impact of diabetes on all-cause mortality because of the increased risk of ischaemic heart disease, stroke, and tuberculosis associated with diabetes.[113–115] In the GBD framework, computation of deaths attributable to elevated fasting plasma glucose more comprehensively captures the effects of diabetes and pre-diabetes on mortality—see the GBD comparative risk assessment for 2015.[116] Given the strong association between diabetes and obesity and the global rise of obesity, the finding that age-standardised death rates for diabetes, including chronic kidney disease due to diabetes mellitus, are not increasing suggests that other protective factors such as treatment might have an effect.[117,118] Spatial patterns show marked variation in death rates, even in places with relatively similar prevalence such as Mexico and the USA.[119] These variations in death rates could be related to variation in cause of death certification, with some medical communities more likely than others to list diabetes as the underlying cause of death, or they might be due to treatment effects. Given the importance of diabetes as a cause of death already, and the likely global rise in prevalence of diabetes, more research is needed to understand the determinants of variation in diabetes death rates.[119]

In this analysis we have estimated that there were more deaths due to chronic kidney disease than in previous analyses because of improved estimates within countries with large populations such as China, India, and Russia. We have also improved our chronic kidney disease subtype estimation strategy by implementing consistent data source inclusion, as well as estimation strategy across the four subtypes. A further improvement is that we have narrowed the definition of deaths due to "chronic kidney disease other" so that deaths formerly included in this category are now attributed to original disease cause, such as polycystic kidney disease. Thus chronic kidney disease subtype mortality results will differ notably from those of previous analyses. Our results indicate that, globally, deaths from chronic kidney disease increased among both males and females, but age-standardised death rates remained relatively unchanged in the past decade. Likely contributors include an increase in the burden of chronic kidney disease risk factors such as diabetes mellitus and hypertension. In 2015 Latin America had the highest chronic kidney disease death rates in the world. Within Mexico, the country with the highest chronic kidney disease death rate, more than half of patients with incident end-stage renal disease have an underlying diagnosis of diabetes mellitus.[120] Unique aetiological contributors, such as those suspected in chronic kidney disease due to other causes, have been shown to cause chronic kidney disease deaths mostly in younger adults in El Salvador and Nicaragua, as well as Sri Lanka.[121] Efforts to delay deaths due to end-stage renal disease currently depend on renal replacement therapy in the form of either maintenance dialysis or renal transplantation. These costly interventions require appropriate medical infrastructure, as well as government subsidisation, to be accessible to the general population. Therefore, these interventions are currently accessible mainly to populations in high-income countries.[122] If deaths due to chronic kidney disease continue to increase globally, further research into possible ways to prevent chronic kidney disease, such as with population-level or individual-level approaches, is warranted. Given that many chronic kidney disease risk factors overlap with cardiovascular risk factors,[123–125] closer collaboration between these two specialties could foster preventive strategies in the future.

Injuries and fatal discontinuities

Experience and evidence from studies on intervention suggest that there is a potential to reduce road injury deaths through a range of interventions. Drunk driving bans, seat belt laws, road engineering including traffic calming, safety devices in vehicles, speed limits, mandatory helmet usage, bans on mobile phone use while driving, and separation of vulnerable road users from vehicles have all been shown to be effective.[126–130] Progress in reducing road injury can be rapid. From 2005 to 2015, western European countries such as Spain (43·8%, 95% UI 39·9–47·3), Portugal (39·6%, 35·4–43·6), and Switzerland (18·8%, 11·8–25·4), had significant reductions in total deaths. Such rapid decreases indicate that not only are there specific interventions that can work,[131,132] but also that population-level reductions are possible in a short period. A reverse trend is apparent in low-income and middle-income countries, partly because the growth in motorisation and traffic density is outpacing the reductions associated with infrastructural development and levels of law enforcement. This trend is particularly the case for major fast-growing BRICS economies (Brazil, Russia, India, China, and South Africa).[133–135]

Global death rates due to interpersonal violence have decreased since 2005, but regional trends were much more diverse. Reductions were largest in Asian and European countries, but rates of deaths due to interpersonal violence in Latin America and southern sub-Saharan Africa remained quite high. Interpersonal violence can often be mitigated or reduced by addressing underlying drivers or risks, such as the accessibility of weapons and use of alcohol and psychoactive drugs.[136–139] In 2015, self-harm was the second-leading cause of death from injury. Nearly half of all self-harm deaths occur in India and China, but the trends in these countries have reversed, decreasing significantly in China but rising in India from 1990 to 2015. Over the past two decades China and India have both experienced rapid economic growth and urbanisation, and therefore the opposing trends might be explained by other factors. Evidence from previous research has shown that a combination of preventive approaches addressing multiple factors, such as increased public awareness, programmes based on behavioural change and coping strategies, physician education, and decreased access to means of self-harm is needed.[140–143]

Age-standardised death rates from drowning fell by nearly 30% globally during the past decade, with greatest reductions occurring in China, southeast Asia, central Asia, and eastern and central Europe. The highest rates of death due to drowning in 2015 were in island nations of Oceania and in the Indian Ocean, southeast Asia, Afghanistan, Bangladesh, and sub-Saharan African countries. Globally, drowning is a leading cause of death in children younger than 5 years. There is potential to reduce drowning deaths by preventive measures such as installing barriers, controlling access to water, education, swimming lessons and safe boating practices, and shipping and ferry regulations.[144–146] However, change in access to open water with increasing urbanisation might be a more important factor driving down drowning deaths than specific prevention measures.

For GBD 2015 we systematically collected data on major transport accidents, natural and man-made disasters, wildfires, pandemics, and wars. Although the accuracy of the death numbers due to some of these causes vary by country (ie, they are usually more accurate in stable or higher income countries), they tend to be more reliable than are the estimates for wars. Indeed, it has been challenging to accurately document the number of casualties from wars and deaths resulting from malnutrition, infections, or disruption in health services during wars.[147–150] The challenge is due to scarcity of vital statistics during wars, the increase in refugee populations who are displaced internally or externally, and the fact that surveys can only capture mortality rates among those who have remained in their households during the time of interviews. Unfortunately, these estimates can also be challenging to capture with a future census because refugees might have settled in other countries. For example, it is estimated that more than 3 million Syrians have settled in neighbouring countries or elsewhere.[151,152] Nonetheless, we believe that providing such estimates, even with a wide UI, will draw attention to the devastating effects of war on health and hopefully lead to better methods to estimate morbidity and mortality from wars.

Measurement challenges and opportunities

The assessment of all-cause mortality in GBD 2015 includes important innovations that have substantially increased uncertainty for adult mortality in some countries. We believe this is a much more accurate reflection of our knowledge of age-specific mortality in countries without vital registration or sample registration systems. The most important changes included processing of sibling history data using single years rather than pooling data for 5-year intervals, and the propagation of uncertainty in HIV/AIDS crude death rates used in the first stage of the spatiotemporal Gaussian process regression model into the estimation of 45q15. In addition to these changes, we have greatly improved our parameter selection process for both 5q0 and 45q15 Gaussian process regression to reflect data density and quality of data partly represented by the data variance. Combined, these changes led to an increased uncertainty interval for 45q15. In many countries in Africa, the width of the uncertainty interval for 45q15 more than doubled. The increase in the uncertainty interval for 45q15 directly leads to higher uncertainty intervals for our age-specific mortality rate estimates. This partly helped with the removal of an arbitrary matching algorithm from GBD 2013, which picked the pairs of draws of all-cause mortality and HIV-specific mortality estimates that were consistent. With the widened uncertainty interval in all-cause mortality estimates, we are able to apply the ensemble model to combine draw-level HIV/AIDS mortality estimates from the demographic estimation process and the epidemiological model of EPP-Spectrum for all 1000 draws.

Cause of death data for low SDI countries in sub-Saharan Africa were limited to a small number of mostly local verbal autopsy data often with small sample size. Members of the INDEPTH network of demographic surveillance systems have been collecting verbal autopsy data in some sites for many years.[153] In the development of the GBD cause of death database, we have been able to make only limited use of INDEPTH verbal autopsy data collected in multiple sites. Some INDEPTH members like Matlab routinely release physician-certified verbal autopsy data in full detail whereas others have published periodic results in journal articles. In 2015, 22 INDEPTH sites published INTERVA model predictions of individual causes of death for the period 1992 to 2012.[153] No primary data from the verbal autopsy interviews have been released to date. Unfortunately, INTERVA model predictions are highly inaccurate. The only validation study comparing INTERVA to an objectively defined cause of death standard at the individual level found it accurately assigned the cause of death in 23·8% of adult deaths, 30·3% of child deaths, and 19·4% of neonatal deaths; at the population level, estimated cause-specific mortality fractions were not better than random guessing.[154,155] This potentially important resource for global health estimation is being underused because of the limitations of current versions of the INTERVA tool for cause ascertainment. Given that injury death assignment might (although there are no objective validation data on this issue) be more plausibly established from INTERVA, we have chosen to use the INTERVA results from INDEPTH for eight types of injuries: transport injuries; falls; drowning; fire, heat, and hot substances; poisonings; venomous animal contact; self-harm; and interpersonal violence. Hopefully, a large number of deaths from INDEPTH verbal autopsies will be assessed using physician-certified verbal autopsy or more robust computer algorithms in the future.

In GBD 2013, for select causes, we developed separate CODEm models for countries with long series of complete vital registration data in order that UI estimation in these settings was not affected by UI in settings with either less complete or lower quality data. For GBD 2015, we standardised this approach. We defined countries with extensive complete vital registration representation as those with vital registration equal to or more than 95% complete for more than 25 years. We also modified the ranges of psi used in testing different ensemble models to be higher, effectively allowing CODEm to evaluate out-of-sample ensembles made up of fewer models. In countries with nearly complete high-quality time series, smaller numbers of models in the ensemble allow the models to follow the data more closely with narrower UIs for many but not all causes.

It is extremely difficult to properly inform national and global policy responses to reduce mortality when available cause of death information is very sparse, outdated, or unreliable. Fortunately, there is now evidence of increased investment and technical support being offered to countries to improve their vital registration systems. Important new partnerships have been formed between major bilateral donors and philanthropic organisations,[156] building on earlier efforts of the Health Metrics Network and the Australian development assistance program, AusAID.[157,158] Regional UN-led partnerships, particularly in Africa and the Asia-Pacific region, are also helping governments to understand the essential role of good vital registration systems in development, and advocating for change. The interventions now being offered in many countries include targeted and strategic training of doctors to correctly fill out death certificates that identify the underlying cause of death; improving practices and exploiting information technology advances to more effectively register deaths, consolidate and validate data, and transfer information more efficiently to policy-relevant destinations; and, perhaps most importantly, facilitating the widespread adoption of automated verbal autopsy methods to cost-effectively provide information on causes of death in populations for which these data are unavailable.[2] Although the initial focus of these efforts is on improving data systems, a substantial impact on data quality and availability can be reasonably expected within the next 3–5 years.[159] This will not only improve the evidence base for guiding local policy decisions, but will also lead to reduced uncertainty in global comparative mortality assessments, such as the GBD study.

WHO led the process of developing new guidelines for reporting on global health estimation.[20] For GBD 2015, we invested substantial resources to ensure that the GBD 2015 studies, including this Article, are compliant with the GATHER recommendations. Figures 1 and 2 provide detailed workflow diagrams. In appendices and the Global Health Data Exchange, we also provide detailed documentation of all sources used in the analysis. For each step in the workflow diagrams, computer code is either on GitHub, such as CODEm 2015 and DisMod-MR 2.1,[160,161] or available on the IHME website for download. Enhanced transparency and documentation highlight the multiple interconnections between analyses, for example, the strong connections between HIV/AIDS incidence, prevalence, and mortality estimation and all-cause mortality estimation in countries with large epidemics. Across this assessment, there are hundreds of separate analytical steps; for each we documented input data, code, and information on model development and performance.

Limitations

Here we highlight some broad cross-cutting limitations to the GBD mortality and cause of death analysis. The analysis of all-cause mortality in countries without vital registration systems is critically dependent on the validity of sibling history data for measuring adult mortality. Although we show, with appropriate corrections for survivor bias (methods appendix pp 21–24), that sibling history data are unbiased when compared with vital registration data, these comparisons are not available for sub-Saharan Africa, where sibling history data are of key importance. Sibling histories in some African countries might underestimate mortality due to the practice of adoption in some countries, but empirical studies in these settings have not confirmed any consistent underestimation of adult mortality.[162]

All-cause mortality in settings with vital registration is corrected for under-registration using the three available demographic methods for the detection of under-registration: generalised growth balance, synthetic extinct generations, and a hybrid approach of these two methods. However, these methods, as shown in simulation studies,[26] are unbiased but imprecise. To further stabilise our estimates of vital registration completeness over time, we synthesise raw estimates of completeness from death distribution methods and implied child death registration completeness by comparing vital registration to GBD under-5 mortality estimates into one coherent time series. Despite these efforts, estimates of completeness can change between GBD revisions as new census data become available or new surveys are released. We propagate uncertainty into the all-cause mortality in the analysis of completeness, but these UIs might be underestimates in some settings because of the scarcity of available data.

Because of the close connection between the estimation of all-cause mortality and HIV/AIDS incidence, prevalence, and mortality in countries with large epidemics, all limitations pertaining to HIV modelling also apply to our estimates of all-cause mortality. For GBD 2015, we used an ensemble model for HIV in which the demographic model and the natural history model of HIV/AIDS death are combined. Despite these attempts to triangulate on the magnitude of the HIV/AIDS epidemic, we assume that the CD4 progression rate, off-ART death rates, and on-ART death rates for age–sex–CD4 categories are the same throughout sub-Saharan Africa. Because of other factors, such as co-infections with tropical diseases or nutritional status, CD4 progression rates can vary across populations. It is also likely that the quality of and access to ART programmes varies across communities, and thus on-ART death rates might well vary. Because of the strong assumptions made in the natural history models (assumptions also made by UNAIDS[163]) about the consistency of these parameter values across countries, we might be underestimating the true variation in HIV/AIDS death rates and all-cause mortality.

Our cause of death analysis depends substantially on the validity of medical certification of causes of death and physician-certified verbal autopsies. Although efforts to redistribute garbage codes to likely underlying causes of death help to enhance comparability, our findings are affected by systematic bias in medical certification of causes of death. We see in the rapid increase in certain causes of death on death certificates—such as Alzheimer's and other dementias, or atrial fibrillation—evidence of diagnostic trends that are generally incompatible with time series data even after garbage code redistribution. For these reasons, we used other methods to estimate these particular causes of death. However, these patterns suggest that garbage coding practices not only vary by country but also across time.

Our results depend critically on the validity of our approach to garbage code redistribution. As we further utilised statistical methods to establish redistribution algorithms over the development of the GBD 2015 results, we saw sizeable changes in major causes of death. For example, changes in how left-sided heart failure and right-sided heart failure are analysed substantially changed the number of deaths reassigned to pneumoconiosis, haemoglobinopathies, or COPD. We believe these changes reflect improvements in our methods, but they also show how some causes of death, even though they result in lower absolute levels of mortality, can be profoundly affected by the redistribution of large garbage codes such as heart failure or sepsis. The sensitivity of our findings to how major garbage codes, such as heart failure, sepsis, or ICD-X59 (exposure to unspecified factor), are redistributed emphasises the importance of more systematic research on garbage code practices and improvements in primary data collection to avoid deaths being certified to garbage codes.

We used CODEm to model all causes for which sufficient numbers of deaths are observed in vital registration, sample registration, or verbal autopsy datasets. For these 167 causes, we conducted rigorous out-of-sample validation exercises and documented prediction error and UI coverage. However, for the remaining causes, particularly those modelled with natural history models, the design of validation tests was severely limited by data sparseness. In the absence of better data collection, particularly for causes of death that mostly occur in data-sparse geographies, our options for more robust model validation will remain limited. The analysis of causes of death in India also has important ramifications for global estimates. The three major sources of cause of death information for India are the Medical Certification of Causes of Death (MCCD), largely collected in urban areas; the Survey of Causes of Death

(Rural; SCD[R]); and verbal autopsy data collected for deaths recorded in the Sample Registration System (SRS) from 2001 to 2013. All three systems are or were maintained by the Registrar-General of India. Unfortunately, whereas the MCCD and SCD(R) data have been released in considerable age, sex, and cause detail for states in India, the SRS data have been released only for large aggregates and not at the state level, although various academic works using data for 2002–04 have been published for specific causes with varying levels of detail. The rich resource of the SRS verbal autopsy data could be much more informative if the standard WHO table of ICD code, age, and sex were publicly released.

Available data from some countries in sub-Saharan Africa pose substantial challenges for cause of death analysis. Only extremely scarce verbal autopsy data are currently available for large populations. Given substantial gradients in mortality within Nigeria, for example, there is substantial risk of over-interpreting the limited verbal autopsy data. Civil registration data are collected in Nigeria, but the completeness is low and the level of garbage coding is very high. New data for countries in the sub-Saharan African region would substantially narrow a major source of uncertainty in sub-Saharan African causes of death.

It is possible that some of the heterogeneity reported in observed and expected causes of early death in different geographies has been artificially created by variations in data quality and the use of different methods. The GBD group makes extensive efforts to try to reduce the effects of variable data quality, and we have used standardised methods for each cause that are the same for all countries.

Lastly, although our estimates of uncertainty intervals reflect multiple sources of uncertainty, they do not include every possible source of uncertainty. For all-cause mortality, we include uncertainty due to the following: sampling error in the underlying data; non-sampling error associated with particular child or adult mortality data types; HIV/AIDS crude death rate; and reference age pattern of mortality used in the GBD model life table. We do not, however, include uncertainty in the measurement of income per capita or educational attainment, and we do not include uncertainty from the choice of our model specification for the first stage of the spatiotemporal Gaussian process regression analysis. For causes of death, we capture sampling uncertainty, model specification uncertainty through the creation of CODEm ensembles, and non-sampling error from subnational or non-representative datasets. We do not, however, capture uncertainty due to garbage code redistribution, uncertainty in the covariates used in the models, or uncertainty due to cause of death assignment in verbal autopsy data. With each iteration of the GBD we have sought to include more comprehensively different sources of uncertainty, and we expect this evolution to continue in the future.

Comparison of different global health estimates

The GBD 2015 estimates for under-5 deaths due to diarrhoea and lower respiratory infection differ from estimates by other agencies, such as the WHO Department of Evidence, Information, and Research and the Maternal and Child Epidemiology Estimation (MCEE) group (results appendix pp 3985–89).[164] In 2015, we estimated the number of under-5 deaths as 5·8 million (95% UI 5·7 million to 6·0 million), which was lower than the MCEE's estimate of 5 945 000 (95% CI 5 707 000–6 395 000) for that year.[165] Our estimates of under-5 deaths due to diarrhoea for 2015 were also lower, at 499 000 (447 000–558 000), than those of the MCEE group (526 000), although we attributed more diarrhoeal deaths among neonates. For 2015, our results for under-5 lower respiratory infection deaths were notably lower than the estimates produced by MCEE, especially for children aged 1 to 59 months (ie, 557 000 [488 000–633 000]) from GBD 2015 and 760 000 from MCEE. Based on the latest estimates for aetiologies of diarrhoea and lower respiratory infection produced by the Child Health Epidemiology Research Group (CHERG), which is now known as MCEE,[166] we found that our estimates for rotavirus are similar for the year 2010. However, in GBD 2015, the estimates for *Cryptosporidium* were five times higher than those of CHERG, and the estimates for *Shigella* were 2·5 times higher. These differences might arise from variations in estimation approaches, as well as the use of various sources and types of data. For example, CHERG generated estimates of pathogen-specific diarrhoea based on the proportion of hospitalised cases of diarrhoea that tested positive for each pathogen,[167] whereas the GBD study uses a counterfactual approach that includes odds ratios of disease given exposure and corrects pathogen prevalence estimates using the results from a PCR analysis of samples from GEMS.[78] Estimates of deaths due to rotavirus in GBD 2015 and CHERG were similar, which is not surprising given the good diagnostic validity of ELISA for rotavirus. However, GBD 2015 estimates for bacterial pathogens were generally higher, which reflects the relatively low sensitivity and specificity of conventional diagnostic methods for these pathogens.[77] For pneumonia, estimates for bacterial aetiologies from GBD 2015 were similar to those from CHERG in terms of total lower respiratory infection deaths and generating similarly large wide uncertainty intervals. However, *H influenzae* type b estimates were lower than the CHERG results for GBD 2015, and our estimates for under-5 deaths due to pneumococcal pneumonia deaths were higher than the CHERG estimates. These differences probably stem from our efforts to correct for vaccine efficacy against bacteraemic pneumococcal disease to instead represent the efficacy against pneumococcal pneumonia. This correction greatly increases the attributable fraction, and uncertainty, for pneumococcal pneumonia.

IARC last produced cancer estimates by country, age, sex, and cancer site for 2012 (GLOBOCAN).[168] GBD and GLOBOCAN definitions are compatible for 25 cancer types. For these cancer sites, the total estimated number of deaths from GLOBOCAN is 7 498 760 in 2012. By comparison, the GBD 2015 estimate was 7 823 429 (7 374 053–8 241 385) for 2012. Worldwide, the largest differences between estimates were for larynx cancer, other pharynx cancers, thyroid cancer, nasopharynx cancer, and myeloma, with differences of 20–85%. GLOBOCAN has been a source for descriptive global cancer epidemiology for many years. However, GBD analyses have some advantages over the past GLOBOCAN estimates. One advantage is that the annual GBD updates allow for the incorporation of new data rapidly. We expect the availability of cancer registry data in low-income and middle-income countries to increase due to the Global Initiative for Cancer Registry Development, which is led by IARC. These data, in addition to increasing the availability of cause of death data, will lead to improvements in cancer estimates, especially for regions with sparse data, and will allow policy makers to adjust health-care strategies in accordance with the latest evidence. The GBD study also provides the unique opportunity for direct comparison of the cancer burden with that of other diseases and therefore for health system investments guided by objective, comprehensive estimates rather than incomplete, unreliable data and advocacy. Furthermore, the GBD 2015 study is compliant with the GATHER guidelines, including reporting uncertainty intervals for each cancer estimate.

A comparison of GBD 2013, GBD 2015, and the two most recent UNAIDS assessments of global HIV/AIDS mortality over time is shown in the results appendix p 4). Although, as noted, GBD methods have changed substantially, our results at the global level are fairly consistent with previous iterations of GBD analyses. UNAIDS, in their latest revision, noticeably changed their assessment of peak global HIV/AIDS mortality from 2·24 million deaths in 2005 to 2·0 million deaths,[169] rendering increased consistency between the latest UNAIDS statistics and GBD 2015. Although it is encouraging that thoughtful analyses of the epidemic and its mortality consequences are converging, additional analysis is needed to discern the differences between the estimates from GBD and UNAIDS, and the changes that occurred in the estimation series by GBD or UNAIDS. It is important to understand differences and changes in models and underlying assumptions such as on-ART and off-ART mortality and their effects on the metrics of HIV/AIDS incidence, prevalence, and mortality provided by GBD and UNAIDS. GBD 2015 mostly used epidemiological and programmatic data provided by UNAIDS in its 2015 iteration. The significant difference between GBD and UNAIDS might mark the important difference in assumptions for on-ART and off-ART mortality, CD4 progression ratio, and background mortality rates. In the GBD studies, we have also found that results are highly sensitive to the assumptions of initial CD4 count used in both the analysis of pre-ART cohort data and the initial population distribution of CD4 count for new infections.[11]

The other major effort to estimate age-specific all-cause mortality and life expectancy other than the annual GBD is the biennial United Nations Population Division assessment published in the World Population Prospects.[170] Although the UN calculates estimates for each age–sex–country–year, the UN Population Division publishes data for most metrics only in 5-year intervals. The UN has yet to publish since the introduction of the new WHO GATHER guidelines and, in most cases, the statistical method used to generate estimates of age-specific mortality is unclear for any given country and hard to reproduce with no codes made available. A comparison of GBD 2015 life expectancy estimates and the UN Population Division estimates for the midpoint of 2010–15 is available in the results appendix (p 5). For the 189 countries for which both series provide estimates, GBD 2015 tends to have higher estimates of life expectancy at birth for both males (111 countries) and females (112 countries). The differences are even more prominent for the time period 1980–85, for which GBD life expectancy is higher for 139 countries and territories for males and 134 for females. Although the correlation between the two sets of estimates is 0·94 for males and 0·97 for females for the period 1980 to 2015, there are systematic differences in all four GBD geographical regions in Africa, north Africa and the Middle east, south Asia, and Oceania, for which the correlation coefficient is less than 0·9. In southern sub-Saharan Africa, the UN Population Division estimates are 0·1 year (95% UI –3·9 to 3·6) lower for males and 1·7 years (–6·3 to 3·3 years) lower for females on average in these countries around the peak of the HIV/AIDS epidemic in 2002. This difference exists mainly because their estimates are based on estimated under-5 death rates and model life tables, based on patterns of mortality in the Coale-Demeny model life table system and the United Nations Model Life Tables for Developing Countries, that are in turn based on observations of age patterns of mortality before 1980.[31,32,170] Unlike UN estimates, GBD estimates of adult mortality rates take into account corrected sibling history data collected in household surveys, which provide direct measurements of adult mortality. The empirical information about adult mortality, used as an entry parameter to GBD's model life table system, certainly helps to improve the accuracy of our mortality age pattern assessment, even in countries affected by the HIV/AIDS epidemic.

Another important difference emerged between the GBD and UN Population Division assessments: mortality and population numbers among youths.

For the period 2010–14, the UN Population Division estimates that 6·3 million deaths occurred globally among people aged 5–14 years, whereas GBD estimates this number at 4·6 million.[170] The difference is mostly driven by the differences between the Coale-Demeny life tables used by the UN compared with our life tables, which use much more recent empirical patterns of mortality, and different assessments of under-5 mortality rate that come from differences in both treatment of data and data synthesis methods. Hill and colleagues[171] reported that, based on complete birth histories in the Demographic and Health Surveys (DHS), which are mostly based in low-income and middle-income countries, mortality among youths might also be much higher than was estimated in GBD 2010. As a data source, long-term recall by mothers of their 5–14-year-old children's deaths, using complete birth histories, has not been validated. We examined the estimates of mortality in India in the 5–14 years age groups from the SRS, which directly measures age-specific mortality in a sample of 7597 villages in rural areas and census enumeration blocks in urban areas in India. We compared these estimates with those from the GBD 2015 and found that estimates from the two series are highly concordant, with a correlation coefficient of 0·95 for the 5–14 years age group and a mean relative difference of –2·2% for the probability of death between the ages of 10 and 14 years in the period 1980 to 2012. Our estimated age pattern of mortality for India is mainly informed by data from the SRS, with exceptions in children younger than 5 years, for whom our under-5 mortality rate data synthesis takes into account under-5 mortality rate estimates from other sources, including the India DHS. As shown in the methods appendix (pp 293–96), for the 5–9 years age group, GBD 2015 estimates of probability of death are mostly consistent with those extracted from the DHS. For the 10–14 years age group, GBD estimates are consistent with both DHS and SRS.

In 2014, WHO published cause-specific mortality estimates at global, regional, and country levels for the years 2000 and 2012.[172] WHO used GBD 2010 mortality results for all but 12 cause groups, for which WHO and UN agencies have historically produced estimates.[172–174] These 12 causes are tuberculosis, HIV/AIDS and other sexually transmitted infections, malaria, whooping cough, measles, schistosomiasis, maternal disorders, cancers, alcohol and drug use disorders, epilepsy, conflict and natural disasters, and road traffic accidents.[172,173] WHO has also generated estimates of YLLs, but comparisons of WHO estimates with those of GBD are limited because WHO chose to use the highest projected life expectancy for 2050—91·9 years—rather than the GBD 2010 normative standard life expectancy of 86·0 years for 2010.[172] GBD 2010 did not include mortality estimates for the year 2012, so WHO estimates for that year were interpolated.

Conclusion

A key goal, if not the fundamental goal, of a health system is to prolong life, especially healthy life, into old age. To do so, decision makers in health need comprehensive and disaggregated evidence on comparative mortality levels in populations, particularly for causes of death that are largely preventable through political action, either through improving health services or strengthening prevention programmes. Traditionally, this evidence has been limited to the findings of relatively conventional and straightforward mortality analyses. As our results show, more novel approaches can provide much more detailed and systematic descriptions of how survival status and cause of death patterns vary according to measures such as SDI, which are becoming increasingly relevant for policy as overall mortality levels fall. Overall population health is likely to improve more rapidly in places where the relationships between determinants of health and cause-specific mortality patterns are understood—especially areas where addressing of these gradients is a key priority for health and development policy. Our analyses provide important new evidence on where such gradients in survival among populations are greatest, and for which causes of death. Thus, although we found continued reductions in major communicable diseases such as HIV/AIDS and malaria in response to concerted global action, and further, albeit more modest reductions in the risk of death from NCDs and injuries, the comprehensive analysis of the effect of SDI on health, across and among countries, is likely to be much more relevant for accelerating global health progress.

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