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Priority health conditions and life expectancy disparities

Authors
Omar Karlsson, PhD [1,2,*] (karlssono@outlook.com)
Angela Y Chang, ScD [3,4] (achang@health.sdu.dk)
Prof Ole Frithjof Norheim, MD, PhD [5,6] (ole.norheim@uib.no)
Wenhui Mao, PhD [7,8] (wenhui.mao@duke.edu)
Sarah Bolongaita, SM [5,6] (sarah.bolongaita@uib.no)
Prof Dean T Jamison, PhD [9,10] (meteor17@me.com)

Affiliations
[1] Visiting Research Fellow, Duke University Population Research Institute, Duke University, 140 Science Dr, Durham, NC 27710, United States
[2] Centre for Economic Demography, School of Economics and Management, Lund University, PO Box 7083, 220 07 Lund, Sweden
[3] Danish Institute for Advanced Study, University of Southern Denmark, Studiestræde 6, Copenhagen, Denmark
[4] Danish Centre for Health Economics, University of Southern Denmark, Campusvej 55, 5230 Odense M, Denmark
[5] Bergen Centre for Ethics and Priority Setting (BCEPS), Department of Global Public Health and Primary Care, University of Bergen, Bergen, PO Box 7804, N-5020, Bergen, Norway
[6] Department of Global Health and Population, Harvard T.H. Chan School of Public Health, 677 Huntington Avenue, Boston, MA 02115, USA
[7] Centre for Policy Impact in Global Health, Duke University, Durham, NC 27708, USA
[8] Duke Global Health Institute, Duke University, Durham, NC 27708, USA
[9] Institute for Global Health Sciences, University of California San Francisco, Mission Hall, Box 1224, 550 16th Street, Third Floor, San Francisco, CA 94158San Francisco, USA
[10] Department of Epidemiology and Biostatistics, University of California San Francisco, 550 16th Street, CA 94158, San Francisco, USA

***Corresponding author**

Abstract

Identifying conditions behind health disparities can guide policy, planning, and financing to battle the most urgent health problems. This study examined the impact of 145 causes of death on life expectancy disparities, highlighting the impact of two sets of "priority conditions"—eight infectious and maternal and child health conditions ("I-8") and seven noncommunicable diseases and injuries ("NCD-7")—across 184 countries and nine geographic regions, 2000–2021. Western Europe and Canada (the "North Atlantic") were used as a benchmark for life expectancy achievable with advanced health care and living standards. Life expectancy gaps were decomposed by cause of death using Pollard's decomposition on the Global Health Estimates from the World Health Organization. The priority conditions accounted for over 70% of the life expectancy gap compared to the North Atlantic in most regions and countries. Outside sub-Saharan Africa, the NCD-7 accounted for the largest share (eg, 82% in China and 49% in India). Only a few conditions not considered priority conditions had any substantial impact, and only in specific contexts. However, COVID-19 increased disparities. The varying impact of specific priority conditions can help focus health policy and guide interventions to reduce risk factors and treat conditions.

Keywords: Life expectancy decomposition; causes of death; priority setting

Introduction

Advances in public health and medicine, together with rising living standards, have greatly improved health, as reflected, for example, in largely uninterrupted gains in life expectancy over the past two centuries.[1,2] However, large health disparities suggest highly uneven improvements across countries. For example, while life expectancy at birth is 82 years in Western Europe, it is 62 years in sub-Saharan Africa.[3] Limited capacity to finance and mobilize resources leaves full coverage of vital services out of reach for many countries.[4] A focus on a limited number of highly cost-effective interventions targeted at conditions with a large or rising impact on health is more feasible.[5–8]

Here, we quantified how much 145 causes of death available in the Global Health Estimates (GHE) from the World Health Organization (WHO) contributed to the life expectancy gap in global regions and countries compared to the North Atlantic (Western Europe and Canada)—which serves as a benchmark for a life expectancy that is achievable with high living standards and advanced health care. We highlight the impact of two sets of causes which are suggested "priority conditions" by the third *Lancet* Commission on Investing in Health:[9] 1) eight infectious and maternal and child health conditions and 2) seven important noncommunicable diseases (NCDs) and injuries.

Life expectancy serves as a reliable summary health indicator that reflects the composite impact of most adverse health exposures and morbidities on population health, including both acute exposures, such as deadly infections and injuries, and an accumulation of adverse exposures over the life course, such as nutrition, environmental contaminants, morbidities, and health behaviors.[10]

Data and methods

Data

Data on number of deaths by cause came from the WHO's GHE (see appendix pp 2–3 for more details).[11,12] Deaths were reported by age and sex for 204 countries over the period 2000–2021. Five-year age groups were used for ages 5–84, with an open-ended group for 85 and older. Deaths before age five were estimated for two age groups: 0–11 months and 1–4 years.

We multiply the proportion of all deaths from each cause within each age interval from the WHO GHE by the corresponding all-cause age-specific mortality rate from the United Nations (UN) World Population Prospects (WPP) 2024.[3] Therefore, the life expectancy and gaps presented in this paper will be the same as those provided by the UN. We used life tables with single year age intervals for ages 0–100+ from the UN WPP and estimated the causes specific mortality rates using the same cause-proportions for all single-year ages within the broader WHO GHE age intervals.

The first eight priority conditions include a set of infectious diseases, maternal deaths, and conditions causing the most child deaths (collectively referred to as the I-8).[5] These were:

1) Neonatal conditions
2) Lower respiratory infections
3) Diarrheal diseases
4) HIV/AIDS
5) Tuberculosis
6) Malaria
7) Childhood-cluster diseases: Whooping cough, Diphtheria, Measles, Tetanus
8) Maternal conditions

Seven NCDs and injuries (NCD-7) were also highlighted as priority conditions:

1) Atherosclerotic cardiovascular diseases (ischemic heart disease, ischemic stroke)

2) Hemorrhagic stroke
3) NCDs strongly linked to infections (stomach cancer, liver cancer secondary to hepatitis B, liver cancer secondary to hepatitis C, cervical cancer, rheumatic heart disease, cirrhosis due to hepatitis B, cirrhosis due to hepatitis C)
4) NCDs strongly linked to tobacco use (mouth and oropharynx cancer; trachea, bronchus, and lung cancer; larynx cancer; chronic obstructive pulmonary disease)
5) Diabetes (diabetes mellitus, chronic kidney disease due to diabetes)
6) Road injury
7) Suicide (self-harm)

Collectively, these 15 priority conditions reflect 30 causes of death as defined in the WHO GHE data (items in parentheses above: see table on page 3 in the appendix). The other 115 causes of death are referred to as "all other causes."

Methods

We used regional classifications from the third *Lancet* Commission on Investing in Health, consisting of seven geographic regions and the three most populous countries, China, India, and the United States (appendix p 4). We focus on 2019 to avoid distortions due to COVID-19 and show results for 2000 for comparison across time. (Supplement 2 provides results for all countries 2000–2021 by sex and overall.)

We decomposed the difference in life expectancy between the North Atlantic and target locations (ie, other regions and countries of interest) into components (in terms of years) attributable to the 145 causes of death. The North Atlantic in 2019 was used, even when analyzing other years in the target locations, to facilitate comparisons across time. The North Atlantic was chosen since it had the greatest life expectancy (82 years[3]) of the regions highlighted in the third *Lancet* Commission on Investing in Health.

We used Pollard's decomposition method to quantify the contribution of each cause to the total life expectancy gap.[13,14] The formulas described here apply specifically to life tables with a radix of one and single-year age intervals.

$$C_i = \sum_{x=1}^{100+} w_x({}_n m_{x,i} - {}_n \ddot{m}_{x,i})$$

Component C_i shows the gap in life expectancy attributable to cause *i*, and is calculated as the difference in the cause-specific mortality rate at age *x* to *x+n* between the target location ($ {}_n m_{x,i}$) and the North Atlantic ($ {}_n \ddot{m}_{x,i}$), multiplied by a weight w_x representing the contribution of deaths at age *x* to the overall life expectancy gap, summed across all ages 0–100+.

The weight w_x is calculated as:

$$w_x = \frac{l_x \ddot{e}_x + \ddot{l}_x e_x + l_{x+1} \ddot{e}_{x+1} + \ddot{l}_{x+1} e_{x+1}}{4}$$

where e_x is life expectancy at age *x* and l_x is the proportion of the original cohort surviving to age *x* in the target location, with two dots over a letter indicating the same measures for the North Atlantic. For age *x=100+*, the weight is calculated as:

$$w_{100+} = \frac{\ddot{T}_{100+}/M_{100+} + T_{100+}/\ddot{M}_{100+,i}}{2}$$

where *T* is the number of years contributed after age *100* and *M* is the all-cause mortality rate at age 100+. The sum of C_i over all causes of death is the total gap in life expectancy between the target location and the North Atlantic.

To facilitate the presentation of results, we removed causes that had a negative impact, which occurred when the target location had achieved lower cause-specific mortality rates than the North Atlantic. However, after this adjustment, adding the impact of all causes together could result in a total impact greater than the actual life expectancy gap. Therefore, we projected the estimated proportional impact of each cause (after removing negative impacts) back onto the life expectancy gap. (Supplement 2 provides results with negative impacts included.)

Supplementary analyses

We present summary statistics on the extent to which the priority conditions accounted for life expectancy disparities across 184 countries with lower life expectancy than the North Atlantic. We also show results using two alternative decomposition methods: Arriaga's[15] method and a method based on counterfactual age-specific mortality rates[16] (see appendix p 6 for description of methods). Finally, we provide estimates for all causes, regions, and countries, 2000–2021, by sex and overall.

Data availability

Global Health Estimates are available from the World Health Organization upon request. The UN WPP 2024 are available online at https://population.un.org/wpp/.

Code availability

All codes used in this paper is available at https://github.com/O-Karlsson/Priority-health-conditions-and-life-expectancy-disparities/.

Table 1. Life expectancy gap compared to the North Atlantic in 2019 attributable to specific I-8 and NCD-7, 2000 and 2019

	Central & Eastern Europe		Central Asia		China		India		Latin Amer-ica & the Caribbean		Mid. East & North Africa		Sub-Saharan Africa		United States		Western Pacific & SE Asia	
	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19
Total gap	14	7.6	21	15	10.0	4.3	20	12	11	7.0	13	7.6	31	22	5.4	3.3	13	7.4
Total impact of NCD-7	9.2	5.2	8.1	7.1	6.3	3.5	5.2	5.6	4.8	2.8	7.1	4.6	4.4	5.0	3.6	1.5	5.0	3.7
	(66)	(68)	(39)	(48)	(63)	(82)	(27)	(49)	(42)	(40)	(56)	(60)	(14)	(23)	(66)	(44)	(39)	(50)
Atherosclerotic CVDs	6.3	3.9	4.2	3.8	1.1	1.2	1.7	2.1	2.0	1.1	4.4	3.0	1.1	1.4	2.0	0.6	1.5	1.2
	(45)	(51)	(20)	(26)	(11)	(27)	(8.5)	(18)	(18)	(15)	(34)	(39)	(3.7)	(6.6)	(37)	(18)	(11)	(16)
Hemorrhagic stroke	0.8	0.4	1.2	0.8	1.7	0.8	0.6	0.6	0.6	0.3	0.6	0.3	1.0	1.0	0.1	<0.1	1.2	1.0
	(5.7)	(4.7)	(5.6)	(5.7)	(17)	(19)	(3.2)	(5.0)	(5.6)	(4.1)	(5.0)	(3.4)	(3.2)	(4.7)	(2.7)	(1.5)	(9.5)	(13)
Tobacco-related NCDs	0.5	0.1	0.9	0.7	1.8	0.7	1.4	1.6	0.4	0.2	0.3	0.1	0.2	0.2	0.7	0.3	0.5	0.3
	(3.7)	(1.8)	(4.3)	(5.0)	(18)	(17)	(7.2)	(14)	(3.8)	(2.5)	(2.1)	(1.5)	(0.7)	(1.1)	(13)	(7.7)	(3.8)	(4.4)
Infection-related NCDs	0.5	0.3	1.1	0.8	1.0	0.5	0.7	0.5	0.5	0.2	0.9	0.5	0.7	0.8	0.1	0.1	0.9	0.5
	(3.7)	(4.0)	(5.2)	(5.5)	(9.6)	(11)	(3.4)	(4.2)	(4.1)	(3.2)	(7.0)	(6.6)	(2.4)	(3.6)	(1.1)	(1.9)	(6.8)	(7.1)
Road injury	0.4	0.2	0.3	0.3	0.5	0.2	0.4	0.3	0.4	0.3	0.5	0.3	0.7	0.7	0.3	0.2	0.5	0.3
	(3.2)	(2.4)	(1.4)	(1.9)	(4.8)	(5.4)	(1.8)	(2.4)	(3.8)	(4.4)	(4.2)	(4.1)	(2.3)	(3.4)	(6.3)	(6.2)	(4.0)	(4.4)
Diabetes	<0.1	0.1	0.5	0.6	0.1	0.1	0.3	0.5	0.8	0.7	0.4	0.5	0.5	0.8	0.2	0.2	0.4	0.4
	(0.2)	(1.5)	(2.3)	(4.4)	(1.4)	(2.2)	(1.5)	(4.2)	(6.8)	(10)	(3.3)	(6.0)	(1.7)	(3.5)	(3.9)	(5.2)	(2.8)	(5.3)
Suicide	0.6	0.2	0.1	0	0.1	0	0.2	0.1	0	0	0	0	0.1	0.1	<0.1	0.1	0.1	0
	(4.3)	(2.6)	(0.4)	(0)	(1.3)	(0)	(1.1)	(1.3)	(0)	(0)	(0)	(0)	(0.2)	(0.5)	(0.9)	(4.3)	(0.4)	(0)
Total impact of I-8	1.1	0.5	8.4	4.2	1.7	0.2	11	3.4	2.5	1.4	2.6	1.0	21	11	0.3	0.1	5.3	2.1
	(8.2)	(7.0)	(40)	(29)	(17)	(3.9)	(55)	(29)	(22)	(20)	(20)	(13)	(67)	(50)	(6.4)	(3.2)	(41)	(28)
Neonatal conditions	0.3	<0.1	3.1	1.9	0.8	0.1	2.6	1.0	0.8	0.4	1.2	0.5	2.1	1.5	0.1	0.1	1.3	0.5
	(2.2)	(0.4)	(15)	(13)	(7.6)	(1.4)	(13)	(8.6)	(7.4)	(5.5)	(9.2)	(6.3)	(6.7)	(7.1)	(2.4)	(2.1)	(10)	(7.4)
Lower respiratory infections	0.3	0.2	1.4	0.7	0.5	<0.1	1.4	0.7	0.8	0.7	0.7	0.3	2.7	2.1	0.1	0	1.1	0.5
	(2.4)	(2.0)	(6.6)	(4.5)	(5.2)	(0.7)	(7.1)	(5.7)	(6.6)	(9.3)	(5.4)	(4.2)	(8.6)	(9.6)	(1.7)	(0)	(8.3)	(7.4)
Diarrheal diseases	<0.1	0	1.4	0.5	0.1	<0.1	2.8	0.9	0.3	0.1	0.3	<0.1	2.6	1.4	0	<0.1	0.8	0.3
	(0.2)	(0)	(7.0)	(3.6)	(1.4)	(0.1)	(14)	(8.1)	(2.4)	(1.2)	(2.4)	(0.6)	(8.2)	(6.5)	(0)	(0.3)	(6.1)	(3.4)
Tuberculosis	0.3	0.1	1.0	0.5	0.2	<0.1	2.4	0.5	0.2	0.1	0.1	0.1	3.6	2.0	<0.1	0	1.4	0.5
	(2.2)	(1.3)	(4.9)	(3.4)	(1.7)	(0.7)	(12)	(4.8)	(1.9)	(1.1)	(1.1)	(0.8)	(12)	(9.2)	(0)	(0)	(11)	(6.4)

	Central & Eastern Europe		Central Asia		China		India		Latin America & the Caribbean		Mid. East & North Africa		Sub-Saharan Africa		United States		Western Pacific & SE Asia	
	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19	'00	'19
Malaria	0	0	<0.1	<0.1	0	0	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	2.3	1.3	0	0	<0.1	<0.1
	(0)	(0)	(0.1)	(0)	(0)	(0)	(0.4)	(0.2)	(0.1)	(0)	(0.2)	(0.1)	(7.2)	(5.9)	(0)	(0)	(0.3)	(0.2)
HIV/AIDS	0.1	0.2	0	0.1	<0.1	<0.1	0.5	0.1	0.3	0.2	<0.1	<0.1	5.1	1.6	0.1	<0.1	0.2	0.1
	(1.0)	(3.2)	(0)	(0.7)	(0.4)	(0.8)	(2.8)	(0.6)	(2.8)	(2.2)	(0.1)	(0.2)	(16)	(7.5)	(2.3)	(0.7)	(1.8)	(1.9)
Childhood-cluster diseases	<0.1	<0.1	1.1	0.3	0.1	<0.1	0.8	0.1	<0.1	<0.1	0.2	<0.1	1.5	0.4	0	0	0.3	0.1
	(0.1)	(0)	(5.2)	(1.8)	(0.8)	(0.1)	(3.9)	(1.0)	(0.2)	(0.2)	(1.2)	(0.5)	(4.7)	(2.0)	(0)	(0)	(2.5)	(0.8)
Maternal conditions	<0.1	<0.1	0.4	0.2	<0.1	<0.1	0.3	<0.1	0.1	<0.1	0.1	<0.1	0.9	0.6	<0.1	<0.1	0.1	<0.1
	(0.1)	(0)	(1.9)	(1.3)	(0.2)	(0.1)	(1.3)	(0.4)	(0.5)	(0.5)	(0.5)	(0.3)	(3.0)	(2.7)	(0.1)	(0.1)	(1.0)	(0.7)
Total impact of other causes	3.6	1.9	4.2	3.4	1.9	0.6	3.6	2.5	4.2	2.8	3.1	2.0	6.0	5.7	1.5	1.7	2.6	1.6
	(26)	(25)	(20)	(23)	(20)	(14)	(18)	(22)	(36)	(40)	(24)	(27)	(19)	(26)	(28)	(52)	(20)	(22)

Note: Number of years are shown with the percentage of the total gap in parentheses below. Both 2000 and 2019 were compared to the North Atlantic in 2019 (which had a life expectancy of 82 years). The I-8 are neonatal conditions, lower respiratory infections, diarrheal diseases, HIV/AIDS, tuberculosis, malaria, childhood-cluster diseases, and maternal conditions. The NCD-7 are atherosclerotic cardiovascular diseases, hemorrhagic stroke, NCDs strongly linked to infections, NCDs strongly linked to tobacco use, diabetes, road injury, and suicide. Data from references 3 and 11.

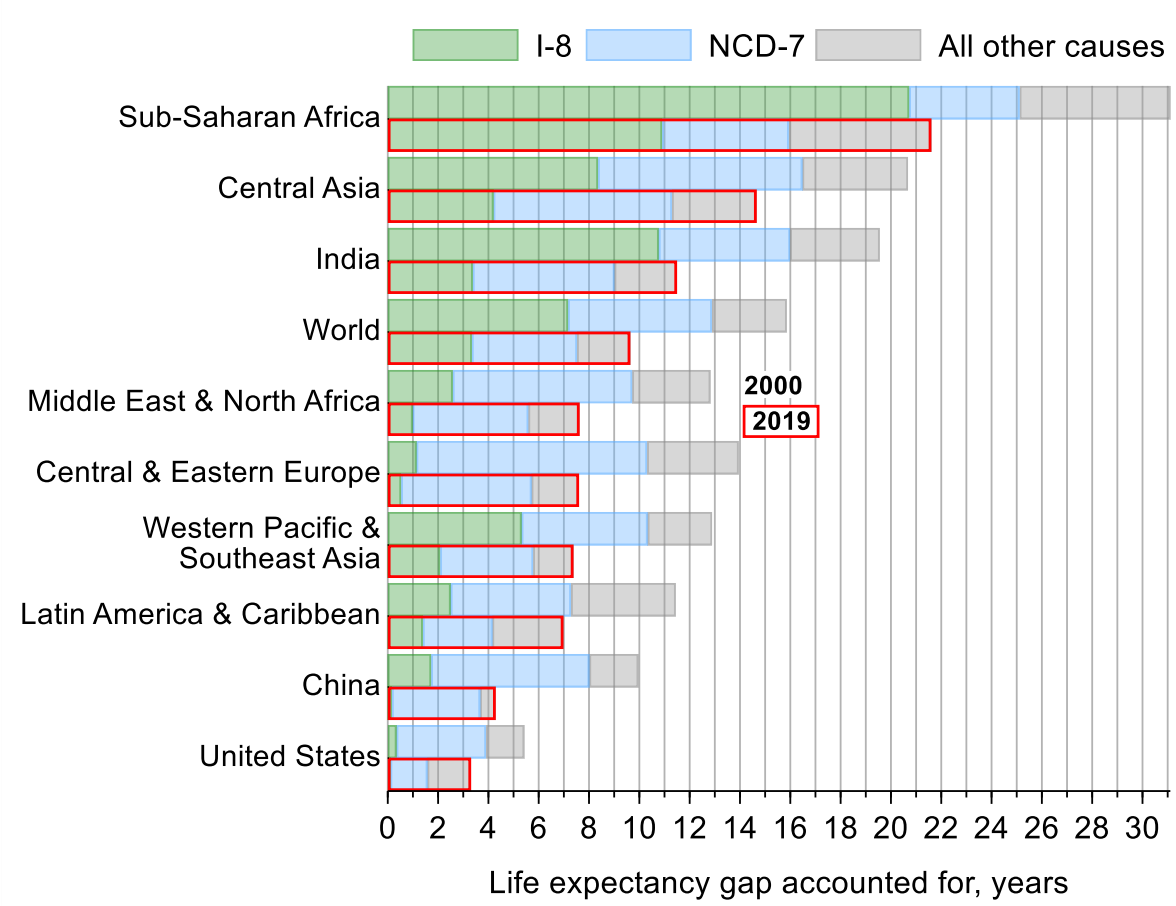
Results

Regions and selected countries in 2000 and 2019

In 2000, sub-Saharan Africa had a 31-year life expectancy gap compared to the (2019) North Atlantic benchmark (figure 1 and table 1). Higher mortality from I-8 accounted for 21 of those years (67% of the total gap). Meanwhile, higher mortality from the NCD-7 accounted for 4.4 years (14%). By 2019, the life expectancy gap for sub-Saharan Africa had declined to 22 years—11 (50%) of which were attributable to I-8 and 5 (23%) to NCD-7. Central Asia had had a nearly even split between I-8 and NCD-7, with 8.1 years (39%) of a 21-year gap explained by I-8 and 8.4 (40%) by the NCD-7 in 2000. In 2019, the life expectancy gap there had declined to 15 years, less of which was explained by I-8 (4.2 years, 29%) and more by the NCD-7 (7.1 years, 48%). In 2000, India had a life expectancy gap of 20 years, 11 (55%) explained by I-8 and 5.2 (27%) attributable to mortality from NCD-7. In 2019, the life expectancy gap in India had declined to 12 years, of which 3.4 (29%) were attributable to I-8 and 5.6 (49%) to NCD-7.

In Western Pacific & Southeast Asia, 5.3 years (41%) of a 13-year life expectancy gap were attributable to I-8 and 5 (39%) to NCD-7 in 2000. In 2019, the life expectancy gap was 7.4 years, 2.1 years (28%) explained by I-8 and 3.7 (50%) by NCD-7. In Latin America & the Caribbean, the life expectancy gap was 11 years in 2000, 2.5 years (22%) accounted for by I-8 and 4.8 (42%) by NCD-7. The gap was 7 years in 2019, 1.4 years (20%) due to I-8, and 2.8 (40%) due to NCD-7. In the Middle East & North Africa, the life expectancy gap was 13 years in 2000, of which 2.6 years (20%) were attributable to I-8 and 7.1 years (56%) to NCD-7. That gap was 7.6 years in 2019, of which 1 year (13%) was attributable to I-8 and 4.6 years (60%) to the NCD-7.

Figure 1. Life expectancy gap compared to the North Atlantic in 2019 attributable to sets of causes, 2000 and 2019



Note: Both 2000 and 2019 were compared to the North Atlantic in 2019 (which had a life expectancy of 82 years). The I-8 are neonatal conditions, lower respiratory infections, diarrheal diseases, HIV/AIDS, tuberculosis, malaria, childhood-cluster diseases, and maternal conditions. The NCD-7 are atherosclerotic cardiovascular diseases, hemorrhagic stroke, NCDs strongly linked to infections, NCDs strongly linked to tobacco use, diabetes, road injury, and suicide. Data from references 3 and 11.

In Central & Eastern Europe in 2000, I-8 accounted for 0.9 years (8.2%) of a 14-year gap, while the NCD-7 accounted for 9.2 years (66%). In 2019, the gap was 7.6 years, of which 0.5 years (7%) were accounted for by I-8 and 5.2 years (68%) by the NCD-7. In China, the I-8 explained 1.7 years (17%) of a 10-year life expectancy gap in 2000, while the NCD-7 accounted for 6.3 years (63%). In 2019, the life expectancy gap in China had declined to 4.3 years, with 0.2 years (4%) attributable to I-8 and 3.5 years (82%) to NCD-7. The United States had a 5.4-year gap in 2000, of which 0.3 years (6%) were explained by I-8 and 3.6

years (66%) by NCD-7. In 2019, the life expectancy gap was 3.3 years, 0.1 years (3%) due to I-8, and 1.5 years (44%) due to NCD-7.

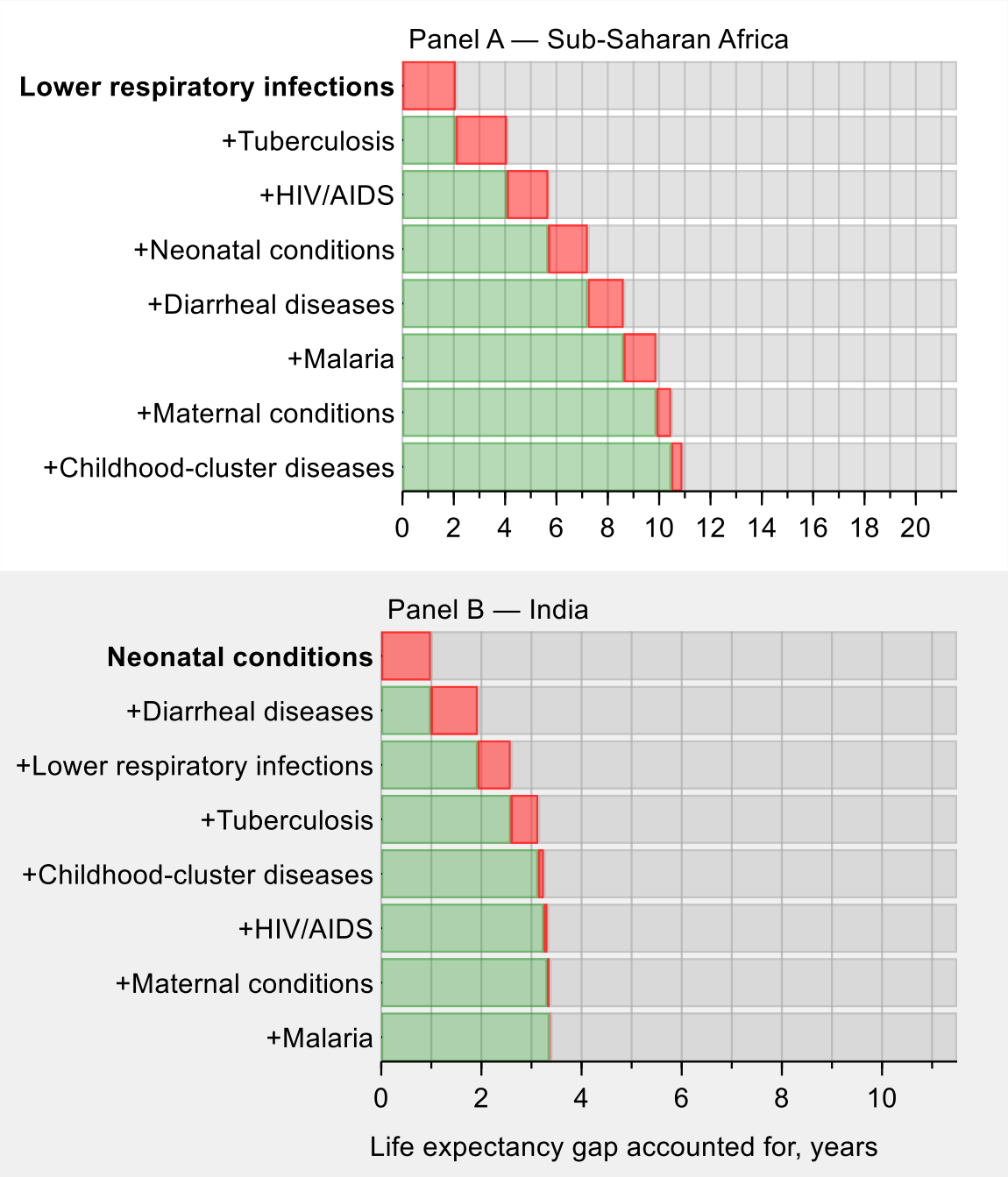
A more detailed look at the causes behind the life expectancy gaps in 2019

In sub-Saharan Africa in 2019, where I-8 still explains half the total life expectancy gap, lower respiratory infections accounted for the largest share by individual cause (2.1 years, 9.6%; figure 2 and table 1). Tuberculosis accounted for 2 years (9.2%), HIV/AIDS for 1.6 years (7.5%), neonatal conditions for 1.5 years (7.1%), and diarrheal diseases for 1.4 years (6.5%). Maternal conditions accounted for 1.2 years (5.4%) for females in sub-Saharan Africa (appendix p 8).

In India in 2019 neonatal conditions and diarrheal diseases accounted for about 1 year (8%) of the life expectancy gap each. Lower respiratory infections and tuberculosis account for around 5% each, contributing 0.7 and 0.5 years, respectively. Further, in India in 2019—where the NCD-7 have risen in importance relative to the I-8 since 2000—atherosclerotic CVDs accounted for the largest share of the life expectancy gap, 2.1 years (18%), followed by tobacco-related NCDs (1.6 years, 14%; figure 3 and table 1). Hemorrhagic stroke, diabetes, and infection-related NCDs each contributed approximately 0.5 years (5%). In China, atherosclerotic CVDs explained 1.2 years (27%) of the life expectancy gap. Hemorrhagic stroke accounted for 0.8 years (19%), tobacco-related NCDs for 0.7 years (17%), and infection-related NCDs for 0.5 years (11%).

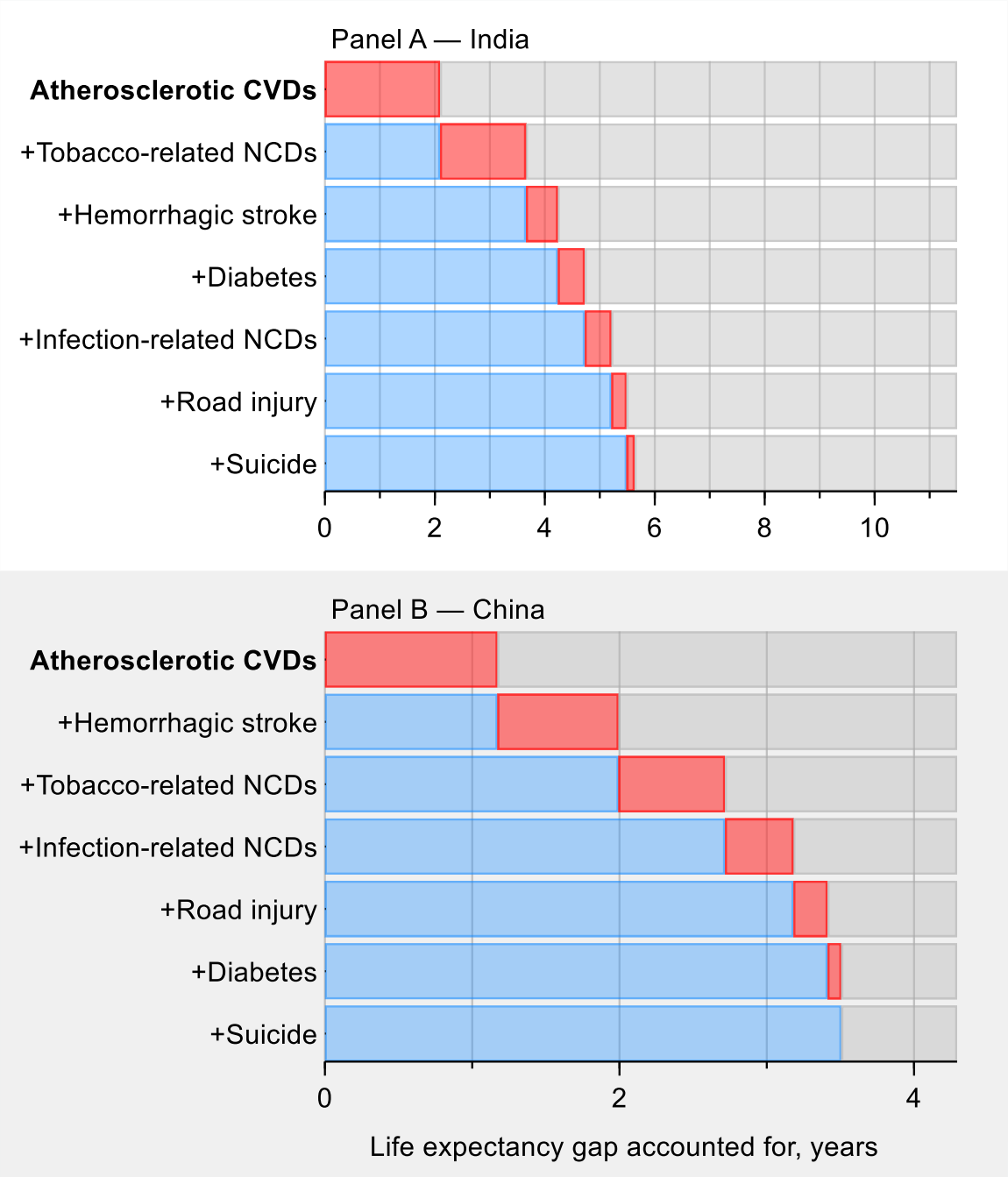
Most I-8 had a reduced impact between 2000 and 2019 (table 1). In sub-Saharan Africa, the impact of HIV/AIDS, diarrheal diseases, malaria, tuberculosis, and childhood cluster diseases declined the most. In India, diarrheal diseases, neonatal conditions, and lower respiratory infections had the most significant decline in impact.

Figure 2. Life expectancy gap compared to the North Atlantic attributable to individual I-8: Sub-Saharan Africa and India, 2019



Note: Life expectancy in the North Atlantic was 82 years in 2019. The full bars show the total life expectancy gap. Red parts show life expectancy gap accounted for by the cause indicated on the y-axis. Green+red parts show the cumulative contribution of the causes indicated at and above each bar on the y-axis to the gap. Gray part shows the proportion not accounted for. Data from references 3 and 11.

Figure 3. Life expectancy gap compared to the North Atlantic attributable to individual NCD-7: India and China, 2019



Note: Life expectancy in the North Atlantic was 82 years in 2019. The full bars show the total life expectancy gap. Red parts show life expectancy gap accounted for by the cause indicated on the y-axis. Blue+red parts show the cumulative contribution of the causes indicated at and above each bar on the y-axis to the gap. Gray part shows the proportion not accounted for. Data from references 3 and 11.

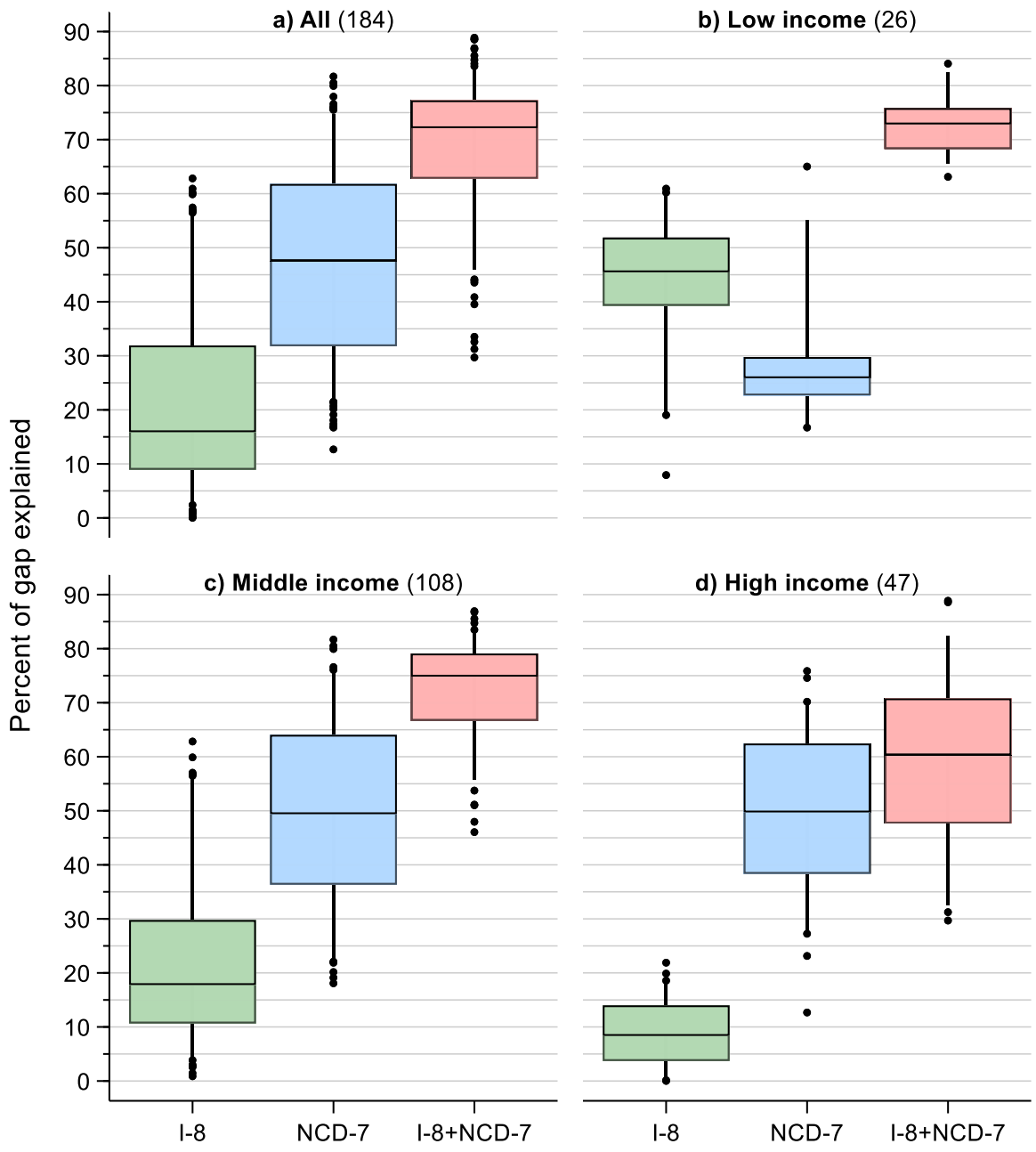
For NCD-7, the change in impact varied across locations and causes of death, with the impact of most causes decreasing over time. In general, there were no substantial increases in the impact of individual NCD-7 conditions in absolute terms, although the impact of atherosclerotic CVDs and diabetes rose somewhat in a few regions, for example, sub-Saharan Africa and India. Meanwhile, there were considerable declines in the impact of atherosclerotic CVDs in Central & Eastern Europe, Middle East & North Africa, and Latin America & the Caribbean. China had a substantial decline in the impact of tobacco-related NCDs, hemorrhagic stroke, and infection-related NCDs.

Country-level analysis

The percentage of life expectancy gap attributable to higher I-8 mortality ranged from 0 to 63% of the total gap across the 184 countries with lower life expectancy than the North Atlantic (with a median of 16%: figure 4 and appendix p 10 for tabulated estimates). The percentage share accounted for by higher mortality from the NCD-7 ranged from 13% to 82% across countries (with a median of 48%). The percentage share accounted for by both I-8 and NCD-7 combined ranged from 30% to 89% across countries and was 72% in the median country.

Only in low-income countries was the median percentage share accounted for by I-8 greater than the NCD-7. There was a large positive correlation ($r = 0.82$) between the share accounted for by I-8 and the total gap in life expectancy across countries (appendix p 11).

Figure 4. Percentage of life expectancy gap compared to the North Atlantic attributable to I-8 and NCD-7: Distribution across countries, 2019



Note: Number of countries is shown in parentheses. Only countries with lower life expectancy than the North Atlantic (or 82 years) were included. Results are shown overall and by 2019 World Bank Income groups (three countries were not classified). Percentiles 5 and 95 (line) and 25, 50, and 75 (box) are shown. Dots indicate country estimates below percentile 5 and above percentile 95. Countries were equally weighted for descriptive statistics. See appendix p 10 for tabulated descriptive statistics. See supplement 2 for a dataset including all estimates. The I-8 are neonatal conditions, lower respiratory infections, diarrheal diseases, HIV/AIDS, tuberculosis, malaria, childhood-cluster diseases, and maternal conditions. The NCD-7 are atherosclerotic cardiovascular diseases, hemorrhagic stroke, NCDs strongly linked to infections, NCDs strongly linked to tobacco use, diabetes, road injury, and suicide. Data from references 3 and 11.

Sex-specific results, alternative decomposition methods, and other important conditions

The impact of I-8 was substantially greater for females in India, primarily due to a larger impact from diarrheal diseases (0.7 years for males and 1.2 for females) and to a lesser extent due to lower respiratory infections and neonatal conditions (appendix pp 8 and 12). Maternal condition also had a notable impact in some regions, such as sub-Saharan Africa and Central Asia. The impact of NCD-7 was somewhat greater for females in sub-Saharan Africa (4.8 vs 5.3 years), primarily due to atherosclerotic CVDs (2.6 vs 3.1) and infection-related NCDs (0.6 vs 1).

Tuberculosis had a greater impact on males in sub-Saharan Africa. Overall, the life expectancy gap was much greater for males than females in Central & Eastern Europe (9.9 vs 5.4-year gap), partially due to atherosclerotic CVDs (4.2 vs 3.4 years) and tobacco-related NCDs (0.6 vs 0 years). Tobacco-related NCDs also had a somewhat bigger impact on males in Central Asia (1 vs 0.5 years). In addition, there was an impact of road injuries for males in some regions, for example, sub-Saharan Africa. Suicide was not a prominent explanatory factor in any region except somewhat for males in Central & Eastern Europe, 0.4 years (3.7%), and in the United States, 0.2 years (6%).

The North Atlantic had a 0.5- and 0.2-year decline in life expectancy between 2019 and 2021, for males and females, respectively (appendix p 13). The gap in life expectancy (compared to the North Atlantic in 2019) had grown considerably in the United States in 2021, to 6.3 years for males and 5.1 years for females, with COVID-19 explaining 1.7 years (27%) and 1.5 years (28%) of the total gap, respectively. Life expectancy in Latin America & the Caribbean, Central & Eastern Europe, and India was impacted by COVID-19 to a much greater extent than in the North Atlantic, increasing the life expectancy gap.

Results were highly similar when using different decomposition methods (appendix pp 15 and 17).

Here, we note all causes not included in the I-8 or NCD-7 that had an impact greater than either 0.5 years or 10% of the total gap in life expectancy in 2019 in the six regions and three countries highlighted. Interpersonal violence accounted for 1.3 years (17% of the total life expectancy gap) for males in Latin America & the Caribbean and 0.6 years (3.6%) in sub-Saharan Africa (appendix p 19). (Interpersonal violence contributed 3 of a 13-year gap for males in El Salvador; the highest globally: see Supplement 2.) In the United States, drug use disorders accounted for 0.5 years (15%) for males and "Alzheimer disease and other dementias" accounted for 0.4 years (12%) for females. Hypertensive heart disease had an impact of 0.8 years (3.6%) for females in sub-Saharan Africa and 0.5 years (6.8%) in the Middle East & North Africa. "Cardiomyopathy, myocarditis, endocarditis" had an impact of 0.5 years (5.5%) for males in Central & Eastern Europe.

Discussion

In the six regions and the three most populous countries highlighted in this paper, mortality from the priority conditions, the I-8 and NCD-7, together accounted for almost 80% of the life expectancy disparity relative to the North Atlantic in most cases. The NCD-7 commonly accounted for over half the total gap in 2019. We observed an impressive decline in the impact of I-8 in sub-Saharan Africa 2000–2019, which drove a large overall decline in the life expectancy disparity. Meanwhile, the impact of NCD-7 rose. Further, India transitioned from having most of the disparity attributable to deaths from I-8 in 2000 to having a larger share explained by NCD-7 in 2019. The NCD-7 and I-8 together accounted for over 70% of the life expectancy disparity in most countries.

Among the 115 causes not among the I-8 and NCD-7, hardly any had a large impact (or more than 10% or 0.5 years of the total life expectancy gap), which underscores the importance of relatively few priority conditions. However, interpersonal violence had a large impact for males in Latin America & the Caribbean, and drug use disorder had a considerable impact in the United States. (However, by 2021, the COVID-19 pandemic had put most regions further behind the North Atlantic, especially India, Latin America & the Caribbean, and Central & Eastern Europe.)

Our results highlight the importance of ensuring coverage of the most essential health interventions aimed at the 15 priority conditions for improving population health. The WHO suggested that in 2021, 4.5 billion people were not covered by essential health services[17,18] and that current health expenditure is far below what is needed to provide these.[4,19,20] The World Bank estimated that even with favorable policies and economic growth, the financing gap in low and middle-income countries would only be reduced by about a third by 2030.[4] In settings with severely constrained finances, covering a limited number of critical interventions addressing the most urgent health problems might be more financially and administratively feasible, without sacrificing population health gains.[5]

The priority conditions are prominent or rising health concerns with known determinants and cost-effective solutions.[5,21] The relative impact of each cause on life expectancy disparities can guide policy emphasis, planning, and the allocation of additional health spending. Of the causes highlighted in this paper, atherosclerotic CVDs accounted for the largest share of the life expectancy gap in all regions except sub-Saharan Africa (where it also accounts for a substantial and increasing share). The importance of atherosclerotic CVDs highlights the need for improving diagnosis of hypertension[22] and medical interventions (eg, statins) and behavioral interventions (eg, reduced smoking, improved diet, and increased physical

activity) to delay mortality from these causes.[23] Preventative interventions for diabetes, such as taxation of sugary drinks,[24] and improved diagnosis and treatment,[25] can be implemented to combat the considerable and rising relative impact of diabetes in some regions.

The significant effect of tobacco-related NCDs in China and India suggests that gains can be made through tobacco control, for instance, by legislation restricting smoking[26] and taxation.[7] However, in both China and India, smoking is much more prevalent among males (while both prevalence and sex differences are smaller in the North Atlantic). Still, the impact of tobacco-related NCDs was similar for males and females in China and greater for females in India, which may suggest that other factors, such as outdoor[27] and indoor[28] air pollution, may play a role.

An expansion of maternal and child health interventions (especially prevention of diarrhea, neonatal conditions, and lower respiratory infections) and tuberculosis interventions remains essential in sub-Saharan Africa, India, Central Asia, and Western Pacific & Southeast Asia. Since childhood deaths often result from repeated adverse exposures, an intervention aimed at reducing deaths from one condition can also indirectly reduce mortality from other causes.[29] Poor health in childhood can also have compounding effects on human development in terms of health,[30,31] physiological[32] and cognitive development[33] and schooling and income,[34] which in turn are linked to life expectancy.[35]

Some of the causes highlighted here contributed little to the life expectancy disparities. The relatively small impact of childhood-cluster diseases highlights the success of the widespread (although incomplete) distribution of vaccines.[36,37] For example, in sub-Saharan Africa, the impact of childhood-cluster diseases was considerable in 2000 (1.5 years) but had declined substantially by 2019 (to 0.4 years). Further, suicide had little (or, often, no) impact on life

expectancy disparities since suicide is not particularly rare in the North Atlantic.[38] Suicide is also only the most extreme consequence of poor mental health, which is a rising health concern, and is associated with heightened mortality from a range of conditions, likely stemming from factors such as health behaviors, access to care, and socioeconomic factors.[39,40]

Previous studies have used the measures of amenable mortality—or deaths that could have been avoided with timely and effective care—to measure shortcomings in health.[41,42] Amenable mortality evidences a similar geographic distribution as the life expectancy disparities in this study and also suggests a greater need for addressing mortality from infectious diseases and maternal and child deaths at lower levels of development.[41] This study takes a more general approach using a more straightforward metric and benchmarks shortcomings to an outcome that has been achieved. However, studies using amenable mortality remind us that further improvements can be achieved even in our benchmark—the North Atlantic—by reducing avoidable deaths.

Some limitations and caveats should be kept in mind when interpreting these results. First, there are caveats related to using life expectancy to identify current shortcomings in health. Mortality often results from repeated or extended periods of adverse exposures (eg, smoking, diet, and early life infections and undernutrition) involving many interlinked factors. Since (period) life expectancy gives a snapshot of current age-specific mortality, this decomposition will not capture the impact of recent health interventions and changes in underlying risk factors that impact mortality rates with delays. For example, recent dramatic declines in tobacco use in India are likely to reduce the impact of tobacco-related NCDs in the future.[43] Therefore, the results from this paper should be viewed together with information on recent changes in underlying risk factors.

Second, there are limitations related to data quality. Data in countries without well-functioning vital registration systems relied on censuses, survey data (eg, sibling survival), and model life tables to estimate all-cause mortality; and various methods and sources for specific causes of death.[12] However, data quality issues were unlikely to be an underlying factor in driving the predominant importance of the priority conditions.

Conclusions

This study underscores the significant impact of 15 priority conditions on life expectancy disparities, with notable regional variations and transitions over time. The decline in deaths from I-8, particularly in sub-Saharan Africa, contrasts with the rising importance of NCD-7, highlighting the evolving nature of global health challenges. These findings emphasize the critical importance of focusing limited resources on the key conditions that contribute the most to poor health and health disparities.

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Role of the funding source

The funding sources played a role in the data collection and analysis, reporting and interpretation of results, or the decision to submit the manuscript for publication. Authors were not precluded from accessing data in the study, and they accept responsibility to submit for publication.

Compliance with ethical standards

This project used publicly accessible secondary aggregate data from the WHO and UN. These activities do not meet the regulatory definition of human subject research. As such, an Institutional Review Board review was not required.

Contributions

Omar Karlsson did data management, analysis, reporting, and wrote the manuscript. Dean Jamison and Omar Karlsson devised the conceptual idea of the paper. All authors provided critical feedback on the manuscript. All authors approved the final manuscript as submitted and agree to be accountable for all aspects of the work.

Declarations of interest

None.

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Supplementary information

Supplements 1 and 2.

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