

Assessing performance of the Healthcare Access and Quality Index, overall and by select age groups, for 204 countries and territories, 1990–2019: a systematic analysis from the Global Burden of Disease Study 2019



GBD 2019 Healthcare Access and Quality Collaborators*



Summary

Background Health-care needs change throughout the life course. It is thus crucial to assess whether health systems provide access to quality health care for all ages. Drawing from the Global Burden of Diseases, Injuries, and Risk Factors Study 2019 (GBD 2019), we measured the Healthcare Access and Quality (HAQ) Index overall and for select age groups in 204 locations from 1990 to 2019.

Methods We distinguished the overall HAQ Index (ages 0–74 years) from scores for select age groups: the young (ages 0–14 years), working (ages 15–64 years), and post-working (ages 65–74 years) groups. For GBD 2019, HAQ Index construction methods were updated to use the arithmetic mean of scaled mortality-to-incidence ratios (MIRs) and risk-standardised death rates (RSDRs) for 32 causes of death that should not occur in the presence of timely, quality health care. Across locations and years, MIRs and RSDRs were scaled from 0 (worst) to 100 (best) separately, putting the HAQ Index on a different relative scale for each age group. We estimated absolute convergence for each group on the basis of whether the HAQ Index grew faster in absolute terms between 1990 and 2019 in countries with lower 1990 HAQ Index scores than countries with higher 1990 HAQ Index scores and by Socio-demographic Index (SDI) quintile. SDI is a summary metric of overall development.

Findings Between 1990 and 2019, the HAQ Index increased overall (by 19·6 points, 95% uncertainty interval 17·9–21·3), as well as among the young (22·5, 19·9–24·7), working (17·2, 15·2–19·1), and post-working (15·1, 13·2–17·0) age groups. Large differences in HAQ Index scores were present across SDI levels in 2019, with the overall index ranging from 30·7 (28·6–33·0) on average in low-SDI countries to 83·4 (82·4–84·3) on average in high-SDI countries. Similarly large ranges between low-SDI and high-SDI countries, respectively, were estimated in the HAQ Index for the young (40·4–89·0), working (33·8–82·8), and post-working (30·4–79·1) groups. Absolute convergence in HAQ Index was estimated in the young group only. In contrast, divergence was estimated among the working and post-working groups, driven by slow progress in low-SDI countries.

Interpretation Although major gaps remain across levels of social and economic development, convergence in the young group is an encouraging sign of reduced disparities in health-care access and quality. However, divergence in the working and post-working groups indicates that health-care access and quality is lagging at lower levels of social and economic development. To meet the needs of ageing populations, health systems need to improve health-care access and quality for working-age adults and older populations while continuing to realise gains among the young.

Funding Bill & Melinda Gates Foundation.

Copyright © 2022 The Author(s). Published by Elsevier Ltd. This is an Open Access article under the CC BY 4.0 license.

Introduction

The share of the global population aged 15 years and older increased from 67% in 1990 to 74% in 2019.^{1,2} These shifts in age structure are forecast to continue into 2100, when 86% of the global population is expected to be older than 15 years.¹ The drugs, equipment, technology, and know-how required to effectively address the health needs of working-age populations and older adults differ from what is required to address the needs of children and adolescents because different diseases and conditions are prominent in the different

age groups.^{3,4} To improve health outcomes and avert premature mortality, health systems must provide access to quality health care for the working-age population and older adults while simultaneously maintaining and improving health-care access and quality for younger generations.

Existing evidence suggests that health systems in low-income and middle-income countries (LMICs) have not been primarily funded and organised around providing access to quality health care for the working-age population and older adults. Non-communicable

Lancet Glob Health 2022

Published Online
October 6, 2022
[https://doi.org/10.1016/S2214-109X\(22\)00429-6](https://doi.org/10.1016/S2214-109X(22)00429-6)

*Collaborators are listed at the end of the Article

Correspondence to:
Prof Rafael Lozano, Institute for Health Metrics and Evaluation, Seattle, WA 98121, USA
rlozano@uw.edu

Research in context

Evidence before this study

The Healthcare Access and Quality (HAQ) Index, previously published in 2017 and 2018, uses 32 causes of amenable mortality to measure health-care access and quality over time in a comparable way across countries. We conducted a PubMed title and abstract search for the period of Jan 1, 1990, to Sept 15, 2020, for “amenable mortality”. A total of 17 studies were found that compared amenable mortality across countries, but only previous iterations of the HAQ Index study provided estimates for all countries and territories and standardised risks that could contribute to variation not associated with health-care access and quality. Only seven studies considered amenable mortality by age group. Just two studies compared changes in amenable mortality over the life course and these studies focused only on countries in the EU and Latin America and the Caribbean, respectively. Another approach, employed by Kruk and colleagues (2018), used amenable mortality along with health-care utilisation data to assess the burden of poor-quality health care in 137 low-income and middle-income countries (LMICs).

Added value of this study

This study examines health-care access and quality in more depth than previous versions of the HAQ Index by assessing performance for the first time for three select age groups: the young (ages 0–14 years), working (ages 15–64 years), and post-working (ages 65–74 years) groups, based on the Organisation for Economic Co-operation and Development definition of the working age population (15–64 years) and the Nolte and McKee definition of maximum age for amenable mortality, 74 years. The updated 2019 HAQ Index uses a mean-weighting scheme, improving its interpretability compared with previous versions based on principal component analysis, but preserving the approach of past iterations by standardising the influence of behavioural and environmental risk factors. The HAQ Indices are computed with ranges of risk-standardised death rates and mortality-to-incidence ratios separately for each age group,

such that the values indicate health-care access and quality relative to the best and worst observed over 1990–2019 in each age group. We measure absolute convergence—ie, whether countries with low 1990 HAQ Index scores had faster growth between 1990 and 2019 than countries with high 1990 HAQ Index scores. We also examined absolute convergence between high Socio-demographic Index (SDI) countries and countries in other SDI quintiles. This analysis adds to the evidence base surrounding how well countries across SDI levels have improved health-care access and quality for younger, working, and older populations over time.

Implications of all the available evidence

The HAQ Index rose in all three age groups on average but changes in the gap with high-SDI countries differed depending on the age group. Absolute convergence was most substantial among 0–14-year-olds; the absolute difference with the average HAQ Index score in high-SDI quintile countries declined (showing convergence) for the high-middle, middle, and low-middle SDI countries. Among the working and post-working age groups, the average gap with the high-SDI-quintile countries declined only in middle-SDI-quintile countries, remaining unchanged or growing in the other quintiles. Growing distance between low-SDI countries and the highest HAQ Index for the working and post-working groups in particular is concerning because the population aged 15 years and older is forecast to comprise 86% of the population worldwide by 2100 and 57% of the population in these countries by 2100. Health systems in LMICs might have more difficulty addressing the health-care needs of populations aged 15 years and older because of a lack of funding directed towards the non-communicable diseases that affect these populations most. To meet the health-care needs of all ages, health systems need to hasten progress in providing access to quality health care for individuals aged 15 years and older while maintaining progress among younger groups.

diseases (NCDs) affect adults more than children and adolescents—98% of NCD deaths were among populations aged 15 years and older in 2019.⁵ A number of NCDs are also risk factors for severe COVID-19 cases, hospitalisation, and death.^{6–11} A growing body of evidence suggests that health systems in LMICs are lagging with respect to NCD care. Less than 2% of the US\$40 billion in development assistance for health disbursed annually in LMICs focuses on NCDs.¹² There is also increasing evidence that these countries have invested a substantial share of government funds for health in areas other than NCDs (eg, HIV/AIDS, malaria, and tuberculosis),¹² suggesting NCD investments might not have kept pace with the growing burden of NCDs. Using inputs to the universal health coverage effective coverage index, effective coverage of a representative set of NCD

interventions is lower on average than coverage of child, maternal, and infectious disease interventions until economic and social development is high.^{13,14} However, the extent to which less investment and low service coverage for NCDs translates into higher rates of amenable mortality for the population that is of working age or older is currently unclear.

Amenable mortality, or deaths from causes that should not occur in the presence of high-quality health care,^{15,16} has been used as a measure of the health-care dimension of health system performance for nearly 50 years.^{15–42} The most widely used list of causes of mortality amenable to health care was developed by Nolte and McKee, and has since been used to compare high-income countries' performances at length.^{10,18,20–37} A recent study by Kruk and colleagues³⁴ used case-fatality rates for causes

included in the McKee and Nolte list and additional diseases to estimate the separate effects of utilisation versus quality for 137 countries. The only studies that are global in scope, however, are the Healthcare Access and Quality (HAQ) Index studies, developed as part of the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD).^{23,24} The HAQ Index is also the only approach that makes estimates of health-care access and quality comparable across locations using risk-standardised death rates (RSDRs) and mortality-to-incidence ratios (MIRs), as a way of excluding drivers not connected to the health system.

A small number of existing studies have compared countries using amenable mortality across the life course, although these only focus on a subset of countries and territories.^{15,22,32,40–42} Using amenable mortality, existing evidence suggests European countries improved health-care access and quality most for children and adolescents, with substantially bigger declines in amenable mortality estimated for these age groups as compared with older populations.¹⁵ Past studies on amenable mortality by age have engaged the debate about the possibility of convergence in mortality and life expectancy.^{38,43,44} Convergence in amenable mortality could be an indication of the diffusion of health-care technology (eg, pharmaceuticals and equipment) and know-how from health systems at the frontier of health-care access and quality to those operating less effectively. Alternatively, wider trends in social and economic development might be more important drivers of improved health-care access and quality through improved ability to pay, investment in health, better education, and other factors.^{45–47}

This study extends previous research on the HAQ Index and investigates health-care access and quality over the life course. Our research questions focused on: (1) how much does health-care access and quality differ across age, and (2) to what extent is there convergence or divergence in health-care access and quality over time by age? We address these questions by computing the HAQ Index separately for three select age groups: young (ages 0–14 years), working (ages 15–64 years), and post-working (65–74 years). We grouped populations on the basis of the Organisation for Economic Co-operation and Development (OECD) definition of working age population (15–64 years) and the age limit (75 years) beyond which deaths were not amenable to health care used by Nolte and McKee.^{25,26,48} With its expanded data inputs and methodological advances, the GBD 2019 study enabled the improved estimation of the HAQ Index,⁵ allowing us to produce the HAQ Index for 204 countries and territories between 1990 and 2019 based on scaled MIRs and RSDRs for 32 causes of death that should not occur in the presence of timely, quality health care. We use the updated index to examine convergence stratified for each age group. For each age group, we considered: whether the HAQ Index grew

faster in countries with lower 1990 scores; whether variation in the HAQ Index declined; and whether, between 1990 and 2019, average HAQ Index scores grew closer to scores in top-performing countries, as grouped by social and economic development. This manuscript was produced as part of the GBD Collaborator Network and in accordance with the GBD Protocol.⁴⁹

Methods

Overview

The 2019 HAQ Index supersedes and improves upon previous versions of the HAQ Index.^{23,24} First, the 2019 HAQ Index draws mortality, incidence, and risk factor estimates from GBD 2019 to generate MIRs and RSDRs, which represent mortality amenable to health-care access and quality. GBD 2019 improved upon previous GBD iterations by adding a substantial amount of new data, using more standardised cross-walking methods, improving redistribution algorithms, processing clinical informatics data to reflect differential access to health-care facilities across locations, and adding new systematic reviews for risk–outcome pairs, among other improvements.^{5,50} Further information on data additions and cause-specific modelling updates (eg, cancers, tuberculosis) can be found in the appendix (pp 59–169) and the GBD 2019 capstone series. Second, in addition to an overall HAQ Index, we estimated the index for three select age groups: young, working age, and post-working age. Third, we expanded the list of causes for which we used MIRs rather than RSDRs, thereby better representing causes for which health-care quality and access do not affect incidence or for which detection and diagnosis is poor in some settings. Finally, we used the arithmetic mean of scaled causes of amenable mortality rather than using principal component analysis weights, improving interpretability but preserving nearly all the cross-country variation of previous versions of the HAQ Index (appendix pp 15–30). The HAQ Index is also one of the most commonly used covariates in the GBD study.

This analysis complies with the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) statement,⁵¹ with further information provided in the appendix (pp 11–13).

Mapping the Nolte and McKee amenable cause list to GBD causes

The first step in our analysis was to identify amenable mortality,³⁴ or mortality that should not be present in locations where health care is accessed and of good quality.^{15,25,26,29} From the list of 34 causes of amenable mortality created by Nolte and McKee,^{15,25,26} we used International Classification of Diseases codes to identify 32 corresponding to causes in the GBD cause list (appendix p 20). Only deaths caused by benign prostatic hyperplasia and thyroid diseases were omitted because GBD includes these causes in a broader residual cause

See Online for appendix

group. Nolte and McKee's residual category "all respiratory diseases" was disaggregated and mapped onto "upper respiratory infections" and "lower respiratory infections". The Nolte and McKee category "other infections" was disaggregated into diphtheria and tetanus.

Age groupings

In addition to the overall HAQ Index (ages 0–74 years), we grouped populations into three select age groups: young (ages 0–14 years), working (ages 15–64 years), and post-working (ages 65–74 years) according to the OECD definition of the working age population (15–64 years). Groupings aim to distinguish health-care access and quality tied to employment (if any), versus access to quality health care enabled by social health insurance coverage related to ageing (among those aged 65 years and older), and from access to child health care and quality (for those younger than 15 years). We cap the amenable age range at 75 years to be consistent with the maximum identified by Nolte and McKee.^{15,25} Additionally, some causes of amenable mortality identified by Nolte and McKee do not pertain to all age groups (appendix p 20).

Risk-standardised death rates and mortality-to-incidence ratios

As in previous HAQ Index studies, we standardised death rates to account for environmental and behavioural risk factors to isolate differences in health-care access and quality from differences due to background risk exposure. We risk-standardised death rates by removing the joint effects of location-specific behavioural and environmental risk factors and replacing them with the global background risk for all locations.⁵² In other words, we eliminated differences across locations due to underlying health risk not related to the health system by setting risks in all locations to the same, global level of risk exposure. Additional information on risk-standardisation is available in the appendix (pp 16–17). Risk-standardisation was used for 20 of the 32 causes of amenable mortality in the analysis (appendix p 20). Five of the 20 causes (tetanus, appendicitis, congenital heart anomalies, adverse effects of medical treatment, and inguinal, femoral, and abdominal hernia) had no attributable risks to standardise and the observed death rate was used.

For other causes, we used MIRs, which provide an approximation of the impact of health-care access and quality on averting death once a disease is developed. We considered MIRs (1) for chronic conditions where incidence of disease is not amenable to health-care access and quality, and (2) when low mortality rates are an indication of inadequate detection, such as for cancer.⁵³ We determined which metric to use on the basis of the convergent validity of amenable mortality with a general summary of health, healthy life expectancy (HALE).⁵⁴ The

rationale is that the form of the death metric most correlated with health-care access and quality will be more correlated with HALE. We selected MIRs when the Pearson correlation was higher for MIR and HALE than RSDRs and HALE (appendix pp 31–32).

Using the amenable age range for a given cause, GBD population estimates were used to age-standardise the MIRs and RSDRs.² Different age structures in the age group analysis were accounted for by rescaling age weights to sum to 1 within each age group.

Constructing the HAQ Index

To construct the HAQ Index, an offset of one death per million was added to age-group-specific MIRs and RSDRs to address the existence of zeroes for age-cause combinations in some countries. All RSDRs and MIRs were subsequently log-transformed. Next, the 1st percentile and 99th percentile of estimates were used to set 0 and 100, respectively, for each of the 32 causes, where 0 is the highest (worst) MIR or RSDR and 100 is the lowest (best) values. Calculations were done separately for each cause (32) and HAQ Index group (four) across all estimates, countries, and years. Because health-care access and quality has generally improved over time, the worst (lowest) MIRs and RSDRs for each cause and age category combination are generally from earlier years and the best (highest) are generally in later years of the time series.

Finally, the updated version of the HAQ Index takes the arithmetic mean of all the scaled causes. The advantage of using the mean rather than weighting inputs based on their variation across time and countries using principal component analysis is that the mean of all scaled causes is easier to interpret. The mean-weighted HAQ Index is highly correlated with previous principal component analysis-weighted versions of the HAQ Index (Pearson correlation coefficient of 0·99, appendix pp 23–26).

Because each MIR and RSDR was calculated separately for each age group and cause, the final HAQ Indices represent the value between the best and worst performers within each group. The HAQ Index values for each grouping are not on the same scale. The rationale for separate scaling is that outcome measures for different age groups do not represent the same health-care access and quality performance. Therefore, the respective indices should be conceptualised as health systems' health-care access and quality relative to worst performers and best performers within each age group across the entire 1990–2019 period.

Examining changes over time and convergence

We examined evidence of convergence in the HAQ Index for each age group with three approaches. We used countries' Socio-demographic Index (SDI),⁵⁵ a summary measure of income per person, fertility rates, and average educational attainment, to represent the role of social and economic development in these changes. First, we

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
Global	54.4 (53.1 to 55.7)	64.5 (62.9 to 66.0)	55.9 (54.3 to 57.5)	51.2 (49.6 to 52.8)	19.6 (17.9 to 21.3)	22.5 (19.9 to 24.7)	17.2 (15.2 to 19.1)	15.1 (13.2 to 17.0)
High SDI	83.4 (82.4 to 84.3)	89.0 (88.2 to 89.8)	82.8 (81.6 to 83.7)	79.1 (77.7 to 80.2)	15.1 (14.3 to 15.9)	11.4 (10.8 to 12.1)	15.0 (14.0 to 16.0)	16.7 (15.6 to 17.8)
High-middle SDI	70.0 (68.8 to 71.2)	79.3 (78.2 to 80.4)	69.6 (68.0 to 71.0)	64.7 (63.0 to 66.2)	17.8 (16.5 to 19.1)	17.7 (16.3 to 19.1)	16.4 (14.9 to 17.8)	15.1 (13.6 to 16.6)
Middle SDI	60.9 (58.7 to 63.0)	68.2 (66.5 to 69.9)	62.7 (60.0 to 65.4)	59.9 (56.4 to 63.5)	25.9 (23.2 to 28.8)	28.4 (26.2 to 30.3)	22.9 (19.0 to 26.7)	22.0 (17.2 to 26.4)
Low-middle SDI	39.0 (36.4 to 41.7)	50.1 (47.2 to 53.1)	41.0 (37.7 to 44.5)	37.8 (34.2 to 41.6)	17.5 (14.1 to 20.7)	20.8 (15.2 to 24.9)	15.0 (11.1 to 19.2)	13.2 (9.4 to 17.5)
Low SDI	30.7 (28.6 to 33.0)	40.4 (37.1 to 44.0)	33.8 (31.0 to 36.6)	30.4 (27.8 to 33.0)	11.8 (9.1 to 14.3)	15.9 (10.2 to 20.6)	9.7 (6.8 to 12.6)	6.8 (4.3 to 9.5)
Central Europe, eastern Europe, and central Asia	61.5 (59.6 to 63.4)	72.6 (70.6 to 74.3)	61.2 (58.7 to 63.5)	59.3 (56.9 to 61.6)	14.5 (12.2 to 16.9)	15.8 (13.9 to 17.8)	11.0 (8.5 to 13.6)	12.1 (9.8 to 14.5)
Central Asia	49.2 (47.6 to 50.8)	62.3 (59.5 to 64.7)	50.6 (49.5 to 51.8)	49.6 (48.0 to 51.1)	10.2 (7.8 to 12.5)	14.9 (12.1 to 17.4)	6.0 (3.9 to 7.9)	3.7 (1.7 to 5.6)
Armenia	63.2 (61.1 to 65.5)	76.8 (74.3 to 78.8)	61.7 (58.8 to 64.6)	55.0 (51.2 to 58.9)	13.6 (11.1 to 16.5)	12.9 (9.9 to 15.9)	9.5 (6.5 to 12.8)	6.1 (2.2 to 10.0)
Azerbaijan	53.3 (49.7 to 56.6)	62.6 (57.7 to 66.7)	57.4 (55.0 to 59.8)	54.9 (51.2 to 58.2)	15.2 (11.5 to 18.5)	15.9 (11.3 to 20.2)	12.3 (8.7 to 15.6)	6.0 (1.6 to 10.1)
Georgia	57.7 (55.7 to 60.0)	71.1 (68.6 to 73.7)	56.0 (53.1 to 58.8)	52.7 (49.6 to 55.9)	5.6 (2.9 to 8.6)	11.4 (8.2 to 14.8)	0.5 (-2.9 to 4.4)	0.4 (-3.4 to 4.2)
Kazakhstan	59.5 (57.4 to 61.5)	72.0 (69.2 to 74.9)	56.1 (53.5 to 58.6)	52.5 (49.6 to 55.7)	14.2 (11.7 to 16.6)	15.4 (12.3 to 18.6)	11.5 (8.4 to 14.2)	7.3 (3.7 to 10.5)
Kyrgyzstan	54.2 (52.2 to 56.1)	68.5 (66.5 to 70.6)	53.4 (51.0 to 55.9)	54.8 (51.9 to 57.7)	13.5 (11.2 to 15.6)	14.6 (12.2 to 16.9)	10.4 (7.7 to 13.1)	8.2 (4.9 to 11.6)
Mongolia	47.4 (43.7 to 51.2)	61.8 (57.4 to 66.3)	45.3 (41.5 to 49.3)	45.6 (41.3 to 49.8)	19.2 (14.1 to 23.6)	26.9 (22.3 to 31.1)	14.0 (8.2 to 18.7)	12.6 (6.7 to 17.9)
Tajikistan	42.5 (39.6 to 45.7)	56.9 (53.4 to 60.6)	45.8 (43.0 to 48.9)	42.8 (39.0 to 46.8)	6.0 (2.5 to 9.2)	10.9 (7.1 to 14.7)	3.6 (0.1 to 7.2)	-3.7 (-8.5 to 1.0)
Turkmenistan	48.7 (45.7 to 51.5)	59.1 (55.7 to 62.7)	48.7 (45.2 to 52.1)	53.8 (49.8 to 57.5)	9.9 (6.3 to 13.2)	13.2 (9.8 to 16.5)	5.7 (1.6 to 9.6)	7.5 (2.9 to 12.0)
Uzbekistan	49.0 (46.8 to 51.4)	64.9 (62.2 to 67.7)	48.4 (45.9 to 51.1)	47.6 (44.7 to 50.7)	8.3 (5.3 to 11.4)	11.5 (8.2 to 14.7)	3.9 (0.7 to 7.4)	0.1 (-3.5 to 3.6)
Central Europe	71.2 (68.8 to 73.5)	82.0 (80.7 to 83.3)	70.2 (67.5 to 72.9)	64.1 (61.4 to 66.8)	21.9 (19.3 to 24.6)	21.8 (19.9 to 23.9)	18.6 (15.8 to 21.7)	17.1 (14.5 to 20.0)
Albania	67.5 (63.7 to 71.1)	62.6 (58.5 to 66.9)	74.8 (70.0 to 78.8)	67.9 (62.7 to 72.8)	22.2 (17.8 to 26.8)	18.3 (14.1 to 23.5)	19.0 (14.0 to 23.3)	20.4 (14.4 to 26.2)
Bosnia and Herzegovina	68.6 (65.0 to 72.1)	78.2 (76.3 to 80.2)	71.0 (66.4 to 75.0)	62.6 (57.8 to 67.3)	17.4 (13.5 to 21.2)	14.0 (11.3 to 16.8)	18.0 (13.4 to 22.4)	15.8 (10.8 to 20.7)
Bulgaria	64.9 (61.1 to 68.1)	78.7 (75.8 to 81.3)	60.3 (56.0 to 64.1)	59.1 (54.2 to 63.2)	10.6 (6.6 to 14.3)	14.5 (11.6 to 17.1)	8.0 (3.5 to 12.2)	10.4 (5.6 to 14.9)
Croatia	81.4 (77.8 to 84.5)	89.8 (87.4 to 92.0)	81.6 (77.3 to 85.1)	73.0 (68.5 to 76.8)	16.9 (13.3 to 20.4)	12.2 (9.7 to 14.5)	18.0 (13.7 to 21.8)	18.3 (13.7 to 22.6)
Czechia	81.5 (78.4 to 84.1)	92.3 (90.0 to 94.4)	80.2 (76.6 to 83.1)	70.5 (66.6 to 74.1)	21.8 (18.4 to 24.8)	16.7 (14.3 to 19.2)	22.5 (18.8 to 25.8)	19.3 (15.0 to 23.5)
Hungary	74.4 (70.8 to 77.4)	87.7 (85.2 to 89.9)	71.3 (67.5 to 74.7)	64.8 (60.7 to 68.4)	19.4 (15.6 to 22.7)	16.2 (13.3 to 19.1)	19.3 (15.3 to 22.9)	16.1 (11.8 to 20.3)
Montenegro	76.1 (73.6 to 78.2)	85.5 (83.6 to 87.5)	75.7 (73.0 to 78.0)	70.6 (67.6 to 73.3)	9.0 (6.1 to 11.8)	13.6 (11.2 to 15.8)	7.1 (4.2 to 9.8)	2.4 (-1.2 to 6.0)
North Macedonia	67.7 (64.3 to 70.7)	77.1 (74.7 to 79.3)	71.0 (67.1 to 74.6)	64.6 (60.5 to 68.3)	18.0 (14.4 to 21.6)	20.4 (17.6 to 23.1)	14.2 (10.0 to 18.0)	12.5 (7.7 to 17.0)
Poland	73.2 (68.7 to 77.7)	87.2 (85.0 to 89.4)	70.6 (65.1 to 76.1)	63.3 (57.6 to 69.0)	22.0 (17.4 to 26.5)	19.5 (17.3 to 22.0)	21.4 (15.8 to 26.9)	19.7 (14.4 to 25.3)
Romania	69.7 (67.2 to 72.1)	81.2 (79.3 to 82.9)	67.3 (64.0 to 70.4)	63.2 (59.1 to 66.7)	21.6 (18.2 to 24.8)	22.0 (19.3 to 24.8)	18.8 (14.3 to 22.9)	13.5 (9.6 to 17.5)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Serbia	72.2 (68.4 to 75.3)	86.5 (84.8 to 88.2)	72.3 (67.8 to 76.2)	63.6 (59.1 to 67.6)	20.0 (16.1 to 23.8)	23.1 (20.3 to 25.8)	16.4 (11.8 to 20.7)	13.3 (8.3 to 18.2)
Slovakia	73.4 (69.5 to 76.9)	84.7 (82.4 to 87.1)	73.0 (68.7 to 76.9)	67.1 (62.6 to 71.3)	17.3 (13.3 to 21.1)	14.1 (11.3 to 16.7)	18.4 (13.9 to 22.5)	14.4 (9.2 to 19.3)
Slovenia	87.8 (84.7 to 90.4)	95.7 (93.7 to 97.3)	87.1 (83.2 to 90.1)	76.4 (71.7 to 80.9)	21.5 (17.0 to 26.0)	15.8 (13.7 to 17.7)	22.5 (16.8 to 28.5)	23.3 (16.5 to 30.9)
Eastern Europe	66.6 (63.7 to 69.7)	81.2 (79.2 to 83.0)	62.6 (58.3 to 66.6)	59.5 (55.9 to 63.3)	14.0 (10.9 to 17.4)	15.3 (13.3 to 17.1)	11.4 (7.3 to 15.5)	10.4 (6.8 to 14.1)
Belarus	71.2 (67.3 to 74.7)	85.0 (82.8 to 87.3)	66.1 (61.8 to 70.1)	64.6 (59.7 to 69.0)	16.0 (11.5 to 20.0)	14.8 (11.9 to 17.7)	13.0 (7.8 to 17.8)	13.5 (8.3 to 18.5)
Estonia	76.4 (73.8 to 79.1)	90.7 (88.7 to 92.5)	73.1 (69.6 to 76.4)	67.2 (62.9 to 71.8)	19.2 (15.7 to 22.7)	14.2 (12.2 to 16.4)	20.0 (15.4 to 24.1)	17.5 (12.1 to 22.6)
Latvia	69.5 (67.1 to 71.6)	85.7 (83.5 to 87.6)	65.1 (62.5 to 67.5)	61.8 (58.4 to 64.9)	12.9 (9.6 to 15.7)	10.1 (8.1 to 12.1)	12.6 (8.6 to 16.1)	12.4 (7.4 to 16.6)
Lithuania	67.9 (65.5 to 70.6)	84.7 (82.8 to 86.4)	63.5 (60.3 to 66.8)	60.3 (56.9 to 63.9)	10.3 (7.1 to 13.3)	9.4 (7.3 to 11.3)	10.2 (5.8 to 14.1)	8.3 (4.1 to 12.5)
Moldova	63.7 (61.8 to 65.6)	78.3 (76.3 to 80.2)	60.2 (57.8 to 62.8)	58.8 (55.8 to 61.8)	14.0 (11.6 to 16.5)	13.1 (10.3 to 16.1)	12.7 (9.9 to 15.6)	8.1 (5.2 to 11.2)
Russia	67.6 (63.8 to 71.5)	80.8 (78.6 to 82.8)	65.2 (60.1 to 70.2)	59.3 (54.6 to 64.2)	15.7 (11.8 to 19.8)	16.2 (14.1 to 18.2)	14.2 (9.0 to 19.4)	11.5 (6.9 to 16.3)
Ukraine	63.1 (58.1 to 68.0)	79.7 (77.4 to 81.8)	55.9 (49.6 to 62.1)	62.4 (56.0 to 68.1)	6.1 (0.9 to 11.0)	7.7 (5.1 to 10.1)	1.4 (-5.1 to 7.4)	7.5 (1.2 to 13.3)
High-income	83.9 (82.6 to 85.0)	87.9 (86.8 to 88.9)	84.4 (82.8 to 85.7)	80.3 (78.5 to 81.9)	16.6 (15.6 to 17.7)	13.7 (12.8 to 14.5)	15.5 (14.3 to 16.6)	18.8 (17.5 to 20.2)
Australasia	89.6 (87.7 to 91.0)	92.3 (90.9 to 93.6)	89.7 (87.3 to 91.2)	86.5 (84.2 to 88.4)	14.7 (13.0 to 16.2)	9.6 (8.2 to 11.2)	14.7 (12.5 to 16.5)	19.8 (17.4 to 22.0)
Australia	90.2 (88.1 to 91.7)	92.5 (90.9 to 93.9)	90.4 (87.7 to 92.0)	87.1 (84.3 to 89.3)	14.4 (12.4 to 16.0)	8.9 (7.3 to 10.7)	14.2 (11.8 to 16.1)	19.9 (17.1 to 22.4)
New Zealand	85.5 (83.3 to 87.7)	90.3 (88.7 to 91.8)	84.9 (82.2 to 87.4)	82.1 (78.9 to 84.7)	14.4 (12.0 to 16.7)	11.6 (9.8 to 13.4)	14.9 (12.2 to 17.4)	17.0 (13.8 to 19.9)
High-income Asia Pacific	86.8 (85.7 to 87.8)	88.7 (87.7 to 89.8)	88.7 (87.2 to 89.9)	84.9 (83.3 to 86.3)	20.9 (19.4 to 22.2)	17.5 (15.8 to 19.3)	19.8 (18.2 to 21.3)	21.6 (19.6 to 23.2)
Brunei	57.0 (54.5 to 59.0)	71.0 (68.4 to 73.4)	58.3 (56.3 to 60.3)	51.4 (48.1 to 54.5)	13.7 (10.7 to 16.6)	9.8 (6.3 to 13.3)	14.9 (12.0 to 18.1)	16.1 (11.8 to 20.3)
Japan	87.5 (86.3 to 88.4)	89.7 (88.6 to 91.2)	88.9 (87.1 to 90.2)	84.9 (82.9 to 86.3)	14.6 (13.1 to 15.7)	10.7 (9.4 to 12.1)	14.0 (12.2 to 15.4)	17.0 (14.7 to 18.9)
Singapore	86.2 (84.4 to 87.6)	91.6 (89.8 to 93.0)	86.0 (83.5 to 88.0)	80.6 (77.9 to 83.0)	25.2 (23.3 to 27.0)	20.7 (18.4 to 22.9)	25.9 (23.3 to 28.2)	25.5 (22.3 to 28.4)
South Korea	86.3 (84.9 to 87.6)	88.5 (86.6 to 90.5)	88.5 (86.7 to 89.9)	84.9 (82.6 to 86.9)	35.8 (33.8 to 37.6)	26.8 (24.2 to 29.5)	35.9 (34.0 to 37.6)	38.5 (35.2 to 41.8)
High-income North America	81.6 (79.8 to 83.2)	87.0 (85.8 to 88.1)	80.4 (78.2 to 82.2)	79.2 (77.1 to 81.1)	9.0 (7.4 to 10.6)	7.4 (6.6 to 8.3)	8.6 (6.6 to 10.5)	11.5 (9.5 to 13.2)
Canada	90.7 (88.6 to 92.2)	92.9 (91.3 to 94.2)	91.4 (88.8 to 93.1)	85.8 (82.2 to 88.6)	11.5 (9.6 to 13.1)	8.0 (6.3 to 9.7)	12.7 (10.3 to 14.8)	15.8 (12.6 to 18.5)
Greenland	62.7 (58.6 to 66.4)	74.9 (70.3 to 79.3)	63.3 (59.4 to 66.8)	58.2 (54.6 to 62.0)	15.4 (11.0 to 19.8)	17.2 (11.8 to 22.3)	14.0 (9.6 to 18.2)	13.5 (9.6 to 17.9)
USA	80.6 (78.6 to 82.3)	86.3 (85.1 to 87.4)	79.1 (76.7 to 81.1)	78.5 (76.3 to 80.4)	8.5 (6.7 to 10.2)	7.1 (6.3 to 8.1)	8.0 (5.7 to 10.0)	10.9 (8.8 to 12.8)
Southern Latin America	62.4 (60.1 to 64.5)	75.0 (73.2 to 76.5)	62.8 (59.5 to 65.6)	57.0 (53.6 to 60.4)	15.8 (13.7 to 17.7)	16.4 (14.4 to 18.2)	14.7 (11.9 to 17.4)	13.7 (10.5 to 16.9)
Argentina	59.9 (57.4 to 62.1)	73.2 (71.3 to 74.9)	60.1 (56.8 to 63.1)	55.7 (51.8 to 59.3)	14.1 (11.9 to 16.2)	15.8 (13.6 to 17.8)	12.2 (9.3 to 15.2)	10.2 (6.6 to 13.9)
Chile	70.9 (68.7 to 72.7)	81.1 (78.8 to 83.2)	71.3 (68.2 to 74.0)	63.3 (59.5 to 66.8)	21.9 (20.0 to 23.7)	17.8 (15.2 to 20.3)	22.4 (19.5 to 25.0)	23.0 (19.6 to 26.5)
Uruguay	64.7 (62.6 to 66.6)	75.7 (73.3 to 78.0)	64.6 (61.3 to 67.6)	57.9 (54.2 to 61.4)	12.3 (10.4 to 14.2)	12.3 (9.5 to 15.0)	11.3 (8.5 to 14.1)	11.7 (8.3 to 15.4)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Western Europe	87.2 (85.7 to 88.7)	92.9 (91.8 to 94.0)	88.0 (86.1 to 89.6)	76.3 (74.0 to 78.5)	18.3 (17.1 to 19.4)	14.0 (13.1 to 15.1)	18.6 (17.0 to 20.0)	19.3 (17.4 to 21.3)
Andorra	89.1 (85.8 to 92.1)	94.5 (92.9 to 96.1)	90.5 (87.0 to 93.7)	79.3 (74.5 to 83.8)	13.5 (8.9 to 19.0)	13.7 (10.4 to 16.9)	11.8 (6.8 to 17.3)	11.5 (4.7 to 19.8)
Austria	88.0 (85.8 to 89.8)	94.6 (92.8 to 96.2)	88.1 (85.5 to 90.1)	78.8 (75.4 to 81.9)	17.1 (15.0 to 19.0)	12.8 (11.0 to 14.7)	18.2 (15.6 to 20.5)	18.2 (14.9 to 21.4)
Belgium	86.6 (84.1 to 88.7)	91.6 (90.0 to 92.9)	87.8 (84.6 to 90.3)	76.5 (72.7 to 79.9)	14.4 (12.0 to 16.5)	10.9 (9.1 to 12.7)	15.2 (12.1 to 17.8)	15.2 (11.5 to 18.5)
Cyprus	86.2 (84.5 to 87.7)	92.1 (89.8 to 94.1)	88.0 (86.4 to 89.5)	75.2 (73.0 to 77.5)	23.3 (20.9 to 25.7)	17.7 (14.6 to 20.9)	23.6 (21.1 to 25.8)	22.2 (18.5 to 25.9)
Denmark	85.5 (83.4 to 87.4)	94.1 (92.6 to 95.6)	85.7 (82.7 to 88.1)	73.8 (70.3 to 77.1)	16.1 (13.9 to 18.0)	11.4 (9.4 to 13.5)	17.9 (14.8 to 20.7)	17.4 (13.5 to 20.9)
Finland	87.7 (85.5 to 89.5)	96.7 (95.2 to 98.1)	85.9 (83.2 to 87.7)	78.9 (75.7 to 81.7)	19.1 (17.0 to 20.9)	12.3 (10.6 to 14.0)	20.4 (17.6 to 22.8)	23.0 (19.7 to 25.9)
France	88.0 (85.5 to 90.2)	92.7 (91.1 to 93.9)	88.8 (85.6 to 91.2)	78.5 (74.8 to 82.0)	19.3 (16.8 to 21.5)	13.2 (11.4 to 15.0)	18.6 (15.4 to 21.1)	21.1 (17.5 to 24.6)
Germany	87.0 (84.3 to 89.2)	94.7 (93.1 to 96.1)	87.3 (84.2 to 89.7)	75.4 (71.6 to 78.9)	19.0 (16.5 to 20.9)	12.7 (11.2 to 14.2)	19.6 (16.8 to 21.7)	18.3 (14.9 to 21.6)
Greece	83.9 (81.4 to 85.9)	90.7 (89.0 to 92.1)	84.4 (81.4 to 86.8)	74.9 (71.4 to 78.3)	8.3 (6.0 to 10.4)	6.8 (5.0 to 8.9)	8.3 (5.4 to 11.1)	12.5 (8.9 to 15.8)
Iceland	93.1 (91.3 to 94.4)	96.1 (92.8 to 98.6)	92.9 (91.5 to 93.8)	84.2 (82.4 to 85.9)	15.2 (13.0 to 17.2)	10.1 (6.4 to 13.4)	15.1 (13.1 to 17.0)	19.8 (16.9 to 22.4)
Ireland	90.1 (88.0 to 91.5)	95.8 (94.2 to 97.2)	90.7 (87.9 to 92.4)	78.4 (75.0 to 81.2)	19.7 (17.8 to 21.4)	11.9 (10.1 to 13.7)	21.6 (19.2 to 23.7)	23.0 (19.3 to 26.4)
Israel	83.1 (80.6 to 85.1)	89.2 (87.4 to 90.8)	83.7 (80.6 to 86.2)	74.0 (70.3 to 77.3)	17.4 (15.1 to 19.5)	14.1 (12.1 to 16.0)	16.5 (13.6 to 19.3)	18.7 (14.9 to 22.1)
Italy	89.6 (87.7 to 90.8)	92.2 (90.9 to 93.3)	91.0 (88.8 to 92.4)	79.5 (76.8 to 81.7)	16.9 (15.0 to 18.4)	15.3 (13.5 to 17.4)	16.4 (14.3 to 18.0)	18.5 (15.5 to 21.5)
Luxembourg	87.5 (85.6 to 89.0)	92.6 (89.6 to 95.0)	89.7 (88.4 to 90.7)	77.5 (75.4 to 79.6)	19.6 (17.4 to 21.7)	13.9 (10.3 to 17.5)	20.5 (18.8 to 22.2)	21.3 (18.6 to 24.1)
Malta	85.1 (83.2 to 86.7)	90.2 (87.0 to 93.1)	86.6 (85.1 to 87.8)	75.2 (73.0 to 77.2)	17.3 (14.9 to 19.6)	10.0 (6.3 to 13.5)	18.1 (16.0 to 20.1)	23.4 (20.4 to 26.5)
Monaco	87.4 (84.4 to 90.2)	92.2 (90.5 to 93.8)	87.7 (84.1 to 90.6)	78.1 (74.5 to 82.4)	10.3 (6.5 to 13.8)	9.2 (6.8 to 11.9)	8.8 (4.4 to 13.3)	10.6 (4.7 to 16.4)
Netherlands	91.1 (88.7 to 92.6)	93.9 (92.5 to 95.1)	92.7 (89.8 to 94.4)	80.5 (76.9 to 83.5)	16.0 (14.0 to 17.6)	12.0 (10.1 to 14.0)	16.3 (13.7 to 18.4)	17.0 (13.5 to 20.2)
Norway	90.4 (88.3 to 92.2)	95.9 (94.6 to 97.0)	90.7 (88.3 to 92.8)	79.4 (76.5 to 82.0)	17.8 (15.7 to 19.9)	13.1 (11.3 to 14.7)	19.1 (16.4 to 21.6)	20.5 (17.6 to 23.5)
Portugal	83.9 (81.5 to 86.0)	91.0 (89.2 to 92.5)	84.0 (80.8 to 86.4)	74.9 (71.0 to 77.9)	23.0 (20.7 to 24.9)	22.6 (20.6 to 24.9)	22.3 (19.3 to 24.9)	22.1 (18.4 to 25.4)
San Marino	88.6 (82.8 to 93.1)	91.8 (89.3 to 93.7)	91.4 (84.1 to 96.2)	80.8 (71.9 to 88.4)	9.0 (2.7 to 14.7)	9.4 (6.4 to 12.3)	7.2 (−0.4 to 13.5)	8.7 (−0.6 to 17.5)
Spain	89.7 (87.2 to 91.4)	92.9 (91.5 to 94.3)	91.2 (88.2 to 93.1)	80.0 (76.8 to 82.5)	18.6 (16.2 to 20.3)	14.0 (12.2 to 16.1)	20.6 (17.7 to 22.7)	19.9 (16.8 to 22.8)
Sweden	90.4 (88.4 to 92.1)	95.7 (94.4 to 96.8)	90.5 (88.1 to 92.4)	78.5 (75.7 to 81.5)	14.0 (11.8 to 16.2)	9.5 (7.9 to 11.4)	15.2 (12.8 to 17.6)	16.1 (13.0 to 19.4)
Switzerland	92.6 (90.1 to 94.3)	95.0 (93.5 to 96.2)	95.0 (92.2 to 96.8)	83.0 (79.5 to 86.3)	14.2 (11.9 to 16.1)	8.8 (7.3 to 10.6)	15.4 (12.4 to 17.8)	15.5 (11.9 to 19.1)
UK	83.3 (80.9 to 85.6)	91.0 (89.7 to 92.3)	82.4 (79.5 to 85.2)	71.9 (68.7 to 75.2)	13.3 (10.8 to 15.8)	10.8 (9.6 to 12.1)	13.1 (10.3 to 15.8)	15.6 (12.3 to 19.5)
Latin America and Caribbean	50.7 (48.5 to 52.8)	58.7 (55.8 to 61.5)	51.4 (49.3 to 53.4)	48.7 (46.8 to 50.7)	18.3 (15.9 to 20.6)	23.8 (20.2 to 27.3)	14.8 (12.6 to 16.8)	13.7 (11.8 to 15.6)
Andean Latin America	53.1 (49.4 to 56.7)	60.5 (56.5 to 64.1)	54.3 (50.5 to 57.8)	52.0 (48.2 to 55.8)	23.2 (19.0 to 27.3)	31.3 (27.2 to 35.3)	19.1 (14.8 to 23.2)	17.7 (13.1 to 21.9)
Bolivia	40.5 (36.5 to 44.8)	50.1 (45.7 to 55.0)	43.1 (38.0 to 48.2)	36.1 (31.1 to 41.3)	20.3 (15.6 to 25.1)	29.2 (24.0 to 34.9)	16.9 (10.7 to 22.8)	12.8 (7.1 to 18.5)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Ecuador	52.9 (49.5 to 56.2)	61.4 (57.6 to 65.1)	52.3 (48.1 to 56.5)	51.4 (46.2 to 56.3)	19.9 (15.6 to 23.9)	24.6 (20.1 to 28.9)	14.7 (9.9 to 19.4)	14.9 (9.1 to 20.3)
Peru	60.0 (54.7 to 64.8)	66.4 (61.6 to 70.7)	60.7 (55.1 to 65.6)	61.1 (55.5 to 66.5)	26.0 (20.3 to 31.2)	33.7 (28.5 to 39.0)	22.6 (16.1 to 28.2)	22.1 (15.0 to 28.7)
Caribbean	42.2 (39.4 to 45.0)	42.6 (38.3 to 47.4)	44.7 (41.5 to 47.5)	47.0 (43.8 to 49.8)	11.4 (7.9 to 14.6)	13.8 (9.6 to 18.0)	9.1 (5.4 to 12.4)	10.7 (7.3 to 13.9)
Antigua and Barbuda	58.2 (55.0 to 61.2)	71.2 (67.0 to 74.9)	55.1 (52.0 to 57.9)	51.9 (48.4 to 55.0)	11.1 (7.7 to 14.5)	4.4 (-0.4 to 9.0)	12.9 (9.5 to 16.3)	13.1 (9.3 to 16.8)
The Bahamas	52.6 (49.3 to 55.6)	70.3 (67.2 to 73.2)	47.1 (43.7 to 50.3)	48.5 (44.7 to 52.2)	10.3 (6.2 to 14.3)	12.1 (8.0 to 16.0)	8.7 (4.0 to 13.1)	11.4 (6.8 to 16.2)
Barbados	59.0 (55.1 to 62.6)	73.8 (70.1 to 77.2)	55.7 (51.5 to 59.4)	52.7 (48.5 to 56.6)	10.9 (6.8 to 14.9)	11.9 (7.5 to 16.0)	11.5 (7.2 to 15.6)	11.7 (7.4 to 16.2)
Belize	49.5 (47.0 to 51.9)	63.2 (60.3 to 66.0)	46.1 (43.0 to 48.7)	49.1 (45.7 to 52.2)	10.6 (7.5 to 13.8)	20.0 (15.6 to 24.3)	4.1 (0.6 to 7.4)	9.0 (4.8 to 12.6)
Bermuda	77.4 (73.9 to 80.2)	87.2 (84.2 to 89.5)	76.3 (72.7 to 79.3)	72.2 (68.5 to 75.3)	21.3 (17.6 to 24.6)	16.1 (12.4 to 19.8)	22.2 (18.3 to 25.8)	23.9 (19.7 to 27.7)
Cuba	66.2 (63.3 to 69.2)	82.1 (79.9 to 84.1)	62.8 (59.6 to 66.3)	58.1 (53.7 to 62.0)	12.4 (8.7 to 16.1)	14.1 (11.5 to 16.6)	12.4 (7.9 to 16.7)	8.8 (3.6 to 13.4)
Dominica	45.2 (41.1 to 49.3)	55.5 (50.7 to 59.9)	46.1 (41.8 to 50.1)	42.3 (37.6 to 46.3)	7.5 (2.9 to 12.1)	1.8 (-3.3 to 6.6)	9.3 (4.4 to 13.9)	9.3 (4.5 to 13.8)
Dominican Republic	45.4 (40.6 to 49.7)	53.5 (48.6 to 58.0)	45.8 (40.9 to 50.7)	47.0 (42.0 to 51.9)	12.0 (7.1 to 16.7)	21.5 (16.2 to 26.4)	7.1 (1.9 to 12.6)	4.3 (-1.3 to 10.2)
Grenada	50.4 (48.3 to 52.4)	67.7 (64.4 to 71.1)	46.9 (44.5 to 49.3)	40.7 (37.5 to 43.5)	13.8 (11.1 to 16.4)	15.1 (10.9 to 19.7)	14.2 (11.2 to 17.3)	12.5 (9.2 to 15.6)
Guyana	37.2 (32.7 to 41.6)	54.1 (49.9 to 58.1)	32.6 (27.6 to 37.2)	33.2 (28.3 to 37.8)	9.4 (4.5 to 14.4)	12.4 (7.1 to 17.6)	7.8 (2.6 to 13.0)	9.3 (4.1 to 14.7)
Haiti	24.5 (20.9 to 29.0)	29.5 (24.3 to 35.9)	25.9 (21.0 to 31.2)	25.2 (19.6 to 31.1)	12.4 (8.2 to 16.4)	14.4 (9.8 to 19.2)	11.4 (5.4 to 16.8)	8.7 (3.4 to 13.9)
Jamaica	55.5 (51.4 to 59.5)	68.1 (64.3 to 71.9)	52.6 (48.2 to 56.8)	52.3 (48.0 to 56.4)	7.8 (3.4 to 12.2)	14.9 (10.4 to 19.1)	4.4 (-0.3 to 8.7)	7.2 (2.7 to 12.0)
Puerto Rico	70.6 (66.4 to 74.4)	80.2 (77.1 to 83.1)	68.9 (64.1 to 73.1)	68.0 (63.1 to 72.3)	16.1 (11.7 to 20.3)	12.0 (8.6 to 15.1)	17.8 (12.9 to 22.3)	19.4 (14.4 to 24.5)
Saint Kitts and Nevis	51.3 (47.3 to 56.1)	67.3 (63.2 to 72.6)	50.1 (44.5 to 57.0)	42.4 (38.3 to 45.7)	19.2 (14.7 to 24.3)	18.5 (13.4 to 24.2)	21.1 (15.3 to 28.5)	16.0 (11.8 to 19.4)
Saint Lucia	52.8 (49.1 to 56.1)	65.8 (61.7 to 69.6)	50.2 (46.7 to 53.2)	50.1 (46.2 to 53.7)	15.0 (11.1 to 18.5)	13.2 (8.2 to 17.8)	14.7 (11.1 to 18.2)	15.4 (11.7 to 19.5)
Saint Vincent and the Grenadines	47.9 (44.8 to 50.9)	63.0 (59.1 to 66.7)	44.0 (40.9 to 46.9)	44.9 (41.8 to 48.1)	9.2 (5.6 to 12.5)	13.8 (9.1 to 18.6)	5.9 (2.5 to 9.2)	8.5 (4.8 to 12.0)
Suriname	43.0 (39.4 to 46.3)	55.9 (51.7 to 59.8)	42.1 (38.5 to 45.3)	42.1 (38.4 to 45.8)	9.6 (5.8 to 13.4)	14.7 (8.3 to 20.1)	7.8 (3.7 to 11.4)	8.3 (4.4 to 12.3)
Trinidad and Tobago	52.9 (48.1 to 57.8)	65.5 (61.5 to 69.5)	48.8 (43.3 to 54.0)	48.5 (43.1 to 53.7)	13.0 (7.9 to 17.9)	11.2 (6.6 to 15.7)	13.1 (7.6 to 18.6)	16.1 (10.5 to 21.7)
Virgin Islands	56.7 (53.3 to 59.9)	77.8 (74.8 to 80.5)	52.8 (48.7 to 56.6)	50.8 (47.8 to 53.9)	9.9 (5.9 to 14.0)	15.9 (12.2 to 19.5)	8.5 (3.5 to 12.8)	7.6 (3.3 to 11.9)
Central Latin America	52.5 (49.4 to 55.8)	62.8 (59.6 to 65.7)	52.0 (48.7 to 55.8)	49.9 (46.5 to 53.4)	18.7 (15.4 to 22.2)	23.9 (20.3 to 27.5)	14.7 (11.4 to 18.4)	14.6 (11.3 to 18.1)
Colombia	61.1 (56.6 to 65.0)	67.6 (64.1 to 71.0)	62.3 (57.4 to 66.7)	59.4 (54.4 to 64.0)	22.2 (17.6 to 26.7)	20.8 (16.4 to 25.4)	20.4 (15.4 to 25.3)	20.9 (15.5 to 26.0)
Costa Rica	64.7 (60.4 to 68.6)	76.5 (73.2 to 79.5)	63.9 (59.4 to 68.1)	62.2 (57.3 to 66.5)	11.7 (7.2 to 16.2)	12.9 (9.6 to 16.3)	9.5 (4.7 to 14.0)	10.0 (4.9 to 14.7)
El Salvador	54.7 (50.3 to 59.0)	67.8 (63.8 to 71.9)	53.7 (48.8 to 58.3)	53.9 (49.5 to 58.5)	21.3 (16.4 to 26.1)	33.1 (27.8 to 38.3)	16.7 (11.7 to 21.8)	16.4 (10.8 to 22.0)
Guatemala	43.6 (39.1 to 47.9)	53.8 (49.8 to 57.7)	41.3 (36.4 to 45.9)	42.2 (37.1 to 47.1)	19.3 (13.8 to 24.2)	27.0 (22.6 to 31.3)	15.9 (9.8 to 21.3)	16.1 (10.3 to 21.4)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Honduras	40.0 (36.2 to 43.5)	55.0 (50.9 to 59.1)	40.4 (35.0 to 44.9)	33.0 (29.9 to 36.3)	12.4 (8.1 to 16.2)	26.8 (21.8 to 32.1)	9.2 (3.6 to 14.2)	–0.2 (–4.2 to 3.6)
Mexico	52.5 (48.7 to 56.8)	63.8 (60.9 to 66.5)	51.3 (46.3 to 56.9)	49.0 (44.0 to 54.6)	17.3 (13.4 to 21.6)	21.7 (18.3 to 25.0)	13.3 (8.4 to 18.6)	13.2 (8.1 to 18.6)
Nicaragua	52.2 (49.2 to 55.3)	63.4 (60.4 to 66.2)	54.7 (51.1 to 58.4)	48.9 (44.9 to 52.9)	15.3 (11.6 to 18.9)	22.7 (18.9 to 26.7)	13.9 (9.3 to 18.2)	8.8 (3.9 to 13.5)
Panama	59.3 (54.9 to 63.6)	63.6 (59.7 to 67.5)	60.8 (55.4 to 65.5)	60.8 (55.7 to 65.3)	14.5 (9.5 to 19.5)	14.2 (9.6 to 18.6)	12.7 (7.2 to 18.0)	14.2 (8.6 to 19.3)
Venezuela	54.1 (49.6 to 58.6)	67.2 (63.9 to 70.6)	52.1 (46.9 to 56.8)	51.6 (46.1 to 56.6)	15.0 (9.8 to 20.0)	17.8 (13.9 to 21.7)	12.1 (6.9 to 17.4)	13.2 (7.7 to 18.6)
Tropical Latin America	52.8 (51.3 to 54.2)	62.4 (59.9 to 65.0)	53.3 (51.5 to 55.0)	48.6 (46.7 to 50.4)	17.4 (15.9 to 19.1)	20.8 (17.7 to 23.9)	15.1 (13.7 to 16.5)	12.0 (10.5 to 14.1)
Brazil	53.0 (51.5 to 54.3)	62.4 (59.9 to 65.0)	53.4 (51.6 to 55.1)	48.6 (46.7 to 50.5)	17.5 (15.9 to 19.1)	20.5 (17.6 to 23.7)	15.2 (13.8 to 16.7)	12.2 (10.6 to 14.2)
Paraguay	51.7 (47.0 to 56.0)	65.1 (60.8 to 68.9)	50.7 (45.8 to 55.1)	48.5 (43.3 to 53.6)	11.7 (6.8 to 16.7)	19.8 (15.6 to 24.5)	6.8 (1.5 to 11.8)	3.9 (–1.6 to 9.7)
North Africa and Middle East	52.3 (49.9 to 54.4)	57.5 (54.7 to 60.3)	56.7 (53.9 to 59.0)	52.1 (50.0 to 54.1)	20.1 (17.4 to 22.6)	23.5 (19.0 to 27.6)	16.3 (13.4 to 18.8)	15.5 (12.5 to 18.4)
Afghanistan	28.9 (25.4 to 32.3)	40.8 (35.9 to 45.2)	30.5 (25.3 to 35.9)	29.6 (25.5 to 35.2)	14.0 (10.5 to 17.6)	19.2 (12.2 to 26.3)	12.4 (6.8 to 17.4)	7.4 (2.8 to 12.8)
Algeria	58.7 (56.0 to 61.2)	64.9 (62.4 to 67.4)	61.5 (58.6 to 64.4)	59.6 (55.5 to 63.9)	19.6 (16.1 to 23.2)	23.3 (19.4 to 27.4)	17.5 (12.9 to 22.4)	15.1 (9.4 to 20.7)
Bahrain	67.6 (65.4 to 69.8)	73.7 (71.5 to 76.2)	71.7 (69.1 to 74.6)	63.0 (59.4 to 66.4)	23.2 (20.1 to 26.0)	18.4 (15.8 to 21.2)	22.1 (18.2 to 26.0)	21.0 (16.4 to 25.6)
Egypt	51.6 (47.1 to 55.5)	63.2 (59.4 to 66.7)	52.9 (47.9 to 57.3)	47.9 (43.0 to 52.9)	19.2 (14.7 to 23.4)	25.6 (20.9 to 29.7)	13.8 (9.0 to 18.1)	12.3 (7.0 to 17.8)
Iran	63.7 (62.1 to 65.3)	70.5 (68.2 to 72.6)	66.1 (64.5 to 67.6)	60.5 (58.4 to 62.5)	22.0 (19.4 to 24.6)	27.9 (23.7 to 32.3)	16.5 (13.8 to 19.2)	16.8 (12.9 to 20.1)
Iraq	57.4 (54.4 to 60.7)	66.5 (62.9 to 69.9)	58.4 (54.2 to 62.5)	57.4 (54.1 to 61.4)	19.5 (15.8 to 23.4)	24.0 (19.3 to 28.7)	15.0 (9.9 to 20.1)	14.2 (8.9 to 20.0)
Jordan	65.1 (62.7 to 67.4)	74.3 (71.4 to 77.1)	68.8 (66.6 to 70.9)	63.6 (60.4 to 66.8)	21.0 (17.2 to 24.7)	15.9 (12.3 to 19.3)	20.8 (16.7 to 24.8)	19.1 (13.9 to 24.3)
Kuwait	77.0 (75.0 to 78.9)	79.8 (77.6 to 81.8)	78.1 (76.2 to 79.8)	67.6 (64.7 to 70.3)	16.8 (14.1 to 19.4)	14.0 (11.3 to 16.7)	17.8 (15.0 to 20.5)	17.1 (13.3 to 21.1)
Lebanon	68.2 (65.4 to 71.2)	77.4 (73.7 to 80.8)	70.4 (66.9 to 74.1)	63.8 (59.2 to 68.3)	22.3 (18.9 to 25.7)	21.0 (16.1 to 25.5)	20.8 (16.6 to 25.2)	19.1 (14.3 to 24.1)
Libya	59.5 (56.1 to 62.8)	67.4 (63.9 to 70.7)	59.1 (55.3 to 62.6)	52.8 (48.6 to 58.0)	15.1 (10.6 to 19.4)	19.5 (14.8 to 24.0)	9.7 (4.8 to 14.4)	9.2 (3.6 to 14.8)
Morocco	48.5 (45.3 to 51.9)	60.2 (55.9 to 64.4)	52.8 (48.4 to 57.2)	46.5 (41.5 to 51.2)	16.1 (12.4 to 19.9)	21.8 (16.1 to 27.6)	12.2 (7.3 to 16.9)	9.7 (5.1 to 14.8)
Oman	67.5 (65.8 to 69.1)	76.8 (75.0 to 78.9)	70.9 (69.2 to 72.6)	59.0 (55.9 to 61.9)	23.5 (19.7 to 26.9)	19.5 (16.0 to 23.0)	21.1 (16.8 to 25.2)	20.3 (14.9 to 25.4)
Palestine	57.3 (55.2 to 59.7)	69.4 (66.7 to 72.2)	59.8 (57.3 to 62.4)	53.3 (49.1 to 57.2)	16.3 (12.3 to 20.4)	19.0 (13.8 to 24.0)	13.4 (8.5 to 18.3)	12.4 (6.3 to 18.4)
Qatar	73.7 (70.9 to 76.5)	78.9 (76.5 to 81.6)	79.1 (76.0 to 82.0)	68.4 (63.8 to 72.5)	24.2 (20.1 to 28.0)	21.5 (17.8 to 24.9)	23.5 (19.5 to 27.7)	18.9 (13.1 to 24.6)
Saudi Arabia	63.3 (60.8 to 65.7)	80.5 (78.2 to 83.1)	60.4 (57.2 to 63.7)	56.2 (53.1 to 59.4)	26.2 (21.2 to 30.7)	27.9 (23.6 to 31.7)	20.8 (13.2 to 28.0)	21.3 (15.1 to 27.6)
Sudan	43.9 (39.3 to 48.3)	48.4 (42.4 to 53.8)	48.9 (42.6 to 55.4)	44.9 (39.6 to 49.3)	19.1 (13.5 to 24.5)	23.1 (13.3 to 32.0)	15.8 (9.0 to 22.6)	10.9 (5.5 to 16.1)
Syria	60.2 (56.2 to 64.0)	63.7 (60.5 to 66.7)	63.8 (59.5 to 67.9)	59.9 (54.6 to 65.0)	21.6 (16.3 to 26.4)	22.3 (17.5 to 27.1)	17.7 (11.4 to 23.6)	14.5 (6.9 to 20.9)
Tunisia	63.9 (59.4 to 67.8)	71.5 (68.7 to 74.2)	67.1 (62.1 to 71.5)	60.7 (54.9 to 65.8)	18.0 (13.0 to 22.6)	24.7 (20.6 to 28.7)	13.9 (8.4 to 18.8)	12.2 (5.6 to 18.5)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Türkiye	64.8 (62.1 to 67.7)	68.9 (66.2 to 71.4)	71.3 (67.8 to 74.6)	61.5 (57.4 to 65.8)	27.9 (24.2 to 31.5)	29.1 (25.1 to 33.4)	25.9 (21.6 to 30.0)	20.2 (14.6 to 25.9)
United Arab Emirates	58.8 (55.5 to 62.2)	75.6 (72.4 to 78.6)	57.7 (53.5 to 61.8)	49.3 (44.5 to 53.8)	18.8 (15.1 to 22.9)	20.0 (16.8 to 23.0)	14.3 (9.1 to 19.7)	15.7 (10.3 to 21.4)
Yemen	39.3 (35.6 to 43.3)	48.5 (43.4 to 54.0)	43.1 (38.3 to 48.1)	38.4 (34.0 to 43.0)	13.4 (8.4 to 18.3)	18.5 (11.0 to 25.7)	9.2 (2.2 to 15.8)	7.5 (1.6 to 12.7)
South Asia	37.9 (34.5 to 41.1)	51.4 (48.3 to 54.3)	39.2 (34.9 to 43.1)	36.0 (31.6 to 40.4)	18.2 (14.4 to 22.0)	21.9 (15.8 to 26.3)	15.3 (10.6 to 20.0)	13.5 (9.0 to 18.7)
Bangladesh	44.1 (40.7 to 48.0)	49.4 (45.4 to 53.6)	45.9 (41.8 to 50.8)	46.4 (41.4 to 52.9)	23.6 (18.8 to 28.3)	25.2 (18.0 to 31.0)	20.6 (15.0 to 25.7)	16.5 (10.3 to 22.6)
Bhutan	42.1 (37.2 to 46.9)	54.8 (49.8 to 60.0)	44.8 (40.0 to 49.6)	37.5 (32.4 to 42.8)	20.1 (11.1 to 26.6)	19.6 (1.4 to 30.4)	18.5 (10.4 to 25.3)	11.9 (6.0 to 17.6)
India	39.2 (35.2 to 43.1)	54.7 (51.3 to 58.0)	40.2 (35.1 to 45.2)	36.4 (31.1 to 41.8)	19.1 (14.5 to 23.8)	23.4 (17.1 to 28.2)	16.1 (10.1 to 21.9)	14.2 (8.9 to 20.1)
Nepal	38.8 (36.2 to 41.9)	53.8 (50.0 to 57.3)	41.2 (37.6 to 45.6)	35.4 (31.6 to 39.9)	19.1 (15.2 to 23.3)	23.5 (16.4 to 28.5)	17.7 (12.0 to 24.0)	10.5 (5.3 to 16.5)
Pakistan	32.4 (27.2 to 37.7)	45.5 (41.4 to 50.2)	33.9 (27.3 to 40.9)	31.2 (24.9 to 37.1)	10.1 (5.0 to 15.5)	9.3 (3.2 to 15.4)	7.3 (0.6 to 14.5)	5.7 (-0.2 to 11.4)
Southeast Asia, east Asia, and Oceania	57.7 (54.9 to 60.4)	64.5 (62.2 to 66.8)	61.0 (57.6 to 64.3)	56.5 (52.7 to 60.2)	26.4 (22.6 to 30.0)	30.0 (27.0 to 32.8)	24.5 (19.6 to 29.3)	22.2 (16.7 to 26.9)
East Asia	69.8 (66.0 to 73.6)	77.9 (76.0 to 79.9)	71.6 (66.7 to 76.1)	64.9 (59.7 to 70.0)	34.5 (29.2 to 39.8)	39.2 (35.7 to 42.4)	30.7 (23.7 to 37.8)	27.2 (20.3 to 33.7)
China	70.2 (66.2 to 74.1)	78.0 (76.1 to 80.0)	72.2 (67.2 to 77.2)	65.3 (59.9 to 70.7)	35.2 (29.7 to 40.6)	39.6 (36.0 to 42.8)	31.5 (24.2 to 39.0)	27.6 (20.5 to 34.3)
North Korea	50.1 (47.1 to 53.4)	67.4 (63.7 to 71.2)	48.4 (44.3 to 52.3)	45.4 (41.6 to 49.1)	13.7 (10.0 to 17.7)	25.9 (20.4 to 31.7)	7.1 (0.7 to 13.6)	5.9 (1.4 to 10.7)
Taiwan	78.0 (74.8 to 81.0)	89.3 (87.5 to 91.2)	76.3 (72.8 to 79.6)	69.6 (64.9 to 73.7)	19.1 (15.1 to 22.5)	12.8 (10.5 to 14.9)	20.3 (16.1 to 24.0)	26.3 (20.8 to 31.2)
Oceania	32.0 (28.2 to 35.8)	40.3 (35.7 to 44.7)	33.4 (29.3 to 37.6)	37.4 (33.3 to 41.4)	4.7 (1.0 to 8.5)	5.2 (0.1 to 10.0)	3.3 (-0.8 to 7.1)	3.4 (-0.5 to 7.0)
American Samoa	45.5 (41.7 to 48.9)	63.0 (58.7 to 66.7)	43.9 (39.9 to 47.5)	44.6 (41.7 to 47.4)	5.3 (1.3 to 9.4)	7.3 (2.5 to 11.9)	3.2 (-0.9 to 7.5)	5.4 (2.0 to 9.0)
Cook Islands	63.0 (59.4 to 66.4)	80.1 (76.9 to 84.4)	58.5 (54.2 to 62.5)	59.1 (55.7 to 62.0)	16.8 (12.4 to 20.9)	21.5 (17.0 to 26.5)	12.8 (7.6 to 17.9)	15.1 (10.9 to 19.2)
Federated States of Micronesia	35.6 (31.8 to 41.6)	57.4 (53.5 to 69.7)	31.3 (27.0 to 38.2)	33.2 (28.1 to 38.7)	10.5 (5.9 to 17.5)	15.0 (9.5 to 28.4)	7.3 (1.5 to 15.7)	7.5 (1.2 to 14.2)
Fiji	38.7 (34.2 to 42.7)	48.9 (44.5 to 53.0)	38.5 (34.0 to 42.8)	41.9 (37.3 to 46.1)	5.4 (0.1 to 10.3)	1.8 (-3.4 to 6.6)	5.4 (-0.1 to 10.8)	4.5 (-1.4 to 10.0)
Guam	56.5 (53.3 to 59.3)	67.0 (64.5 to 69.5)	55.8 (52.4 to 58.6)	59.1 (55.6 to 62.2)	4.9 (1.6 to 8.3)	3.5 (0.8 to 6.2)	2.6 (-0.8 to 6.1)	12.0 (7.5 to 16.2)
Kiribati	24.2 (21.2 to 27.2)	42.0 (37.9 to 46.2)	24.1 (20.8 to 28.0)	25.3 (20.8 to 29.7)	8.2 (4.2 to 12.0)	11.8 (5.8 to 17.4)	7.0 (2.7 to 11.3)	5.8 (1.1 to 10.7)
Marshall Islands	32.1 (28.2 to 35.9)	51.8 (48.1 to 55.6)	28.9 (24.9 to 33.1)	32.0 (26.6 to 36.8)	6.3 (2.4 to 10.6)	4.9 (0.4 to 9.2)	4.4 (0.1 to 9.2)	7.3 (2.5 to 12.2)
Nauru	35.5 (32.8 to 38.4)	50.5 (47.0 to 53.8)	32.7 (30.0 to 35.9)	35.4 (31.4 to 39.6)	6.4 (3.4 to 9.2)	6.6 (2.4 to 10.5)	4.9 (1.3 to 8.1)	5.7 (1.5 to 9.8)
Niue	47.8 (43.9 to 51.7)	58.1 (54.3 to 61.5)	47.5 (42.2 to 52.3)	46.6 (43.4 to 50.2)	10.0 (5.4 to 14.7)	6.2 (1.9 to 10.8)	10.8 (4.5 to 16.7)	9.6 (5.7 to 13.9)
Northern Mariana Islands	55.7 (53.1 to 58.2)	69.1 (65.7 to 72.2)	54.9 (52.1 to 57.8)	54.5 (52.1 to 57.1)	6.1 (2.9 to 9.4)	4.3 (1.2 to 6.9)	6.5 (1.9 to 10.9)	7.3 (3.9 to 10.9)
Palau	48.5 (45.3 to 51.9)	62.3 (59.2 to 65.5)	47.2 (43.8 to 51.1)	48.0 (44.1 to 51.6)	8.7 (4.0 to 13.5)	10.1 (5.1 to 14.8)	6.9 (1.6 to 12.7)	8.7 (3.8 to 13.7)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Papua New Guinea	31.4 (27.1 to 35.5)	38.5 (33.6 to 43.2)	33.3 (28.5 to 38.2)	37.4 (31.9 to 42.7)	4.6 (0.4 to 9.2)	6.4 (0.9 to 11.5)	3.0 (–1.9 to 8.1)	1.5 (–3.5 to 6.2)
Samoa	43.7 (39.2 to 48.1)	63.1 (58.7 to 67.4)	41.4 (36.6 to 46.6)	41.0 (37.4 to 44.5)	9.8 (4.1 to 15.8)	16.2 (9.8 to 22.9)	6.8 (–0.0 to 14.2)	7.5 (2.6 to 12.2)
Solomon Islands	30.3 (27.6 to 33.8)	52.7 (49.2 to 56.4)	26.1 (23.4 to 30.9)	30.4 (26.0 to 35.8)	7.7 (4.2 to 11.6)	9.4 (4.5 to 14.2)	5.7 (1.6 to 9.9)	5.7 (0.9 to 11.1)
Tokelau	45.9 (41.7 to 50.0)	65.0 (61.8 to 68.4)	43.4 (38.1 to 48.9)	43.6 (39.1 to 48.0)	14.1 (9.1 to 19.4)	15.5 (11.1 to 19.6)	12.2 (5.8 to 18.6)	12.4 (7.0 to 17.5)
Tonga	45.8 (42.0 to 49.8)	61.1 (56.7 to 64.9)	44.8 (40.3 to 49.2)	45.3 (41.5 to 48.8)	6.8 (2.4 to 11.2)	8.5 (3.6 to 13.3)	4.9 (–0.4 to 9.9)	5.2 (0.5 to 9.6)
Tuvalu	37.7 (33.3 to 41.5)	57.8 (53.9 to 61.6)	34.4 (30.2 to 38.5)	36.3 (30.8 to 41.2)	14.7 (9.4 to 19.4)	23.6 (16.2 to 29.8)	10.6 (4.5 to 16.1)	10.6 (4.7 to 15.6)
Vanuatu	31.1 (27.1 to 35.1)	49.0 (45.4 to 52.8)	28.3 (23.8 to 33.5)	31.5 (26.6 to 37.0)	3.8 (–1.2 to 8.7)	4.2 (–0.8 to 9.3)	2.1 (–5.1 to 8.8)	3.0 (–2.7 to 8.5)
Southeast Asia	43.2 (40.8 to 45.5)	55.0 (52.4 to 57.6)	45.0 (41.8 to 48.0)	42.6 (40.2 to 45.3)	16.0 (13.2 to 19.0)	22.4 (17.1 to 26.4)	13.4 (10.1 to 16.9)	10.9 (7.8 to 14.2)
Cambodia	38.0 (35.4 to 41.0)	49.9 (44.6 to 54.1)	38.2 (34.5 to 42.3)	34.7 (31.4 to 38.8)	19.6 (15.4 to 23.7)	27.2 (19.0 to 33.0)	18.4 (12.9 to 23.9)	10.8 (6.1 to 16.0)
Indonesia	40.9 (36.5 to 45.3)	55.6 (52.3 to 58.8)	42.8 (36.4 to 48.2)	39.5 (35.0 to 45.8)	15.0 (10.4 to 20.1)	24.0 (18.3 to 28.6)	12.0 (5.6 to 18.0)	7.3 (2.1 to 14.1)
Laos	33.0 (28.8 to 36.9)	45.2 (40.2 to 50.1)	34.8 (30.2 to 39.4)	33.0 (28.9 to 37.1)	20.1 (14.4 to 25.3)	27.0 (17.5 to 34.5)	20.0 (13.2 to 26.2)	11.2 (5.5 to 16.8)
Malaysia	55.4 (51.4 to 59.1)	74.6 (72.0 to 77.2)	55.2 (50.7 to 59.4)	45.9 (41.3 to 50.1)	17.3 (13.2 to 21.4)	17.8 (14.7 to 21.2)	15.5 (10.8 to 20.0)	15.2 (10.4 to 20.3)
Maldives	60.7 (58.6 to 62.8)	67.6 (64.3 to 71.3)	65.8 (63.8 to 68.0)	59.2 (55.7 to 62.7)	29.9 (26.2 to 33.4)	28.2 (23.3 to 34.1)	30.0 (25.9 to 34.1)	26.3 (21.1 to 32.1)
Mauritius	56.7 (53.5 to 59.6)	70.5 (67.8 to 73.0)	53.8 (50.3 to 57.0)	56.9 (53.6 to 60.1)	11.2 (7.9 to 14.6)	8.3 (5.2 to 11.2)	10.7 (7.3 to 14.1)	15.7 (12.0 to 19.4)
Myanmar	37.5 (33.6 to 41.2)	47.0 (41.5 to 52.3)	39.3 (35.3 to 43.3)	40.2 (36.7 to 43.3)	18.5 (12.4 to 25.1)	24.3 (16.0 to 32.9)	16.5 (8.8 to 24.1)	11.0 (4.3 to 17.0)
Philippines	40.8 (35.9 to 46.0)	52.3 (49.4 to 55.0)	41.6 (35.3 to 48.5)	41.5 (35.4 to 48.3)	6.9 (1.5 to 12.6)	13.4 (8.8 to 17.5)	3.9 (–3.0 to 11.1)	1.9 (–5.1 to 9.3)
Seychelles	52.8 (50.6 to 55.0)	70.3 (67.4 to 73.2)	52.2 (50.0 to 54.4)	47.7 (45.0 to 50.5)	13.4 (10.6 to 16.2)	7.4 (4.2 to 10.8)	14.0 (11.2 to 16.8)	13.0 (9.5 to 16.7)
Sri Lanka	60.5 (55.9 to 64.4)	73.9 (70.4 to 77.0)	60.2 (55.3 to 64.2)	57.1 (51.7 to 62.0)	21.8 (16.9 to 26.4)	20.6 (16.5 to 24.8)	19.8 (14.7 to 24.3)	21.1 (14.6 to 27.2)
Thailand	62.5 (58.2 to 66.5)	73.9 (71.5 to 76.6)	63.4 (58.1 to 68.2)	61.1 (56.0 to 66.0)	19.5 (14.8 to 23.9)	20.5 (17.1 to 24.2)	17.7 (11.9 to 23.2)	16.5 (10.2 to 22.3)
Timor-Leste	35.7 (31.7 to 42.7)	51.4 (47.0 to 59.7)	36.7 (31.5 to 45.5)	32.2 (27.6 to 37.4)	15.4 (9.7 to 23.4)	25.0 (13.9 to 37.5)	12.6 (5.2 to 21.6)	4.8 (0.0 to 10.8)
Viet Nam	55.6 (52.9 to 58.4)	68.7 (65.6 to 71.8)	56.4 (53.0 to 60.0)	51.1 (47.4 to 55.2)	20.1 (16.3 to 24.2)	19.0 (14.6 to 23.5)	17.4 (11.8 to 23.3)	17.1 (11.3 to 22.5)
Sub-Saharan Africa	29.0 (26.7 to 31.7)	33.7 (29.4 to 38.4)	34.3 (31.2 to 37.5)	29.8 (27.4 to 32.4)	11.4 (8.1 to 14.6)	14.4 (8.2 to 20.0)	11.1 (7.6 to 14.4)	6.9 (4.4 to 9.6)
Central sub-Saharan Africa	28.3 (25.2 to 31.6)	40.5 (33.8 to 46.7)	31.1 (27.2 to 35.0)	27.0 (22.9 to 30.8)	12.6 (8.4 to 16.9)	20.2 (12.4 to 26.1)	10.5 (5.6 to 15.7)	6.6 (2.1 to 10.8)
Angola	29.3 (25.2 to 33.5)	40.6 (33.8 to 47.1)	32.7 (27.4 to 38.0)	28.2 (23.8 to 32.3)	15.4 (9.3 to 21.3)	21.7 (13.1 to 29.9)	14.8 (6.4 to 22.5)	8.6 (1.9 to 14.7)
Central African Republic	15.2 (10.8 to 19.9)	26.2 (21.1 to 31.4)	17.3 (11.8 to 23.4)	17.2 (12.3 to 22.4)	4.0 (–0.7 to 8.7)	7.2 (0.8 to 13.6)	3.1 (–2.7 to 8.8)	2.4 (–2.2 to 7.1)
Congo (Brazzaville)	34.0 (30.0 to 38.1)	51.5 (44.5 to 57.2)	35.9 (31.2 to 40.7)	30.6 (26.3 to 34.7)	14.5 (9.3 to 19.6)	18.8 (12.3 to 25.4)	14.6 (7.8 to 21.2)	11.2 (5.3 to 16.4)
Democratic Republic of the Congo	29.0 (25.8 to 32.4)	42.3 (34.3 to 49.7)	31.2 (27.0 to 35.6)	27.3 (22.7 to 32.1)	11.4 (6.9 to 16.0)	20.7 (11.3 to 28.4)	7.5 (1.8 to 13.9)	5.8 (0.8 to 11.1)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Equatorial Guinea	42.4 (35.4 to 48.8)	59.1 (50.2 to 67.7)	44.9 (37.1 to 51.6)	38.1 (31.9 to 44.4)	30.1 (21.7 to 37.6)	38.1 (28.3 to 47.9)	30.4 (21.1 to 39.2)	21.2 (13.7 to 28.6)
Gabon	39.6 (35.7 to 44.1)	57.2 (49.5 to 64.4)	41.5 (36.3 to 46.8)	35.3 (30.8 to 40.6)	15.1 (9.9 to 20.3)	22.4 (14.6 to 29.5)	13.5 (7.2 to 20.4)	10.7 (5.5 to 16.7)
Eastern sub-Saharan Africa	28.6 (26.4 to 30.9)	38.7 (34.4 to 43.6)	32.3 (29.4 to 35.7)	27.4 (24.8 to 30.4)	13.6 (10.2 to 16.8)	19.1 (11.8 to 25.2)	12.6 (9.2 to 16.0)	7.4 (4.6 to 9.9)
Burundi	25.8 (22.1 to 30.0)	38.1 (31.7 to 45.5)	27.5 (23.1 to 32.4)	24.4 (20.1 to 28.8)	10.8 (5.4 to 15.9)	17.2 (7.8 to 25.4)	7.8 (1.4 to 14.0)	5.7 (-0.4 to 11.2)
Comoros	31.8 (28.8 to 36.2)	45.0 (39.2 to 50.9)	35.6 (30.9 to 41.8)	28.7 (24.9 to 32.4)	10.3 (-3.8 to 16.8)	14.4 (-1.4 to 22.8)	8.3 (-8.8 to 16.9)	6.5 (-3.3 to 12.4)
Djibouti	32.6 (27.5 to 37.8)	40.9 (34.7 to 47.2)	36.3 (29.7 to 43.3)	30.6 (25.6 to 35.5)	9.0 (2.7 to 14.8)	10.9 (2.7 to 19.0)	7.0 (-0.8 to 14.5)	5.4 (-0.4 to 10.8)
Eritrea	25.6 (21.1 to 30.3)	40.1 (32.7 to 46.9)	25.9 (20.8 to 31.7)	23.1 (18.8 to 28.1)	12.2 (6.3 to 17.7)	18.5 (8.9 to 27.5)	10.3 (3.8 to 16.7)	4.9 (-1.7 to 10.8)
Ethiopia	31.2 (27.4 to 35.6)	42.1 (36.9 to 47.1)	35.9 (29.8 to 42.7)	29.2 (24.9 to 34.1)	21.5 (16.5 to 26.9)	26.9 (18.4 to 34.8)	23.4 (16.6 to 30.5)	14.2 (9.0 to 19.9)
Kenya	33.4 (29.2 to 38.1)	51.4 (46.8 to 55.8)	34.9 (29.1 to 40.9)	27.8 (23.2 to 33.0)	5.3 (0.5 to 10.3)	13.8 (6.8 to 19.6)	1.9 (-4.3 to 8.9)	1.3 (-3.1 to 5.8)
Madagascar	29.0 (25.1 to 33.3)	42.8 (38.3 to 47.8)	32.0 (26.6 to 37.4)	28.6 (23.3 to 34.1)	9.3 (4.2 to 14.2)	21.7 (13.0 to 28.2)	6.1 (0.6 to 11.7)	1.9 (-3.6 to 7.9)
Malawi	29.9 (26.9 to 33.1)	41.9 (36.0 to 47.7)	32.3 (28.2 to 37.0)	28.1 (24.7 to 31.9)	11.3 (6.2 to 15.8)	21.8 (11.9 to 29.7)	6.8 (0.9 to 12.6)	5.3 (0.7 to 9.7)
Mozambique	25.1 (21.6 to 29.2)	40.7 (34.3 to 47.0)	26.5 (21.9 to 31.8)	22.6 (18.9 to 26.7)	8.8 (3.8 to 13.6)	21.0 (11.2 to 29.6)	2.8 (-3.1 to 8.9)	1.5 (-3.3 to 6.4)
Rwanda	31.8 (28.9 to 34.9)	41.9 (35.4 to 48.5)	35.6 (31.5 to 40.3)	30.7 (27.1 to 34.2)	17.3 (12.8 to 21.6)	21.4 (12.3 to 29.2)	17.0 (11.1 to 22.8)	13.3 (8.3 to 18.1)
Somalia	16.7 (11.8 to 21.6)	26.2 (21.1 to 31.9)	18.9 (13.0 to 25.1)	19.7 (13.7 to 25.4)	3.9 (-1.1 to 8.6)	6.0 (-1.8 to 13.0)	2.1 (-4.7 to 8.2)	2.2 (-3.0 to 7.4)
South Sudan	29.1 (24.2 to 34.2)	33.6 (27.4 to 39.2)	35.6 (28.4 to 42.6)	30.2 (24.5 to 36.6)	9.5 (4.2 to 14.4)	11.5 (2.4 to 18.7)	6.8 (-1.5 to 14.1)	5.4 (-0.6 to 11.1)
Tanzania	32.5 (29.5 to 35.4)	37.3 (31.0 to 43.1)	37.6 (33.2 to 42.0)	32.9 (29.6 to 36.3)	8.9 (4.7 to 13.1)	12.9 (4.2 to 19.9)	7.0 (1.4 to 12.7)	6.2 (1.6 to 10.4)
Uganda	32.4 (29.1 to 35.8)	43.5 (37.0 to 50.3)	36.6 (32.7 to 40.8)	30.9 (27.5 to 34.7)	9.8 (5.0 to 14.4)	13.4 (4.8 to 21.2)	6.3 (-0.2 to 12.3)	6.5 (1.5 to 11.4)
Zambia	31.6 (28.2 to 35.5)	45.1 (38.8 to 51.4)	33.0 (28.3 to 38.3)	29.1 (25.1 to 34.1)	12.6 (7.3 to 17.7)	23.1 (12.1 to 31.1)	8.4 (2.5 to 14.9)	6.9 (1.8 to 12.4)
Southern sub-Saharan Africa	39.8 (37.9 to 41.9)	54.3 (50.8 to 57.8)	40.2 (37.6 to 42.7)	36.5 (34.8 to 38.2)	6.9 (4.0 to 9.7)	11.5 (6.9 to 16.0)	6.3 (2.8 to 9.6)	1.0 (-1.5 to 3.6)
Botswana	37.5 (33.4 to 42.0)	51.6 (46.7 to 56.5)	37.0 (31.6 to 43.2)	30.2 (26.2 to 34.8)	10.1 (5.5 to 15.5)	5.2 (-1.2 to 11.3)	10.4 (3.2 to 18.6)	7.2 (1.6 to 13.1)
Eswatini	32.5 (28.3 to 36.8)	47.7 (43.8 to 51.5)	32.0 (26.2 to 38.2)	28.6 (24.2 to 32.6)	5.1 (-0.8 to 10.8)	7.9 (1.6 to 13.5)	2.9 (-5.3 to 10.8)	2.2 (-4.1 to 7.4)
Lesotho	26.3 (22.2 to 30.5)	44.7 (40.5 to 48.4)	25.2 (20.1 to 30.8)	22.5 (17.4 to 27.0)	0.9 (-4.1 to 6.2)	4.8 (-0.7 to 10.3)	-2.2 (-8.6 to 4.7)	-2.0 (-7.0 to 3.4)
Namibia	39.9 (35.5 to 44.9)	57.5 (52.2 to 63.8)	39.1 (33.8 to 44.8)	32.0 (27.9 to 36.6)	14.3 (7.9 to 20.4)	15.6 (5.8 to 24.0)	13.4 (4.9 to 20.4)	8.5 (2.9 to 13.8)
South Africa	44.6 (42.2 to 46.9)	60.9 (57.4 to 64.2)	45.5 (42.0 to 48.6)	41.4 (39.1 to 43.6)	9.6 (6.7 to 12.7)	17.7 (13.0 to 22.1)	9.6 (5.8 to 13.4)	-0.8 (-3.8 to 2.2)
Zimbabwe	28.6 (25.7 to 31.7)	44.7 (39.9 to 51.1)	27.2 (23.4 to 31.5)	23.6 (20.2 to 27.2)	-2.6 (-6.7 to 2.0)	-1.1 (-8.8 to 7.5)	-4.6 (-9.9 to 1.1)	-2.1 (-6.3 to 2.5)
Western sub-Saharan Africa	29.7 (26.3 to 33.5)	30.5 (26.3 to 34.9)	37.0 (32.6 to 41.7)	32.2 (28.4 to 36.4)	10.3 (6.1 to 14.9)	11.2 (5.4 to 16.9)	10.5 (5.3 to 15.8)	7.2 (3.1 to 11.5)
Benin	31.4 (26.4 to 36.0)	34.5 (28.2 to 41.4)	36.5 (31.2 to 41.9)	32.0 (27.4 to 36.8)	11.3 (5.8 to 16.4)	14.5 (7.2 to 22.1)	9.0 (2.9 to 15.2)	7.3 (1.8 to 12.6)

(Table continues on next page)

	2019 HAQ Index (95% UI)				Absolute change 1990–2019 (95% UI)			
	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)	Overall (0–74 years)	Young (0–14 years)	Working (15–64 years)	Post-working (65–74 years)
(Continued from previous page)								
Burkina Faso	28.5 (24.9 to 32.4)	30.5 (25.0 to 36.1)	33.2 (29.0 to 38.0)	29.3 (25.0 to 33.9)	7.6 (3.4 to 11.8)	8.5 (2.0 to 15.0)	5.0 (-0.6 to 10.9)	3.5 (-1.7 to 8.7)
Cabo Verde	50.2 (47.7 to 52.9)	65.7 (61.7 to 70.2)	51.9 (49.0 to 54.6)	45.4 (42.3 to 48.6)	14.1 (10.6 to 17.4)	22.3 (16.3 to 27.9)	11.6 (8.0 to 15.3)	6.0 (1.8 to 9.9)
Cameroon	33.7 (29.2 to 38.2)	39.9 (34.3 to 46.5)	37.0 (31.7 to 42.7)	33.5 (28.6 to 38.5)	9.8 (4.5 to 15.3)	10.8 (3.6 to 18.9)	7.8 (1.6 to 14.7)	8.0 (2.3 to 13.8)
Chad	23.8 (20.3 to 27.2)	25.5 (20.5 to 32.2)	28.8 (23.9 to 34.1)	26.5 (22.1 to 30.9)	6.3 (2.1 to 10.3)	7.8 (1.9 to 13.4)	6.5 (0.6 to 12.8)	3.4 (-1.5 to 8.0)
Côte d'Ivoire	34.3 (30.4 to 39.4)	40.8 (34.9 to 48.2)	37.3 (32.4 to 42.8)	33.4 (29.0 to 38.5)	11.3 (6.2 to 16.7)	14.1 (6.6 to 21.9)	8.7 (2.7 to 15.3)	7.2 (2.2 to 12.8)
The Gambia	34.7 (31.4 to 39.0)	47.6 (41.5 to 53.7)	36.8 (32.3 to 41.9)	31.7 (27.3 to 37.2)	7.4 (1.8 to 13.2)	17.3 (8.9 to 26.1)	4.3 (-3.8 to 12.3)	2.9 (-4.2 to 10.0)
Ghana	36.1 (32.8 to 40.0)	47.4 (41.3 to 53.9)	38.6 (35.0 to 42.9)	35.2 (31.5 to 38.9)	10.0 (5.5 to 14.9)	13.1 (5.8 to 20.7)	7.8 (2.4 to 13.6)	7.6 (2.2 to 13.3)
Guinea	25.7 (21.4 to 30.5)	27.3 (21.2 to 34.2)	31.4 (26.5 to 36.2)	29.1 (24.8 to 33.9)	8.5 (3.6 to 13.8)	13.5 (6.2 to 20.8)	6.9 (1.0 to 13.0)	3.9 (-1.3 to 9.2)
Guinea-Bissau	24.3 (20.6 to 27.8)	36.6 (31.4 to 41.7)	25.7 (21.7 to 29.9)	23.2 (19.2 to 27.2)	10.6 (5.3 to 16.1)	19.2 (11.7 to 25.7)	8.3 (2.1 to 14.4)	6.6 (0.4 to 12.5)
Liberia	35.7 (31.6 to 40.3)	42.1 (35.0 to 49.3)	39.7 (34.5 to 45.1)	35.7 (30.5 to 41.0)	17.3 (12.3 to 22.3)	29.1 (18.8 to 37.7)	11.9 (5.3 to 18.3)	9.2 (2.9 to 15.1)
Mali	29.6 (24.8 to 35.3)	28.7 (21.9 to 36.6)	35.2 (30.3 to 41.0)	31.7 (26.6 to 37.0)	11.0 (5.5 to 16.1)	12.0 (4.9 to 19.2)	11.9 (5.5 to 17.7)	6.6 (1.0 to 12.0)
Mauritania	42.1 (37.2 to 48.2)	53.1 (45.9 to 60.5)	45.3 (39.6 to 51.7)	40.0 (34.9 to 46.3)	20.0 (14.1 to 26.6)	24.1 (15.6 to 32.6)	20.1 (13.4 to 26.9)	16.4 (10.7 to 22.9)
Niger	26.5 (21.3 to 32.0)	28.1 (20.9 to 37.4)	31.8 (26.5 to 37.9)	27.8 (22.7 to 33.7)	10.4 (4.8 to 15.6)	14.2 (6.7 to 21.4)	9.4 (3.2 to 15.1)	6.4 (1.0 to 11.5)
Nigeria	31.6 (26.0 to 38.0)	30.8 (25.8 to 36.4)	40.1 (32.1 to 49.0)	34.8 (28.0 to 42.4)	11.1 (4.3 to 18.2)	10.9 (3.9 to 17.8)	11.8 (1.7 to 21.5)	8.3 (0.4 to 16.3)
São Tomé and Príncipe	41.4 (37.5 to 45.2)	54.0 (48.3 to 58.6)	43.1 (38.2 to 47.3)	35.6 (31.5 to 39.4)	13.4 (8.1 to 18.0)	28.0 (21.1 to 34.4)	8.4 (1.6 to 13.9)	5.1 (-0.1 to 10.1)
Senegal	34.0 (30.4 to 38.4)	43.3 (38.0 to 49.5)	37.0 (32.5 to 42.3)	33.2 (29.0 to 38.3)	10.9 (5.2 to 16.7)	19.6 (11.8 to 27.7)	7.6 (1.4 to 14.3)	6.2 (-0.6 to 12.4)
Sierra Leone	30.9 (26.1 to 35.9)	30.5 (23.5 to 38.3)	34.8 (29.8 to 39.9)	32.2 (27.4 to 37.3)	9.9 (3.6 to 15.9)	15.0 (7.2 to 22.8)	3.9 (-2.5 to 11.1)	4.8 (-1.7 to 11.3)
Togo	33.5 (29.9 to 37.3)	45.5 (39.7 to 51.0)	35.3 (30.8 to 40.1)	31.2 (27.0 to 35.2)	8.8 (4.0 to 13.4)	17.2 (10.6 to 23.4)	5.6 (-0.4 to 11.9)	4.5 (-0.9 to 9.8)

HAQ=Healthcare Access and Quality. SDI=Socio-demographic Index. UI=uncertainty interval.

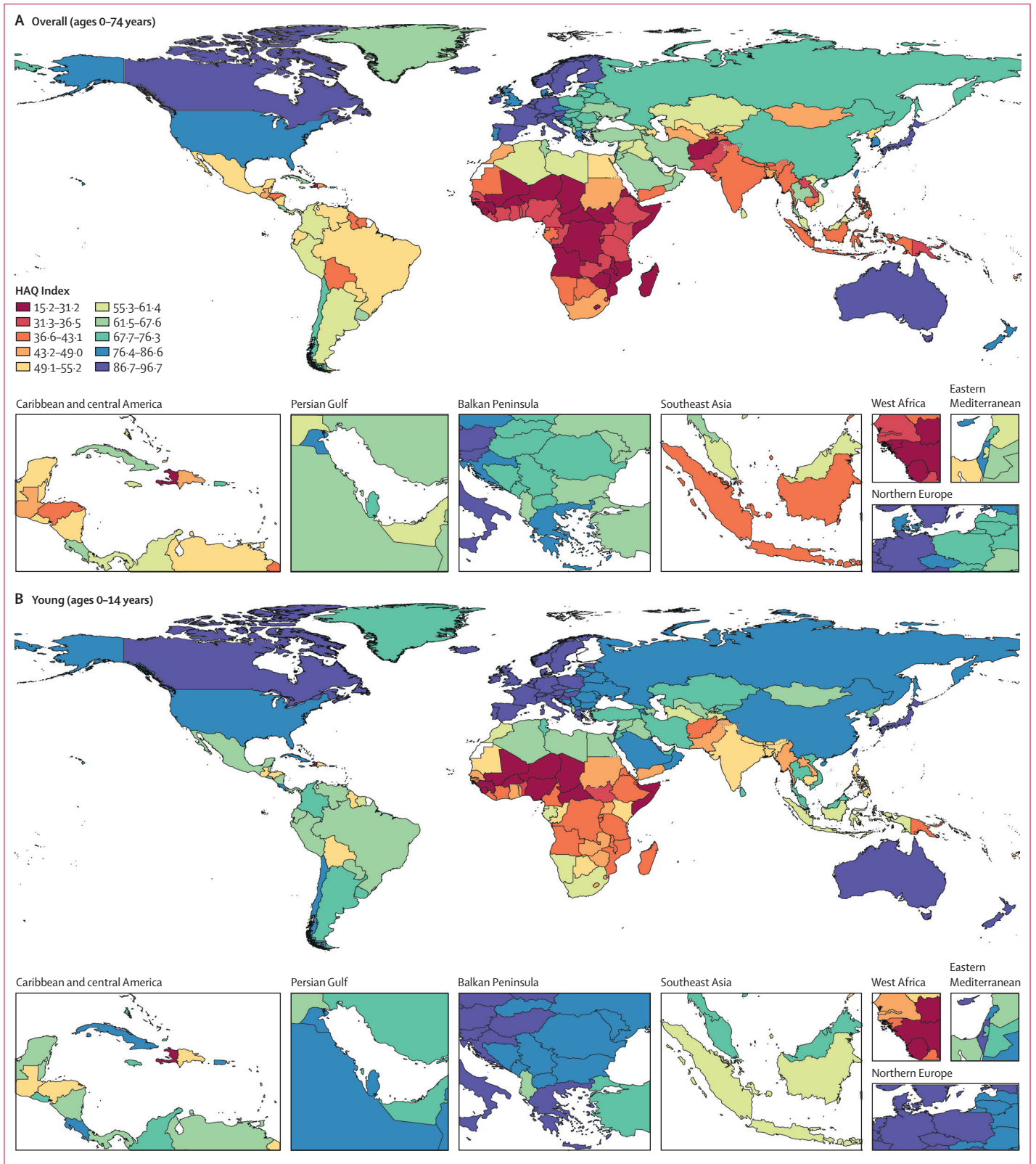
Table: HAQ Index estimates, by location, in 2019 and absolute change from 1990 to 2019, overall and by select age group

assessed whether the HAQ Index increased more in countries starting with lower HAQ Index scores. We ran ordinary least squares regressions of the absolute change and the average annual percent change in the HAQ Index between 1990 and 2019 on the 1990 HAQ Index score. In a sensitivity analysis, we included the 1990–2019 change in SDI as a covariate in this regression. A regression of HAQ Index on SDI between 1990 and 2019, with standard errors clustered by location, was also conducted to assess the share of variation in HAQ Index explained by SDI, as represented by R^2 . Second, we examined whether the coefficient of variation (the standard deviation divided by the mean) calculated for each year and age group declined over time, which would indicate that HAQ Index scores have become more similar since 1990. Third, we quantified the 1990–2019

change in the gap between the average HAQ Index in high-SDI-quintile countries versus the average HAQ Index in the four other SDI quintiles. Wherever results are aggregated, we weight values by each country's 2019 population.

Uncertainty analysis

We estimated uncertainty by taking 1000 draws from the posterior distribution for each cause of mortality amenable to health care and then used those draws to estimate the HAQ Index for each location and year. We ordered the draws and defined the 95% uncertainty interval (UI) by selecting the 25th draw for the lower bound of uncertainty and the 975th draw for the upper bound of uncertainty. The mean was taken across the draws to calculate the point estimate. Analyses were done with R version 3.1.2.



(Figure 1 continues on next page)

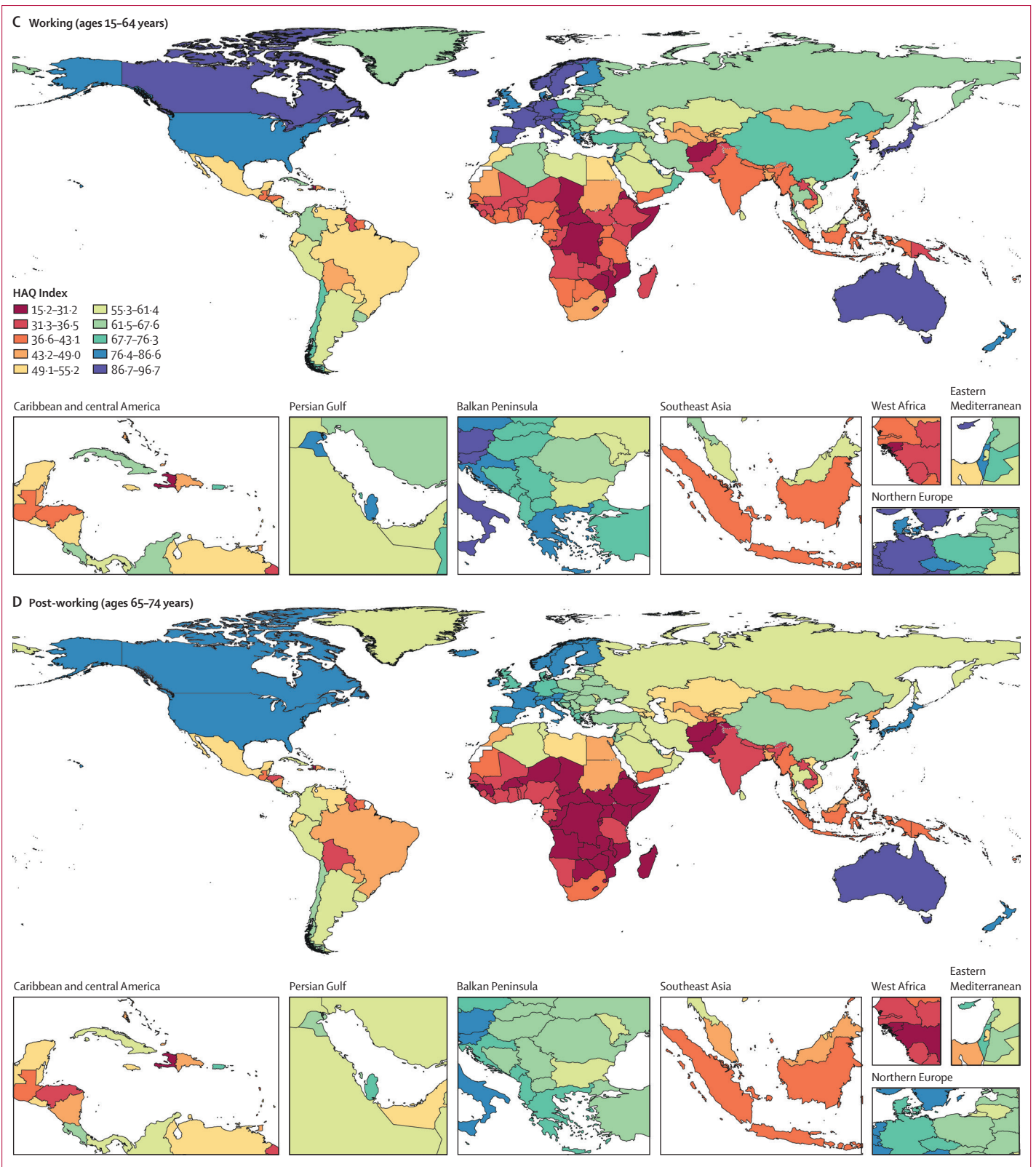


Figure 1: HAQ Index, overall and by select age group, 2019, by country and territory
 HAQ=Healthcare Access and Quality.



Figure 2: Change over time in HAQ Index, 1990–2019, overall and by select age group
HAQ=Healthcare Access and Quality. SDI=Socio-demographic Index.

Role of the funding source

The funder of the study had no role in the study design, data collection, data analysis, data interpretation, or writing of the report.

Results

In 2019, the global mean HAQ Index was 54.4 (95% UI 52.1–55.7), ranging from 15.2 to 93.1 across all countries and territories (table, figure 1A). The HAQ Index scores differed depending on levels of development and super-region. In high-SDI countries, the average HAQ Index score was 83.4 (82.4–84.3) in 2019, whereas low-SDI countries had an average HAQ Index score of 30.7 (28.6–33.0). Across GBD super-regions, the high-income region had the highest HAQ Index score (83.9, 82.6–85.0) and the sub-Saharan African region had the lowest average score (29.0, 26.7–31.7).

Globally, the overall HAQ Index increased by 19.6 points between 1990 and 2019, with improvements in HAQ Index scores in 185 of 204 countries and territories. Zimbabwe was the only country that did not improve (for others, the UIs overlapped). In 1990, Zimbabwe ranked 133rd globally, but in 2019 it dropped to 194th, a decline driven primarily by lack of progress across four diseases: inguinal, femoral, and abdominal hernia; idiopathic epilepsy; lower respiratory infections; and tuberculosis—but nearly all conditions failed to improve. Lesotho also had a substantial drop in rank order over the same period, falling from 151st to 185th globally. Although HAQ Index scores improved minimally for Central African Republic and Somalia, the two countries saw no change in global rank order over the time period. The gap between the

lowest and highest HAQ Index scores in 2019 (77.9, 95% UI 15.2–93.1) was larger than the gap in 1990 (69.9, 9.7–79.6). High-SDI-quintile countries increased by 15.1 points, as compared with 25.9 points in middle-SDI and 11.8 points in low-SDI countries (figure 2). Across regions, increases were highest in east Asia (32.4 point increase), Andean Latin America (22.7 point increase), and high-income Asia Pacific (19.6 point increase). The smallest regional improvements over the time period occurred in Oceania (3.9 point increase), southern sub-Saharan Africa (6.3 point increase), and central Asia (8.2 point increase).

In 2019, the young age group had a global HAQ Index score of 64.5 (95% UI 62.9–66.0; figure 1B). This is an increase of 22.5 points (19.9–24.7) or 66.0% (52.8–77.0) relative to 1990 (table, figure 3). High-SDI countries had an average young HAQ Index of 89.0 (88.2–89.8) versus 40.4 (37.1–44.0) in low-SDI countries in 2019 (table, figure 2).

The global HAQ Index was 55.9 (95% UI 54.3–57.5) for the working age group in 2019 (figure 1C). The average improved by 17.2 points (15.2–19.1) or 50.8% (41.6–60.1) over 1990–2019. In 2019, the working HAQ Index was 82.8 (81.6–83.7) in high-SDI countries, 49.0 (46.0–52.0) points higher than the scores in low-SDI countries on average (33.8, 31.0–36.6; figure 2).

The post-working group had a global HAQ Index of 51.2 (95% UI 49.6–52.8; figure 1D). The post-working group improved by 15.1 points (13.2–17.0) or 45.6% (36.2–55.9) from its 1990 score. High-SDI countries' average HAQ Index (79.1, 77.7–80.2) was 48.7 (45.8–51.5) points higher than low-SDI

countries' average HAQ Index in 2019 (30.4, 27.8–33.0; figure 2).

In percentage terms, the young HAQ Index increased more than the working and post-working HAQ Indices from 1990 to 2019 (figure 3). Countries with lower scores in 1990 had higher percentage increases in all three age groups but relative convergence was similarly fastest among the young and slowest among the post-working followed by the working age groups (figure 4). HAQ Index scores in countries with the lowest scores for the young group in 1990 increased more than countries with higher scores in absolute terms as well (figure 4): we found that for each additional 10 points in the 1990 young HAQ Index, scores increased 1.3 points more slowly ($p < 0.0001$). In contrast, countries with higher scores increased faster for the working and post-working age groups: for each additional 10 points in the 1990 score, the 2019 HAQ Index was 1.1 points higher for the working group ($p < 0.0001$) and 2.1 points higher for the post-working group ($p < 0.0001$). Over 1990–2019, the coefficient of variation declined most in the young group (0.128, 95% UI 0.082 to 0.167) as compared with the working (0.039, 0.008 to 0.066) and post-working (0.004, –0.024 to 0.029) groups.

HAQ Index scores and trends over time varied substantially by SDI quintile. The 1990–2019 percentage increases in the young HAQ Index score were highest in the three lowest SDI quintiles (figure 3). Increases were lowest among the young age group in high-SDI countries (15.6%, 95% UI 14.7–16.6). Regressing HAQ Index on SDI over 1990–2019, 89% of variation in the young HAQ Index, as represented by the R^2 , was explained by just SDI, as compared with 75% of variation in the working group HAQ Index and 77% in the post-working group HAQ Index (see appendix p 40 for full regression results). The gap between the high-SDI-quintile HAQ Index scores versus other locations decreased substantially in the young age group (figure 5), with the biggest absolute declines in the middle-SDI group (17.0, 14.8–19.0), followed by the low-middle (9.5, 3.9–13.5) and high-middle (6.3, 4.9–7.8) SDI groups. For the working and post-working age groups, only middle-SDI countries reduced this gap. In contrast, low-SDI countries increased the gap with high-SDI countries by 5.3 (2.4–8.2) points in the working group and 9.9 (7.3–12.4) in the post-working group.

Discussion

Our analysis showed improvements in the overall and select age group HAQ Indices in almost every country and territory between 1990 and 2019. However, disparities in HAQ Index scores across locations persisted into 2019. Between 1990 and 2019, the gap with the high-SDI quintile in the young group declined or was steady for all SDI levels. In the two other age groups, only the middle-SDI-quintile countries closed the average gap with high-SDI-quintile countries, and the gap for the

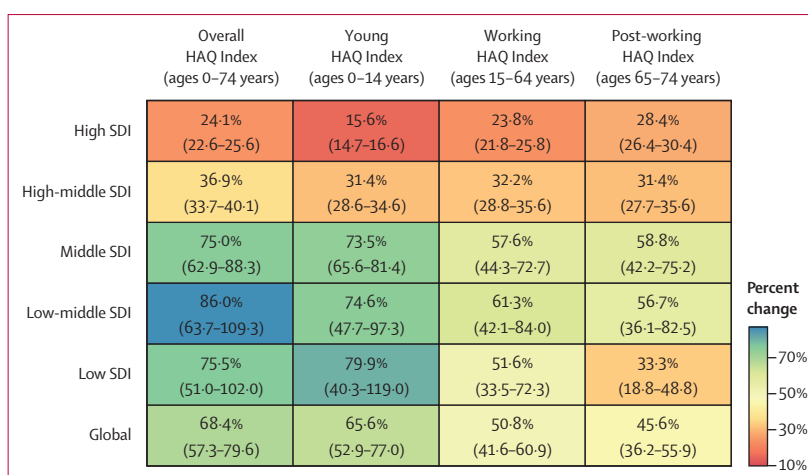


Figure 3: Percentage change in HAQ Index by select age group and SDI quintile between 1990 and 2019

Values in parentheses are 95% uncertainty intervals. HAQ=Healthcare Access and Quality. SDI=Socio-demographic Index.

low-SDI-quintile countries grew. While we find evidence of convergence in the young HAQ Index, social and economic development remains a crucial predictor of levels and trends in health-care access and quality.

Countries with higher social and economic development had better performance in the HAQ Index—nearly 50 points separates the lowest and highest SDI quintiles for the overall and age-group scores. Social and economic development supports countries in raising more funds for health, pooling resources for health insurance, improving the health-care workforce, and other factors that enhance the ability of health systems to improve health-care access and quality.^{46,56,57} Greater resources also enable purchasing of more expensive technology, equipment, and pharmaceuticals to prevent and treat disease.

This study emphasised major improvements in the HAQ Index for the young age group between 1990 and 2019. Countries with lower scores in the past have made strides in closing disparities with highest performers on the HAQ Index. This observation aligns with the convergence theory advanced by the *Lancet* Commission on Investing in Health—that the burden of infectious diseases and maternal, neonatal, and child health in high-mortality LMICs could converge to the rates seen in best-performing middle-income countries.⁵⁸ More substantial improvements in the young HAQ Index relative to the other age groups might be related to the billions of dollars in development assistance disbursed for these health areas over the past 30 years,⁵⁹ and the creation and diffusion of relatively effective and cheap technologies, such as vaccines and oral rehydration salts that reduced mortality due to vaccine-preventable diseases and diarrhoea.^{60–64}

In contrast, our analysis shows less convergence in the post-working and working groups. This observation can be explained in part by comparatively lower funding for

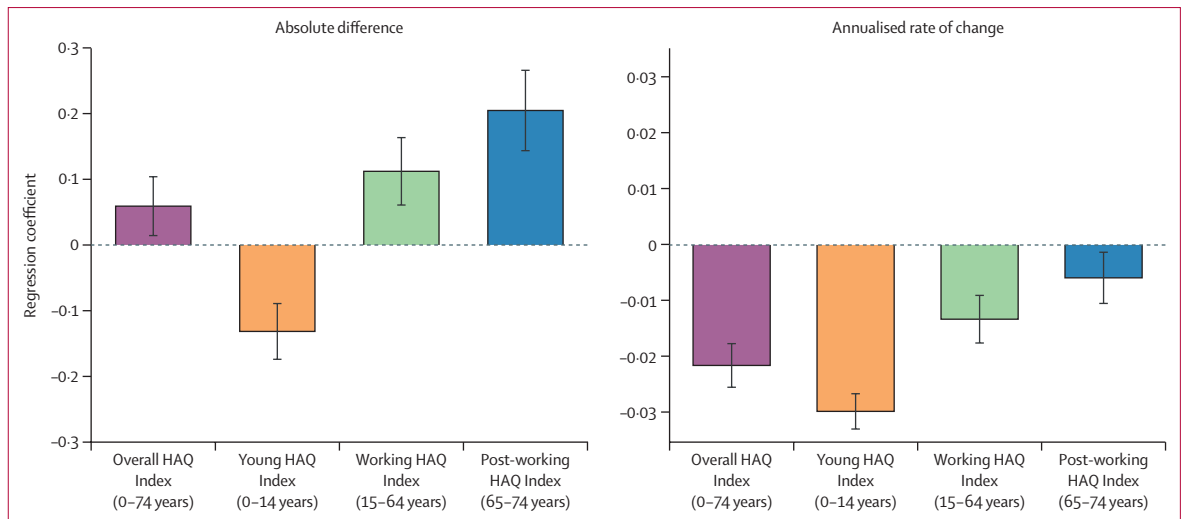


Figure 4: Testing for convergence: absolute and relative change in HAQ Index, 1990–2019, versus 1990 HAQ Index, overall and by select age group Bars represent the coefficients estimated from a linear regression of the absolute or relative (annual average percent) change in the HAQ Index between 1990 and 2019 on the 1990 HAQ Index value, conducted for each group separately. Black error bars represent the coefficients' 95% uncertainty intervals. HAQ=Healthcare Access and Quality.

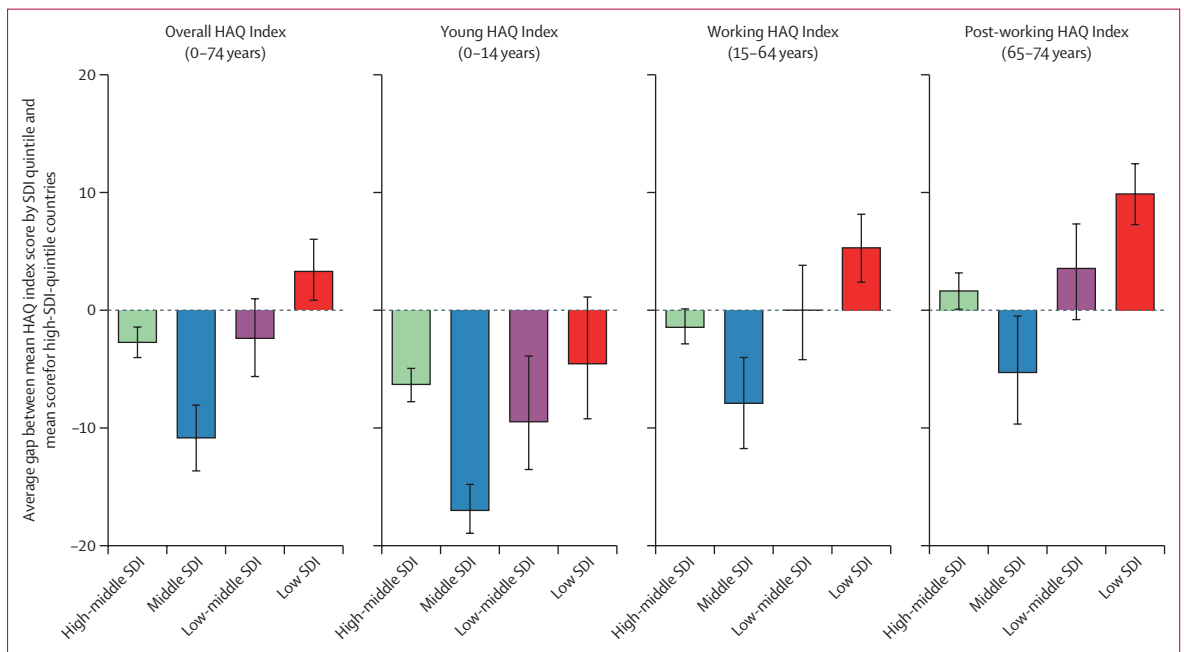


Figure 5: Change in gap in HAQ Index score between high-SDI quintile and other quintiles, overall and by select age group, 1990–2019 Black error bars represent 95% uncertainty intervals. HAQ=Healthcare Access and Quality. SDI=Socio-demographic Index.

NCD care; in addition, conditional on the same set of diseases and conditions, averting mortality for older people requires more complex responses, a higher level of organisational capacity, higher costs, and different technology, treatment, and diagnostics.^{65–69} Differences could also be explained by how health systems evolve to meet their populations' needs. High-SDI countries had a higher median age than the low-SDI countries with the lowest average HAQ Index scores in 2019.¹ More broadly, some of these shortcomings might be due to the lack of

robust primary health care. Health systems should address health needs across the life course, along the continuum of care, and focus on health more holistically rather than homing in on a single disease.⁷⁰

Given transitions in burden of disease and ageing, lags in improving health-care access and quality for the working and post-working age groups could have broader social and economic consequences. In the absence of formal health system capacity for elder care, women and children often bear the brunt of care-taking duties, with

implications for gender equity and educational attainment.^{71,72} If lack of access to high-quality health care depresses labour force participation or productivity among the working age group, countries going through the demographic transition might be unable to benefit from the demographic dividend,⁷³ with implications for tax revenue, intra-family income transfers, and the broader ability of countries to confront increasing dependency ratios (ratio of the working age adult population to populations typically not working: aged 0–14 years and ≥ 65 years) forecasted for decades to come.¹

Future analyses of the HAQ Index should focus on the direct and indirect effects the COVID-19 pandemic. The COVID-19 pandemic threatens to reverse the gains in health-care access and quality observed over the past 30 years. Although most COVID-19 deaths occur among older people, the pandemic might well threaten health-care access and quality gains achieved at all ages, through lack of health system capacity, drains on infrastructure, staff, and other health system resources, or alternatively through the channel of reduced social and economic development.⁷⁴ Particularly as COVID-19 vaccination rates rise in high-income countries while lower-income countries continue to face supply and access shortages, the ongoing pandemic could further increase gaps in health-care access and quality between low-SDI and high-SDI countries. Even so, the COVID-19 pandemic has also brought about innovation in the provision of health care, catalysing an expansion in the use of telemedicine that could have lasting benefits, including for the equity of health-care access and quality.⁷⁵

This study has a number of important strengths. This analysis provides a comparable measure of health-care access and quality for 204 countries and territories over 1990–2019. It examines differences in health-care access and quality by age, shedding light on one area of health system performance across the life course.

Some of the limitations of the HAQ Index have been highlighted in the previous analyses.^{12,13,21} First, we were not able to further disaggregate characteristics of health-care access or quality, including separating quality from other features of health care,^{76,77} determining the ability of any particular client or group to seek and obtain care, or estimating the role of acceptability or cultural barriers.⁷⁸ Second, the Nolte and McKee list has not been updated, resulting in the omission of some causes of death that could be amenable to timely and appropriate health care. Future analyses should consider expanding this list of causes. Third, our analysis is subject to limitations in the GBD cause of death estimation, such as death misclassifications and lack of complete vital registration records differing by country. Fourth, using MIRs for cancers and other causes instead of RSDRs provided an improved indicator of country-level differences in access to effective care, but broader MIR use is limited by the sparsity of data and methodological demands. Fifth, we only consider amenable mortality up to the age of 74 years

because we chose to be consistent with past versions of the HAQ Index and with Nolte and McKee's views that mortality might not be amenable with quality health-care access after age 75 years. Future analyses should interrogate this view and consider whether extending the age range beyond age 74 years would be more consistent with life expectancy. Sixth, grouping populations by the OECD definition of working-age connects our analysis with a more high-income country perspective; alternative age groupings could be useful and pertinent depending on the country context. Seventh, we recognise that the direct and indirect determinants of health are broad and varied. Multiple factors outside of the immediate health sector, including policies, social determinants, and other drivers, could affect access to quality health care—eg, access contingent upon employment or age. Eighth, we acknowledge that uncertainty can differ depending on the age group, since different data quality, population size, and cause variation exist across age. This could affect both the bounds set when scaling MIRs and RSDRs to 0–100 as well as in the analysis of coefficient of variation over time; however, we believe the effect to be minimal.

Understanding the causal pathways and drivers is a vital research endeavour; however, to provide a more focused analysis, we limited this index to evaluation of health services only. Finally, in future research, we propose that two areas of work should be prioritised: the incorporation of how access and quality of care expressly impact non-fatal outcomes, and further segmentation of the HAQ Index by age—including for the important group of adolescents.

Health-care access and quality has improved in almost all countries and territories since 1990, progress which is essential for achieving effective universal health coverage and health for all.¹³ However, major gaps in the HAQ Index persist across countries. Convergence in performance for the young population, although far from fully realised, suggests that the major investments, technology innovations, and policy priority focused on these groups are yielding successes. The slower convergence between best-performing health systems and other health systems in the HAQ Index for working and post-working populations is concerning as the demographic transition looms large. Further prioritisation of investments and cost-effective health care is essential for addressing health-care needs, maintaining a healthy workforce, and ensuring fiscal sustainability as populations age worldwide.

GBD 2019 Healthcare Access and Quality Collaborators

Annie Haakenstad*, Jamal Akeem Yearwood*, Nancy Fullman, Corinne Bintz, Kelly Bienhoff, Marcia R Weaver, Vishnu Nandakumar, Jonah N Joffe, Kate E LeGrand, Megan Knight, Cristiana Abbafati, Mohsen Abbasi-Kangevari, Amir Abdoli, Roberto Ariel Abeldaño Zuñiga, Isaac Akinkunmi Adedeji, Victor Adekanmbi, Olatunji O Adetokunboh, Muhammad Sohail Afzal, Saira Afzal, Marcela Agudelo-Botero, Bright Opoku Ahinkorah, Sajjad Ahmad, Ali Ahmadi, Sepideh Ahmadi, Ali Ahmed, Tarik Ahmed Rashid, Budi Aji, Wuraola Akande-Sholabi,

- Khurshid Alam, Hanadi Al Hamad, Robert Kaba Alhassan, Liaqat Ali, Vahid Alipour, Syed Mohamed Aljunid, Edward Kwabena Ameyaw, Tarek Tawfik Amin, Hubert Amu, Dickson A Amugsi, Robert Ancuceanu, Pedro Prata Andrade, Afifa Anjum, Jalal Arabloo, Morteza Arab-Zozani, Hany Ariffin, Judie Arulappan, Zahra Aryan, Tahira Ashraf, Desta Debalkie Atnafu, Alok Atreya, Marcel Ausloos, Leticia Avila-Burgos, Getinet Ayano, Martin Amogre Ayanore, Samad Azari, Ashish D Badiye, Atif Amin Baig, Mohan Bairwa, Shankar M Bakkannavar, Shrikala Baliga, Palash Chandra Banik, Till Winfried Bärnighausen, Fabio Barra, Amadou Barrow, Sanjay Basu, Mohsen Bayati, Rebuma Belete, Arielle Wilder Bell, Devidas S Bhagat, Akshaya Srikanth Bhagavathula, Pankaj Bhardwaj, Nikha Bhardwaj, Sonu Bhaskar, Kritika Bhattacharyya, Zulfiqar A Bhutta, Sadia Bibi, Ali Bijani, Boris Bikbov, Antonio Biondi, Obasanjo Afolabi Bolarinwa, Aime Bonny, Hermann Brenner, Danilo Buonsenso, Katrin Burkart, Reinhard Busse, Zahid A Butt, Nadeem Shafique Butt, Florentino Luciano Caetano dos Santos, Lucero Cahuana-Hurtado, Luis Alberto Cámera, Rosario Cárdenas, Vera L A Carneiro, Ferrán Catalá-López, Joht Singh Chandan, Jaykaran Charan, Prachi P Chavan, Simiao Chen, Shu Chen, Sonali Gajanan Choudhari, Enayet Karim Chowdhury, Mohiuddin Ahsanul Kabir Chowdhury, Massimo Cirillo, Barbara Corso, Omid Dadras, Saad M A Dahlawi, Xiaochen Dai, Lalit Dandona, Rakhi Dandona, William James Dangel, Claudio Alberto Dávila-Cervantes, Kairat Davletov, Keshab Deuba, Meghnath Dhimal, Mandira Lamichhane Dhimal, Shirin Djalalinia, Huyen Phuc Do, Leila Doshmangir, Bruce B Duncan, Andem Effiong, Elham Ehsani-Chimeh, Islam Y Elgendy, Muhammed Elhadi, Iman El Sayed, Maha El Tantawi, Daniel Asfaw Erku, Sharareh Eskandarieh, Jawad Fares, Farshad Farzadfar, Simone Ferrero, Lorenzo Ferro Desideri, Florian Fischer, Nataliya A Foigt, Masoud Foroutan, Takeshi Fukumoto, Peter Andras Gaal, Santosh Gaihre, William M Gardner, Tushar Garg, Abera Getachew Obsa, Mansour Ghafourifard, Ahmad Ghashghae, Nermin Ghith, Syed Amir Gilani, Paramjit Singh Gill, Salime Goharinezhad, Mahaveer Golechha, Jenny S Guadamuz, Yuming Guo, Rajat Das Gupta, Rajeev Gupta, Vivek Kumar Gupta, Veer Bala Gupta, Mohammad Hamiduzzaman, Asif Hanif, Josep Maria Haro, Ahmed I Hasaballah, Md Mehedi Hasan, M Tasdik Hasan, Abdawahab Hashi, Simon I Hay, Khezhar Hayat, Mohammad Heidari, Golnaz Heidari, Nathaniel J Henry, Claudiu Herteliu, Ramesh Holla, Sahadat Hossain, Sheikh Jamal Hossain, Mohammad Bellal Hossain Hossain, Mehdi Hosseinzadeh, Sorin Hostiuc, Soodabeh Hoveidamaneh, Vivian Chia-rong Hsieh, Guoqing Hu, Junjie Huang, M Mamun Huda, Susan C Ifeagwu, Kevin S Ikuta, Olayinka Stephen Ilesanmi, Seyed Sina Naghibi Irvani, Rakibul M Islam, Sheikh Mohammed Shariful Islam, Nahlah Elkudssiah Ismail, Hiroyasu Iso, Gaetano Isola, Ramaiah Itumalla, Masao Iwagami, Mohammad Ali Jahani, Nader Jahanmehar, Rajesh Jain, Mihajlo Jakovljevic, Manthan Dilipkumar Janodia, Sathish Kumar Jayapal, Shubha Jayaram, Ravi Prakash Jha, Jost B Jonas, Tamas Joo, Nitin Joseph, Mikko Jürisson, Ali Kabir, Leila R Kalankesh, Rohollah Kalhor, Aruna M Kamath, Kaloyan Kamenov, Himal Kandel, Rami S Kantar, Neeti Kapoor, Marina Karanikolos, Srinivasa Vittal Katikireddi, Taras Kavetsky, Norito Kawakami, Gbenga A Kayode, Leila Keikavoosi-Arani, Mohammad Keykhaei, Yousef Saleh Khader, Himanshu Khajuria, Rovshan Khalilov, Mohammad Khammaria, Md Nuruzzaman Khan, Moien AB Khan, Maseer Khan, Mehdi Khezeli, Min Seo Kim, Yun Jin Kim, Sezer Kisa, Adnan Kisa, Vitalii Klymchuk, Kamrun Nahar Koly, Oleksii Korzh, Soewarta Kosen, Parvaiz A Koul, Barthelemy Kuate Defo, G Anil Kumar, Dian Kusuma, Hmwe Hmwe Kyu, Anders O Larsson, Savita Lasrado, Wei-Chen Lee, Yo Han Lee, Chiachi Bonnie Lee, Shanshan Li, Giancarlo Lucchetti, Preetam Bhalchandra Mahajan, Azeem Majeed, Alaa Makki, Reza Malekzadeh, Ahmad Azam Malik, Deborah Carvalho Malta, Mohammad Ali Mansournia, Lorenzo Giovanni Mantovani, Adolfo Martinez-Valle, Francisco Rogerlândio Martins-Melo, Seydeh Zahra Masoumi, Manu Raj Mathur, Richard James Maude, Pallab K Maulik, Martin McKee, Walter Mendoza, Ritesh G Menezes, George A Mensah, Atte Meretoja, Tuomo J Meretoja, Tomislav Mestrovic, Irmina Maria Michalek, Erkin M Mirrahimov, Awoke Misganaw, Sanjeev Misra, Babak Moazen, Mokhtar Mohammadi, Shafiu Mohammed, Modhurima Moitra, Ali H Mokdad, Mariam Molokhia, Lorenzo Monasta, Mohammad Ali Moni, Ghobad Moradi, Rafael Silveira Moreira, Jonathan F Mosser, Ebrahim Mostafavi, Simin Mouodi, Ahmarshah Jayaraman Nagarajan, Chie Nagata, Mohsen Naghavi, Vinay Nangia, Sreenivas Narasimha Swamy, Aparna Ichalngod Narayana, Bruno Ramos Nascimento, Hasan Nassereldine, Biswa Prakash Nayak, Javad Nazari, Ionut Negoii, Samata Nepal, Sandhya Neupane Kandel, Josephine W Ngunjiri, Huong Lan Thi Nguyen, Cuong Tat Nguyen, Dina Nur Anggraini Ningrum, Jean Jacques Noubiap, Bogdan Oancea, Onome Bright Oghenetege, In-Hwan Oh, Andrew T Olagunju, Babayemi Oluwaseun Olakunde, Ahmed Omar Bali, Emad Omer, Obinna E Onwujekwe, Adrian Otoiu, Jagadish Rao Padubidri, Raffaele Palladino, Adrian Pana, Songhomitra Panda-Jonas, Seithikurippu R Pandi-Perumal, Shahina Pardhan, Deepak Kumar Pasupula, Praveen Kumar Pathak, George C Patton, Shrikant Pawar, Jeevan Pereira, Manju Paliana, Bakhtiar Piroozii, Vivek Podder, Khem Narayan Pokhrel, Maarten J Postma, Sergio I Prada, Zahiruddin Quazi Syed, Navid Rabiee, Raghu Anekal Radhakrishnan, Md. Mosfequr Rahman, Mosiur Rahman, Mahfuzar Rahman, Mohammad Hifz Ur Rahman, Amir Masoud Rahmani, Chhabhi Lal Ranabhat, Chyitra R Rao, Sowmya J Rao, Davide Rasella, Salman Rawaf, David Laith Rawaf, Lal Rawal, Andre M N Renzaho, Bhageerathy Reshmi, Serge Resnikoff, Aziz Rezapour, Seyed Mohammad Riahi, Rezaul Karim Ripon, Simona Sacco, Masoumeh Sadeghi, Umar Saeed, Amirhossein Sahebkar, Biniyam Sahiledengle, Harihar Sahoo, Maitreyi Sahu, Joseph S Salama, Payman Salamati, Abdallah M Samy, Juan Sanabria, Milena M Santric-Milicevic, Brijesh Sathian, Monika Sawhney, Maria Inês Schmidt, Abdul-Aziz Seidu, Sadaf G Sepanlou, Allen Seylani, Masood Ali Shaikh, Aziz Sheikh, Adithi Shetty, Mika Shigematsu, Rahman Shiri, K M Shivakumar, Azad Shokri, Jasvinder A Singh, Dharendra Narain Sinha, Valentin Yurieovich Skryabin, Anna Aleksandrovna Skryabina, Ahmad Sofi-Mahmudi, Raúl A R C Sousa, Jacqueline H Stephens, Jing Sun, Miklós Szócska, Rafael Tabarés-Seisdedos, Hooman Tadbiri, Animum Tagele Tamiru, Kavumpurathu Raman Thankappan, Roman Topor-Madry, Marcos Roberto Tovani-Palone, Mai Thi Ngoc Tran, Bach Xuan Tran, Niharika Tripathi, Jaya Prasad Tripathy, Christopher E Troeger, Deinzal Robles Uezono, Saif Ullah, Anayat Ullah, Bhaskaran Unnikrishnan, Marco Vacante, Sahel Valadan Tahbaz, Pascual R Valdez, Milena Vasic, Massimiliano Veroux, Dominique Vervoort, Francesco S Violante, Sergey Konstantinovich Vladimirov, Vasily Vlassov, Bay Vo, Yasir Waheed, Richard G Wamai, Yuan-Pang Wang, Yanzhong Wang, Paul Ward, Taweewat Wiangkham, Lalit Yadav, Seyed Hossein Yahyazadeh Jabbari, Kazumasa Yamagishi, Sanni Yaya, Vahid Yazdi-Feyzabadi, Sihan Yi, Vahit Yiğit, Naohiro Yonemoto, Mustafa Z Younis, Chuanhua Yu, Ismaeel Yunusa, Sojib Bin Zaman, Mikhail Sergeevich Zastrozhin, Zhi-jiang Zhang, Chenwen Zhong, Yves Miel H Zuniga, Stephen S Lim, Christopher J L Murray, Rafael Lozano.
- *Contributed equally to the work.
- Affiliations**
 Institute for Health Metrics and Evaluation (A Haakenstad ScD, N Fullman MPH, C Bintz BA, K Bienhoff MA, Prof M R Weaver PhD, V Nandakumar MS, J N Joffe MS, K E LeGrand MPH, M Knight BS, K Burkart PhD, X Dai PhD, Prof L Dandona MD, Prof R Dandona PhD, W J Dangel Med, W M Gardner AB, Prof S I Hay FMedSci, K S Ikuta MD, H H Kyu PhD, T Mestrovic PhD, M Moitra MPH, A H Mokdad PhD, J F Mosser MD, Prof M Naghavi PhD, H Nassereldine MD, M Sahu MS, J S Salama MSc, C E Troeger MPH, Prof S S Lim PhD, Prof C J L Murray DPhil, Prof R Lozano MD), Department of Health Metrics Sciences, School of Medicine (Prof M R Weaver PhD, K Burkart PhD, X Dai PhD, Prof R Dandona PhD, Prof S I Hay FMedSci, H H Kyu PhD, A Misganaw PhD, A H Mokdad PhD, Prof M Naghavi PhD, Prof S S Lim PhD, Prof C J L Murray DPhil, Prof R Lozano MD), Division of Allergy and Infectious Diseases (K S Ikuta MD), Department

of Anesthesiology & Pain Medicine (A M Kamath MD), University of Washington, Seattle, WA, USA; Department of Global Health and Population (A Haakenstad ScD), Brigham and Women's Hospital (Z Aryan MD), T.H. Chan School of Public Health (Prof T W Bärnighausen MD), Center for Primary Care (S Basu PhD), Department of Global Health and Social Medicine (A W Bell MSW), Division of Cardiology (I Y Elgendy MD), Division of General Internal Medicine (Prof A Sheikh MD), Harvard University, Boston, MA, USA; Department of Nutrition (J A Yearwood MPH), Gates Ventures, Seattle, WA, USA; Department of Juridical and Economic Studies (C Abbafati PhD), La Sapienza University, Rome, Italy; Non-communicable Diseases Research Center (M Abbasi-Kangevari MD, Z Aryan MD, Prof F Farzadfar DSc, M Keykhaei MD), National Institute for Health Research (E Ehsani-Chimeh PhD), Multiple Sclerosis Research Center (S Eskandarieh PhD), Students' Scientific Research Center (SSRC) (M Keykhaei MD), Digestive Diseases Research Institute (Prof R Malekzadeh MD, S G Sepanlou MD), Department of Epidemiology and Biostatistics (M Mansournia PhD), Sina Trauma and Surgery Research Center (Prof P Salamati MD), Tehran University of Medical Sciences, Tehran, Iran; Zoonoses Research Center (A Abdoli PhD), Jahrom University of Medical Sciences, Jahrom, Iran; Postgraduate Department (Prof R A Abeldaño Zuñiga PhD), University of Sierra Sur, Miahuatlan de Porfirio Diaz, Mexico; National Research Council of Mexico, Mexico City, Mexico (Prof R A Abeldaño Zuñiga PhD); Department of Sociology (I A Adedeji PhD), Olabisi Onabanjo University, Ago-Iwoye, Nigeria; Department of Obstetrics & Gynecology (V Adekanmbi PhD), The Office of Health Policy & Legislative Affairs (W Lee PhD), University of Texas, Galveston, TX, USA; DSI-NRF Centre of Excellence for Epidemiological Modelling and Analysis (SACEMA) (O O Adetokunboh PhD), Stellenbosch University, Stellenbosch, South Africa; Division of Epidemiology & Biostatistics (O O Adetokunboh PhD), Stellenbosch University, Cape Town, South Africa; Department of Life Sciences (M S Afzal PhD), University of Management and Technology, Lahore, Pakistan; Department of Community Medicine (Prof S Afzal PhD), King Edward Memorial Hospital, Lahore, Pakistan; Department of Public Health (Prof S Afzal PhD), Public Health Institute, Lahore, Pakistan; Center for Policy, Population & Health Research (Prof M Agudelo-Botero PhD), Health Policy and Population Research Center (CIPPS) (A Martinez-Valle PhD), National Autonomous University of Mexico, Mexico City, Mexico; The Australian Centre for Public and Population Health Research (ACPPHR) (B O Ahinkorah MPH), School of Computing Sciences (Prof J Sun PhD), University of Technology Sydney, Sydney, NSW, Australia; Department of Health and Biological Sciences (S Ahmad PhD), Abasin University, Peshawar, Pakistan; Department of Epidemiology and Biostatistics (A Ahmadi PhD), Community-Oriented Nursing Midwifery Research Center (M Heidari PhD), Shahrekord University of Medical Sciences, Shahrekord, Iran; Department of Epidemiology (A Ahmadi PhD), School of Advanced Technologies in Medicine (S Ahmadi PhD), Virtual School of Medical Education & Management (N Jahanmehr PhD), Prevention of Cardiovascular Disease Research Center (N Jahanmehr PhD), Shahid Beheshti University of Medical Sciences, Tehran, Iran; School of Pharmacy (A Ahmed Mphil), Monash University, Bandar Sunway, Malaysia; Department of Pharmacy (A Ahmed Mphil), Quaid I Azam University Islamabad, Islamabad, Pakistan; Department of Computer Science and Engineering (T Ahmed Rashid PhD), University of Kurdistan Hewler, Erbil, Iraq; Faculty of Medicine and Public Health (B Aji DrPH), Jenderal Soedirman University, Purwokerto, Indonesia; Department of Clinical Pharmacy and Pharmacy Administration (W Akande-Sholabi PhD), Department of Community Medicine (O S Ilesanmi PhD), Department of Obstetrics and Gynecology (O B Oghenetega MSc), University of Ibadan, Ibadan, Nigeria; Geriatric and Long Term Care Department (H Al Hamad MD, B Sathian PhD), Rumailah Hospital (H Al Hamad MD), Hamad Medical Corporation, Doha, Qatar; Murdoch Business School (K Alam PhD), Murdoch University, Perth, WA, Australia; Institute of Health Research (R K Alhassan PhD), Department of Population and Behavioural Sciences (H Amu PhD), Department of Health Policy Planning and Management (M A Ayanore PhD), University of Health and Allied Sciences, Ho, Ghana; Department of Biological Sciences (L Ali PhD), Multidisciplinary Department (A Ullah MS), National University of Medical Sciences (NUMS), Rawalpindi, Pakistan; Health Management and Economics Research Center (V Alipour PhD, J Arabloo PhD, A Rezapour PhD), Department of Health Economics (V Alipour PhD), Hospital Management Research Center (S Azari PhD), Preventive Medicine and Public Health Research Center (S Goharinezhad PhD), Minimally Invasive Surgery Research Center (A Kabir MD), Iran University of Medical Sciences, Tehran, Iran; Department of Health Policy and Management (Prof S M Aljunid PhD), Kuwait University, Kuwait, Kuwait; International Centre for Casemix and Clinical Coding (Prof S M Aljunid PhD), National University of Malaysia, Bandar Tun Razak, Malaysia; School of Graduate Studies (E K Ameyaw MPhil), Lingnan University, Hong Kong, China; Public Health Department (Prof T T Amin MD), Cairo University, Cairo, Egypt; Maternal and Child Wellbeing (D A Amugsi PhD), African Population and Health Research Center, Nairobi, Kenya; Department of Pharmacy (Prof R Ancuceanu PhD), Department of Legal Medicine and Bioethics (S Hostiu PhD), Department of General Surgery (I Negoii PhD), Carol Davila University of Medicine and Pharmacy, Bucharest, Romania; Universal Health Coverage Health System Strengthening Cluster (P P Andrade MD), WHO Country Office São Tomé and Príncipe, São Tomé, Sao Tome and Principe; Erasmus School of Health Policy and Management (P P Andrade MD), Erasmus University, Rotterdam, Netherlands; Department of Public Health and Informatics (A Anjum BHlthSci, R K Ripon MSPH), Jahangirnagar University, Dhaka, Bangladesh; Social Determinants of Health Research Center (M Arab-Zozani PhD), Cardiovascular Diseases Research Center (S Riahi PhD), Birjand University of Medical Sciences, Birjand, Iran; Department of Paediatrics (Prof H Ariffin MD), University of Malaya Medical Centre (Prof H Ariffin MD), University of Malaya, Kuala Lumpur, Malaysia; Department of Maternal and Child Health (J Arulappan DSc), Sultan Qaboos University, Muscat, Oman; University Institute of Radiological Sciences and Medical Imaging Technology (T Ashraf MS), Faculty of Allied Health Sciences (Prof S Gilani PhD), University Institute of Public Health (A Hanif PhD, A A Malik PhD), The University of Lahore, Lahore, Pakistan; Department of Health System and Health Economics (D D Atnafu MPH), Bahir Dar University, Bahir Dar, Ethiopia; Department of Forensic Medicine (A Atreya MD), Lumbini Medical College, Palpa, Nepal; School of Business (Prof M Ausloos PhD), University of Leicester, Leicester, UK; Department of Statistics and Econometrics (Prof M Ausloos PhD, Prof C Herteliu PhD, A Otoi PhD, A Pana MD), Bucharest University of Economic Studies, Bucharest, Romania; Center for Health Systems Research (L Avila-Burgos ScD), National Institute of Public Health, Cuernavaca, Mexico; School of Indigenous Studies (G Ayano MSc), University of Western Australia, Perth, WA, Australia; School of Public Health (G Ayano MSc, E K Chowdhury PhD), Curtin University, Perth, WA, Australia; Department of Health Economics (M A Ayanore PhD), Centre for Health Policy Advocacy Innovation & Research in Africa (CHPAIR-Africa), Accra, Ghana; Department of Forensic Science (A D Badiye PhD, N Kapoor PhD), Government Institute of Forensic Science, Nagpur, India; Unit of Biochemistry (A A Baig PhD), Universiti Sultan Zainal Abidin (Sultan Zainal Abidin University), Kuala Terengganu, Malaysia; Centre for Community Medicine (M Bairwa MD), All India Institute of Medical Sciences, New Delhi, India; Department of Forensic Medicine and Toxicology (S M Bakkannavar MD, J Padubidri MD), Manipal College of Pharmaceutical Sciences (Prof M D Janodia PhD), Manipal College of Dental Sciences (Prof A I Narayana PhD, Prof R A Radhakrishnan PhD), Department of Community Medicine (C R Rao MD), Department of Health Information Management (B Reshmi PhD), Manipal Academy of Higher Education, Manipal, India (B Reshmi PhD); Department of Microbiology (Prof S Baliga MD), Kasturba Medical College (R Holla MD, Prof B Unnikrishnan MD), Department of Community Medicine (N Joseph MD), Department of Obstetrics and Gynaecology (A Shetty MS), Manipal Academy of Higher Education, Mangalore, India; Department of Non-communicable Diseases (P C Banik MPhil), Bangladesh University of Health Sciences, Dhaka, Bangladesh; Heidelberg Institute of Global Health (HIGH) (Prof T W Bärnighausen MD, S Chen DSc, B Moazen MSc), Heidelberg University, Heidelberg, Germany; Academic Unit of Obstetrics and

Gynecology (F Barra MD), Department of Neurosciences, Rehabilitation, Ophthalmology, Genetics, Maternal and Child Health (DINOEMI) (Prof S Ferrero PhD), University Eye Clinic (L Ferro Desideri MD), University of Genoa, Genoa, Italy; Department of Public & Environmental Health (A Barrow MPH), University of The Gambia, Brikama, The Gambia; Epidemiology and Disease Control Unit (A Barrow MPH), Ministry of Health, Kotu, The Gambia; School of Public Health (S Basu PhD), Imperial College Business School (D Kusuma DSc), Department of Primary Care and Public Health (Prof A Majeed MD, R Palladino MD, Prof S Rawaf MD), WHO Collaborating Centre for Public Health Education and Training (D L Rawaf MD), The George Institute for Global Health (Prof S Yaya PhD), Imperial College London, London, UK; Health Human Resources Research Center (M Bayati PhD), Non-communicable Disease Research Center (Prof R Malekzadeh MD, S G Sepanlou MD), Shiraz University of Medical Sciences, Shiraz, Iran; Department of Medical Laboratory Sciences (R Belete MSc), Haramaya University, Harar, Ethiopia; Department of Social Services (A W Bell MSW), Tufts Medical Center, Boston, MA, USA; Department of Forensic Chemistry (D S Bhagat PhD), Government Institute of Forensic Science, Aurangabad, India; Department of Health (A S Bhagavathula PharmD), University of Arkansas, Fayetteville, AR, USA; Department of Anatomy (Prof N Bhardwaj MD), Department of Community Medicine and Family Medicine (P Bhardwaj MD), School of Public Health (P Bhardwaj MD), Department of Pharmacology (J Charan MD), Department of Surgical Oncology (Prof S Misra MCh), All India Institute of Medical Sciences, Jodhpur, India; Neurovascular Imaging Laboratory (S Bhaskar PhD), NSW Brain Clot Bank, Sydney, NSW, Australia; Department of Neurology and Neurophysiology (S Bhaskar PhD), South West Sydney Local Health District and Liverpool Hospital, Sydney, NSW, Australia; Department of Statistical and Computational Genomics (K Bhattacharyya MSc), National Institute of Biomedical Genomics, Kalyani, India; Department of Statistics (K Bhattacharyya MSc), University of Calcutta, Kolkata, India; Centre for Global Child Health (Prof Z A Bhutta PhD), University of Toronto, Toronto, ON, Canada; Centre of Excellence in Women & Child Health (Prof Z A Bhutta PhD), Aga Khan University, Karachi, Pakistan; Institute of Soil and Environmental Sciences (S Bibi PhD, S Ullah PhD), University of Agriculture, Faisalabad, Faisalabad, Pakistan; Social Determinants of Health Research Center (A Bijani PhD, M A Jahani PhD, S Mouodi PhD), Babol University of Medical Sciences, Babol, Iran; Mario Negri Institute for Pharmacological Research, Ranica, Italy (B Bikbov MD); Department of General Surgery and Medical-Surgical Specialties (Prof A Biondi PhD, Prof G Isola PhD, M Vacante PhD), Department of Medical and Surgical Sciences and Advanced Technologies (Prof M Veroux PhD), University of Catania, Catania, Italy; Discipline of Public Health Medicine (O A Bolarinwa MSc), University of KwaZulu-Natal, Durban, South Africa; Faculty of Medicine and Pharmaceutical Sciences (A Bonny MD), University of Douala, Douala, Cameroon; Department of Cardiology (A Bonny MD), Centre Hospitalier Montfermeil (Montfermeil Hospital Center), Montfermeil, France; Division of Clinical Epidemiology and Aging Research (Prof H Brenner MD), German Cancer Research Center, Heidelberg, Germany; Department of Woman and Child Health and Public Health (D Buonsenso MD), Agostino Gemelli University Policlinic IRCCS (Fondazione Policlinico Universitario A. Gemelli IRCCS), Roma, Italy; Global Health Research Institute (D Buonsenso MD), Università Cattolica del Sacro Cuore (Catholic University of Sacred Heart), Roma, Italy; Department of Health Care Management (Prof R Busse PhD, S Mohammed PhD), Technical University of Berlin, Berlin, Germany; Department of Family and Community Medicine (N S Butt PhD), Rabigh Faculty of Medicine (A A Malik PhD), King Abdulaziz University, Jeddah, Saudi Arabia; School of Public Health and Health Systems (Z A Butt PhD), University of Waterloo, Waterloo, ON, Canada; Al Shifa School of Public Health (Z A Butt PhD), Al Shifa Trust Eye Hospital, Rawalpindi, Pakistan; Institute of Microengineering (F Caetano dos Santos PhD), Federal Polytechnic School of Lausanne, Lausanne, Switzerland; School of Public Health and Administration (L Cahuana-Hurtado PhD), Peruvian University Cayetano Heredia, Lima, Peru; Internal Medicine Department (Prof L A Cámara MD), Hospital Italiano de Buenos Aires, Buenos Aires, Argentina; Board of Directors (Prof L A Cámara MD), Argentine Society of Medicine, Buenos Aires, Argentina (Prof P R Valdez MEd); Department of Health Care (Prof R Cárdenas DSc), Metropolitan Autonomous University, Mexico City, Mexico; School of Sciences (V L A Carneiro MSc), University of Minho, Braga, Portugal; Directive Board (R A Sousa FEAQQ), Association of Licensed Optometry Professionals, Linda-a-Velha, Portugal (V L A Carneiro MSc); National School of Public Health (F Catalá-López PhD), Institute of Health Carlos III, Madrid, Spain; Clinical Epidemiology Program (F Catalá-López PhD), Ottawa Hospital Research Institute, Ottawa, ON, Canada; Institute of Applied Health Research (J S Chandan MPH), University of Birmingham, Birmingham, UK; Department of Epidemiology and Environmental Health (P P Chavan PhD), University at Buffalo, Buffalo, NY, USA; Center of Excellence for Population Ageing Research (CEPAR) (S Chen MSc), School of Medicine (P K Maulik PhD), School of Optometry and Vision Science (Prof S Resnikoff MD), University of New South Wales, Sydney, NSW, Australia; Department of Community Medicine (Prof S G Choudhari MD, Prof Z Quazi Syed PhD), Datta Meghe Institute of Medical Sciences, Wardha, India; Department of Epidemiology and Preventative Medicine (E K Chowdhury PhD), Department of Epidemiology and Preventive Medicine (Prof Y Guo PhD, R M Islam PhD), Department of Human Centred Computing (M Hasan MSc), School of Public Health and Preventive Medicine (S Li PhD), The School of Clinical Sciences at Monash Health (S Zaman MPH), Monash University, Melbourne, VIC, Australia; James P Grant School of Public Health (M Chowdhury MPH), Centre for Noncommunicable Diseases and Nutrition (R Gupta MPH), BRAC University, Dhaka, Bangladesh; Department of Epidemiology and Biostatistics (M Chowdhury MPH, R Gupta MPH), Department of Clinical Pharmacy and Outcomes Sciences (I Yunusa PhD), University of South Carolina, Columbia, SC, USA; Department of Public Health (Prof M Cirillo MD, R Palladino MD), University of Naples Federico II, Naples, Italy; Institute of Neuroscience (B Corso PhD), National Research Council, Pisa, Italy; Section Global Health and Rehabilitation (O Dadras DrPH), Western Norway University of Applied Sciences, Bergen, Norway; Department of Global Public Health and Primary Care (O Dadras DrPH), University of Bergen, Bergen, Norway; Environmental Health Department (S M A Dahlawi PhD), Forensic Medicine Division (Prof R G Menezes MD), Imam Abdulrahman Bin Faisal University, Dammam, Saudi Arabia; Health Policy Research (M R Mathur PhD), Public Health Foundation of India, Gurugram, India (Prof L Dandona MD, Prof R Dandona PhD, G Kumar PhD); Indian Council of Medical Research, New Delhi, India (Prof L Dandona MD); Department of Population and Development (C A Dávila-Cervantes PhD), Latin American Faculty of Social Sciences Mexico, Mexico City, Mexico; Health Research Institute (K Davletov PhD), Al Farabi Kazakh National University, Almaty, Kazakhstan; National Centre for AIDS and STD Control (K Deuba DrPH), Save the Children, Kathmandu, Nepal; Department of Global Public Health (K Deuba DrPH), Karolinska Institute, Stockholm, Sweden; Research Department (C L Ranabhat PhD), Policy Research Institute, Kathmandu, Nepal (M L Dhimal PhD); Global Institute for Interdisciplinary Studies, Kathmandu, Nepal (M L Dhimal PhD); Health Research Section (M Dhimal PhD), Nepal Health Research Council, Kathmandu, Nepal; Development of Research and Technology Center (S Djalalinia PhD), Ministry of Health and Medical Education, Tehran, Iran; Center of Excellence in Behavioral Medicine (H P Do PhD), Nguyen Tat Thanh University, Ho Chi Minh City, Vietnam; Department of Health Policy and Management (I Doshmangir PhD), Department of Medical Surgical Nursing (M Ghafourifard PhD), School of Management and Medical Informatics (L R Kalankesh PhD), Tabriz University of Medical Sciences, Tabriz, Iran; Postgraduate Program in Epidemiology (Prof B B Duncan MD, Prof M I Schmidt MD), Federal University of Rio Grande do Sul, Porto Alegre, Brazil; Centre Clinical Epidemiology and Biostatistics (A Effiong MB), University of Newcastle, Newcastle, NSW, Australia; Biomedical Informatics and Medical Statistics Department (I El Sayed PhD), Pediatric Dentistry and Dental Public Health Department (Prof M El Tantawi PhD), Alexandria University, Alexandria, Egypt; Division of Cardiology (I Y Elgendy MD), Massachusetts General Hospital, Boston, MA, USA; Faculty of Medicine (M Elhadi MD), University of Tripoli, Tripoli, Libya; Centre for Applied

Health Economics (D A Erku PhD), School of Medicine (Prof J Sun PhD), Griffith University, Gold Coast, QLD, Australia; Department of Neurological Surgery (J Fares MD), Northwestern University, Chicago, IL, USA; Institute of Public Health (F Fischer PhD), Charité Medical University Berlin, Berlin, Germany; Institute of Gerontology (N A Foigt PhD), National Academy of Medical Sciences of Ukraine, Kyiv, Ukraine; Department of Medical Parasitology (M Foroutan PhD), Faculty of Medicine (M Foroutan PhD), Abadan University of Medical Sciences, Abadan, Iran; Department of Dermatology (T Fukumoto PhD), Kobe University, Kobe, Japan; Health Services Management Training Centre (P A Gaal PhD, T Joo MSc), Faculty of Health and Public Administration (M Szócska PhD), Semmelweis University, Budapest, Hungary; Department of Applied Social Sciences (P A Gaal PhD), Sapientia Hungarian University of Transylvania, Târgu-Mureş, Romania; Institute of Applied Health Sciences (IAHS) (S Gaihre PhD), University of Aberdeen, Coleraine, UK; Department of Radiology (T Garg MBBS), King Edward Memorial Hospital, Mumbai, India; School of Psychology (A Getachew Obsa MA), Addis Ababa University, Addis Ababa, Ethiopia; School of Public Health (A Ghashghaee BSc), Institute for Prevention of Non-communicable Diseases (R Kalhor PhD), Health Services Management Department (R Kalhor PhD), Qazvin University of Medical Sciences, Qazvin, Iran; Research Group for Social Epidemiology (N Ghith PhD), Lund University, Lund, Sweden; Afro-Asian Institute, Lahore, Pakistan (Prof S Gilani PhD); Warwick Medical School (Prof P S Gill DM), University of Warwick, Coventry, UK; Health Systems and Policy Research (M Golechha PhD), Indian Institute of Public Health, Gandhinagar, India; Department of Pharmacy Systems, Outcomes, and Policy (J S Guadamuz PhD), University of Illinois at Chicago, Chicago, IL, USA; Department of Epidemiology (Prof Y Guo PhD), Binzhou Medical University, Yantai City, China; Department of Preventive Cardiology (Prof R Gupta MD), Eternal Heart Care Centre & Research Institute, Jaipur, India; Department of Medicine (Prof R Gupta MD), Mahatma Gandhi University Medical Sciences, Jaipur, India; School of Medicine (V Gupta PhD), Deakin University, Geelong, VIC, Australia; Department of Clinical Medicine (Prof V K Gupta PhD), School of Engineering (N Rabiee PhD), Macquarie University, Sydney, NSW, Australia; Faculty of Health (M Hamiduzzaman PhD), Southern Cross University, Billing, QLD, Australia; Research Unit (J M Haro MD), University of Barcelona, Barcelona, Spain; Biomedical Research Networking Center for Mental Health Network (CiberSAM), Barcelona, Spain (J M Haro MD); Department of Zoology and Entomology (A I Hasaballah PhD), Al Azhar University, Cairo, Egypt; Institute for Social Science Research (M Hasan MPH), ARC Centre of Excellence for Children and Families over the Life Course (M Hasan MPH), The University of Queensland, Indooroopilly, QLD, Australia; Department of Public Health (A Hashi PhD), Jigjiga University, Jigjiga, Ethiopia; Institute of Pharmaceutical Sciences (K Hayat MS), University of Veterinary and Animal Sciences, Lahore, Pakistan; Department of Pharmacy Administration and Clinical Pharmacy (K Hayat MS), Xian Jiaotong University, Xian, China; Independent Consultant, Santa Clara, CA, USA (G Heidari MD); Nuffield Department of Clinical Medicine (N J Henry BS), Nuffield Department of Medicine (Prof R J Maude PhD), University of Oxford, Oxford, UK; School of Business (Prof C Herteliu PhD), London South Bank University, London, UK; Department of Population Sciences (Prof M B H Hossain PhD), University of Dhaka, Dhaka, Bangladesh; University College London, London, UK (S Hossain MS); Maternal and Child Health Division (S J Hossain MPH, S Zaman MPH), Health System and Population Studies Divisions (K N Koly MSc), International Centre for Diarrhoeal Disease Research, Bangladesh, Dhaka, Bangladesh; Institute of Research and Development (M Hosseinzadeh PhD), Duy Tan University, Da Nang, Vietnam; Department of Computer Science (M Hosseinzadeh PhD), Diplomacy and Public Relations Department (A Omar Bali PhD), University of Human Development, Sulaymaniyah, Iraq; Clinical Legal Medicine Department (S Hostiuc PhD), National Institute of Legal Medicine Mina Minovici, Bucharest, Romania; Burn Research Center (S Hoveidamanesh MD), Shahid Motahari Hospital, Tehran, Iran; Department of Health Services Administration (V Hsieh PhD, C B Lee PhD), China Medical University, Taichung, Taiwan; Department of Epidemiology and Health Statistics (Prof G Hu PhD), Central South University, Changsha, China; Jockey Club School of Public Health and Primary Care (J Huang MD, C Zhong MD), The Chinese University of Hong Kong, Hong Kong, China; Institute for Social Science Research (M Huda MSc), Faculty of Health and Behavioural Sciences (M Moni PhD), The University of Queensland, Brisbane, QLD, Australia; Department of Public Health and Primary Care (S C Ifeagwu MPH), University of Cambridge, Cambridge, UK; Department of Community Medicine (O S Ilesanmi PhD), University College Hospital, Ibadan, Ibadan, Nigeria; Independent Consultant, Tabriz, Iran (S N Irvani MD); Institute for Physical Activity and Nutrition (S Islam PhD), Deakin University, Burwood, VIC, Australia; Sydney Medical School (S Islam PhD), Save Sight Institute (H Kandel PhD), University of Sydney, Sydney, NSW, Australia; Department of Clinical Pharmacy (Prof N Ismail PhD), MAHSA University, Bandar Saujana Putra, Malaysia; Public Health Department of Social Medicine (Prof H Iso MD), Graduate School of Medicine (Prof K Yamagishi MD), Osaka University, Suita, Japan; Department of Health Management (R Itumalla PhD), University of Hail, Hail, Saudi Arabia; Department of Health Services Research (M Iwagami PhD), Research and Development Center for Health Services (Prof K Yamagishi MD), University of Tsukuba, Tsukuba, Japan; Department of Non-communicable Disease Epidemiology (M Iwagami PhD), European Observatory on Health Systems and Policies (M Karanikolos PhD), Department of Health Services Research and Policy (M Karanikolos PhD, Prof M McKee DSc), Center for Global Mental Health (K N Koly MSc), London School of Hygiene & Tropical Medicine, London, UK; Non-communicable Disease Department (R Jain MD), National Health Mission, Lucknow, India; Department of Medicine (R Jain MD), Mahavir Sikshan Sansthan, Kanpur, India; Institute of Advanced Manufacturing Technologies (Prof M Jakovljevic PhD), Peter the Great St. Petersburg Polytechnic University, St. Petersburg, Russia; Institute of Comparative Economic Studies (Prof M Jakovljevic PhD), Hosei University, Tokyo, Japan; Centre of Studies and Research (S Jayapal PhD), Ministry of Health, Muscat, Oman; Department of Biochemistry (Prof S Jayaram MD), Government Medical College, Mysuru, India; Department of Community Medicine (R P Jha MSc), Dr. Baba Saheb Ambedkar Medical College & Hospital, Delhi, India; Department of Community Medicine (R P Jha MSc), Banaras Hindu University, Varanasi, India; Institute of Molecular and Clinical Ophthalmology Basel, Basel, Switzerland (Prof J B Jonas MD); Department of Ophthalmology (Prof J B Jonas MD), Heidelberg University, Mannheim, Germany; Institute of Family Medicine and Public Health (M Jürisson PhD), University of Tartu, Tartu, Estonia; Department of Noncommunicable Diseases (K Kamenov PhD), World Health Organization (WHO), Geneva, Switzerland; Sydney Eye Hospital (H Kandel PhD), South Eastern Sydney Local Health District, Sydney, NSW, Australia; The Hansjörg Wyss Department of Plastic and Reconstructive Surgery (R S Kantar MD), Nab'a Al-Hayat Foundation for Medical Sciences and Health Care, New York City, NY, USA; Cleft Lip and Palate Surgery (R S Kantar MD), Global Smile Foundation, Norwood, MA, USA; MRC/CSO Social and Public Health Sciences Unit (S V Katikireddi PhD), University of Glasgow, Glasgow, UK; Department of Surface Engineering (Prof T Kavetskyy PhD), The John Paul II Catholic University of Lublin, Lublin, Poland; Drohobych Ivan Franko State Pedagogical University, Drohobych, Ukraine (Prof T Kavetskyy PhD); Department of Mental Health (Prof N Kawakami PhD), University of Tokyo, Tokyo, Japan; International Research Center of Excellence (G A Kayode PhD), Institute of Human Virology Nigeria, Abuja, Nigeria; Julius Centre for Health Sciences and Primary Care (G A Kayode PhD), Utrecht University, Utrecht, Netherlands; Department of Healthcare Services Management, School of Health (L Keikavoosi-Arani PhD), Alborz University of Medical Sciences, Karaj, Iran; Department of Public Health (Prof Y S Khader PhD), Jordan University of Science and Technology, Irbid, Jordan; Amity Institute of Forensic Sciences (H Khajuria PhD, B P Nayak PhD), Amity University, Noida, India; Department of Biophysics and Biochemistry (Prof R Khalilov PhD), Baku State University, Baku, Azerbaijan; Russian Institute for Advanced Study (Prof R Khalilov PhD), Moscow State Pedagogical University, Moscow, Russia; Health Promotion Research Center (M Khammarnia PhD), Zahedan University of Medical Sciences, Zahedan, Iran; Epidemiology

Department (M Khan MD), Jazan University, Jazan, Saudi Arabia; Department of Population Science (M Khan PhD), Jatiya Kabi Kazi Nazrul Islam University, Mymensingh, Bangladesh; Family Medicine Department (M A Khan MSc), United Arab Emirates University, Al Ain, United Arab Emirates; Primary Care Department (M A Khan MSc), NHS North West London, London, UK; Social Development and Health Promotion Research Center (M Khezeli PhD), Kermanshah University of Medical Sciences, Kermanshah, Iran; Department of Genomics and Digital Health (M Kim MD), Samsung Advanced Institute for Health Sciences & Technology (SAIHST), Seoul, South Korea; Public Health Center (M Kim MD), Ministry of Health and Welfare, Wando, South Korea; School of Traditional Chinese Medicine (Y Kim PhD), Xiamen University Malaysia, Sepang, Malaysia; School of Health Sciences (Prof A Kisa PhD), Kristiania University College, Oslo, Norway; Department of Global Community Health and Behavioral Sciences (Prof A Kisa PhD), Tulane University, New Orleans, LA, USA; Department of Nursing and Health Promotion (S Kisa PhD), Oslo Metropolitan University, Oslo, Norway; Community-based Services Development (V Klymchuk DSc), Mental Health for Ukraine Project, Lviv, Ukraine; Laboratory of social psychology (V Klymchuk DSc), Institute of social and political psychology, Kyiv, Ukraine; Department of General Practice – Family Medicine (Prof O Korzh DSc), Kharkiv Medical Academy of Postgraduate Education, Kharkiv, Ukraine; Independent Consultant, Jakarta, Indonesia (S Kosen MD); Department of Internal and Pulmonary Medicine (Prof P A Koul MD), Sheri Kashmir Institute of Medical Sciences, Srinagar, India; Department of Demography (Prof B Kuate Defo PhD), Department of Social and Preventive Medicine (Prof B Kuate Defo PhD), University of Montreal, Montreal, QC, Canada; Faculty of Public Health (D Kusuma DSc), University of Indonesia, Depok, Indonesia; Department of Medical Sciences (Prof A O Larsson PhD), Uppsala University, Uppsala, Sweden; Department of Clinical Chemistry and Pharmacology (Prof A O Larsson PhD), Uppsala University Hospital, Uppsala, Sweden; Department of Otorhinolaryngology (S Lasrado MS), Father Muller Medical College, Mangalore, India; Department of Preventive Medicine (Prof Y Lee PhD), Korea University, Seoul, South Korea; School of Medicine (Prof G Lucchetti PhD), Federal University of Juiz de Fora, Juiz de Fora, Brazil; Department of Community Medicine (P B Mahajan MD), Jawaharlal Institute of Postgraduate Medical Education and Research, Karaikal, India; Mass Communication Department (A Makki PhD), University of Sharjah, Sharjah, United Arab Emirates; Department of Maternal and Child Nursing and Public Health (Prof D C Malta PhD), Department of Clinical Medicine (Prof B R Nascimento PhD), Clinical Hospital (Prof B R Nascimento PhD), Federal University of Minas Gerais, Belo Horizonte, Brazil; School of Medicine and Surgery (Prof L G Mantovani DSc), University of Milan Bicocca, Monza, Italy; Laboratory of Public Health (Prof L G Mantovani DSc), IRCCS Auxologico, Milan, Italy; Joint Learning Network for Universal Coverage, Arlington, VA, USA (A Martinez-Valle PhD); Campus Caucaia (F R Martins-Melo PhD), Federal Institute of Education, Science and Technology of Ceará, Caucaia, Brazil; Department of Midwifery (S Masoumi PhD), Hamadan University of Medical Sciences, Hamadan, Iran; Institute of Population Health Sciences (M R Mathur PhD), University of Liverpool, Liverpool, UK; Epidemiology Department (Prof R J Maude PhD), Mahidol Oxford Tropical Medicine Research Unit, Bangkok, Thailand; Research Division (P K Maulik PhD), Research and Development Division (L Yadav PhD), The George Institute for Global Health, New Delhi, India; Peru Country Office (W Mendoza MD), United Nations Population Fund (UNFPA), Lima, Peru; Center for Translation Research and Implementation Science (G A Mensah MD), National Institutes of Health, Bethesda, MD, USA; Department of Medicine (G A Mensah MD), University of Cape Town, Cape Town, South Africa; Neurology Unit (A Meretoja MD), Breast Surgery Unit (T J Meretoja MD), Helsinki University Hospital, Helsinki, Finland; School of Health Sciences (A Meretoja MD), Department of Pediatrics (Prof G C Patton MD), University of Melbourne, Melbourne, VIC, Australia; University of Helsinki, Helsinki, Finland (T J Meretoja MD); University Centre Varazdin (T Mestrovic PhD), University North, Varazdin, Croatia; Woman-Mother-Child Department (I Michalek PhD), Lausanne University Hospital, Lausanne, Switzerland; Internal Medicine Programme (Prof E M Mirrakhimov PhD), Kyrgyz State Medical Academy, Bishkek, Kyrgyzstan; Department of Atherosclerosis and Coronary Heart Disease (Prof E M Mirrakhimov PhD), National Center of Cardiology and Internal Disease, Bishkek, Kyrgyzstan; National Data Management Center for Health (A Misganaw PhD), Ethiopian Public Health Institute, Addis Ababa, Ethiopia; Institute of Addiction Research (ISFF) (B Moazen MSc), Frankfurt University of Applied Sciences, Frankfurt, Germany; Department of Information Technology (M Mohammadi PhD), Lebanese French University, Erbil, Iraq; Health Systems and Policy Research Unit (S Mohammed PhD), Ahmadu Bello University, Zaria, Nigeria; Faculty of Life Sciences and Medicine (M Molokhia PhD), School of Population Health and Environmental Sciences (Y Wang PhD), King's College London, London, UK; Clinical Epidemiology and Public Health Research Unit (L Monasta DSc), Burlo Garofolo Institute for Maternal and Child Health, Trieste, Italy; Social Determinants of Health Research Center (G Moradi PhD, B Piroozi PhD, A Shokri PhD), Department of Epidemiology and Biostatistics (G Moradi PhD), Kurdistan University of Medical Sciences, Sanandaj, Iran; Department of Public Health (Prof R S Moreira PhD), Oswaldo Cruz Foundation, Recife, Brazil; Public Health (Prof R S Moreira PhD), Federal University of Pernambuco, Recife, Brazil; Department of Medicine (E Mostafavi PhD), Stanford Cardiovascular Institute (E Mostafavi PhD), Stanford University, Palo Alto, CA, USA; Research and Analytics Department (A J Nagarajan MTech), Initiative for Financing Health and Human Development, Chennai, India; Department of Research and Analytics (A J Nagarajan MTech), Bioinsilico Technologies, Chennai, India; Department of Education for Clinical Research (C Nagata PhD), National Center for Child Health and Development, Tokyo, Japan; Suraj Eye Institute, Nagpur, India (V Nangia MD); Mysore Medical College and Research Institute (Prof S Narasimha Swamy MD), Government Medical College, Mysore, India; Department of Pediatrics (J Nazari MD), Arak University of Medical Sciences, Arak, Iran; Department of General Surgery (I Negoi PhD), Emergency Hospital of Bucharest, Bucharest, Romania; Department of Community Medicine (S Nepal MD), Kathmandu University, Palpa, Nepal; Estia Health Blakehurst (S Neupane Kandel BSN), Estia Health, Sydney, NSW, Australia; Department of Biological Sciences (J W Ngunjiri DrPH), University of Embu, Embu, Kenya; Institute for Global Health Innovations (C T Nguyen MPH, H L T Nguyen MPH), Duy Tan University, Hanoi, Vietnam; Public Health Department (D N A Ningrum MPH), Universitas Negeri Semarang, Kota Semarang, Indonesia; Graduate Institute of Biomedical Informatics (D N A Ningrum MPH), Taipei Medical University, Taipei, Taiwan; Centre for Heart Rhythm Disorders (J Noubiap MD), School of Public Health (V Podder HSc), University of Adelaide, Adelaide, SA, Australia; Administrative and Economic Sciences Department (Prof B Oancea PhD), University of Bucharest, Bucharest, Romania; Department of Preventive Medicine (I Oh PhD), Kyung Hee University, Dongdaemun-gu, South Korea; Department of Psychiatry and Behavioural Neurosciences (A T Olagunju MD), McMaster University, Hamilton, ON, Canada; Department of Psychiatry (A T Olagunju MD), University of Lagos, Lagos, Nigeria; Community Prevention and Care Services (B O Olakunde PhD), National AIDS Control Committee, Abuja, Nigeria; Mass Communication Department (E Omer PhD), Ajman University, Dubai, United Arab Emirates; Department of Pharmacology and Therapeutics (Prof O E Onwujekwe PhD), University of Nigeria Nsukka, Enugu, Nigeria; Department of Health Metrics (A Pana MD), Center for Health Outcomes & Evaluation, Bucharest, Romania; Privatpraxis, Heidelberg, Germany (S Panda-Jonas MD); Saveetha Medical College and Hospitals (S R Pandi-Perumal MSc), Saveetha University, Chennai, India; Vision and Eye Research Institute (Prof S Pardhan PhD), Anglia Ruskin University, Cambridge, UK; Cardiology Department (D Pasupula MD), MercyOne North Iowa Medical Center, Mason City, IA, USA; Department of Geography (Prof P K Pathak PhD), Jamia Millia Islamia, New Delhi, India; Department of Geography (Prof P K Pathak PhD), University of Delhi, New Delhi, India; Population Health Theme (Prof G C Patton MD), Murdoch Childrens Research Institute, Melbourne, VIC, Australia; Department of Genetics (S Pawar PhD), Yale University, New Haven, CT, USA; Department of Orthopedics (J Pereira MS), Yenepoya Medical College, Mangalore, India; Department

of Community Medicine (M Paliana MD), Mahatma Gandhi Medical College & Hospital, Jaipur, India; Medical College (V Podder HSc), Tairunnessa Memorial Medical College and Hospital, Gazipur, Bangladesh; HIV and Mental Health Department (K N Pokhrel PhD), Integrated Development Foundation Nepal, Kathmandu, Nepal; University Medical Center Groningen (Prof M J Postma PhD), School of Economics and Business (Prof M J Postma PhD), University of Groningen, Groningen, Netherlands; Centro de Investigaciones Clínicas (S I Prada PhD), Fundación Valle del Lili (Clinical Research Center, Valle del Lili Foundation), Cali, Colombia; PROESA (S I Prada PhD), ICESI University, Cali, Colombia; Pohang University of Science and Technology, Pohang, South Korea (N Rabiee PhD); Pure Earth, Dhaka, Bangladesh (M Rahman PhD); Department of Population Science and Human Resource Development (Prof M Rahman PhD, M Rahman DrPH), University of Rajshahi, Rajshahi, Bangladesh; Department of Community Medicine (M Rahman PhD), Maharishi Markandeshwar Medical College & Hospital, Solan, India; Future Technology Research Center (A Rahmani PhD), National Yunlin University of Science and Technology, Yunlin, Taiwan; Health and Public Policy Department (C L Ranabhat PhD), Global Center for Research and Development, Kathmandu, Nepal; Department of Oral Pathology (S Rao MDS), Sharavathi Dental College and Hospital, Shimogga, India; Institute of Collective Health (Prof D Rasella PhD), Federal University of Bahia, Salvador, Brazil; University College London Hospitals, London, UK (D L Rawaf MD); Academic Public Health England (Prof S Rawaf MD), Public Health England, London, UK; School of Health, Medical and Applied Sciences (L Rawal PhD), CQ University, Sydney, NSW, Australia; School of Medicine (Prof A M N Renzaho PhD), Translational Health Research Institute (Prof A M N Renzaho PhD), Western Sydney University, Campbelltown, NSW, Australia; Brien Holden Vision Institute, Sydney, NSW, Australia (Prof S Resnikoff MD); Department of Neurology (Prof S Sacco MD), University of L'Aquila, L'Aquila, Italy; Cardiac Rehabilitation Research Center (Prof M Sadeghi MD), Isfahan University of Medical Sciences, Isfahan, Iran; International Center of Medical Sciences and Research, Islamabad, Pakistan (Prof U Saeed PhD); Department of Pathology and Microbiology (Prof U Saeed PhD), Jinnah Medical College, Peshawar, Pakistan; Applied Biomedical Research Center (A Sahebkar PhD), Biotechnology Research Center (A Sahebkar PhD), Mashhad University of Medical Sciences, Mashhad, Iran; Department of Public Health (B Sahiledengle MPH), Madda Walabu University, Bale Robe, Ethiopia; Department of Development Studies (H Sahoo PhD), International Institute for Population Sciences, Mumbai, India; Department of Entomology (A M Samy PhD), Ain Shams University, Cairo, Egypt; Department of Surgery (Prof J Sanabria MD), Marshall University, Huntington, WV, USA; Department of Nutrition and Preventive Medicine (Prof J Sanabria MD), Case Western Reserve University, Cleveland, OH, USA; Faculty of Medicine (Prof M M Santric-Milicevic PhD), School of Public Health and Health Management (Prof M M Santric-Milicevic PhD), University of Belgrade, Belgrade, Serbia; Faculty of Health & Social Sciences (B Sathian PhD), Bournemouth University, Bournemouth, UK; Department of Public Health Sciences (M Sawhney PhD), University of North Carolina at Charlotte, Charlotte, NC, USA; Department of Population and Health (A Seidu MPHil), University of Cape Coast, Cape Coast, Ghana; College of Public Health, Medical and Veterinary Sciences (A Seidu MPHil), James Cook University, Townsville, QLD, Australia; National Heart, Lung, and Blood Institute (A Seylani BS), National Institute of Health, Rockville, MD, USA; Independent Consultant, Karachi, Pakistan (M A Shaikh MD); Centre for Medical Informatics (Prof A Sheikh MD), University of Edinburgh, Edinburgh, UK; National Institute of Infectious Diseases, Tokyo, Japan (M Shigematsu PhD); Finnish Institute of Occupational Health, Helsinki, Finland (R Shiri PhD); Public Health Dentistry Department (Prof K M Shivakumar PhD), Krishna Institute of Medical Sciences Deemed to be University, Karad, India; School of Medicine (Prof J A Singh MD), University of Alabama at Birmingham, Birmingham, AL, USA; Medicine Service (Prof J A Singh MD), US Department of Veterans Affairs (VA), Birmingham, AL, USA; Department of Epidemiology (D N Sinha PhD), School of Preventive Oncology, Patna, India; Department of Epidemiology (D N Sinha PhD), Healis Sekhsaria Institute for Public Health, Mumbai, India; Department No.16 (V Y Skryabin MD), Moscow Research and Practical Centre on Addictions, Moscow, Russia; Department of Infectious Diseases and Epidemiology (A A Skryabina MD), Pirogov Russian National Research Medical University, Moscow, Russia; Department of Oral Health (A Sofi-Mahmudi DDS), Non-communicable Diseases Research Center (NCDRC), Tehran, Iran; Cochrane Iran Associate Centre, National Institute for Medical Research Development (NIMAD) (A Sofi-Mahmudi DDS), Iranian Ministry of Health and Medical Education, Tehran, Iran; College of Medicine and Public Health (J H Stephens PhD), Flinders University, Bedford Park, SA, Australia; Department of Medicine (Prof R Tabarés-Seisdedos PhD), University of Valencia, Valencia, Spain; Carlos III Health Institute (Prof R Tabarés-Seisdedos PhD), Biomedical Research Networking Center for Mental Health Network (CiberSAM), Madrid, Spain; Health Policy and Management (D Vervoort MD), Johns Hopkins University, Baltimore, MD, USA (H Tadbiri MD); Department of Midwifery (A T Tamiru MSc), University of Gondar, Gondar, Ethiopia; Department of Public Health and Community Medicine (Prof K R Thankappan MD), Central University of Kerala, Kasaragod, India; Institute of Public Health (R Topor-Madry PhD), Jagiellonian University Medical College, Kraków, Poland; Agency for Health Technology Assessment and Tariff System, Warsaw, Poland (R Topor-Madry PhD); Saveetha Dental College and Hospitals (M R Tovani-Palone PhD), Saveetha Institute of Medical and Technical Sciences (SIMATS), Chennai, India; Modestum, Eastbourne, UK (M R Tovani-Palone PhD); Department of Health Economics (B X Tran PhD), Hanoi Medical University, Hanoi, Vietnam; School of Public Health and Social Work (M T N Tran PhD), Queensland University of Technology, Brisbane, QLD, Australia; Health Informatics Department (M T N Tran PhD), Hanoi Medical University, Ha Noi, Vietnam; National Institute of Medical Statistics (N Tripathi PhD), National Institute of Medical Statistics, New Delhi, India; Department of Community Medicine (J P Tripathy MD), All India Institute of Medical Sciences, Nagpur, India; Health Technology Assessment Unit (D R Uezono BSc, Y H Zuniga BS), Department of Health Philippines, Manila, Philippines; College of Public Health (D R Uezono BSc), University of the Philippines Manila, Manila, Philippines; Clinical Cancer Research Center (S Valadan Tahbaz PhD, S Yahyazadeh Jabbari MD), Milad General Hospital, Tehran, Iran; Department of Microbiology (S Valadan Tahbaz PhD), Islamic Azad University, Tehran, Iran; Velez Sarsfield Hospital, Buenos Aires, Argentina (Prof P R Valdez MD); Institute of Public Health of Serbia, Belgrade, Serbia (M Vasic PhD); Department of Medical and Surgical Sciences (Prof F S Violante MD), University of Bologna, Bologna, Italy; Occupational Health Unit (Prof F S Violante MD), Sant'Orsola Malpighi Hospital, Bologna, Italy; Digital Biodesign and Personalized Healthcare Research Center (S K Vladimirov PhD), I.M. Sechenov First Moscow State Medical University, Moscow, Russia; Department of Information Technologies and Management (S K Vladimirov PhD), Moscow Institute of Physics and Technology, Dolgoprudny, Russia; Department of Health Care Administration and Economics (Prof V Vlassov MD), National Research University Higher School of Economics, Moscow, Russia; Faculty of Information Technology (B Vo PhD), HUTECH University, Ho Chi Minh City, Vietnam; Shaheed Zulfiqar Ali Bhutto Medical University (SZABMU), Islamabad, Pakistan (Prof Y Waheed PhD); Department of Cultures, Societies and Global Studies (R G Wamai PhD), Northeastern University, Boston, MA, USA; School of Public Health (R G Wamai PhD), University of Nairobi, Nairobi, Kenya; Department of Psychiatry (Y Wang PhD), University of São Paulo, São Paulo, Brazil; Centre for Health Policy Research (Prof P Ward PhD), Torrens University - Australia, Adelaide, SA, Australia; Department of Physical Therapy (T Wiangkham PhD), Naresuan University, Phitsanulok, Thailand; Caring Futures Institute (L Yadav PhD), Flinders University, Adelaide, SA, Australia; School of International Development and Global Studies, Faculty of Social Sciences (Prof S Yaya PhD), University of Ottawa, Ottawa, ON, Canada; Health Services Management Research Center (V Yazdi-Feyzabadi PhD), Department of Health Management, Policy, and Economics (V Yazdi-Feyzabadi PhD), Kerman University of Medical Sciences, Kerman, Iran; Saw Swee Hock School of Public Health (S Yi PhD), National University of Singapore, Singapore, Singapore; Center for Population Health Research (S Yi PhD), KHANA,

Phnom Penh, Cambodia; Department of Health Management (V Yiğit PhD), Süleyman Demirel Üniversitesi (Süleyman Demirel University), Isparta, Turkey; Department of Neuropsychopharmacology (N Yonemoto PhD), National Center of Neurology and Psychiatry, Kodaira, Japan; Department of Public Health (N Yonemoto PhD), Juntendo University, Tokyo, Japan; Department of Health Policy and Management (Prof M Z Younis PhD), Jackson State University, Jackson, MS, USA; School of Business & Economics (Prof M Z Younis PhD), University Putra Malaysia, Kuala Lumpur, Malaysia; Department of Epidemiology and Biostatistics (Prof C Yu PhD), School of Medicine (Z Zhang PhD), Wuhan University, Wuhan, China; Department of Bioengineering and Therapeutic Sciences (Prof M S Zastrozhin PhD), University of California San Francisco, San Francisco, CA, USA; Addictology Department (Prof M S Zastrozhin PhD), Russian Medical Academy of Continuous Professional Education, Moscow, Russia; #MentalHealthPH, Quezon City, Philippines (Y H Zuniga BS)

Contributors

Please see the appendix (pp 3–7) for more detailed information about individual author contributions to the research, divided into the following categories: managing the overall research enterprise; writing the first draft of the manuscript; primary responsibility for applying analytical methods to produce estimates; primary responsibility for seeking, cataloguing, extracting, or cleaning data; designing or coding figures and tables; providing data or critical feedback on data sources; developing methods or computational machinery; providing critical feedback on methods or results; drafting the manuscript or revising it critically for important intellectual content; and managing the estimation or publications process.

Declaration of interests

S Afzal reports participation on a Data Safety Monitoring Board or Advisory Board with the Corona Expert Advisory Group and Infectious Diseases Expert Advisory Group and is a Fellow of Faculty of Public Health, UK and the Dean of Public Health and Preventive Medicine and a chairperson for Community Medicine at King Edward Medical University, Pakistan. R Ancuceanu reports payment or honoraria for lectures, presentations, speaker's bureaus, manuscript writing or educational events from Abbvie, B. Braun, Sandoz, and Laropharm. S Bhaskar is the Board Director of the Rotary Club of Sydney, chair of Rotary District 9675, Diversity, Equity, and Inclusion, and is the chair/co-manager, Global Health and Migration Community Hub at the Global Health Hub Germany. B Bikbov reports support for the present manuscript from the European Union's Horizon 2020 Marie Skłodowska-Curie research and innovation programme grant number 703226, and reports grants or contracts from the Lombardy Region, paid to their institution, outside of the submitted work. J S Chandan reports grants or contracts from the National Institute for Health and Care Research as well as the Youth Endowment Fund, outside of the submitted work. N Fullman reports funding from WHO and Gates ventures, outside of the submitted work. C Herteliu reports grants or contracts from the Romanian Ministry of Research Innovation and Digitalization (ID-585-CTR-42-PFE-2021), outside the submitted work. C Herteliu and A Pana report grants or contracts from Romanian National Authority for Scientific Research and Innovation (PN-III-P4-ID-PCCF-2016-0084, PN-III-P2-2.1-SOL-2020-2-0351), outside the submitted work. S V Katikireddi reports support for the current manuscript from the Medical Research Council (MC_UU_00022/2) and Scottish Government Chief Scientist Office (MC_UU_00022/2), payments made to their institution. S Mohammed reports support for the present manuscript from the Bill & Melinda Gates Foundation and reports a fellowship grant from Alexander von Humboldt Foundation, outside of the submitted work. L Monasta reports support for the present manuscript from the Italian Ministry of Health (Ricerca Corrente 34/2017), payments made to their institution. J Mosser reports support for the present manuscript from the Bill & Melinda Gates Foundation and report grants from Gavi, outside of the submitted work. S Sacco reports grants for contracts from Novartis, and Uriach as payments to their institution; personal consulting fees from Pfizer, AstraZeneca, Lilly, Novartis, Teva, Lundbeck, Abbott, and Novo Nordisk; payment or honoraria for lectures, presentations, speakers bureaus,

manuscript writing or educational events from Allerga-Abbvie, Abbott, Novartis, Lilly, Lundbeck, and Teva as personal payments; support for attending meetings or travel from Lilly; and is president elect of the European Stroke Organisation and second vice president of the European Headache Federation. S Sacco also reports receipt of equipment, materials, drugs, medical writing, gifts, or other services from Allergan-Abbvie, Novartis, and Novo Nordisk, all outside the submitted work. J A Singh reports consulting fees from Crealta/Horizon, Medisys, Fidia, PK Med, Two Labs, Adept Field Solutions, Clinical Care options, Clearview healthcare partners, Putnam associates, Focus forward, Navigant consulting, Spherix, MedIQ, Jupiter Life, UBM, Trio Health, Medscape, WebMD, and Practice Point communications, and the National Institutes of Health and the American College of Rheumatology; payment or honoraria for participating in the speakers bureau for Simply Speaking; support for attending meetings or travel from the steering committee of OMERACT, to attend their meeting every 2 years; participation on a data safety monitoring board or advisory board as an unpaid member of the FDA Arthritis Advisory Committee; leadership or fiduciary role in other board, society, committee or advocacy group, paid or unpaid, as a member of the steering committee of OMERACT, an international organisation that develops measures for clinical trials and receives arms length funding from 12 pharmaceutical companies, with the Veterans Affairs Rheumatology Field Advisory Committee as Chair, and with the UAB Cochrane Musculoskeletal Group Satellite Center on Network Meta-analysis as a director and editor; stock or stock options in TPT Global Tech, Vaxart pharmaceuticals, Atyu Biopharma, Adaptimmune Therapeutics, GeoVax Labs, Pieris Pharmaceuticals, Enzolytics, Series Therapeutics, Tonix Pharmaceuticals, and Charlotte's Web Holdings and previously owned stock options in Amarin, Viking, and Moderna pharmaceuticals; all outside the submitted work. D R Uezono is an employee of Roche Philippines, and their involvement in this article is done outside of their scope as an employee of Roche.

Data sharing

For detailed information regarding input data sources and to download the data used in these analyses, please visit the Global Health Data Exchange GBD 2019 website at <https://ghdx.healthdata.org/gbd-2019>.

Acknowledgments

O Adetokunboh acknowledges support from Department of Science and Innovation and National Research Foundation. S Afzal acknowledges the institutional support of King Edward Medical University. S Aljunid acknowledges Department of Health Policy and Management, College of Public Health, Health Science Centre, Kuwait University for the approval and support to participate in this research project. M Ausloos, C Herteliu, and A Pana acknowledge partial support by a grant of the Romanian National Authority for Scientific Research and Innovation, CNDS-UEFISCDI, project number PN-III-P4-ID-PCCF-2016-0084. C Herteliu also acknowledges partial support by a grant of the Romanian Ministry of Research Innovation and Digitalization, MCID, project number ID-585-CTR-42-PFE-2021. T Bärnighausen was supported by the Alexander von Humboldt Foundation through the Alexander von Humboldt Professor award, funded by the Federal Ministry of Education and Research. B Bikbov acknowledges funding from the European Union's Horizon 2020 research and innovation programme under Marie Skłodowska-Curie grant agreement No. 703226. Institute of Applied Health Sciences; School of Medicine, Medical Sciences and Nutrition, University of Aberdeen, Scotland. The salary for N Githi is covered by a grant from Novo Nordisk Foundation (NNF16OC0021856). V B Gupta acknowledges funding support from National Health and Medical Research Council (NHMRC) Australia. V K Gupta acknowledges funding support from National Health and Medical Research Council (NHMRC) Australia. T Joo acknowledges support from the National Research, Development and Innovation Office of Hungary under grant RRF-2.3.1-21-2022-00006 (Data-driven Health Division of Health Security National Laboratory). S Vittal Katikireddi acknowledges funding from a NRS Senior Clinical Fellowship (SCAF/15/02), the Medical Research Council (MC_UU_00022/2), and the Scottish Government Chief Scientist Office (SPHSU17). M N Khan acknowledges the support of Jatiya Kabi Kazi Nazrul Islam University, Mymensingh, Bangladesh. Y J Kim acknowledges support from the Research Management Centre,

Xiamen University Malaysia [XMUMRF/2020-C6/ITCM/0004]. G Lucchetti is a grantee of the Brazilian National Council for Scientific and Technological Development Research Productivity - Level 1D. L Mantovani acknowledges support by Italian Ministry of Health Ricerca Corrente - IRCCS Multimedia. M Molokhia acknowledges support by the National Institute for Health Research Biomedical Research Center at Guy's and St Thomas' National Health Service Foundation Trust and King's College London. L Monasta reports support for the present manuscript from the Italian Ministry of Health on project Ricerca Corrente 34/2017 and payments made to the Institute for Maternal and Child Health IRCCS Burlo Garofolo. R Moreira acknowledges the CNPQ productivity grant (316607/2021-5). B R Nascimento is partially supported by CNPq (Research Productivity Grant, 312382/2019-7), the Edwards Lifesciences Foundation (Improving the prevention and detection of Heart Valve disease across the Lifespan, 2021), and FAPEMIG (grant APQ-000627-20). J R Padubidri acknowledges Kasturba Medical College, Mangalore, Manipal Academy of Higher Education, Manipal, India for their constant support in conducting research. D Rasella reports financial support from the Spanish Ministry of Science and Innovation and State Research Agency through the Centro de Excelencia Severo Ochoa 2019-2023 programme (CEX2018-000806-S), and financial support from the Generalitat de Catalunya through the Centres de Recerca de Catalunya programme. U Saeed would like to acknowledge the International Center of Medical Sciences Research (ICMSR), Islamabad (44000), Pakistan. A M Samy acknowledges the support from Ain Shams University and the Egyptian Fulbright Mission Program. U Saeed would like to acknowledge Kasturba Medical College, Mangalore, Manipal Academy of Higher Education, Manipal for supporting research activities. R T S is supported by the Spanish Ministry of Science and Innovation, Institute of Health Carlos III, CIBERSAM, INCLIVA (PID2021-129099OB-I00). D Vervoort is supported by the Canadian Institutes of Health Research (CIHR) Vanier Canada Graduate Scholarship. S B Zaman acknowledges receiving a scholarship from the Australian Government Research Training Program (RTP) in support of his academic career. Serbian part of this GBD contribution was co-financed through Grant OI 175 014 of the Ministry of Education Science and Technological Development of The Republic of Serbia. This work was supported, in whole or in part, by the Bill & Melinda Gates Foundation OPP1152504. Under the grant conditions of the Foundation, a Creative Commons Attribution 4.0 Generic License has already been assigned to the Author Accepted Manuscript version that might arise from this submission.

Editorial note: The Lancet Group takes a neutral position with respect to territorial claims in published maps and institutional affiliations.

References

- Vollset SE, Goren E, Yuan CW, et al. Fertility, mortality, migration, and population scenarios for 195 countries and territories from 2017 to 2100: a forecasting analysis for the Global Burden of Disease Study. *Lancet* 2020; **396**: 1285–306.
- Wang H, Abbas KM, Abbasifard M, et al. Global age-sex-specific fertility, mortality, healthy life expectancy (HALE), and population estimates in 204 countries and territories, 1950–2019: a comprehensive demographic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396**: 1160–203.
- Meara JG, Leather AJM, Hagander L, et al. Global Surgery 2030: evidence and solutions for achieving health, welfare, and economic development. *Lancet* 2015; **386**: 569–624.
- Stephenson T. How children's responses to drugs differ from adults. *Br J Clin Pharmacol* 2005; **59**: 670–73.
- Vos T, Lim SS, Abbafati C, et al. Global burden of 369 diseases and injuries in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396**: 1204–22.
- Blumfield E, Levin TL. COVID-19 in pediatric patients: a case series from the Bronx, NY. *Pediatr Radiol* 2020; **50**: 1369–74.
- Daneshgari G, Dubin DP, Gould DJ. Cutaneous manifestations of COVID-19: an evidence-based review. *Am J Clin Dermatol* 2020; **21**: 627–39.
- Varatharaj A, Thomas N, Ellul MA, et al. Neurological and neuropsychiatric complications of COVID-19 in 153 patients: a UK-wide surveillance study. *Lancet Psychiatry* 2020; **7**: 875–82.
- Nienhaus A, Hod R. COVID-19 among health workers in Germany and Malaysia. *Int J Environ Res Public Health* 2020; **17**: E4881.
- Levin AT, Hanage WP, Owusu-Boaitey N, Cochran KB, Walsh SP, Meyerowitz-Katz G. Assessing the age specificity of infection fatality rates for COVID-19: systematic review, meta-analysis, and public policy implications. *Eur J Epidemiol* 2020; **35**: 1123–38.
- US Centers for Disease Control and Prevention. Science brief: evidence used to update the list of underlying medical conditions that increase a person's risk of severe illness from COVID-19. 2021. <https://www.cdc.gov/coronavirus/2019-ncov/science/science-briefs/underlying-evidence-table.html> (accessed June 15, 2021).
- Micah AE, Su Y, Bachmeier SD, et al. Health sector spending and spending on HIV/AIDS, tuberculosis, and malaria, and development assistance for health: progress towards Sustainable Development Goal 3. *Lancet* 2020; **396**: 693–724.
- Lozano R, Fullman N, Mumford JE, et al. Measuring universal health coverage based on an index of effective coverage of health services in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396**: 1250–84.
- Murray CJL, Abbafati C, Abbas KM, et al. Five insights from the Global Burden of Disease Study 2019. *Lancet* 2020; **396**: 1135–59.
- Nolte E, McKee M. Does health care save lives? Avoidable mortality revisited. London: The Nuffield Trust, 2004.
- Beltrán-Sánchez H. Avoidable mortality. In: Rogers RG, Crimmins EM, eds. International handbook of adult mortality. Dordrecht: Springer Netherlands, 2011: 491–508.
- Rutstein DD, Berenberg W, Chalmers TC, et al. Measuring the quality of medical care. A clinical method. *N Engl J Med* 1976; **294**: 582–88.
- The Commonwealth Fund. Mortality amenable to health care. <https://datacenter.commonwealthfund.org/topics/mortality-amenable-health-care> (accessed Feb 10, 2021).
- Gianino MM, Lenzi J, Fantini MP, Ricciardi W, Damiani G. Declining amenable mortality: a reflection of health care systems? *BMC Health Serv Res* 2017; **17**: 735.
- Schoenbaum SC, Schoen C, Nicholson JL, Cantor JC. Mortality amenable to health care in the United States: the roles of demographics and health systems performance. *J Public Health Policy* 2011; **32**: 407–29.
- Allin S, Grignon M. Examining the role of amenable mortality as an indicator of health system effectiveness. *Health Policy* 2014; **9**: 12–19.
- Aburto JM, Riffe T, Canudas-Romo V. Trends in avoidable mortality over the life course in Mexico, 1990–2015: a cross-sectional demographic analysis. *BMJ Open* 2018; **8**: e022350.
- Barber RM, Fullman N, Sorensen RJD, et al. Healthcare Access and Quality Index based on mortality from causes amenable to personal health care in 195 countries and territories, 1990–2015: a novel analysis from the Global Burden of Disease Study 2015. *Lancet* 2017; **390**: 231–66.
- Fullman N, Yearwood J, Abay SM, et al. Measuring performance on the Healthcare Access and Quality Index for 195 countries and territories and selected subnational locations: a systematic analysis from the Global Burden of Disease Study 2016. *Lancet* 2018; **391**: 2236–71.
- Nolte E, McKee M. Measuring the health of nations: analysis of mortality amenable to health care. *BMJ* 2003; **327**: 1129.
- Nolte E, McKee CM. Measuring the health of nations: updating an earlier analysis. *Health Aff (Millwood)* 2008; **27**: 58–71.
- Kamarudeen S. Amenable mortality as an indicator of healthcare quality - a literature review. *Health Stat Q* 2010; **47**: 66–80.
- Mackenbach JP, Hoffmann R, Khoshaba B, et al. Using 'amenable mortality' as indicator of healthcare effectiveness in international comparisons: results of a validation study. *J Epidemiol Community Health* 2013; **67**: 139–46.
- Nolte E, McKee M. Variations in amenable mortality—trends in 16 high-income nations. *Health Policy* 2011; **103**: 47–52.
- Nolte E, McKee CM. In amenable mortality—deaths avoidable through health care—progress in the US lags that of three European countries. *Health Aff (Millwood)* 2012; **31**: 2114–22.
- Hoffmann R, Plug I, Khoshaba B, McKee M, Mackenbach JP. Amenable mortality revisited: the AMIEHS study. *Gac Sanit* 2013; **27**: 199–206.

- 32 Weber A, Clerc M. Deaths amenable to health care: converging trends in the EU? *Health Policy* 2017; **121**: 644–52.
- 33 Vergara-Duarte M, Borrell C, Pérez G, et al. Sentinel amenable mortality: a new way to assess the quality of healthcare by examining causes of premature death for which highly efficacious medical interventions are available. *BioMed Res Int* 2018; **2018**: 5456074.
- 34 Kruk ME, Gage AD, Joseph NT, Danaei G, García-Saisó S, Salomon JA. Mortality due to low-quality health systems in the universal health coverage era: a systematic analysis of amenable deaths in 137 countries. *Lancet* 2018; **392**: 2203–12.
- 35 Karanikolos M, Mackenbach JP, Nolte E, Stuckler D, McKee M. Amenable mortality in the EU—has the crisis changed its course? *Eur J Public Health* 2018; **28**: 864–69.
- 36 Jarčuška P, Janičko M, Barták M, Gavurová B, Vagašová T. Mortality amenable to health care in European Union countries and its limitations. *Cent Eur J Public Health* 2017; **25** (suppl 2): S16–22.
- 37 Gianino MM, Lenzi J, Bonaudo M, et al. Patterns of amenable child mortality over time in 34 member countries of the Organisation for Economic Co-operation and Development (OECD): evidence from a 15-year time trend analysis (2001–2015). *BMJ Open* 2019; **9**: e027909.
- 38 Alvarez JA, Aburto JM, Canudas-Romo V. Latin American convergence and divergence towards the mortality profiles of developed countries. *Popul Stud (Camb)* 2020; **74**: 75–92.
- 39 Mackenbach JP, Hu Y, Artnik B, et al. Trends in inequalities in mortality amenable to health care in 17 European countries. *Health Aff (Millwood)* 2017; **36**: 1110–18.
- 40 Dregan A, McNeill A, Gaughran F, et al. Potential gains in life expectancy from reducing amenable mortality among people diagnosed with serious mental illness in the United Kingdom. *PLoS One* 2020; **15**: e0230674.
- 41 Zilidis C, Stuckler D, McKee M. Use of amenable mortality indicators to evaluate the impact of financial crisis on health system performance in Greece. *Eur J Public Health* 2020; **30**: 861–66.
- 42 Pereyra-Zamora P, Copete JM, Oliva-Arocas A, et al. Changes in socioeconomic inequalities in amenable mortality after the economic crisis in cities of the Spanish Mediterranean coast. *Int J Environ Res Public Health* 2020; **17**: E6489.
- 43 Mayer-Foulkes D. Convergence clubs in cross-country life expectancy dynamics. Helsinki: UNU-WIDER, 2001. <https://www.econstor.eu/handle/10419/52979> (accessed July 29, 2021).
- 44 Bloom DE, Canning D. Mortality traps and the dynamics of health transitions. *Proc Natl Acad Sci USA* 2007; **104**: 16044–49.
- 45 Musgrove P. Public and private roles in health: theory and financing patterns. Washington, DC: World Bank, 1996. <https://openknowledge.worldbank.org/handle/10986/13656> (accessed May 12, 2022).
- 46 Fan VY, Savedoff WD. The health financing transition: a conceptual framework and empirical evidence. *Soc Sci Med* 2014; **105**: 112–21.
- 47 Cutler DM, Lleras-Muney A. Education and health: evaluating theories and evidence. NBER working paper no. w12352. <https://papers.ssrn.com/abstract=913315> (accessed May 12, 2022).
- 48 Organisation for Economic Co-operation and Development. OECD data: working age population. <http://data.oecd.org/pop/working-age-population.htm> (accessed June 14, 2021).
- 49 Institute for Health Metrics and Evaluation. Protocol for the Global Burden of Diseases, Injuries, and Risk Factors Study (GBD). March, 2020. http://www.healthdata.org/sites/default/files/files/Projects/GBD/March2020_GBD%20Protocol_v4.pdf (accessed Sept 12, 2022).
- 50 Murray CJL, Aravkin AY, Zheng P, et al. Global burden of 87 risk factors in 204 countries and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2020; **396**: 1223–49.
- 51 Stevens GA, Alkema L, Black RE, et al. Guidelines for Accurate and Transparent Health Estimates Reporting: the GATHER statement. *Lancet* 2016; **388**: e19–23.
- 52 Forouzanfar MH, Afshin A, Alexander LT, et al. Global, regional, and national comparative risk assessment of 79 behavioural, environmental and occupational, and metabolic risks or clusters of risks, 1990–2015: a systematic analysis for the Global Burden of Disease Study 2015. *Lancet* 2016; **388**: 1659–724.
- 53 Sunkara V, Hébert JR. The colorectal cancer mortality-to-incidence ratio as an indicator of global cancer screening and care. *Cancer* 2015; **121**: 1563–69.
- 54 Salomon JA, Wang H, Freeman MK, et al. Healthy life expectancy for 187 countries, 1990–2010: a systematic analysis for the Global Burden of Disease Study 2010. *Lancet* 2012; **380**: 2144–62.
- 55 Global Burden of Disease Collaborative Network. Global Burden of Disease Study 2019 (GBD 2019) Socio-demographic Index (SDI) 1950–2019. Seattle, WA: Institute for Health Metrics and Evaluation (IHME), 2020. <https://ghdx.healthdata.org/record/ihme-data/gbd-2019-socio-demographic-index-sdi-1950-2019> (accessed Sept 12, 2022).
- 56 GBD 2019 Human Resources for Health Collaborators. Measuring the availability of human resources for health and its relationship to universal health coverage: estimates for 204 countries and territories from 1990 to 2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet* 2022; **399**: 2129–54.
- 57 Cutler D, Deaton A, Lleras-Muney A. The determinants of mortality. *J Econ Perspect* 2006; **20**: 97–120.
- 58 Jamison DT, Summers LH, Alleyne G, et al. Global health 2035: a world converging within a generation. *Lancet* 2013; **382**: 1898–955.
- 59 Skirbekk V, Ottersen T, Hamavid H, Sadat N, Dieleman JL. Vast majority of development assistance for health funds target those below age sixty. *Health Aff (Millwood)* 2017; **36**: 926–30.
- 60 Reiner RC Jr, Graetz N, Casey DC, et al. Variation in childhood diarrheal morbidity and mortality in Africa, 2000–2015. *N Engl J Med* 2018; **379**: 1128–38.
- 61 Burstein R, Henry NJ, Collison ML, et al. Mapping 123 million neonatal, infant and child deaths between 2000 and 2017. *Nature* 2019; **574**: 353–58.
- 62 Wiens KE, Lindstedt PA, Blacker BF, et al. Mapping geographical inequalities in oral rehydration therapy coverage in low-income and middle-income countries, 2000–17. *Lancet Glob Health* 2020; **8**: e1038–60.
- 63 Sbarra AN, Rolfe S, Nguyen JQ, et al. Mapping routine measles vaccination in low- and middle-income countries. *Nature* 2021; **589**: 415–19.
- 64 Mosser JF, Gagne-Maynard W, Rao PC, et al. Mapping diphtheria-pertussis-tetanus vaccine coverage in Africa, 2000–2016: a spatial and temporal modelling study. *Lancet* 2019; **393**: 1843–55.
- 65 Marino M, de Belvis AG, Tanzariello M, et al. Effectiveness and cost-effectiveness of integrated care models for elderly, complex patients: a narrative review. Don't we need a value-based approach? *Int J Care Coord* 2018; **21**: 120–39.
- 66 Chin-Yee N, D'Egidio G, Thavorn K, Heyland D, Kyeremanteng K. Cost analysis of the very elderly admitted to intensive care units. *Crit Care* 2017; **21**: 109.
- 67 Hazra NC, Rudisill C, Gulliford MC. Determinants of health care costs in the senior elderly: age, comorbidity, impairment, or proximity to death? *Eur J Health Econ* 2018; **19**: 831–42.
- 68 Duault LA, Brown L, Fried L. The elderly: an invisible population in humanitarian aid. *Lancet Public Health* 2018; **3**: e14.
- 69 Li L, Du T, Hu Y. The effect of population ageing on healthcare expenditure from a healthcare demand perspective among different age groups: evidence from Beijing City in the People's Republic of China. *Risk Manag Healthc Policy* 2020; **13**: 1403–12.
- 70 WHO. Primary health care. <https://www.who.int/news-room/factsheets/detail/primary-health-care> (accessed May 12, 2022).
- 71 Sharma N, Chakrabarti S, Grover S. Gender differences in caregiving among family - caregivers of people with mental illnesses. *World J Psychiatry* 2016; **6**: 7–17.
- 72 Mathiowetz N, Oliker S. The gender gap in caregiving to adults. University of Wisconsin-Milwaukee. November, 2005. www.atusers.umd.edu/wip2/papers/Oliker.pdf (accessed Dec 1, 2018).
- 73 Bloom D, Canning D, Sevilla J. The demographic dividend: a new perspective on the economic consequences of population change. RAND, 2003. https://www.rand.org/pubs/monograph_reports/MR1274.html (accessed Feb 10, 2021).
- 74 Migliori GB, Thong PM, Akkerman O, et al. Worldwide effects of coronavirus disease pandemic on tuberculosis services, January–April 2020. *Emerg Infect Dis* 2020; **26**: 2709–12.

-
- 75 Leite H, Hodgkinson IR, Gruber T. New development: 'Healing at a distance'—telemedicine and COVID-19. *Public Money Manag* 2020; **40**: 483–85.
- 76 Donabedian A. The quality of care. How can it be assessed? *JAMA* 1988; **260**: 1743–48.
- 77 Donabedian A. Evaluating the quality of medical care. 1966. *Milbank Q* 2005; **83**: 691–729.
- 78 Frenk J. Concept and measurement of accessibility. *Salud Publica Mex* 1985; **27**: 438–53 (in Spanish).