

# THE LANCET

## Global Health

### Supplementary appendix 2

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

Supplement to: GBD 2019 Pakistan Collaborators. The state of health in Pakistan and its provinces and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019. *Lancet Glob Health* 2023; **11**: e229–43.

## Supplementary appendix to “The state of health of Pakistan and its provinces and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019”

This appendix provides supplemental information and more detailed results for “The state of health of Pakistan and its provinces and territories, 1990–2019: a systematic analysis for the Global Burden of Disease Study 2019.”

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## Section 1: Abbreviations

<b>Abbreviation</b>	<b>Full phrase</b>
CODEm	Cause of Death Ensemble modelling
COPD	chronic obstructive pulmonary disease
COVID-19	coronavirus disease 2019
DALY	disability-adjusted life-years
GATHER	Guidelines for Accurate and Transparent Health Estimates Reporting
GBD	Global Burden of Diseases, Injuries, and Risk Factors Study
HALE	healthy life expectancy
HAQ	Healthcare Access and Quality
IHD	ischaemic heart disease
IHME	Institute for Health Metrics and Evaluation
LE	life expectancy
LMIC	low- and middle-income countries
SARS-CoV-2	severe acute respiratory syndrome coronavirus 2
SDI	Socio-demographic Index
SDG	Sustainable Development Goals
SEV	summary exposure value
SRS	sample registration survey
TB	tuberculosis
UHC	universal health coverage
U5M	under-5 mortality
UI	uncertainty interval
WHO	World Health Organization
YLD	years lived with disability
YLL	years of life lost

## Section 2: GATHER compliance

This study complies with GATHER recommendations. We have documented the steps in our analytical procedures and detailed the data sources used. See section 9 for the GATHER checklist. The GATHER recommendations can be found on the [GATHER website](#).

## Section 3: Pakistan subnational locations

Pakistan subnational locations and administrative units

<b>Name</b>	<b>Capital</b>	<b>Designation</b>
Azad Jammu and Kashmir	Muzaffarabad	Territory
Balochistan	Quetta	Province
Gilgit-Baltistan	Gilgit	Territory
Islamabad Capital Territory	Islamabad	Territory
Khyber Pakhtunkhwa*	Peshawar	Province

Punjab	Lahore	Province
Sindh	Karachi	Province

\*Formerly known as North-West Frontier Province (NWFP)

## Section 4: Data sources

### 4.1. Input data sources used in GBD 2019 national and subnational estimation of Pakistan

Further information on the data sources utilised for this study can be found within the Global Health Data Exchange (GHDx) via the Data Input Sources tool, accessible here:

<http://ghdx.healthdata.org/gbd-2019/data-input-sources>

<b>Input data for GBD 2019 national and subnational estimation of Pakistan</b>
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#### 4.2. Source counts by national and subnational administrative units

##### Pakistan source counts by location

Location	Source counts
Pakistan	1571
Azad Jammu & Kashmir	272
Balochistan	296
Gilgit-Baltistan	255
Islamabad Capital Territory	268
Khyber Pakhtunkhwa	319
Punjab	323
Sindh	384

## Section 5: Politics and governance

### 5.1. Political chronology, 1990–2019

Year	Event(s)
1990	Benazir Bhutto dismissed as prime minister
1991	Prime Minister Nawaz Sharif begins economic liberalisation programmes
1993	Prime Minister Sharif resigns under pressure from military. Benazir Bhutto reelected.
1996	President Leghari dismisses Bhutto government amid corruption allegations.
1997	Nawaz Sharif returns as prime minister after Muslim League wins elections.
1998	Pakistan conducts nuclear tests after India explodes several nuclear devices.
1999	Benazir Bhutto and husband convicted of corruption and given jail sentences. Bhutto voluntarily exiled.
1999	General Pervez Musharraf seizes power in coup.
2000	Nawaz Sharif sentenced to life imprisonment on hijacking and terrorism charges over his actions to prevent the 1999 coup.
2001	General Pervez Musharraf names himself president while remaining head of the military.
2002	Musharraf wins another five years in office in a controversial referendum.
2005	Pakistan tests its first nuclear-capable cruise missile.
2005	Earthquake kills tens of thousands of people in Pakistani-administered Kashmir.
2007	Pakistan and India sign an agreement aimed at reducing the risk of accidental nuclear war.
2007	Ex-prime minister Benazir Bhutto returns from exile.
2007	Musharraf's reelection challenged by Supreme Court. He declares emergency rule, dismisses Chief Justice Chaudhry, and appoints new Supreme Court, which confirms his re-election.
2007	Benazir Bhutto assassinated at election campaign rally in Rawalpindi.
2008	Pakistan People's Party (PPP) nominee Yusuf Raza Gilani becomes Prime Minister at head of coalition with Nawaz Sharif's Muslim League party following parliamentary elections.
2008	President Musharraf resigns.
2012	Supreme Court disqualifies Prime Minister Gilani from holding office. Parliament approves Water and Power Minister Raja Pervez Ashraf as his successor.
2013	Parliament approves Nawaz Sharif as prime minister after his Muslim League-N wins parliamentary elections in May.
2017	Prime Minister Nawaz Sharif is forced to resign after being disqualified by the Supreme Court over corruption charges. He is convicted and given a jail sentence. Parliament approves Shahid K. Abbasi as his successor.
2018	Former international cricket star Imran Khan becomes Prime Minister.

## 5.2. Additional notes on the 18th amendment

The National Assembly of Pakistan ratified the 18<sup>th</sup> amendment of the constitution on April 8, 2010. The 18th amendment brought massive changes to the Pakistan political system. It confined the federal government's role in the health-care industry to health information, interprovincial coordination, global health, and health regulation, while all other health responsibilities were brought under provincial governments.

## Section 6: Appendix tables

Appendix Table 1: Life expectancy, HALE, and SDI for both sexes for Pakistan and comparator countries

We also analysed national estimates for six comparator countries: Iran, Indonesia, Afghanistan, China, Bangladesh, and India. Comparator countries were chosen based on similar socio-demographic levels and/or location adjacency. Supplemental Appendix Table 1 shows life expectancy and HALE for males, females, and both sexes combined for Pakistan, China, India, Iran, Afghanistan, Bangladesh, and Indonesia in 1990 and 2019. Life expectancy in Pakistan increased from 61.7 years (95% UI 60.9–62.6) in 1990 to 66.4 (63.8–69.1) in 2019 for males and from 61.6 (60.8–62.4) to 67.5 (65.1–70.1) for females, an increase of 7.6% (3.0–12.0) and 9.6% (5.3–14.0), respectively. HALE increased from 54.1 (51.8–56.2) in 1990 to 58.2 (55.3–61.1) in 2017 for males and from 52.5 (45.0–54.9) to 57.8 (54.6–60.9) for females, an increase of 7.6% (3.5–11.8) and 10.1% (6.3–13.8), respectively. Among all seven countries, only Afghanistan had a lower life expectancy and HALE than Pakistan in 2019. Both India and Bangladesh had lower life expectancies and HALE in 1990 than Pakistan but higher ones in 2019.

Supplementary Table 1. Comparison of life expectancy (LE), healthy life expectancy (HALE), and Socio-demographic Index (SDI) between Pakistan and select countries, 1990–2019

	Life expectancy at birth, HALE, and Socio-demographic index, both sexes																			
	Life expectancy at birth			LE % Change			HALE			HALE % Change			Socio-Demographic index			SDI % Change				
	1990	2010	2019	1990–2010	2010–2019	1990–2019	1990	2010	2019	1990–2010	2010–2019	1990–2019	1990	2010	2019	1990–2010	2010–2019	1990–2019		
Pakistan	61.1 (60.0–62.1)	63.3 (61.7–65.0)	65.9 (63.8–67.8)	3.60%	4.11%	7.86%	53.2 (50.8–55.3)	55.1 (52.7–57.6)	57.2 (54.3–60.1)	3.57%	3.81%	7.52%	0.26	0.417	0.476	60.38%	14.15%	83.08%		
South Asia	59.5 (58.9–60.3)	67.0 (66.3–67.7)	70.4 (69.2–71.7)	12.61%	5.07%	18.32%	51.2 (48.7–53.4)	57.6 (54.9–59.9)	60.4 (57.3–63.1)	12.50%	4.80%	17.97%	0.312	0.455	0.539	45.83%	18.46%	72.76%		
Bangladesh	58.2 (57.1–59.2)	70.0 (69.0–71.1)	74.6 (72.4–76.7)	20.27%	6.57%	28.18%	50.7 (48.3–52.8)	61.0 (58.2–63.5)	64.5 (61.3–67.4)	20.32%	5.74%	27.22%	0.246	0.389	0.475	58.13%	22.11%	93.09%		
India	59.6 (58.7–60.5)	67.3 (66.4–68.1)	70.8 (69.3–72.2)	12.92%	5.20%	18.79%	51.1 (48.5–53.3)	57.6 (54.9–60.1)	60.5 (57.4–63.3)	12.72%	5.03%	18.40%	0.327	0.469	0.558	43.43%	18.98%	70.64%		
Nepal	58.3 (56.3–60.3)	69.0 (67.5–70.5)	71.1 (69.4–73.2)	18.35%	3.04%	21.96%	50.4 (47.7–53.1)	59.8 (56.9–62.3)	61.5 (58.6–64.4)	18.65%	2.84%	22.02%	0.198	0.358	0.427	80.81%	19.27%	115.66%		
Mexico	70.9 (70.5–71.2)	75.2 (75.0–75.5)	75.6 (74.6–76.7)	6.06%	0.53%	6.63%	61.4 (58.7–63.8)	65.4 (62.2–67.7)	65.2 (62.3–68.1)	6.19%	0.31%	6.51%	0.492	0.593	0.636	20.53%	7.25%	29.27%		
Brazil	67.3 (66.9–67.7)	73.8 (73.5–74.2)	75.8 (75.4–76.3)	9.66%	2.71%	12.63%	58.0 (55.2–60.4)	63.5 (60.5–66.1)	65.2 (62.2–67.9)	9.48%	2.68%	12.41%	0.484	0.594	0.64	22.73%	7.74%	32.23%		
Afghanistan	53.8 (51.4–56.0)	60.5 (57.5–63.2)	63.3 (60.7–65.9)	12.45%	4.63%	17.66%	45.6 (41.3–49.0)	51.7 (48.0–54.8)	54.1 (50.7–57.2)	13.38%	4.64%	18.64%	0.179	0.248	0.332	38.55%	33.87%	85.47%		
Iran (Islamic Republic of)	66.7 (65.9–67.4)	75.5 (75.2–75.7)	77.8 (77.5–78.0)	13.19%	3.05%	16.64%	57.8 (55.1–60.1)	65.0 (62.0–67.6)	66.8 (63.7–69.7)	12.46%	2.77%	15.57%	0.43	0.636	0.697	47.91%	9.59%	62.09%		
China	68.1 (67.0–69.4)	74.9 (74.2–75.7)	77.6 (76.3–79.0)	9.99%	3.60%	13.95%	60.5 (58.1–62.7)	66.6 (64.1–68.8)	68.5 (65.9–71.0)	10.08%	2.85%	13.22%	0.44	0.624	0.692	41.82%	10.90%	57.27%		
Indonesia	64.1 (63.2–64.9)	69.3 (68.2–70.3)	71.4 (70.0–73.0)	8.11%	3.03%	11.39%	55.9 (53.5–58.1)	60.9 (58.4–63.2)	62.6 (59.9–65.0)	8.94%	2.79%	11.99%	0.458	0.593	0.658	29.48%	10.96%	43.67%		
Maldives	65.5 (64.8–66.2)	77.8 (77.2–78.3)	79.1 (77.6–80.6)	18.78%	1.67%	20.76%	57.5 (55.1–59.7)	68.1 (65.3–70.5)	69.1 (66.1–71.8)	18.43%	1.47%	20.17%	0.321	0.519	0.579	61.68%	11.56%	80.37%		
Sri Lanka	69.6 (68.9–70.3)	74.1 (73.9–74.2)	77.3 (74.8–80.1)	6.47%	4.32%	11.06%	61.0 (58.4–63.3)	64.5 (61.7–66.9)	66.9 (63.3–70.3)	5.74%	3.72%	9.67%	0.505	0.624	0.685	23.56%	9.78%	35.64%		
Nigeria	54.7 (52.9–56.6)	59.6 (57.5–61.8)	64.3 (62.2–66.6)	8.96%	7.89%	17.55%	47.6 (45.3–50.1)	52.0 (49.1–54.7)	56.0 (53.0–58.9)	9.24%	7.69%	17.65%	0.249	0.378	0.461	51.81%	23.96%	85.14%		
				Average change:	11.53%	3.96%	15.96%				Average change:	11.55%	3.66%	15.64%			Average change:	44.76%	15.47%	67.60%

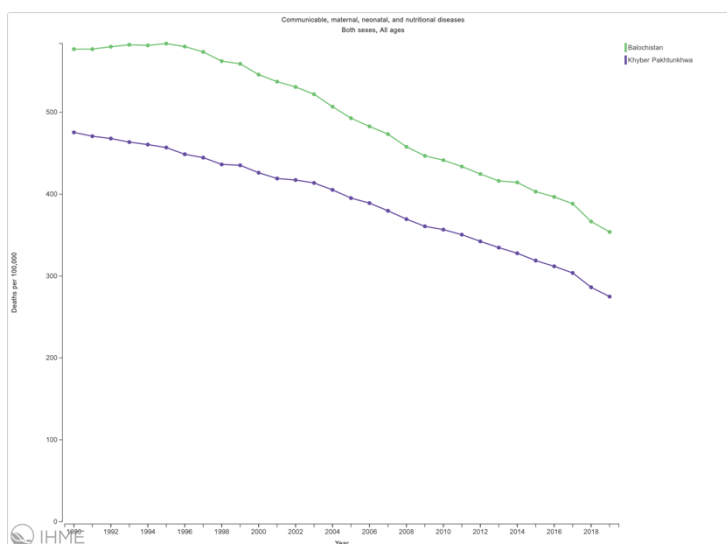
Appendix Table 2: Healthcare Access and Quality Index for Pakistan, 1990-2019

Healthcare Access and Quality (HAQ) Index for Pakistan and subnational units, 1990–2019			
	Healthcare Access and Quality (HAQ) Index		HAQ Index % change
	1990	2019	1990–2019
Pakistan	21.9 (20.2–23.6)	32.1 (30.4–33.8)	46.94%
Azad Jammu & Kashmir	24.3 (22.6–26.0)	37.7 (36.1–39.3)	54.79%
Balochistan	24.6 (22.9–26.3)	30.5 (29.0–32.2)	24.13%
Gilgit-Baltistan	22.2 (20.4–24.1)	29.7 (28.2–31.3)	33.89%
Islamabad Capital Territory	38.3 (36.6–40.3)	56.1 (54.4–57.7)	46.21%
Khyber Pakhtunkhwa	29.0 (27.2–30.7)	32.4 (30.8–33.9)	11.63%
Punjab	20.4 (18.8–22.4)	31.5 (30.0–33.1)	54.17%
Sindh	24.4 (22.7–26.2)	36.1 (34.5–37.7)	47.59%

## Section 7: Appendix figures

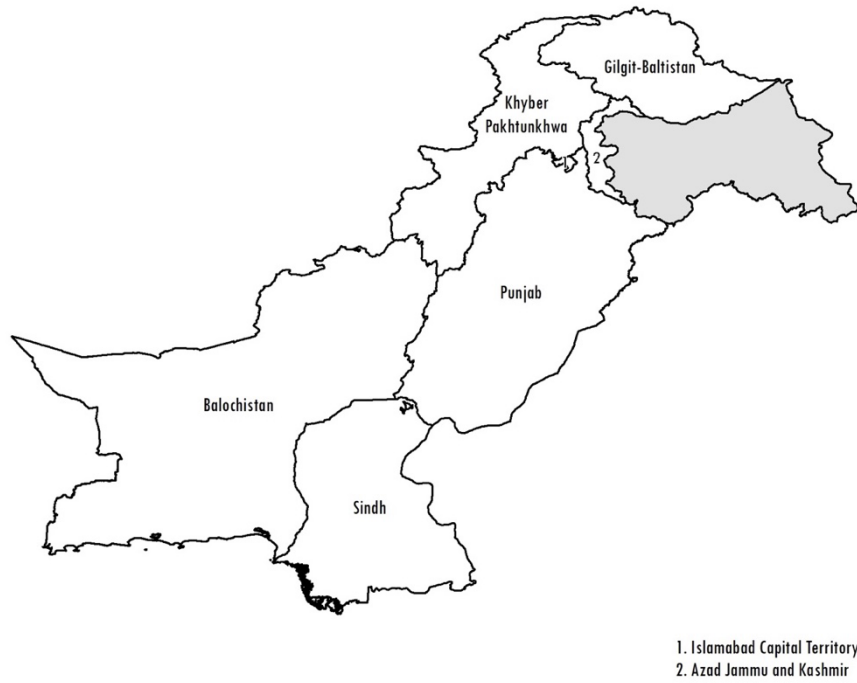
Appendix Figure 1: Trends in communicable, maternal, neonatal, and nutritional causes for Khyber Pakhtunkhwa and Balochistan

(This image is accessible via GBD compare: <http://ihmeuw.org/5yh9>)

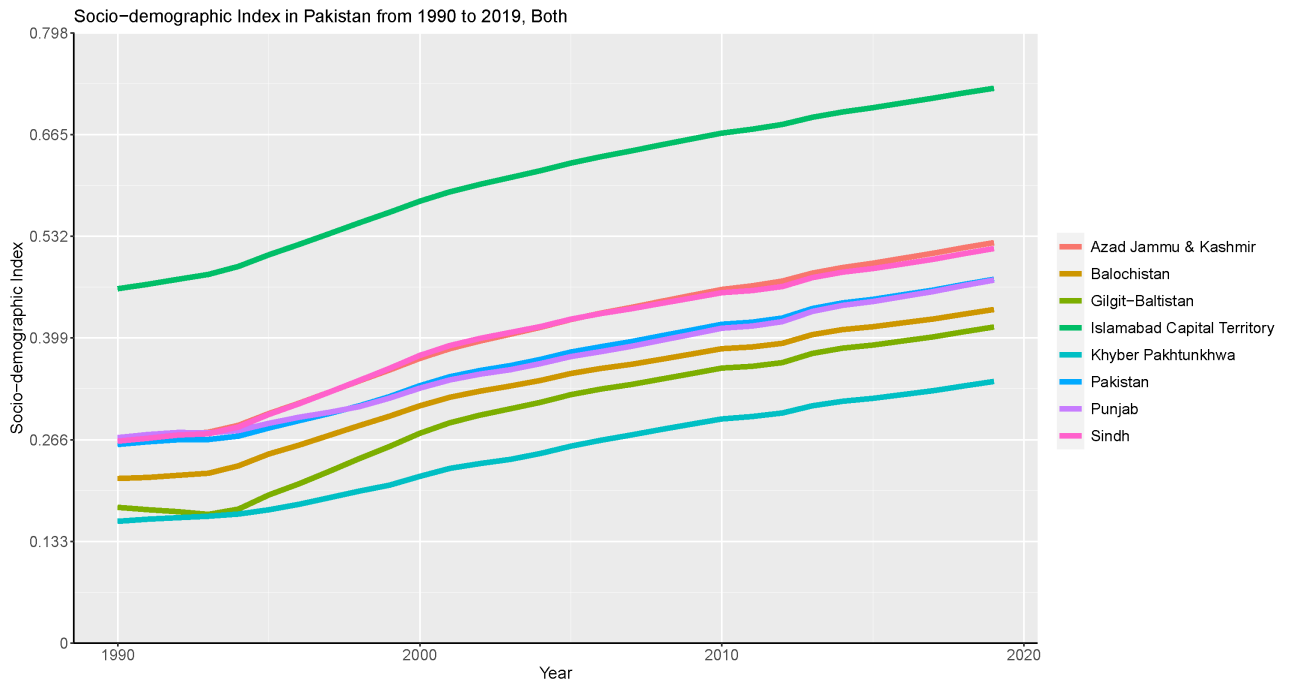




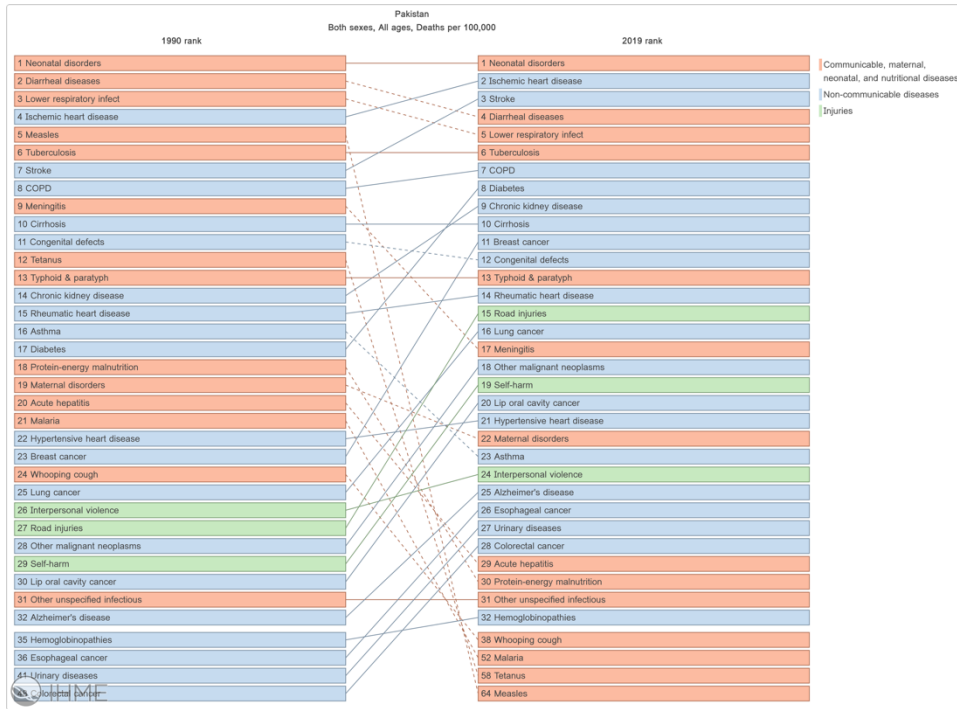
Appendix Figure 2: Political map of Pakistan



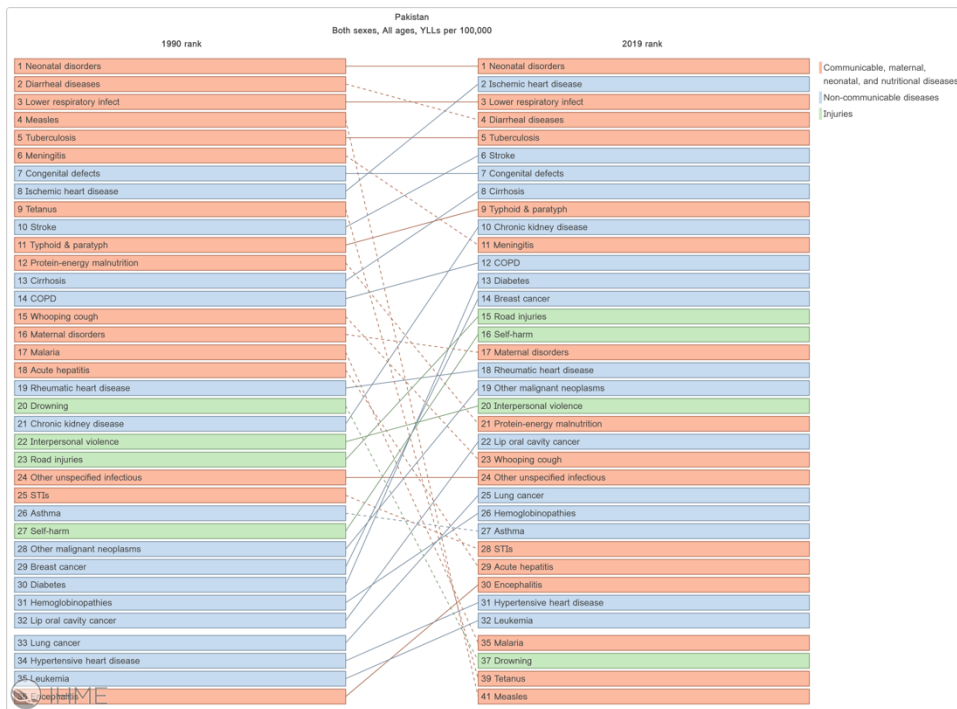
Appendix Figure 3: SDI values for Pakistan and seven subnational units, 1990–2019



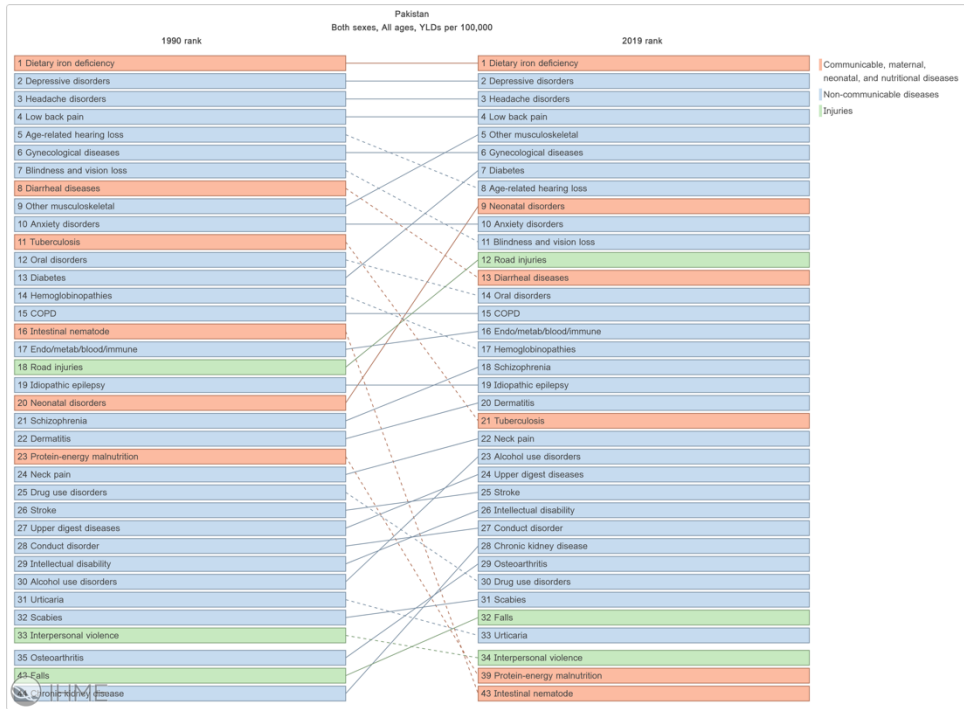
Appendix Figure 4: Leading causes of all-age deaths for both sexes, 1990 to 2019



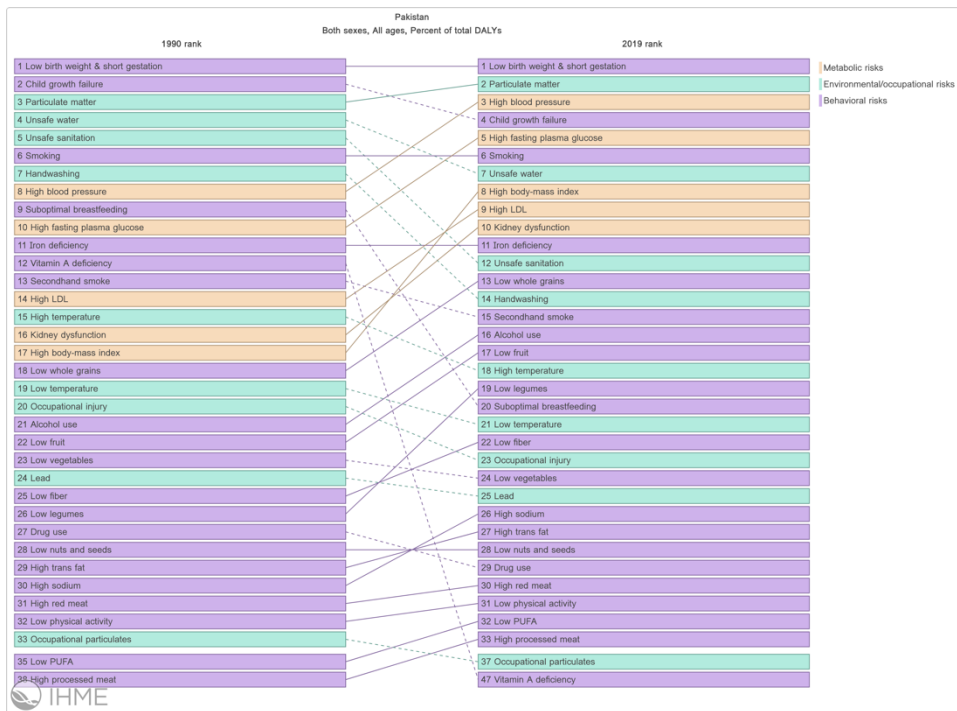
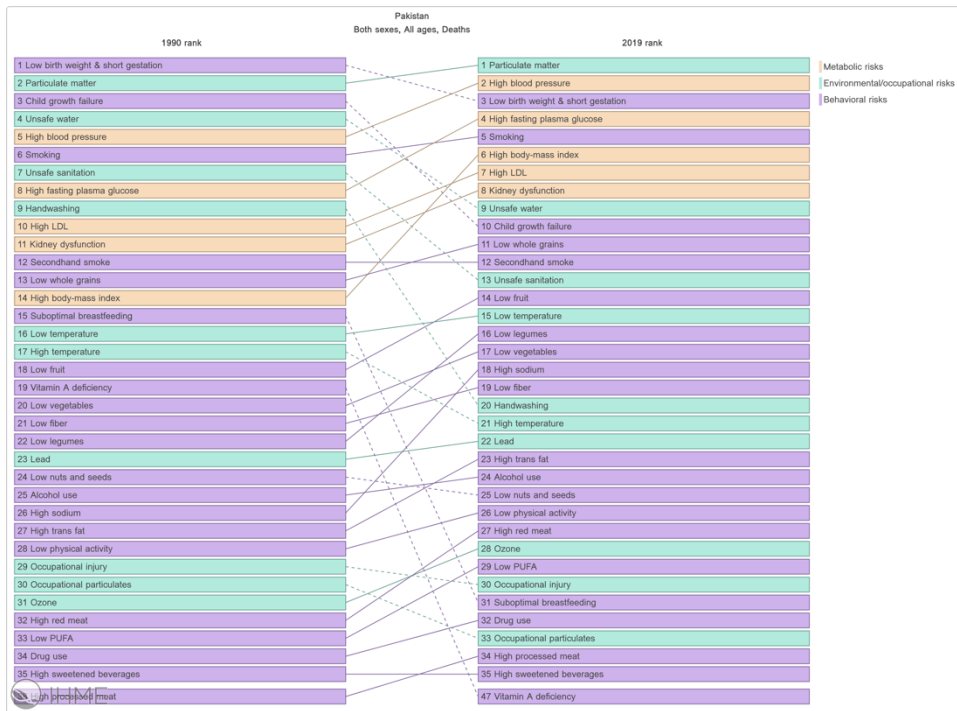
Appendix Figure 5: Leading causes of YLLs for all ages and both sexes, 1990 and 2019



Appendix Figure 6: Changes in YLDs for all ages and both sexes, 1990 and 2019



Appendix Figure 7: Number of deaths (top) and percentage of DALYs (bottom) attributable to the leading risk factors for all ages and both sexes, 1990 and 2019



## Section 8: GATHER tables

### GATHER checklist

Item #	Checklist item	Reported on page #
<b>Objectives and funding</b>		
1	Define the indicator(s), populations (including age, sex, and geographic entities), and time period(s) for which estimates were made.	2; 11-15
2	List the funding sources for the work.	4; 15; 28
<b>Data Inputs</b>		
<i>For all data inputs from multiple sources that are synthesised as part of the study:</i>		
3	Describe how the data were identified and how the data were accessed.	11-15; Appendix
4	Specify the inclusion and exclusion criteria. Identify all ad-hoc exclusions.	11-15; Appendix
5	Provide information on all included data sources and their main characteristics. For each data source used, report reference information or contact name/institution, population represented, data collection method, year(s) of data collection, sex and age range, diagnostic criteria or measurement method, and sample size, as relevant.	11-15; Appendix
6	Identify and describe any categories of input data that have potentially important biases (e.g., based on characteristics listed in item 5).	11-15; Appendix
<i>For data inputs that contribute to the analysis but were not synthesised as part of the study:</i>		
7	Describe and give sources for any other data inputs.	11-15; Appendix
<i>For all data inputs:</i>		
8	Provide all data inputs in a file format from which data can be efficiently extracted (e.g., a spreadsheet rather than a PDF), including all relevant meta-data listed in item 5. For any data inputs that cannot be shared because of ethical or legal reasons, such as third-party ownership, provide a contact name or the name of the institution that retains the right to the data.	Appendix; GHDx URL
<b>Data analysis</b>		
9	Provide a conceptual overview of the data analysis method. A diagram may be helpful.	11-15
10	Provide a detailed description of all steps of the analysis, including mathematical formulae. This description should cover, as relevant, data cleaning, data pre-processing, data adjustments and weighting of data sources, and mathematical or statistical model(s).	11-15; Appendix
11	Describe how candidate models were evaluated and how the final model(s) were selected.	11-15; Appendix
12	Provide the results of an evaluation of model performance, if done, as well as the results of any relevant sensitivity analysis.	N/A
13	Describe methods for calculating uncertainty of the estimates. State which sources of uncertainty were, and were not, accounted for in the uncertainty analysis.	14
14	State how analytic or statistical source code used to generate estimates can be accessed.	Available through GHDx link (upon publication)

<b>Results and Discussion</b>		
<b>15</b>	Provide published estimates in a file format from which data can be efficiently extracted.	N/A
<b>16</b>	Report a quantitative measure of the uncertainty of the estimates (e.g. uncertainty intervals).	14
<b>17</b>	Interpret results in light of existing evidence. If updating a previous set of estimates, describe the reasons for changes in estimates.	5-7
<b>18</b>	Discuss limitations of the estimates. Include a discussion of any modelling assumptions or data limitations that affect interpretation of the estimates.	26-27