Estimated Country-Specific Rates of Hospitalized Care for Detected COVID Infections

Laura Skrip[1] and Brittany Hagedorn[1] on behalf of the IDM COVID-19 Response Team

[1]Institute for Disease Modeling, covid@idmod.org

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Executive Summary

- **Purpose:** To provide estimates of expected rates of hospital-based care required for COVID-19 cases after accounting for the context in low- and middle-income countries (LMICs).
- **Background:** It has been estimated that approximately 19% of all COVID-19 infected individuals will require hospitalization for specialized care. This data is based on the best-known evidence to date, but reporting has predominantly been from more developed economies that have somewhat different chronic disease burdens and population age structure than those in LMICs. Furthermore, some LMICs have adopted hospitalization of all cases as a control strategy, maxing out bed capacity and confounding needs for specialized medical care.
- **Key Findings:** The percentage of COVID-19 cases in LMICs requiring specialized medical care may be lower than that observed to date in the HMICs, most notably in countries like Bangladesh, Senegal, and Nigeria. In contrast, LMICs such as South Africa with age structures more similar to those in HMICs and with high rates of untreated non-communicable disease, HIV, and TB could be at risk for higher than observed trends for specialized hospital care among their cases. The interplay of disease control, age structure, and disease prevalence warrants attention to better understand high-risk groups and undertake efforts to protect them in LMIC settings.
- **Geography:** Ethiopia, Kenya, Nigeria, Senegal, South Africa, Bangladesh, India, and Pakistan.

Methods

We identified age-specific rates of comorbidities that have established or potential associations with increased vulnerability to COVID-19 complications and death. Country-specific data included here on tuberculosis, HIV, hypertension, and diabetes were derived from population- and/or community-based studies and from WHO country profile documents. Details on the data sources of prevalence rates for each country are in the Appendix. We also identified estimates (not age-adjusted) for percentages of treatment or control of conditions for each country.

Increasing evidence exists for heightened risk of severe disease and mortality among confirmed COVID-19 cases with diabetes, hypertension, cardiovascular disease, among other non-communicable conditions. Despite clinical hypotheses suggesting mechanisms for increased susceptibility, there are currently limited data to support any relationship between heightened risk of severe disease due to COVID and tuberculosis or HIV.

As data are predominately available for settings with low TB/HIV prevalence and high rates of treatment coverage for these infections, further investigation in LMIC settings is warranted to understand if individuals (namely, those who are not on treatment) may be at increased risk. Their inclusion in some scenarios here is intended to provide the most conservative hospitalization rates, given lack of age-specific treatment rates.

Assuming the distribution of underlying conditions among cases reflects that in the general population, we derived the proportion of cases in each age group with at least one underlying condition. Due to the lack of age-specific data on co-occurrence of underlying conditions (except HIV/TB), we considered two scenarios. The “less conservative scenario” based on an assumption that no individual had more than one underlying condition, such that the percentage of an age group with an underlying condition was equal to the sum of percentages across all conditions (% with HIV + % with TB +

% with HIV/TB coinfection + % with hypertension + % with diabetes). The "more conservative" scenario based on an assumption of complete overlap of underlying conditions, such that the percentage of an age group with an underlying condition was equal to the percentage associated with the most prevalent condition in that age category. Furthermore, due to the currently inconclusive evidence around increased risk of severe disease among people with TB and HIV, we considered a third scenario based on prevalence of hypertension and diabetes only. 95% confidence intervals around point estimates are provided for both scenarios and reflect standard deviations provided or calculated for the individual conditions.

The proportion of cases requiring specialized medical care in each age category was assumed to be 9.7% (95% CI: 8.8%-10.6%) of those without any underlying conditions and 44% (95% CI: 42.0%-45.9%) of those with one or more underlying conditions, based on a recent report describing hospitalization rates among US cases. That is, the percentage of cases in a given age group requiring care in a hospital was equal to 9.7% x (100%-P) + 14% x P for the percentage of the group with one or more underlying conditions (P). The 95% confidence intervals were calculated for the reported percentages using the number of patients in the study.

We used country-specific population age structures, derived from the International Programs Database of the US Census Bureau (2020 data) to calculate the overall country estimates for the percentage of cases requiring specialized care. That is, we multiplied the percentage of cases in a given age group requiring care in a hospital, as described in the previous paragraph, times the percentage of the population falling in that age group, and summed the results of all age groups. This is likely an overly conservative estimate since children have generally experienced more mild manifestations of the disease and required less hospitalized care.

Considerations: Our estimates for the need of hospitalized care in LMIC settings are based on observations around hospitalization (ICU and non-ICU) and underlying conditions from over 120,000 confirmed COVID-19 cases reported to the US CDC from all 50 states and four territories, and among individuals repatriated to the US. It is therefore expected that these would reflect trends among cases in the general population during periods of widespread local transmission and routine testing of people under surveillance or self-presenting.

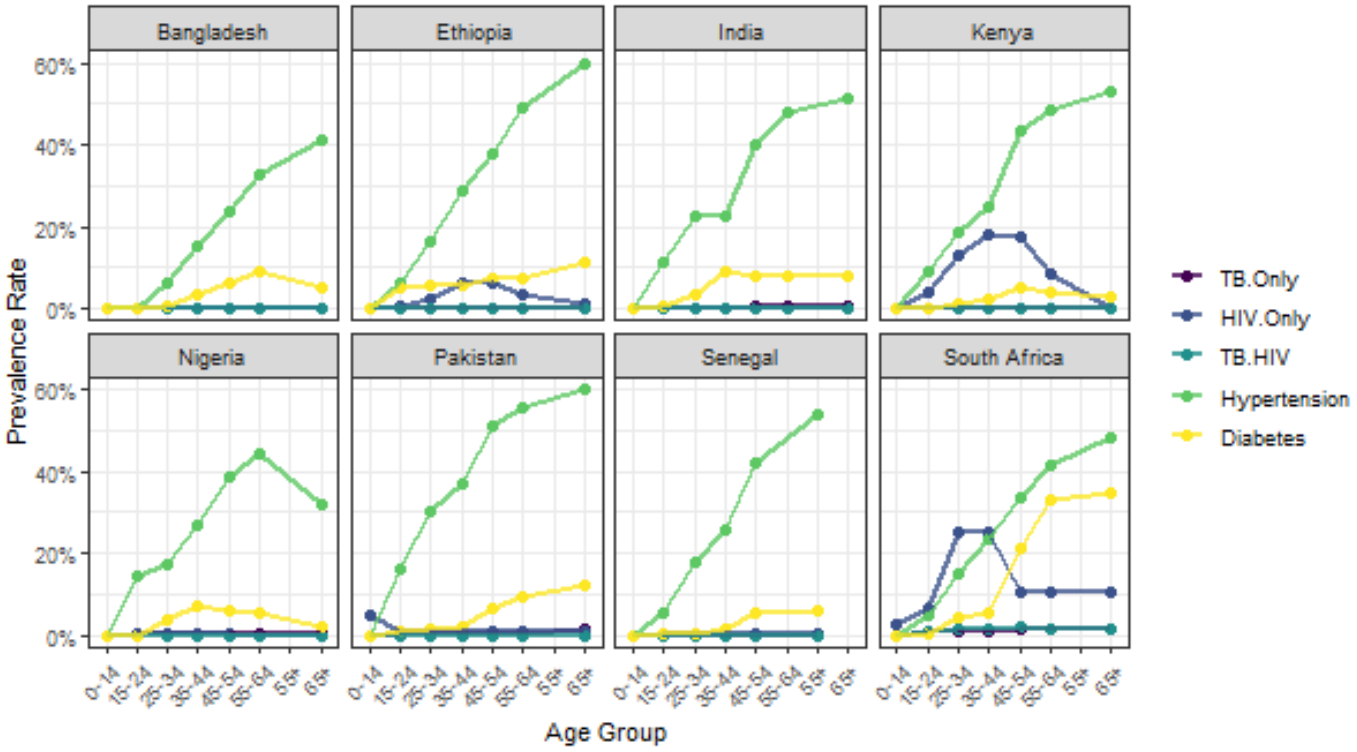
In the absence of routine testing, observed needs for hospitalized care may be higher than those estimated here since a higher proportion of cases being detected would be symptomatic and seeking care, when compared to cases detected through active surveillance efforts. Hospital care is expected to be needed for individuals experiencing severe (dyspnea, hypoxia, or >50% lung involvement on imaging) or critical disease (respiratory failure, shock, or multiorgan system dysfunction), as previously defined.

As hospitalization data in LMIC settings becomes available, it will be important to validate the methods and update the data sources used in this analysis.

Results

The age-specific prevalence rates of TB, HIV, TB-HIV coinfection, hypertension, and diabetes are presented in Figure 1, across the eight countries. Non-communicable diseases tended to be more prevalent in older age groups (see end of Results section for country-level data tables). Nigeria was an exception, with reports of lower rates of hypertension and diabetes in the 65 and older age group relative to younger age groups. In Ethiopia, Kenya, and South Africa, HIV is more prevalent than non-communicable conditions for some age groups. A recent trend in HIV among children in Pakistan is also reflected.

Figure 1. Prevalence of conditions that may be associated with risk of COVID-related hospitalization and mortality. Rates are per-person and do not reflect joint prevalence except for the TB-HIV rate.



The age-specific rates of estimated needs for specialized care among cases reflects the trends in underlying conditions (Figures 2 and 3). For analyses including all conditions and those including hypertension and diabetes only, the greatest differences between the less and more conservative scenarios were observed for South Africa due to the relatively high rates of multiple conditions. For other countries, hypertension was considerably more prevalent than all other conditions for age groups representing individuals over 15 years.

Figure 2. Estimated hospitalization rates by country and age group, accounting for HIV and TB. Shaded area represents the range of possible values, given the less-conservative (green) and more-conservative (purple) assumptions about the co-existence of multiple conditions in a given individual.

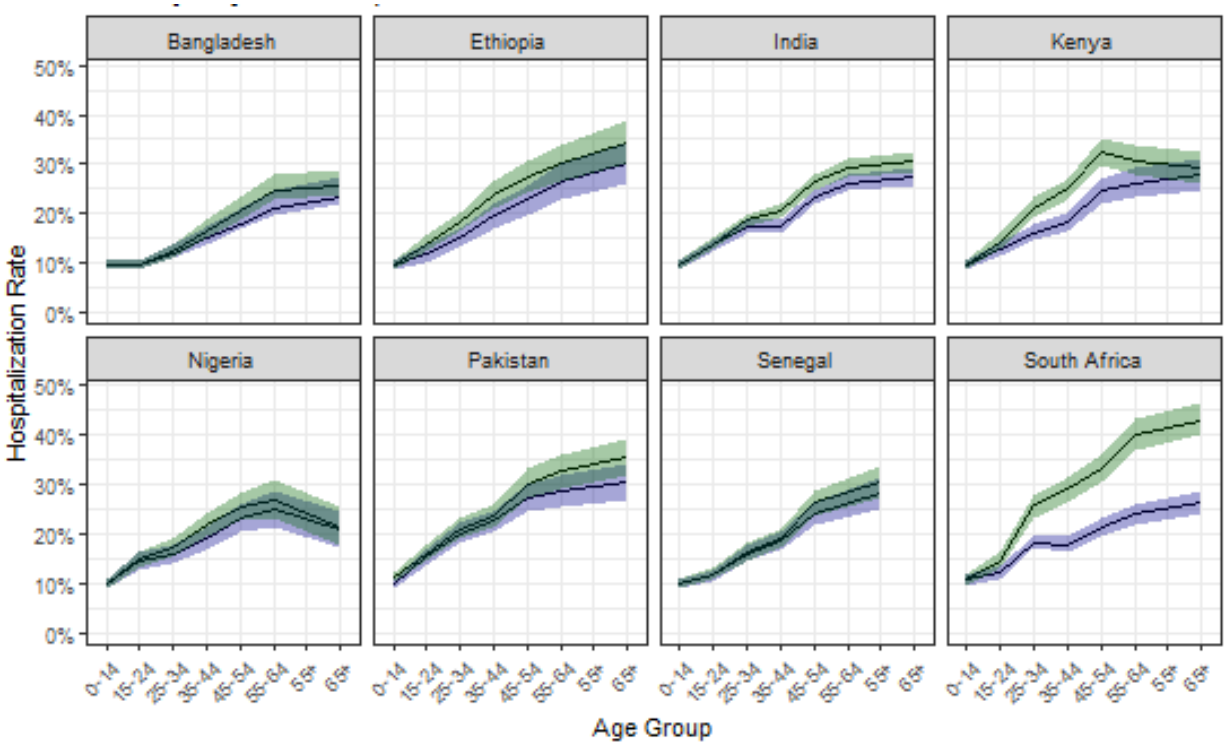
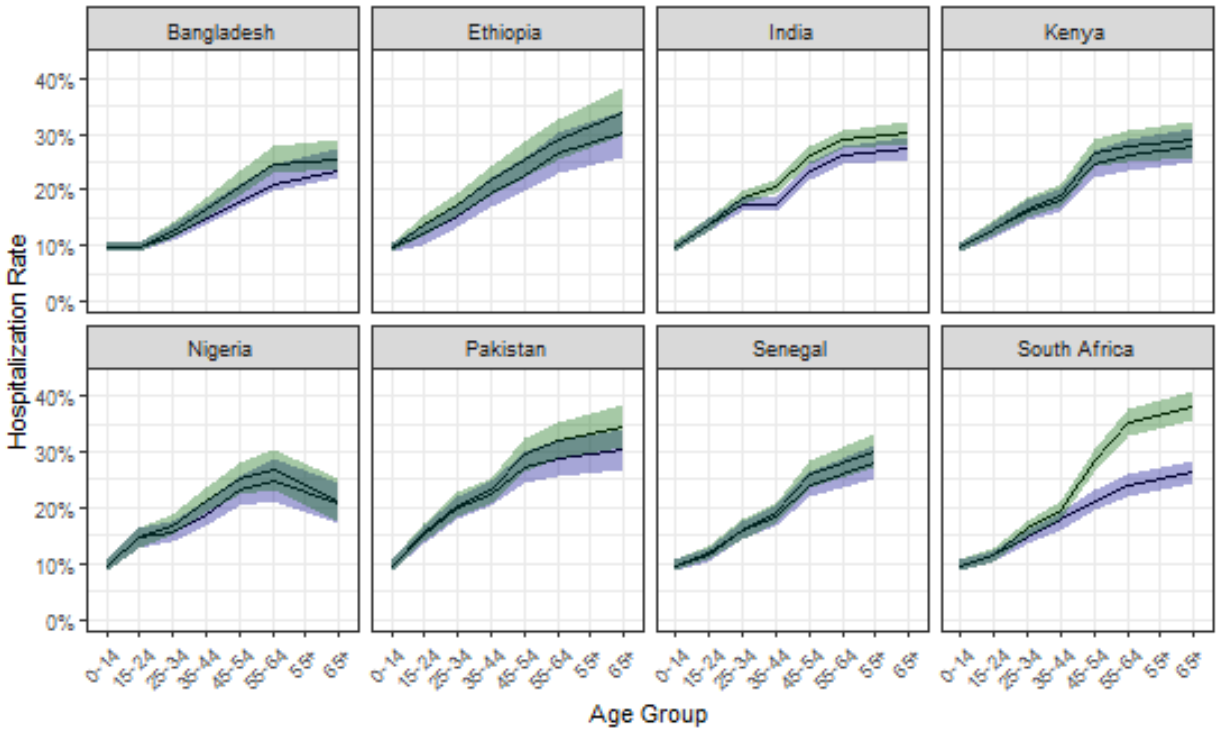


Figure 3. Estimated hospitalization rates by country and age group, based on hypertension and diabetes only. Shaded area represents the range of possible values, given the less-conservative (green) and more-conservative (purple) assumptions about the co-existence of the two conditions in a given individual.



Aggregating the age-specific rates into a single country-level estimate offers insight into the expected percentage of all cases requiring specialized care in hospitals (versus isolation alone). Accounting for age distributions and rates of underlying conditions that have been or may be associated with increased risk of severe disease, these estimates are generally lower than the 19% being reported in several other settings, such as the US and China (Figure 4). While on average less than the 19% reference point, the confidence intervals for the less conservative scenarios in Kenya and India suggest that rates of hospitalized care required in those settings could reach or exceed it. This observation for Kenya disappears when considering increased risk among individuals with underlying diabetes or hypertension alone. Pakistan and South Africa have at least one scenario in which estimated rates of hospitalized care could reach or exceed the 19% mark.

It is important to note that scenario estimates including TB and HIV as risk factors for severe disease should be re-examined as additional evidence on any relationship, or lack thereof, become available.

Figure 4. Country-level estimates of the percentage COVID-19 cases requiring hospital-based care

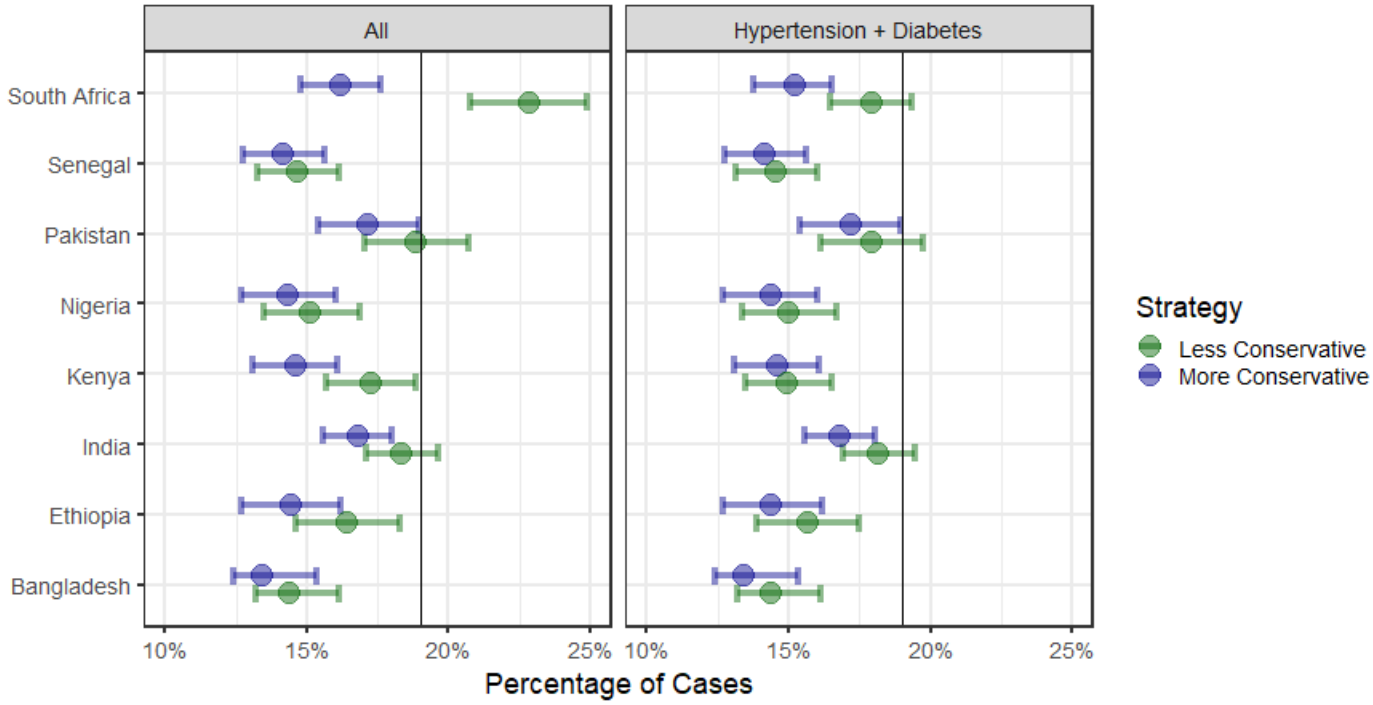
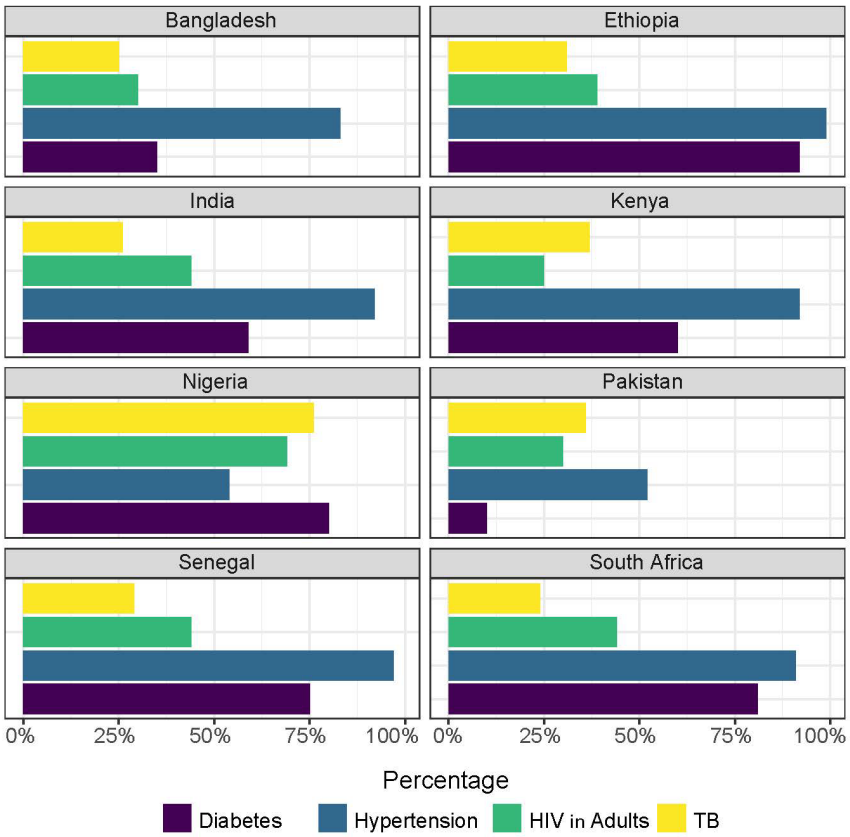


Figure 4 Data Table.

Country	Hypertension, Diabetes, HIV, TB				Hypertension and Diabetes Only			
	Less Conservative		More Conservative		Less Conservative		More Conservative	
	Point Estimate	**95% CI**	**Point Estimate**	**95% CI**	**Point Estimate**	**95% CI**	**Point Estimate**	**95% CI**
Ethiopia	14%	(13%, 16%)	16%	(15%, 18%)	14%	(13%, 16%)	16%	(14%, 17%)
Kenya	15%	(13%, 16%)	17%	(16%, 19%)	15%	(13%, 16%)	15%	(13%, 16%)
Nigeria	14%	(13%, 16%)	15%	(13%, 17%)	14%	(13%, 16%)	15%	(13%, 17%)
Senegal	14%	(13%, 16%)	15%	(13%, 16%)	14%	(13%, 16%)	15%	(13%, 16%)
South Africa	16%	(15%, 18%)	23%	(21%, 25%)	15%	(14%, 17%)	18%	(16%, 19%)
Bangladesh	13%	(12%, 15%)	14%	(13%, 16%)	13%	(12%, 15%)	14%	(13%, 16%)
India	17%	(16%, 18%)	18%	(17%, 20%)	17%	(16%, 18%)	18%	(17%, 19%)
Pakistan	17%	(15%, 19%)	19%	(17%, 21%)	17%	(15%, 19%)	18%	(16%, 20%)

Our estimates account for prevalence of underlying conditions without differentiating risk between controlled versus uncontrolled illness. Awareness and treatment of underlying conditions, particularly hypertension and diabetes, is lower in LMICs (Figure 5) than higher income countries, on which our analysis of hospitalization rates is based. As information becomes available, accounting for the role of disease management could affect the estimates as well as offer insight into indirect COVID-19 intervention strategies to treat the conditions that enhance risk of severe disease.

Figure 5. Percentage of disease prevalence that is uncontrolled and/or untreated for relevant comorbidities.



Input Data

Data used to generate the Results figures are presented for each country.

Ethiopia

Table 1. *Population-level, age-specific distributions of conditions in Ethiopia.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.18%	0.29%	0.0090%	<0.001%	<0.001%	0.29%	0.48%	<0.001%	<0.001%
15-24	0.28%	0.72%	0.015%	6.6%	4.9%	6.6%	12%	6.6%	11%
25-34	0.20%	2.6%	0.011%	16%	5.9%	16%	25%	16%	22%
35-44	0.25%	6.3%	0.013%	29%	5.9%	28%	41%	29%	35%
45-54	0.32%	6.0%	0.017%	38%	7.5%	37%	52%	38%	45%
55-64	0.35%	3.3%	0.018%	49%	7.5%	49%	60%	49%	57%
65+	0.22%	0.99%	0.011%	59%	11%	59%	72%	59%	71%

Table 2A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 1.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.8%	(8.9%, 11%)	9.9%	(9.0%, 11%)
15-24	12%	(10%, 14%)	14%	(12%, 16%)
25-34	15%	(13%, 17%)	18%	(16%, 20%)
35-44	20%	(17%, 22%)	24%	(21%, 27%)
45-54	23%	(10%, 26%)	27%	(24%, 31%)
55-64	27%	(23%, 30%)	30%	(27%, 34%)
65+	30%	(26%, 34%)	34%	(30%, 39%)

Table 2B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 1.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	12%	(10%, 14%)	14%	(12%, 15%)
25-34	15%	(13%, 17%)	17%	(15%, 19%)
35-44	20%	(17%, 22%)	22%	(19%, 24%)
45-54	23%	(20%, 26%)	25%	(22%, 28%)
55-64	27%	(23%, 30%)	29%	(26%, 33%)
65+	30%	(26%, 34%)	34%	(30%, 38%)

Kenya

Table 3. *Population-level, age-specific distributions of conditions in Kenya.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.029%	<0.001%	0.0080%	<0.001%	<0.0001%	0.029%	0.037%	<0.0001%	<0.0001%
15-24	0.17%	3.9%	0.064%	13%	0.25%	9.2%	14%	9.2%	9.5%
25-34	0.31%	13%	0.11%	19%	1.3%	19%	34%	19%	20%
35-44	0.26%	18%	0.095%	25%	2.1%	25%	45%	25%	27%
45-54	0.27%	17%	0.10%	44%	5.4%	44%	67%	44%	49%
55-64	0.28%	8.3%	0.10%	48%	4.2%	48%	61%	48%	53%
65+	0.35%	<0.001%	0.094%	53%	3.0%	53%	57%	53%	56%

Table 4A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 3.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	13%	(11%, 14%)	14%	(13%, 16%)
25-34	16%	(14%, 18%)	21%	(19%, 23%)
35-44	18%	(16%, 20%)	25%	(23%, 27%)
45-54	25%	(22%, 27%)	33%	(30%, 35%)
55-64	26%	(24%, 29%)	31%	(28%, 34%)
65+	28%	(25%, 31%)	29%	(26%, 32%)

Table 4B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 3.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	13%	(11%, 14%)	13%	(12%, 14%)
25-34	16%	(14%, 18%)	17%	(15%, 18%)
35-44	18%	(16%, 20%)	19%	(17%, 21%)
45-54	25%	(22%, 27%)	27%	(24%, 29%)
55-64	26%	(24%, 29%)	28%	(25%, 31%)
65+	28%	(25%, 31%)	29%	(26%, 32%)

Nigeria

Table 5. *Population-level, age-specific distributions of conditions in Nigeria.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.015%	0.024%	0.002%	<0.001%	<0.001%	0.024%	0.041%	<0.001%	<0.001%
15-24	0.24%	0.11%	0.033%	14%	<0.001%	14%	15%	14%	14%
25-34	0.44%	0.24%	0.060%	17%	3.6%	17%	22%	17%	21%
35-44	0.54%	0.23%	0.074%	27%	7.1%	27%	35%	27%	34%
45-54	0.66%	0.12%	0.090%	39%	6.3%	39%	46%	39%	45%
55-64	0.53%	0.055%	0.072%	44%	5.4%	44%	50%	44%	50%
65+	0.58%	0.047%	0.079%	32%	1.8%	32%	34%	32%	34%

Table 6A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 5.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	15%	(13%, 16%)	15%	(13%, 16%)
25-34	16%	(14%, 18%)	17%	(15%, 19%)
35-44	19%	(17%, 21%)	22%	(19%, 24%)
45-54	23%	(20%, 26%)	25%	(23%, 28%)
55-64	25%	(21%, 29%)	27%	(23%, 31%)
65+	21%	(17%, 24%)	22%	(18%, 25%)

Table 6B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 5.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	15%	(13%, 16%)	15%	(13%, 16%)
25-34	16%	(14%, 18%)	17%	(15%, 19%)
35-44	19%	(17%, 21%)	21%	(19%, 24%)
45-54	23%	(20%, 26%)	25%	(22%, 28%)
55-64	25%	(21%, 29%)	27%	(23%, 31%)
65+	21%	(17%, 24%)	21%	(18%, 25%)

Senegal

Table 7. *Population-level, age-specific distributions of conditions in Senegal.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.006%	0.073%	<0.001%	<0.001%	<0.001%	0.073%	0.078%	<0.001%	<0.001%
15-24	0.013%	0.40%	0.001%	5.3%	0.60%	5.3%	6.3%	5.3%	5.9%
25-34	0.036%	0.40%	0.002%	18%	0.60%	18%	19%	18%	19%
35-44	0.037%	0.40%	0.002%	26%	1.5%	26%	27%	26%	27%
45-54	0.018%	0.40%	0.001%	42%	5.4%	42%	48%	42%	48%
55+	0.008%	0.40%	0.000%	54%	5.9%	54%	60%	54%	60%

Table 8A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 7.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	12%	(10%, 13%)	12%	(11%, 13%)
25-34	16%	(14%, 18%)	16%	(15%, 18%)
35-44	18%	(17%, 20%)	19%	(17%, 21%)
45-54	24%	(22%, 27%)	26%	(24%, 29%)
55+	28%	(25%, 31%)	30%	(27%, 34%)

Table 8B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 7.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	12%	(10%, 13%)	12%	(11%, 13%)
25-34	16%	(14%, 18%)	16%	(14%, 18%)
35-44	18%	(17%, 20%)	19%	(17%, 21%)
45-54	24%	(22%, 27%)	26%	(24%, 28%)
55+	28%	(25%, 31%)	30%	(27%, 33%)

South Africa

Table 9. *Population-level, age-specific distributions of conditions in South Africa.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.001%	2.7%	0.002%	<0.001%	<0.001%	2.7%	2.7%	<0.001%	<0.001%
15-24	0.78%	6.8%	1.1%	5.2%	0.40%	6.8%	14%	5.2%	5.6%
25-34	0.86%	25%	1.2%	15%	4.4%	25%	47%	15%	20%
35-44	1.0%	11%	1.5%	24%	5.4%	24%	56%	24%	29%
45-54	1.3%	11%	1.8%	33%	21%	33%	68%	33%	55%
55-64	1.2%	11%	1.8%	42%	33%	42%	89%	42%	75%
65+	1.2%	11%	1.8%	48%	35%	48%	97%	48%	83%

Table 10A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 9.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	11%	(9.5%, 12%)	11%	(9.5%, 12%)
15-24	12%	(11%, 13%)	15%	(13%, 16%)
25-34	18%	(17%, 20%)	26%	(23%, 28%)
35-44	18%	(16%, 19%)	29%	(26%, 32%)
45-54	21%	(19%, 23%)	33%	(30%, 36%)
55-64	24%	(22%, 26%)	40%	(37%, 43%)
65+	26%	(24%, 28%)	43%	(40%, 46%)

Table 10B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 9.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	11%	(10%, 13%)	12%	(10%, 13%)
25-34	15%	(13%, 16%)	16%	(15%, 18%)
35-44	18%	(16%, 19%)	20%	(18%, 21%)
45-54	21%	(19%, 23%)	28%	(26%, 30%)
55-64	24%	(22%, 26%)	35%	(33%, 38%)
65+	26%	(24%, 28%)	38%	(36%, 41%)

Bangladesh

Table 11. *Population-level, age-specific distributions of conditions in Bangladesh.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-4	0.001%	0.010%	0.000%	<0.001%	<0.001%	0.010%	0.011%	<0.001%	<0.001%
5-14	0.003%	0.010%	0.000%	<0.001%	<0.001%	0.010%	0.013%	<0.001%	<0.001%
15-24	0.019%	0.014%	0.000%	<0.001%	<0.001%	0.019%	0.034%	<0.001%	<0.001%
25-34	0.022%	0.014%	0.000%	6.4%	0.80%	6.4%	7.7%	6.4%	7.7%
35-44	0.019%	0.014%	0.000%	15%	3.7%	15%	20%	15%	20%
45-54	0.020%	0.014%	0.000%	24%	6.4%	24%	32%	24%	32%
55-64	0.018%	0.014%	0.000%	33%	9.3%	33%	43%	33%	43%
65+	0.017%	0.014%	0.000%	40%	4.9%	40%	46%	40%	46%

Table 12A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 11.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-4	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
5-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
25-34	12%	(11%, 14%)	12%	(11%, 14%)
35-44	15%	(14%, 17%)	17%	(15%, 19%)
45-54	18%	(17%, 21%)	20%	(19%, 23%)
55-64	21%	(20%, 25%)	24%	(23%, 28%)
65+	24%	(22%, 27%)	25%	(24%, 29%)

Table 12B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 11.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-4	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
5-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
25-34	12%	(11%, 14%)	12%	(11%, 14%)
35-44	15%	(14%, 17%)	17%	(15%, 19%)
45-54	18%	(17%, 21%)	21%	(19%, 23%)
55-64	21%	(20%, 25%)	25%	(23%, 28%)
65+	23%	(22%, 27%)	25%	(24%, 29%)

Table 13. *Population-level, age-specific distributions of conditions in India.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.012%	0.10%	<0.001%	<0.001%	0.32%	0.32%	0.43%	<0.001%	<0.001%
15-24	0.10%	0.20%	0.003%	12%	0.46%	12%	12%	12%	12%
25-34	0.12%	0.20%	0.004%	22%	3.2%	22%	26%	22%	26%
35-44	0.34%	0.19%	0.010%	22%	9.0%	22%	32%	22%	31%
45-54	0.58%	0.18%	0.018%	40%	8.2%	40%	49%	40%	48%
55-64	0.75%	0.18%	0.023%	48%	8.2%	48%	57%	48%	56%
65+	0.63%	0.18%	0.020%	52%	8.2%	52%	61%	52%	60%

Table 14A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 13.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.8%	(8.8%, 11%)	9.9%	(9.0%, 11%)
15-24	14%	(13%, 15%)	14%	(13%, 15%)
25-34	17%	(16%, 19%)	19%	(17%, 20%)
35-44	17%	(16%, 19%)	21%	(19%, 22%)
45-54	23%	(22%, 25%)	26%	(25%, 28%)
55-64	26%	(24%, 28%)	29%	(28%, 31%)
65+	27%	(26%, 29%)	30%	(29%, 33%)

Table 14B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 13.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.8%	(8.8%, 11%)	9.8%	(9.0%, 11%)
15-24	14%	(13%, 15%)	14%	(13%, 15%)
25-34	17%	(16%, 19%)	18%	(17%, 20%)
35-44	17%	(16%, 19%)	20%	(19%, 22%)
45-54	23%	(22%, 25%)	26%	(25%, 28%)
55-64	26%	(24%, 28%)	29%	(27%, 31%)
65+	27%	(26%, 29%)	30%	(28%, 32%)

Pakistan

Table 15. *Population-level, age-specific distributions of conditions in Pakistan.*

Age Group	TB Only	HIV Only	TB-HIV	Hyper-tension	Diabetes	All		Hypertension + Diabetes	
						More	Less	More	Less
0-14	0.034%	5.0%	<0.001%	<0.001%	<0.001%	0.034%	5.0%	<0.001%	<0.001%
15-24	0.24%	1.0%	<0.001%	7.7%	0.70%	16%	18%	16%	17%
25-34	0.23%	1.0%	<0.001%	11%	1.3%	30%	33%	30%	32%
35-44	0.40%	1.0%	<0.001%	14%	1.8%	37%	40%	37%	39%
45-54	0.52%	1.0%	0.001%	23%	6.7%	51%	59%	51%	58%
55-64	0.59%	1.0%	0.001%	26%	10%	55%	67%	55%	65%
65+	1.4%	1.0%	0.001%	28%	12%	60%	75%	60%	72%

Table 16A. *Percentage of cases hospitalized by age after accounting for potential comorbid risk factors. 95% confidence intervals represent uncertainty in the reported percentages in Table 15.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	11%	(10%, 12%)
15-24	15%	(14%, 17%)	16%	(14%, 18%)
25-34	20%	(18%, 22%)	21%	(19%, 23%)
35-44	22%	(20%, 25%)	24%	(21%, 26%)
45-54	27%	(24%, 30%)	30%	(27%, 33%)
55-64	29%	(26%, 32%)	33%	(29%, 36%)
65+	30%	(27%, 34%)	35%	(32%, 39%)

Table 16B. *Percentage of cases hospitalized by age after accounting for hypertension and diabetes only. 95% confidence intervals represent uncertainty in the reported percentages in Table 15.*

Age Group	More conservative approach		Less conservative approach	
	%	95% CI	%	95% CI
0-14	9.7%	(8.8%, 11%)	9.7%	(8.8%, 11%)
15-24	15%	(14%, 17%)	15%	(14%, 17%)
25-34	20%	(18%, 22%)	21%	(18%, 23%)
35-44	22%	(20%, 25%)	23%	(21%, 25%)
45-54	27%	(24%, 30%)	29%	(27%, 32%)
55-64	29%	(26%, 32%)	32%	(29%, 35%)
65+	30%	(27%, 34%)	35%	(31%, 38%)

Appendix

Age-specific rates of conditions that may be associated with increased COVID-morbidity and mortality were identified using published population- or community-based surveys, as well as country profiles from WHO and UNAIDS. In some cases, although multiple studies were reviewed to ensure consistency in prevalence estimates across different settings or population subgroups within a country, data were derived from a single source.

Ethiopia's estimates were derived from the following:

1. Kebede AH, Alebachew Z, Tsegaye F, Lemma E, Abebe A, Agonafir M, et al. The first population-based national tuberculosis prevalence survey in Ethiopia, 2010-2011. Int J Tuberc Lung Dis. 2014;18: 635–639.
2. Ethiopia Tuberculosis Profile. World Health Organization; Accessed April 4, 2020. Available: https://www.who.int/tb/data/en/
3. Ethiopia Population-Based HIV Impact Assessment I. Ethiopia Population-Based HIV Impact Assessment 2017-2018. Summary Sheet: Preliminary Findings. 2020. Available: https://phia.icap.columbia.edu/countries/ethiopia/
4. Teweldemedhin M, Asres N, Gebreyesus H, Asgedom SW. Tuberculosis-Human Immunodeficiency Virus (HIV) co-infection in Ethiopia: a systematic review and meta-analysis. BMC Infect Dis. 2018;18: 676.
5. Demisse AG, Greffie ES, Abebe SM, Bulti AB, Alemu S, Abebe B, et al. High burden of hypertension across the age groups among residents of Gondar city in Ethiopia: a population based cross sectional study. BMC Public Health. 2017.
6. Abdissa SG, Feleke Y, Awol M. Prevalence of hypertension and pre-hypertension in Addis Ababa, Ethiopia: A survey done in recognition of World Hypertension Day, 2014. Ethiop J Health Dev. 2015;29: 22–30.

Kenya's estimates were derived from the following:

1. Kimanga DO, Ogola S, Umuro M, Ng'ang'a A, Kimondo L, Murithi P, et al. Prevalence and incidence of HIV infection, trends, and risk factors among persons aged 15-64 years in Kenya: results from a nationally representative study. J Acquir Immune Defic Syndr. 2014;66 Suppl 1: S13–26.
2. Claassens MM, van Schalkwyk C, Floyd S, Ayles H, Beyers N. Symptom screening rules to identify active pulmonary tuberculosis: Findings from the Zambian South African Tuberculosis and HIV/AIDS Reduction (ZAMSTAR) trial prevalence surveys. PLoS One. 2017;12: e0172881.
3. Chege PM. Multiple cardiovascular disease risk factors in rural Kenya: evidence from a health and demographic surveillance system using the WHO STEP-wise approach to chronic disease risk factor surveillance. S Afr Fam Pract . 2016;58: 54–61.
4. Kenya National Bureau of Statistics. Kenya STEPwise Survey for Non-Communicable Diseases: Risk Factors 2015 Report. Division of Non Communicable Diseases Ministry of Health; 2016. Available: http://www.health.go.ke/wp-content/uploads/2016/04/Steps-Report-NCD-2015.pdf
5. Kenya Tuberculosis Profile. World Health Organization; Accessed April 30, 2020. Available: https://www.who.int/tb/data/en/

Nigeria's estimates were derived from the following:

1. National Tuberculosis Control Programme. Report: First National TB Prevalence Survey 2012, Nigeria. Federal Ministry of Health; 2012.

2. 2013 National HIV Validated Data – NACA Nigeria. [cited 30 Apr 2020]. Available: https://naca.gov.ng/2013-national-hiv-validated-data/

3. Andy JJ, Peters EJ, Ekrikpo UE, Akpan NA, Unadike BC, Ekott JU. Prevalence and correlates of hypertension among the Ibibio/Annangs, Efiks and Obolos: a cross sectional community survey in rural South-South Nigeria. Ethn Dis. 2012;22: 335–339. Available: https://www.ncbi.nlm.nih.gov/pubmed/22870578

4. Isara AR, Okundia PO. The burden of hypertension and diabetes mellitus in rural communities in southern Nigeria. Pan Afr Med J. 2015;20: 103.

5. Nigeria Tuberculosis Profile. World Health Organization; Accessed April 30, 2020. Available: https://www.who.int/tb/data/en/

South Africa's estimates were derived from the following:

1. Human Sciences Research Council. South African National HIV Prevalence, Incidence, Behaviour and Communication Survey, 2017. [cited 30 Apr 2020]. Available: http://www.hsrc.ac.za/en/departments/saph/HAST_National_HIV_Survey

2. Claassens MM, van Schalkwyk C, Floyd S, Ayles H, Beyers N. Symptom screening rules to identify active pulmonary tuberculosis: Findings from the Zambian South African Tuberculosis and HIV/AIDS Reduction (ZAMSTAR) trial prevalence surveys. PLoS One. 2017;12: e0172881.

3. Cois A, Ehrlich R. Antihypertensive treatment and blood pressure trends among South African adults: A repeated cross-sectional analysis of a population panel survey. PLoS One. 2018;13: e0200606.

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5. South Africa Tuberculosis Profile. World Health Organization; Accessed April 30, 2020. Available: https://www.who.int/tb/data/en/

Bangladesh's estimates were derived from the following:

1. UNAIDS. Country factsheet: Bangladesh. 2018. Available: https://www.unaids.org/en/regionscountries/countries/bangladesh

2. Non-Communicable Disease Risk Factor Survey Bangladesh 2010. World Health Organization; 2011. Available: https://www.who.int/chp/steps/2010_STEPS_Report_Bangladesh.pdf?ua=1

3. National Tuberculosis Control Program. Tuberculosis Control in Bangladesh, Annual Report 2015. 2015 Nov. Available: https://dghs.gov.bd/index.php/en/mis-docs/national-tuberculosis-program-en

4. Bangladesh Tuberculosis Profile. World Health Organization; Accessed April 30, 2020. Available: https://www.who.int/tb/data/en/

Pakistan's estimates were derived from the following:

1. Mir F, Mahmood F, Siddiqui AR, Baqi S, Abidi SH, Kazi AM, et al. HIV infection predominantly affecting children in Sindh, Pakistan, 2019: a cross-sectional study of an outbreak. Lancet Infect Dis. 2020;20: 362–370.

2. Qadeer E, Fatima R, Yaqoob A, Tahseen S, Ul Haq M, Ghafoor A, et al. Population Based National Tuberculosis Prevalence Survey among Adults (>15 Years) in Pakistan, 2010-2011. PLoS One. 2016;11: e0148293.

3. Pakistan Health Research Council. Non-Communicable Diseases Survey, Pakistan. 2016. Available: https://www.who.int/ncds/surveillance/steps/2014_Pakistan_STEPS_Report.pdf

4. Pakistan Tuberculosis Profile. World Health Organization; Accessed April 30, 2020. Available: https://www.who.int/tb/data/en/

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