

The health sector cost of different policy responses to COVID-19 in low- and middle- income countries

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Abstract

Much attention has focussed in recent months on the impact that COVID-19 has on health sector capacity, including critical care bed capacity and resources such as personal protective equipment. However, much less attention has focussed on the overall cost to health sectors, including the full human resource costs and the health system costs to address the pandemic. Here we present estimates of the total costs of COVID-19 response in low- and middle-income countries for different scenarios of COVID-19 mitigation over a one year period. We find costs vary substantially by setting, but in some settings even mitigation scenarios place a substantial fiscal impact on the health system. We conclude that the choices facing many low- and middle- income countries, without further rapid emergency financial support, are stark, between fully funding an effective COVID-19 response or other core essential health services.

This is preliminary report that has not yet been peer reviewed. These estimates should not yet guide policy in specific countries nor be reported as established information. We are placing these in the public domain to inform those who are estimating Covid costs in low- and middle- income countries about the methods and assumptions required; highlight the broad level of fiscal impact and to invite comments for others working in this field, prior to submission to peer review publication.

These estimates have been subjected to a detailed validation and error checking process internally. Nevertheless, given the dearth of data to inform Covid cost estimates at this time, our results depend on a range of assumptions. Comments and suggestions to improve this work are welcomed and can be sent to the authors below:

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Introduction

Since the declaration of Coronavirus Disease 2019 (COVID-19) as a public health emergency of international concern by the World Health Organization (WHO) in January 2020 [1], the disease has affected more than 22 million people and caused nearly 290,000 deaths worldwide [2]. While only a minority of cases will experience severe (15%) or critical (5%) disease that requires hospitalisation [3], the estimated costs of implementing WHO pandemic response guidelines in low- and middle-income countries (LMICs) are potentially substantial [4]. These estimates are all the more staggering in the context of over-stretched LMIC health systems, whose capacity to expand the provision of critical care was already limited before the COVID-19 pandemic [5, 6].

While there are financial costing tools available for countries to plan their short term resource requirements [7-9], there are few published estimates of the medium-term economic costs of prevention, tracing and treatment of COVID-19 cases for different epidemic scenarios to inform policy choice and longer term investment. Reliable economic cost estimates are essential for economic evaluations and priority setting around COVID-19 interventions. They can be used for example, to estimate potential cost savings from new COVID-19 vaccines as these become available' as well as for informing policy choices seeking to balance the broader macro-economic costs of mitigation strategies against the costs to the health system. Although to date, much of the policy concern rightly focuses on the sizeable health and macro-economic impact of COVID-19 in LMICs, it is important that the health sector costs of COVID-19 are also considered as the opportunity costs of the health sector response to COVID-19 on other health areas may be high [10, 11].

Most available cost data to inform these analyses is from high-income countries and/or does not encompass the full COVID-19 response cascade, nor the underlying health system costs [12-14]. To date, there is only one set of economic cost estimates from Kenya that takes into account low-cost case management scenarios appropriate to resource-constrained LMIC settings [15]. This paper presents the first study aiming to project the economic burden of COVID-19 response to LMIC health systems under different pandemic mitigation scenarios in the medium term.

Methods

Epidemiological scenarios

Our estimates of COVID-19 cases for different scenarios come from the epidemiological model produced by the London School of Hygiene and Tropical Medicine, estimating the health impact of COVID-19 for 92 LMICs (<https://cmmid.github.io/topics/covid19/LMIC-projection-reports.html>). For each country, the model produces estimates on the number of cases, hospitalisations, number of days in hospital for severe cases (general ward) and critical cases (intensive care unit), and deaths for 57 distinct epidemiological scenarios over a one year period [16].

For the costing, four epidemiological scenarios were chosen out of the set of 57 possible scenarios. Scenario 1 represents an unmitigated epidemic. The other three scenarios were chosen because they represent a range of plausible policy options from highly mitigated to more moderate approaches (scenarios 4,14 and 49). Descriptions of the scenarios are presented below in Table 1. Further details can be found in the references above, and the numbers of cases, hospitalisations and bed-days for each country in Supplement S1.

Defining the COVID-19 health sector response

In line with the World Health Organisation we costed six priority areas of health sector response COVID-19: a) emergency response mechanisms at the national level; b) risk communication and community engagement; c) case finding, contact tracing and management; d) surveillance; e) public health measures; and, f) case management. For each of these we estimated a unit cost as per Table 2 below.

Our aim was to estimate a 'real world' cost that reflects local prices and resource use, and models of service delivery that are considered feasible given resource constraints in low- and middle-income countries, rather than a full normative costing of national or global guidelines.

To estimate the activity level average (unit) costs for each of the above we used an ingredients based costing approach. Our basis for prices and resource use was recent local cost and resource use data from three countries: Ethiopia (low income country), Pakistan (lower middle income country, and South Africa (upper middle income country). We selected these countries as we were not able to collect primary cost data directly from COVID-19 service delivery points, so chose countries where we had recently conducted large scale costing exercises around either tuberculosis (TB) or general health services. This gave us current local data on actual resource use, input prices and health system unit cost data for services such as outpatient consultations, inpatient bed-days, a range of

laboratory tests, including PCR tests and contact tracing. In the case of Ethiopia and South Africa, we had recent data from TB studies. In the case of Pakistan, the research team had been working with the Ministry of Health in 2019/20 to collect ingredients costs for all essential services as part of the Disease Control Priorities Project (DCP). While not primary data collection, all costs were subjected to a review by technical working groups as part of DCP that included practitioners at all levels of the health system. Members of the working groups were asked to consider feasibility as they reviewed and adapted the costs of different essential services.

To adapt this prior data on costs to COVID-19, we then used a combination of: review of COVID-19 resource planning tools and budgets, detailed expert consultation both with international and local experts and literature searches on primary cost data collection on the costs of clinical care in LMICs. Clinical management costs were based on expert consultation on essential critical care, including a detailed estimation of oxygen therapy needs; and considering recent cost data collection on critical care in LMICs²⁰; and, length of stay and prevalence of complications from China. While we had access and reviewed length of stay data from different LMICs, this revealed either exceptionally high (early cases) or low (during surge) lengths of stay, and therefore the early data from China across the whole epidemic were felt to be the best estimate of a length of stay (considering those who die during care). Supplement S1 contains the summary level units used for each activity and the unit costs of each, and all assumptions used, including a comparison between normative recommendations for clinical case management and the assumptions used in this costing, based on expert consultation of feasibility.

We then extrapolated the detailed ingredients costing done for Ethiopia, Pakistan and South Africa to low, lower middle, and upper middle income countries respectively. Each cost input in the ingredients costing was classified as a tradeable good, non-tradeable good, or staff cost. To convert the tradeable good from the base country (e.g. Ethiopia) to a 'second' country (e.g. Afghanistan) we apportioned the percentage of the unit cost that was composed of tradeable goods in 2019 US\$ from the base country to the second country.

Non-tradeable goods include buildings, heavy machinery, and other equipment. To convert these costs from a base country to a second country we used purchasing power parity (PPP) conversion rates. We multiplied the proportion of the unit cost that was defined as non-tradeable (in 2019 US\$) by the ratio of the 2019 GDP per capita (adjusted for PPP) of the second country, divided by the 2019 GDP per capita (adjusted for PPP) of the base country. Data on GDP per capita (adjusted for PPP) can be found in the World Bank database [17].

To convert staff costs from a base country to a second country we used conversion rates from Serje et al (2018) [18]. Serje et al (2018) use regression analysis on a dataset containing wages from health workers of different skill levels for 193 countries in order to predict wages by country income level relative to GDP per capita. We used the GDP per capita multipliers presented in the paper in order to convert the staff wages from the base country to the second country.

Finally, we then estimate the total cost of each scenario, against the % of government and total health expenditure in each country and gross domestic product.

Results

Our combined primary data and expert reviewed ingredients costs of managing a mild case with home visits from health care providers ranged from \$13 (Pakistan) to \$147 (South Africa) per case. Hospital-based care for a severe case ranged from \$33.32 (Pakistan) to \$106 (South Africa) per day, while costs for a critical case were much higher at \$221 (Pakistan) - \$1,082 (South Africa) per day in hospital (see supplementary results appendix Table SR1). Table 2 shows our estimates of the mean unit cost per activity when these costs are extrapolated for low-income, lower-middle income, and upper-middle income countries. Table 2 includes the costs of managing the national emergency response mechanisms, risk communication and community engagement, case finding and surveillance, public health measures, screening and diagnosis, and case management.

Average cost per capita by country income category are reported in Table 3, considering the total number of cases, and other units. Table SR2 and SR3 show the underlying costs per capita and total estimated annual costs per country, by intervention scenario. For example, an unmitigated epidemic would cost an average of \$5.2 billion per country, ranging from \$11.3 million in Sao Tome and Principe to \$127.8 billion in India. This is equivalent to an average of \$50 per capita in LIC, \$62 in LMIC, and \$84 in UMIC (Table SR2). A 30-day lockdown would reduce these annual costs to an average of \$4.66 billion (10.3M – 115.1B), or \$44-\$74/capita. An intervention resulting in social distancing of 20% year-round would further reduce costs to 3.84 billion (8.86M-96.08B), or \$37-\$60/capita. Finally, an intervention leading to generalized social distancing of 60% year-round would to costs that are on average less than half those of the unmitigated epidemic (5.15M-58.56B or \$21-36 percapita).

In all scenarios, costs of the COVID-19 response were predominantly attributable to screening and diagnosis and case management, particularly management of critical cases (Table 4). Case finding, contact tracing and surveillance, and public health measures in contrast made up less than 5% of the

total response costs. National-level costs of coordinating the emergency response and risk communication likewise constituted a small proportion of overall costs, amounting to less than 1% of total costs on average. The maps in Figures 1a and 1b show the extent to which total costs increase with less stringent social distancing policies, and how social distancing can be more effective than temporary lockdown at containing costs.

Our sensitivity analysis (presented in Table SR8) shows that our estimates are particularly sensitive to our assumptions on the number of symptomatic cases tested. Doubling the estimated number of symptomatic cases tested from 10% to 20% increased our 'unmitigated' cost estimates from \$50-\$84/capita to \$57-\$90/capita. A ten-fold increase in the number of symptomatic cases tested, from 10% to 100%, resulted in nearly doubling our 'unmitigated' cost estimates to \$121-137 per capita. The effect of this assumption was constant across all scenarios.

Discussion

We find that the costs to health sector of responding to COVID-19 are substantial in LMICs, even when estimating the costs of essential critical care only. High levels of social distancing, however, may halve these costs within a one year period compared to allowing the pandemic to proceed in an unmitigated manner in the first year. The total cost and the costs as a proportion of health expenditure and GDP vary substantially across countries, with some countries likely to be able to 'afford' the costs, and for others the financial impact of COVID-19 on the health sector in its first year being higher than normal annual costs for the health sector in totality.

Our methods are subject to many limitations. Normally we would estimate 'real world' costs collecting extensive primary cost data on actual service delivery. In the case of COVID-19, we have not been able to do this. We have therefore had to rely substantially on data collected for other purposes and on expert opinion from LMICs to make key assumptions on how services may be delivered. We aimed to include the total costs to the health system and our aim was to estimate 'real world costs' in terms of the resource needs to deliver the most essential care. However, our costs are unlikely to reflect actual expenditures, as countries may either provide more care to specific patients, or struggle to provide even the most essential care given the current restrictions on expenditure. Likewise, the case numbers that our estimates rely upon are unlikely to match the real case numbers currently being observed in many LMICs, as they represent single policy options, and a time period of one year from the start of the epidemic. Finally, we do not include the costs of protecting health care workers delivering other essential services outside the COVID-19 response.

Despite these limitations, our work highlights several critical qualitative recommendations for those working in COVID-19 policy. First, it is imperative, that global agencies and funders continue to act to ensure sufficient resources are made available globally for LMICs to respond, as the epidemic evolves. While much of the focus is on the macro-economic impact of COVID-19 and mortality impact, the fiscal impact on the health sector is likely to be substantial also needs to be considered if health systems in LMICs are to continue to deliver health services effectively. Second, it is clear that some countries are much more vulnerable to fiscal impact on the health sector than others. While specific short term financing needs for COVID-19 will fluctuate considerably over time, we highlight that some countries fundamentally will struggle to cope with almost any COVID-19 scenario, whereas others may be less vulnerable; which could help target support. Finally, our results demonstrate the myriad decisions about care, protection and patient experience that are required to plan resource needs of the response for which there is little discussion or data on what is feasible in LMICs. This is a task that cannot be met using a global perspective, but need country specific input to reflect the specific health system characteristics of each country. We therefore also call for urgent support to encourage interaction of economists, planners, service managers and epidemiological modellers to inform COVID-19 policy at the country level across LMICs.

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Main Table and Figures

Table 1 Scenario Descriptions

Scenario 1	Unmitigated epidemic
Scenario 4	The whole population is covered in this intervention scenario. The intervention is triggered by daily incidence reaching 1 per 10,000. The intervention includes self-isolation of symptomatic persons for duration of symptoms, modelled as an additional reduction in contacts among symptomatic people of 75 %.The intervention includes distancing measures that reduce contacts at school by 20 %.The intervention includes distancing measures that reduce contacts at work by 20 %.The intervention includes distancing measures that reduce contacts in other settings by 20 %.The intervention includes distancing measures that reduce contacts in the home setting by 0%. There is no difference in intervention by age.
Scenario 14	The whole population is covered in this intervention scenario. The intervention is triggered by daily incidence reaching 1 per 10,000. The intervention includes self-isolation of symptomatic persons for duration of symptoms, modelled as an additional reduction in contacts among symptomatic people of 25 %.The intervention includes distancing measures that reduce contacts at school by 60 %.The intervention includes distancing measures that reduce contacts at work by 60 %.The intervention includes distancing measures that reduce contacts in other settings by 60 %.The intervention includes distancing measures that reduce contacts in the home setting by 0 %. There is no difference in intervention by age.
Scenario 49	49.The intervention is temporary lockdown which leads to 100 % of the population reducing their contacts through school, home, work and other settings by 100 %, 0 %, 37.5 % and 37.5 % respectively for whilst in lockdown. Lockdown occurs for the first 30 days. After lockdown is lifted 100 % of the population reducing their contacts through school, home, work and other settings by 20 %, 0 %, 20 % and 20 % respectively for whilst not in lockdown

Table 2. Weighted average (mean) unit cost per activity by country income category (2019 US\$)

	Low Income Countries (LIC)	Lower-Middle Income Countries (LMIC)	Upper-Middle Income Countries (UMIC)
1.a. Emergency Response Mechanisms: National level	1,150.10	2,697.74	6,243.97
1.b. Emergency Response Mechanisms: Training of health staff	7,917.32	17,602.46	44,470.55
2. Risk communication & community engagement	101.44	240.58	551.17
3.a. Case finding, contact tracing and management: Contact tracing	2.93	9.84	19.24
3.b. Case finding, contact tracing and management: Quarantine of contacts	2.83	6.36	15.81
4.a. Surveillance: Case notification	2.83	6.36	15.81
4.b. Surveillance: Reporting (national level)	6.99	14.89	40.47
5. Public health measures: Hygiene education	61.29	145.82	333.91
6. Screening and diagnosis	30.86	37.85	63.98
7.a. Case Management: Home-based care	17.56	51.53	202.55
7.b. Case Management: Hospital-based (severe case)	34.74	42.68	136.44
7.c. Case Management: Hospital-based (critical case)	299.28	329.74	1,379.74
7.d. Case Management: Death	64.52	64.52	64.52

Table 3. Average Cost per Capita by Country Income Category (2019 US\$)

	Average Cost per Capita by Country Income Category (2019 US\$)			
	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Low Income Countries (LIC)	49.21	36.73	20.52	43.60
Lower-Middle Income Countries (LMIC)	61.14	45.96	27.34	54.98
Upper-Middle Income Countries (UMIC)	82.87	59.02	35.49	72.84

Table 4. Average % of Total Costs by Activity by Country Income Category by Scenario

	Scenario 1			Scenario 4			Scenario 14			Scenario 49		
	LIC	LMIC	UMIC	LIC	LMIC	UMIC	LIC	LMIC	UMIC	LIC	LMIC	UMIC
1.a. Emergency Response Mechanisms: National level	0.03%	0.01%	0.02%	0.04%	0.02%	0.02%	0.07%	0.03%	0.04%	0.03%	0.01%	0.02%
1.b. Emergency Response Mechanisms: Training of health staff	0.05%	0.12%	0.18%	0.07%	0.16%	0.27%	0.13%	0.27%	0.44%	0.06%	0.13%	0.21%
2. Risk communication & community engagement	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.01%	0.00%	0.00%	0.00%	0.00%	0.00%
3.a. Case finding, contact tracing and management: Contact tracing	0.96%	2.19%	1.24%	0.98%	2.27%	1.31%	0.96%	2.23%	1.25%	0.96%	2.22%	1.25%
3.b. Case finding, contact tracing and management: Quarantine of contacts	0.93%	1.17%	1.04%	0.95%	1.21%	1.10%	0.93%	1.17%	1.05%	0.93%	1.18%	1.06%
4.a. Surveillance: Case notification	0.13%	0.17%	0.15%	0.14%	0.17%	0.16%	0.13%	0.17%	0.15%	0.13%	0.17%	0.15%
4.b. Surveillance: Reporting (national level)	0.00%	0.00%	0.01%	0.00%	0.01%	0.01%	0.01%	0.01%	0.02%	0.00%	0.01%	0.01%
5. Public health measures: Hygiene education	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%
6. Screening and diagnosis	58.42%	48.42%	25.10%	59.71%	50.07%	26.54%	58.25%	48.58%	25.26%	58.78%	48.91%	25.45%
7.a. Case Management: Home-based care	1.19%	2.37%	2.56%	1.22%	2.45%	2.72%	1.19%	2.40%	2.59%	1.20%	2.39%	2.60%
7.b. Case Management: Hospital-based (severe case)	6.65%	8.50%	10.72%	6.41%	8.14%	10.44%	6.67%	8.40%	10.67%	6.58%	8.39%	10.65%
7.c. Case Management: Hospital-based (critical case)	31.23%	36.62%	58.79%	30.10%	35.10%	57.25%	31.26%	36.33%	58.34%	30.92%	36.16%	58.40%
7.d. Case Management: Death	0.40%	0.43%	0.19%	0.39%	0.41%	0.18%	0.40%	0.42%	0.18%	0.40%	0.42%	0.18%

Figure 1a. Total costs as a proportion of GDP per capita

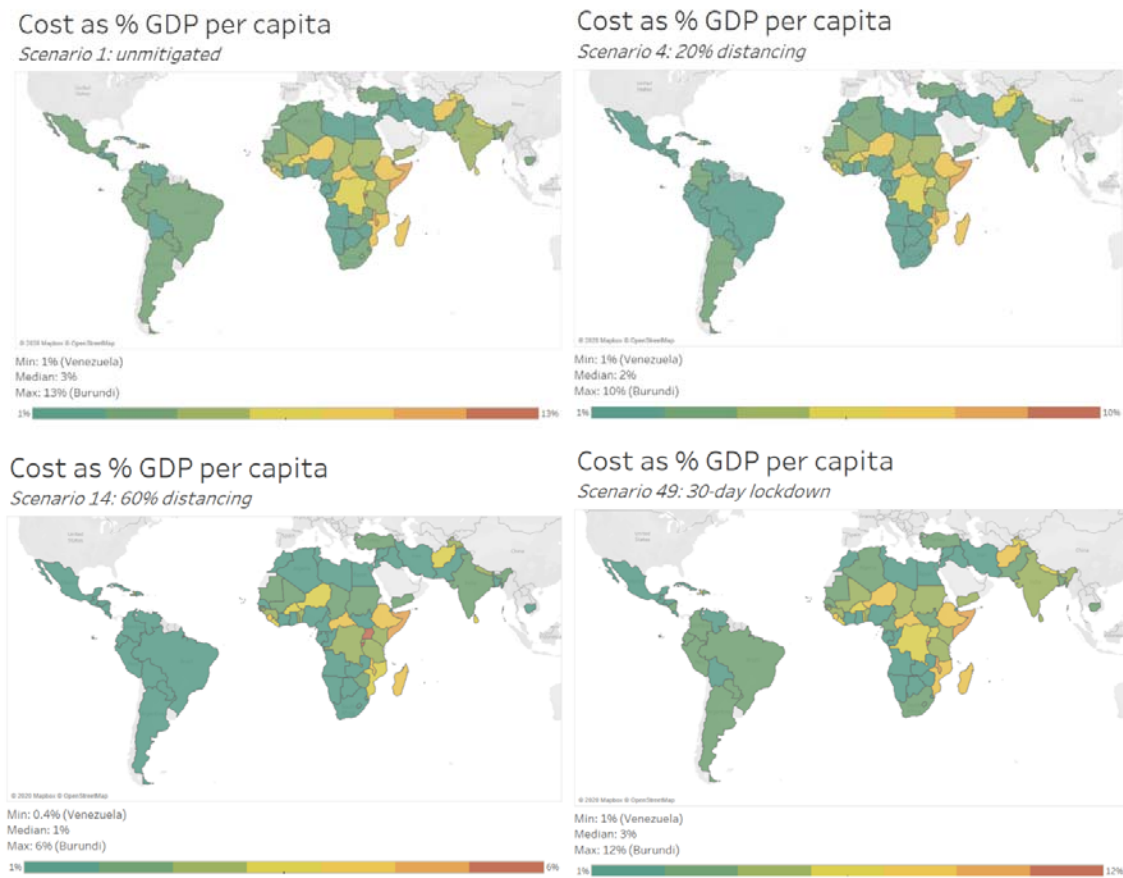
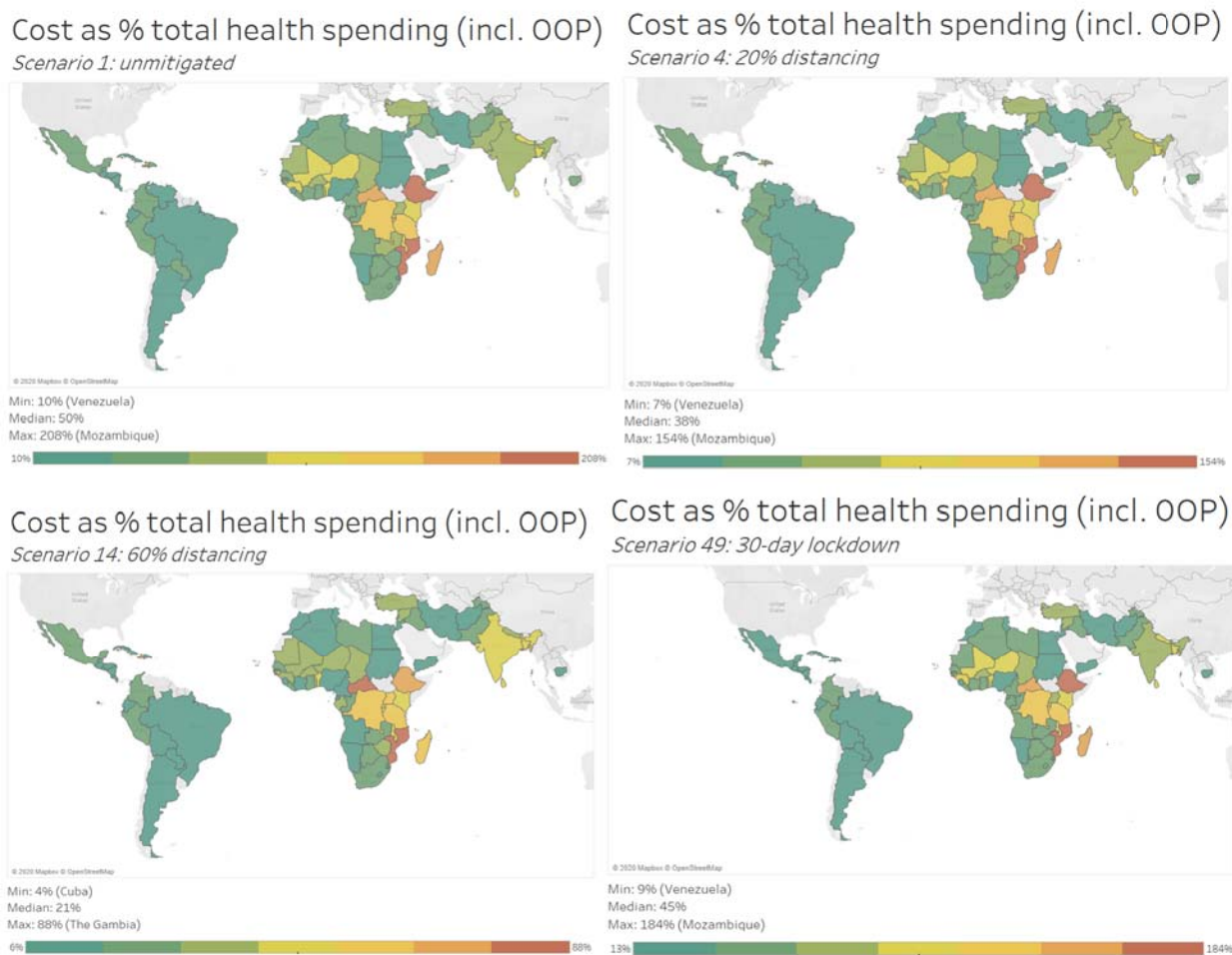


Figure 1b. Total costs as a proportion of total health spending, including out-of-pocket payments



Supplemental Results Tables

Table SR1. Unit costs per activity for base countries (2019 US\$)

Activity	Unit Type	Unit Cost (2019 US\$)		
		Ethiopia	Pakistan	South Africa
1.a. Emergency Response Mechanisms: National level	Per country per day	559.26	778.90	7,697.16
1.b. Emergency Response Mechanisms: Training of health staff	One-off per site	4,813.58	8,096.53	68,141.36
2. Risk communication & community engagement	Per country per day	74.14	91.67	1,133.44
3.a. Case finding, contact tracing and management: Contact tracing	Per person contacted	3.48	2.54	26.23
3.b. Case finding, contact tracing and management: Quarantine of contacts	Per person quarantined	1.72	2.35	29.22
4.a. Surveillance: Case notification	Per positive case	1.72	2.35	29.22
4.b. Surveillance: Reporting (national level)	Per country per week	3.69	6.52	68.26
5. Public health measures: Hygiene education	Per education campaign per month	44.58	54.66	682.05
6. Screening and diagnosis	Per person screened and tested	36.97	26.98	73.12
7.a. Case Management: Home-based care	Per person requiring home-based care	22.90	12.45	146.57
7.b. Case Management: Hospital-based (severe case)	Per day of hospitalisation (severe case)	35.29	33.32	105.88
7.c. Case Management: Hospital-based (critical case)	Per day of hospitalisation (critical case)	505.56	221.18	1,081.94
7.d. Case Management: Death	Per COVID-related death	64.52	64.52	64.52

Table SR2: Cost per Capita by Country per Scenario (2019 US\$)

Country	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Afghanistan	\$ 42.91	\$ 31.69	\$ 17.89	\$ 37.66
Algeria	\$ 170.48	\$ 113.61	\$ 59.33	\$ 144.09
Angola	\$ 55.30	\$ 43.35	\$ 21.15	\$ 50.86
Argentina	\$ 381.86	\$ 272.68	\$ 172.94	\$ 337.16
Bangladesh	\$ 60.48	\$ 45.53	\$ 25.80	\$ 54.30
Benin	\$ 53.05	\$ 40.34	\$ 21.95	\$ 47.44
Bolivia	\$ 73.01	\$ 53.55	\$ 23.96	\$ 65.06
Botswana	\$ 186.86	\$ 134.47	\$ 75.96	\$ 163.93
Brazil	\$ 272.86	\$ 191.02	\$ 109.30	\$ 237.90
Burkina Faso	\$ 47.56	\$ 36.44	\$ 21.13	\$ 42.53
Burundi	\$ 36.54	\$ 27.25	\$ 14.96	\$ 32.19
Cabo Verde	\$ 72.18	\$ 51.79	\$ 29.02	\$ 63.29
Cambodia	\$ 49.37	\$ 34.85	\$ 14.09	\$ 42.52
Cameroon	\$ 45.79	\$ 35.08	\$ 19.23	\$ 41.36
Central African Republic	\$ 39.10	\$ 29.37	\$ 17.99	\$ 34.60
Chad	\$ 42.57	\$ 30.45	\$ 15.46	\$ 36.92
Colombia	\$ 243.23	\$ 170.71	\$ 95.34	\$ 212.16
Comoros	\$ 47.50	\$ 35.66	\$ 19.64	\$ 42.39
Congo, Dem. Rep.	\$ 41.27	\$ 30.99	\$	\$

			15.05	36.49
			\$	\$
Congo, Rep.	\$ 52.39	\$ 40.41	24.93	47.65
			\$	\$
Costa Rica	\$ 300.45	\$ 208.46	121.44	261.18
			\$	\$
Cote d'Ivoire	\$ 47.48	\$ 35.51	16.05	42.28
			\$	\$
Cuba	\$ 177.94	\$ 124.79	74.54	155.92
			\$	\$
Djibouti	\$ 63.38	\$ 48.87	27.93	57.73
			\$	\$
Dominican Republic	\$ 241.43	\$ 172.09	100.59	212.38
			\$	\$
Ecuador	\$ 192.89	\$ 139.37	80.49	170.24
			\$	\$
Egypt, Arab Rep.	\$ 65.48	\$ 46.51	24.28	57.61
			\$	\$
El Salvador	\$ 92.14	\$ 67.64	38.64	82.62
			\$	\$
Equatorial Guinea	\$ 176.53	\$ 136.72	76.69	160.93
			\$	\$
Eswatini	\$ 65.63	\$ 49.31	23.26	59.24
			\$	\$
Ethiopia	\$ 69.49	\$ 51.53	28.21	61.19
			\$	\$
Gabon	\$ 168.26	\$ 126.68	80.05	151.45
			\$	\$
Gambia, The	\$ 52.29	\$ 39.81	22.82	46.54
			\$	\$
Ghana	\$ 54.47	\$ 41.05	18.71	48.84
			\$	\$
Guatemala	\$ 118.41	\$ 86.00	49.53	104.09
			\$	\$
Guinea	\$ 54.11	\$ 41.04	22.89	48.41
			\$	\$
Guinea-Bissau	\$ 48.97	\$ 37.35	22.37	43.93
			\$	\$
Haiti	\$ 58.37	\$ 43.34	25.19	51.95
			\$	\$
Honduras	\$ 61.56	\$ 46.89	28.43	55.70
			\$	\$
India	\$ 93.33	\$ 70.12	42.75	84.06
			\$	\$
Iran, Islamic Rep.	\$ 89.86	\$ 60.68	34.65	76.81
			\$	\$
Iraq	\$ 151.13	\$ 112.54	62.28	134.73
			\$	\$
Jordan	\$ 104.75	\$ 75.06	46.21	91.30
			\$	\$
Kenya	\$ 80.49	\$ 65.63	42.54	74.51
			\$	\$
Lebanon	\$ 233.83	\$ 170.83	115.21	207.94
			\$	\$
Lesotho	\$ 48.88	\$ 35.07	16.17	42.60
			\$	\$
Liberia	\$ 47.76	\$ 36.12	21.52	42.59
			\$	\$
Libya	\$ 197.28	\$ 137.16	72.53	170.74
			\$	\$
Madagascar	\$ 47.93	\$ 35.39	18.97	42.20
			\$	\$
Malawi	\$ 40.95	\$ 30.27	16.15	35.92
			\$	\$
Mali	\$ 45.49	\$ 32.63	16.59	39.60
			\$	\$
Mauritania	\$ 46.96	\$ 35.86	22.55	42.28
			\$	\$
Mauritius	\$ 424.52	\$ 293.12	185.65	367.56
			\$	\$
Morocco	\$ 90.69	\$ 67.48	42.16	81.61
			\$	\$
Mozambique	\$ 43.10	\$ 31.90	17.03	37.95
			\$	\$
Namibia	\$ 107.73	\$ 79.92	37.34	95.34
			\$	\$
Nepal	\$ 73.35	\$ 54.18	27.55	65.05
			\$	\$
Nicaragua	\$ 59.49	\$ 44.13	24.50	52.93

Niger	\$ 37.52	\$ 26.71	\$ 13.53	\$ 32.35
Nigeria	\$ 52.31	\$ 40.65	\$ 22.70	\$ 47.61
Pakistan	\$ 44.49	\$ 32.37	\$ 18.38	\$ 38.84
Paraguay	\$ 173.69	\$ 122.32	\$ 63.04	\$ 151.38
Peru	\$ 223.50	\$ 155.85	\$ 79.73	\$ 193.43
Rwanda	\$ 51.04	\$ 38.32	\$ 21.12	\$ 45.36
Sao Tome and Principe	\$ 52.24	\$ 41.08	\$ 23.90	\$ 47.59
Senegal	\$ 48.94	\$ 37.55	\$ 21.67	\$ 44.10
Sierra Leone	\$ 46.26	\$ 35.06	\$ 20.91	\$ 41.31
Somalia	\$ 34.07	\$ 25.41	\$ 13.44	\$ 29.90
South Africa	\$ 192.41	\$ 144.25	\$ 85.86	\$ 174.88
South Sudan	\$ 41.66	\$ 31.55	\$ 15.04	\$ 37.25
Sri Lanka	\$ 262.03	\$ 187.59	\$ 121.06	\$ 230.21
Sudan	\$ 46.53	\$ 35.05	\$ 19.11	\$ 41.44
Syrian Arab Republic	\$ 51.82	\$ 40.43	\$ 24.75	\$ 47.54
Tajikistan	\$ 56.95	\$ 40.38	\$ 20.72	\$ 49.42
Tanzania	\$ 57.34	\$ 43.62	\$ 24.19	\$ 51.55
Togo	\$ 47.51	\$ 36.17	\$ 19.77	\$ 42.43
Tunisia	\$ 96.55	\$ 68.87	\$ 40.42	\$ 85.31
Turkey	\$ 396.71	\$ 287.41	\$ 189.07	\$ 351.45
Uganda	\$ 47.00	\$ 37.19	\$ 32.95	\$ 43.30
Venezuela, RB	\$ 151.61	\$ 110.73	\$ 70.13	\$ 136.26
West Bank and Gaza	\$ 56.41	\$ 42.82	\$ 26.25	\$ 51.07
Yemen, Rep.	\$ 46.60	\$ 32.94	\$ 16.37	\$ 40.04
Zambia	\$ 43.13	\$ 33.22	\$ 16.20	\$ 38.91
Zimbabwe	\$ 52.44	\$ 42.80	\$ 40.49	\$ 49.55

Table SR3. Total annual costs per country (2019 US\$)

Country	Total Annual Costs per Country (2019 US\$)			
	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Afghanistan	1,595,006,688	1,177,904,724	664,951,614	1,399,789,895
Algeria	7,198,927,335	4,797,609,340	2,505,281,318	6,084,882,367
Angola	1,703,804,507	1,335,741,419	651,587,956	1,567,094,020
Argentina	16,990,791,939	12,132,966,200	7,694,951,524	15,001,801,214
Bangladesh	9,758,429,693	7,346,626,409	4,162,921,283	8,762,131,868
Benin	609,231,361	463,323,321	252,112,394	544,803,973
Bolivia	828,941,402	607,984,156	272,020,642	738,627,623

Botswana	421,205,098	303,116,161	171,230,132	369,522,644
Brazil	57,156,312,626	40,013,304,222	22,894,275,352	49,832,168,384
Burkina Faso	939,419,926	719,748,836	417,278,324	840,119,232
Burundi	408,399,996	304,544,873	167,162,430	359,734,439
Cabo Verde	39,247,227	28,162,920	15,780,012	34,414,567
Cambodia	802,267,483	566,274,013	229,000,547	690,985,182
Cameroon	1,154,599,786	884,467,637	484,883,954	1,043,034,826
Central African Republic	182,433,804	137,035,951	83,939,501	161,434,468
Chad	658,884,973	471,303,516	239,244,463	571,410,658
Colombia	12,075,940,244	8,475,322,329	4,733,454,628	10,533,617,075
Comoros	39,533,969	29,677,244	16,343,351	35,281,984
Congo, Dem. Rep.	3,469,615,019	2,605,619,705	1,265,377,537	3,067,476,753
Congo, Rep.	274,760,274	211,912,215	130,725,594	249,919,561
Costa Rica	1,502,087,635	1,042,161,571	607,146,919	1,305,750,553
Cote d'Ivoire	1,190,399,892	890,204,132	402,280,265	1,059,989,337
Cuba	2,017,494,968	1,414,934,979	845,099,624	1,767,876,988
Djibouti	60,775,939	46,862,116	26,784,302	55,355,583
Dominican Republic	2,565,684,173	1,828,777,716	1,068,959,610	2,256,950,992
Ecuador	3,295,395,303	2,380,985,925	1,375,043,118	2,908,422,164
Egypt, Arab Rep.	6,445,190,291	4,577,530,923	2,389,669,661	5,670,659,187
El Salvador	591,579,720	434,268,407	248,098,581	530,457,154
Equatorial Guinea	231,075,219	178,959,540	100,391,379	210,653,340
Eswatini	74,567,166	56,029,505	26,432,806	67,309,663
Ethiopia	7,589,595,244	5,627,795,574	3,081,548,357	6,683,485,989
Gabon	356,596,194	268,464,549	169,638,184	320,961,919
Gambia, The	119,218,198	90,763,358	52,035,644	106,107,646
Ghana	1,621,297,684	1,221,891,384	556,920,614	1,453,846,283
Guatemala	2,042,320,674	1,483,251,542	854,210,602	1,795,402,698
Guinea	671,793,449	509,527,263	284,208,408	600,953,264
Guinea-Bissau	91,777,597	70,013,569	41,923,342	82,337,549
Haiti	649,227,561	482,130,225	280,151,525	577,852,090
Honduras	590,251,293	449,603,344	272,545,259	534,058,049
India	126,241,607,727	94,845,714,832	57,820,205,064	113,697,199,394
Iran, Islamic Rep.	7,350,914,852	4,963,443,606	2,834,585,552	6,283,486,292
Iraq	5,808,461,053	4,325,177,524	2,393,641,505	5,178,286,305
Jordan	1,042,846,812	747,309,105	460,019,255	908,958,207
Kenya	4,136,465,948	3,372,960,785	2,186,416,908	3,829,322,849
Lebanon	1,601,468,785	1,169,981,518	789,069,252	1,424,189,709
Lesotho	103,041,897	73,935,288	34,089,165	89,815,951
Liberia	230,138,172	174,077,339	103,699,634	205,216,814
Libya	1,317,562,603	916,036,535	484,376,095	1,140,287,493

Madagascar	1,258,737,705	929,396,816	498,242,703	1,108,391,195
Malawi	742,886,055	549,184,096	293,026,156	651,787,586
Mali	867,812,732	622,492,840	316,411,256	755,421,554
Mauritania	206,771,925	157,899,063	99,305,744	186,164,959
Mauritius	537,143,681	370,884,267	234,900,728	465,076,712
Mexico	34,115,201,144	24,625,827,163	15,782,810,293	30,216,622,750
Morocco	3,267,515,013	2,431,152,726	1,519,075,135	2,940,380,785
Mozambique	1,271,233,930	940,866,088	502,228,251	1,119,434,522
Namibia	263,758,483	195,667,209	91,410,118	233,404,625
Nepal	2,060,381,058	1,521,796,884	773,785,915	1,827,252,564
Nicaragua	384,638,289	285,335,078	158,382,871	342,217,217
Niger	842,039,860	599,341,108	303,663,836	725,945,647
Nigeria	10,247,169,054	7,962,255,548	4,445,505,322	9,326,514,000
Pakistan	9,441,146,849	6,868,761,344	3,901,350,552	8,242,469,426
Paraguay	1,208,234,685	850,884,034	438,489,428	1,053,013,278
Peru	7,149,625,157	4,985,660,537	2,550,356,751	6,187,688,798
Rwanda	627,950,026	471,398,249	259,768,907	558,014,561
Sao Tome and Principe	11,024,075	8,669,252	5,044,582	10,042,513
Senegal	775,913,554	595,256,052	343,558,437	699,179,799
Sierra Leone	353,894,747	268,216,325	159,990,783	316,044,465
Somalia	511,309,434	381,354,484	201,668,843	448,722,521
South Africa	11,117,131,659	8,334,446,288	4,960,920,248	10,104,268,308
South Sudan	457,247,980	346,307,159	165,112,181	408,857,053
Sri Lanka	5,678,100,834	4,065,040,082	2,623,300,200	4,988,596,480
Sudan	1,944,960,100	1,465,299,051	798,971,465	1,732,370,209
Syrian Arab Republic	876,059,081	683,467,982	418,397,444	803,740,032
Tajikistan	518,284,390	367,451,171	188,545,177	449,773,206
Tanzania	3,229,078,738	2,456,724,397	1,362,187,767	2,903,091,232
Togo	374,774,447	285,340,906	155,932,903	334,768,272
Tunisia	1,116,665,762	796,503,718	467,489,081	986,577,100
Turkey	32,657,064,433	23,659,504,785	15,564,550,540	28,931,632,252
Uganda	2,007,915,732	1,588,879,797	1,407,932,788	1,849,941,504
Venezuela, RB	4,377,122,572	3,196,922,891	2,024,556,702	3,933,821,378
West Bank and Gaza	257,722,952	195,636,416	119,932,408	233,328,972
Yemen, Rep.	1,328,176,781	938,682,001	466,480,766	1,141,026,798
Zambia	748,338,033	576,387,647	281,151,582	675,092,378
Zimbabwe	757,131,633	617,966,425	584,680,182	715,488,782

Table SR4: Health System Costs of COVID 19 Response per capita as % of GDP per capita (nominal)

Country	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Afghanistan	8.24%	6.08%	3.43%	7.23%
Algeria	4.14%	2.76%	1.44%	3.50%
Angola	1.61%	1.26%	0.62%	1.48%
Argentina	3.27%	2.33%	1.48%	2.89%
Bangladesh	3.56%	2.68%	1.52%	3.20%
Benin	5.88%	4.47%	2.43%	5.26%
Bolivia	2.06%	1.51%	0.68%	1.83%
Botswana	2.26%	1.63%	0.92%	1.98%
Brazil	3.06%	2.14%	1.23%	2.67%
Burkina Faso	6.65%	5.10%	2.95%	5.95%
Burundi	13.45%	10.03%	5.50%	11.85%
Cabo Verde	1.99%	1.42%	0.80%	1.74%
Cambodia	3.27%	2.31%	0.93%	2.82%
Cameroon	2.99%	2.29%	1.25%	2.70%
Central African Republic	8.22%	6.17%	3.78%	7.27%
Chad	5.84%	4.18%	2.12%	5.07%
Colombia	3.65%	2.56%	1.43%	3.18%
Comoros	3.36%	2.52%	1.39%	3.00%
Congo, Dem. Rep.	7.35%	5.52%	2.68%	6.50%
Congo, Rep.	2.44%	1.88%	1.16%	2.22%
Costa Rica	2.50%	1.73%	1.01%	2.17%
Cote d'Ivoire	2.77%	2.07%	0.94%	2.46%
Cuba	2.02%	1.41%	0.84%	1.77%
Djibouti	2.06%	1.59%	0.91%	1.87%
Dominican Republic	3.00%	2.14%	1.25%	2.64%
Ecuador	3.04%	2.20%	1.27%	2.68%
Egypt, Arab Rep.	2.57%	1.82%	0.95%	2.26%
El Salvador	2.27%	1.67%	0.95%	2.04%
Equatorial Guinea	1.72%	1.33%	0.75%	1.57%
Eswatini	1.58%	1.19%	0.56%	1.43%
Ethiopia	9.00%	6.67%	3.65%	7.92%
Gabon	2.12%	1.59%	1.01%	1.90%
Gambia, The	7.30%	5.56%	3.19%	6.50%
Ghana	2.47%	1.86%	0.85%	2.22%
Guatemala	2.60%	1.89%	1.09%	2.29%
Guinea	6.16%	4.67%	2.61%	5.51%
Guinea-Bissau	6.29%	4.80%	2.88%	5.65%
Haiti	6.72%	4.99%	2.90%	5.98%
Honduras	2.46%	1.88%	1.14%	2.23%
India	4.64%	3.49%	2.13%	4.18%
Iran, Islamic Rep.	1.60%	1.08%	0.62%	1.36%
Jordan	2.47%	1.77%	1.09%	2.15%
Kenya	4.71%	3.84%	2.49%	4.36%
Lebanon	2.83%	2.07%	1.39%	2.51%
Lesotho	3.76%	2.70%	1.24%	3.28%
Liberia	7.05%	5.33%	3.18%	6.29%
Libya	2.72%	1.89%	1.00%	2.36%
Madagascar	9.09%	6.71%	3.60%	8.00%
Malawi	10.52%	7.77%	4.15%	9.23%

Mali	5.06%	3.63%	1.84%	4.40%
Mauritania	3.95%	3.02%	1.90%	3.56%
Mauritius	3.78%	2.61%	1.65%	3.27%
Mexico	2.79%	2.02%	1.29%	2.48%
Morocco	2.80%	2.08%	1.30%	2.52%
Mozambique	8.64%	6.39%	3.41%	7.61%
Namibia	1.82%	1.35%	0.63%	1.61%
Nepal	7.09%	5.24%	2.66%	6.29%
Nicaragua	2.93%	2.18%	1.21%	2.61%
Niger	9.06%	6.45%	3.27%	7.81%
Nigeria	2.58%	2.00%	1.12%	2.35%
Pakistan	3.00%	2.18%	1.24%	2.62%
Paraguay	2.98%	2.10%	1.08%	2.60%
Peru	3.22%	2.25%	1.15%	2.79%
Rwanda	6.60%	4.96%	2.73%	5.87%
Sao Tome and Principe	2.61%	2.05%	1.19%	2.38%
Senegal	3.22%	2.47%	1.42%	2.90%
Sierra Leone	8.66%	6.57%	3.92%	7.74%
South Africa	3.02%	2.26%	1.35%	2.74%
Sri Lanka	6.39%	4.57%	2.95%	5.61%
Sudan	4.76%	3.59%	1.96%	4.24%
Syrian Arab Republic	2.55%	1.99%	1.22%	2.34%
Tajikistan	6.89%	4.88%	2.51%	5.98%
Tanzania	5.46%	4.15%	2.30%	4.91%
Togo	6.99%	5.32%	2.91%	6.25%
Tunisia	2.80%	2.00%	1.17%	2.47%
Turkey	4.23%	3.07%	2.02%	3.75%
Venezuela, RB	0.94%	0.69%	0.44%	0.85%
Yemen, Rep.	4.93%	3.49%	1.73%	4.24%
Zambia	2.80%	2.16%	1.05%	2.53%
Zimbabwe	2.44%	1.99%	1.89%	2.31%

Table SR5: Health System Costs of COVID 19 Response as % of total health spending (excl. OOP)

Country	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Afghanistan	74.95%	55.35%	31.25%	65.78%
Algeria	65.46%	43.63%	22.78%	55.33%
Angola	58.08%	45.53%	22.21%	53.42%
Argentina	39.98%	28.55%	18.11%	35.30%
Bangladesh	176.74%	133.06%	75.40%	158.70%
Benin	174.48%	132.70%	72.20%	156.03%
Bolivia	34.28%	25.14%	11.25%	30.54%
Botswana	49.18%	35.39%	19.99%	43.15%
Brazil	26.86%	18.80%	10.76%	23.42%
Burkina Faso	116.17%	89.01%	51.60%	103.89%
Burundi	197.95%	147.61%	81.02%	174.36%
Cabo Verde	45.37%	32.56%	18.24%	39.79%
Cambodia	63.56%	44.86%	18.14%	54.75%
Cameroon	71.03%	54.41%	29.83%	64.16%
Central African Republic	238.96%	179.50%	109.95%	211.46%
Chad	134.35%	96.10%	48.78%	116.51%
Colombia	71.46%	50.15%	28.01%	62.33%
Comoros	80.51%	60.43%	33.28%	71.85%
Congo, Dem. Rep.	201.15%	151.06%	73.36%	177.84%
Congo, Rep.	74.44%	57.42%	35.42%	67.71%
Costa Rica	33.80%	23.45%	13.66%	29.38%
Cote d'Ivoire	70.27%	52.55%	23.75%	62.58%
Cuba	18.33%	12.86%	7.68%	16.06%
Djibouti	90.30%	69.62%	39.79%	82.24%
Dominican Republic	58.29%	41.55%	24.29%	51.28%
Ecuador	38.21%	27.61%	15.94%	33.73%
Egypt, Arab Rep.	49.99%	35.51%	18.54%	43.99%
El Salvador	31.35%	23.02%	13.15%	28.11%
Equatorial Guinea	62.74%	48.59%	27.26%	57.19%
Eswatini	29.75%	22.36%	10.55%	26.86%
Ethiopia	252.46%	187.20%	102.50%	222.32%
Gabon	76.36%	57.49%	36.33%	68.73%
Gambia, The	249.81%	190.19%	109.04%	222.34%
Ghana	80.68%	60.80%	27.71%	72.35%
Guatemala	49.06%	35.63%	20.52%	43.13%
Guinea	144.46%	109.57%	61.12%	129.23%
Guinea-Bissau	125.38%	95.65%	57.27%	112.48%
Haiti	154.72%	114.90%	66.77%	137.71%
Honduras	30.85%	23.50%	14.25%	27.91%
India	148.82%	111.81%	68.16%	134.03%
Iran, Islamic Rep.	21.63%	14.61%	8.34%	18.49%
Jordan	46.86%	33.58%	20.67%	40.84%
Kenya	121.56%	99.13%	64.25%	112.54%
Lebanon	35.31%	25.80%	17.40%	31.41%
Lesotho	57.16%	41.01%	18.91%	49.82%
Liberia	69.91%	52.88%	31.50%	62.34%
Libya	63.11%	43.88%	23.20%	54.62%
Madagascar	198.72%	146.73%	78.66%	174.98%
Malawi	138.39%	102.30%	54.59%	121.42%

Mali	152.71%	109.54%	55.68%	132.94%
Mauritania	100.40%	76.67%	48.22%	90.39%
Mauritius	76.75%	53.00%	33.57%	66.46%
Mexico	58.54%	42.26%	27.08%	51.85%
Morocco	52.90%	39.36%	24.59%	47.60%
Mozambique	224.38%	166.07%	88.65%	197.59%
Namibia	26.75%	19.84%	9.27%	23.67%
Nepal	161.39%	119.20%	60.61%	143.13%
Nicaragua	31.62%	23.45%	13.02%	28.13%
Niger	165.40%	117.73%	59.65%	142.60%
Nigeria	65.94%	51.23%	28.61%	60.01%
Pakistan	112.40%	81.78%	46.45%	98.13%
Paraguay	53.08%	37.38%	19.26%	46.26%
Peru	70.63%	49.25%	25.19%	61.13%
Rwanda	106.17%	79.70%	43.92%	94.35%
Sao Tome and Principe	49.69%	39.07%	22.74%	45.26%
Senegal	93.02%	71.37%	41.19%	83.83%
Sierra Leone	53.60%	40.62%	24.23%	47.87%
South Africa	44.94%	33.69%	20.05%	40.84%
Sri Lanka	171.15%	122.53%	79.07%	150.37%
Sudan	30.61%	23.06%	12.57%	27.26%
Syrian Arab Republic	78.34%	61.12%	37.42%	71.88%
Tajikistan	102.25%	72.49%	37.20%	88.73%
Tanzania	161.51%	122.88%	68.13%	145.21%
Togo	122.53%	93.29%	50.98%	109.45%
Tunisia	37.64%	26.85%	15.76%	33.26%
Turkey	84.65%	61.33%	40.34%	74.99%
Venezuela, RB	9.61%	7.02%	4.44%	8.63%
Yemen, Rep.	64.69%	45.72%	22.72%	55.58%
Zambia	76.27%	58.75%	28.66%	68.81%
Zimbabwe	55.82%	45.56%	43.10%	52.75%

Table SR6: Health System Costs of COVID 19 Response as % of total health spending (incl. OOP)

Country	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Afghanistan	42.25%	31.20%	17.61%	37.08%
Algeria	50.02%	33.33%	17.41%	42.28%
Angola	42.95%	33.67%	16.43%	39.51%
Argentina	34.52%	24.65%	15.64%	30.48%
Bangladesh	102.82%	77.41%	43.86%	92.33%
Benin	121.61%	92.48%	50.32%	108.75%
Bolivia	26.77%	19.64%	8.79%	23.86%
Botswana	46.73%	33.63%	19.00%	41.00%
Brazil	18.71%	13.10%	7.49%	16.31%
Burkina Faso	88.42%	67.74%	39.27%	79.07%
Burundi	151.67%	113.10%	62.08%	133.59%
Cabo Verde	36.01%	25.84%	14.48%	31.57%
Cambodia	40.09%	28.30%	11.44%	34.53%
Cameroon	41.90%	32.10%	17.60%	37.85%
Central African Republic	167.01%	125.45%	76.84%	147.79%
Chad	83.37%	59.63%	30.27%	72.30%
Colombia	59.47%	41.74%	23.31%	51.88%
Comoros	46.50%	34.91%	19.22%	41.50%
Congo, Dem. Rep.	146.36%	109.92%	53.38%	129.40%
Congo, Rep.	49.72%	38.35%	23.66%	45.23%
Costa Rica	27.67%	19.20%	11.19%	24.06%
Cote d'Ivoire	50.14%	37.50%	16.95%	44.65%
Cuba	16.62%	11.66%	6.96%	14.56%
Djibouti	71.80%	55.36%	31.64%	65.39%
Dominican Republic	40.31%	28.73%	16.79%	35.46%
Ecuador	27.20%	19.65%	11.35%	24.01%
Egypt, Arab Rep.	30.86%	21.92%	11.44%	27.15%
El Salvador	24.66%	18.10%	10.34%	22.11%
Equatorial Guinea	36.30%	28.11%	15.77%	33.09%
Eswatini	27.07%	20.34%	9.60%	24.44%
Ethiopia	183.71%	136.22%	74.59%	161.78%
Gabon	62.33%	46.92%	29.65%	56.10%
Gambia, The	202.13%	153.88%	88.22%	179.90%
Ghana	58.54%	44.12%	20.11%	52.49%
Guatemala	32.00%	23.24%	13.38%	28.13%
Guinea	96.46%	73.16%	40.81%	86.29%
Guinea-Bissau	92.60%	70.64%	42.30%	83.07%
Haiti	109.17%	81.07%	47.11%	97.17%
Honduras	21.27%	16.21%	9.82%	19.25%
India	90.42%	67.94%	41.42%	81.44%
Iran, Islamic Rep.	15.59%	10.52%	6.01%	13.32%
Jordan	36.61%	26.24%	16.15%	31.91%
Kenya	95.18%	77.62%	50.31%	88.12%
Lebanon	26.73%	19.52%	13.17%	23.77%
Lesotho	48.08%	34.50%	15.90%	41.90%
Liberia	47.47%	35.91%	21.39%	42.33%
Libya	63.11%	43.88%	23.20%	54.62%
Madagascar	162.41%	119.91%	64.29%	143.01%
Malawi	124.24%	91.85%	49.01%	109.00%

Mali	112.89%	80.98%	41.16%	98.27%
Mauritania	66.53%	50.81%	31.95%	59.90%
Mauritius	51.80%	35.77%	22.65%	44.85%
Mexico	41.70%	30.10%	19.29%	36.94%
Morocco	35.59%	26.48%	16.55%	32.03%
Mozambique	208.39%	154.24%	82.33%	183.51%
Namibia	24.83%	18.42%	8.61%	21.97%
Nepal	103.83%	76.69%	38.99%	92.08%
Nicaragua	23.91%	17.74%	9.85%	21.27%
Niger	104.35%	74.27%	37.63%	89.96%
Nigeria	37.63%	29.24%	16.33%	34.25%
Pakistan	68.03%	49.49%	28.11%	59.39%
Paraguay	38.50%	27.12%	13.97%	33.56%
Peru	55.06%	38.39%	19.64%	47.65%
Rwanda	99.81%	74.92%	41.29%	88.69%
Sao Tome and Principe	43.43%	34.16%	19.87%	39.57%
Senegal	61.29%	47.02%	27.14%	55.23%
Sierra Leone	37.86%	28.70%	17.12%	33.82%
South Africa	41.70%	31.27%	18.61%	37.90%
Sri Lanka	114.01%	81.62%	52.67%	100.16%
Sudan	17.60%	13.26%	7.23%	15.68%
Syrian Arab Republic	78.34%	61.12%	37.42%	71.88%
Tajikistan	61.57%	43.65%	22.40%	53.43%
Tanzania	132.50%	100.81%	55.90%	119.13%
Togo	81.46%	62.02%	33.89%	72.76%
Tunisia	26.91%	19.19%	11.26%	23.77%
Turkey	72.68%	52.66%	34.64%	64.39%
Venezuela, RB	9.61%	7.02%	4.44%	8.63%
Yemen, Rep.	35.75%	25.27%	12.56%	30.71%
Zambia	68.03%	52.40%	25.56%	61.37%
Zimbabwe	46.04%	37.58%	35.55%	43.51%

Table SR7: Health System Costs of COVID 19 Response as % of government health spending

Country	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Afghanistan	1461.58%	1079.37%	609.33%	1282.69%
Algeria	96.72%	81.75%	33.66%	81.75%
Angola	131.58%	121.02%	50.32%	121.02%
Argentina	53.71%	47.42%	24.33%	47.42%
Bangladesh	984.27%	883.78%	419.89%	883.78%
Benin	849.59%	759.74%	351.58%	759.74%
Bolivia	52.17%	46.49%	17.12%	46.49%
Botswana	87.93%	77.14%	35.75%	77.14%
Brazil	80.84%	70.48%	32.38%	70.48%
Burkina Faso	289.72%	259.10%	128.69%	259.10%
Burundi	679.59%	598.61%	278.16%	598.61%
Cabo Verde	79.91%	70.07%	32.13%	70.07%
Cambodia	291.48%	251.05%	83.20%	251.05%
Cameroon	532.62%	481.16%	223.68%	481.16%
Central African Republic	1607.91%	1422.83%	739.81%	1422.83%
Chad	712.01%	617.48%	258.53%	617.48%
Colombia	112.68%	98.29%	44.17%	98.29%
Comoros	553.08%	493.60%	228.65%	493.60%
Congo, Dem. Rep.	1641.60%	1451.34%	598.70%	1451.34%
Congo, Rep.	176.09%	160.17%	83.78%	160.17%
Costa Rica	45.22%	39.31%	18.28%	39.31%
Cote d'Ivoire	272.68%	242.80%	92.15%	242.80%
Cuba	20.46%	17.93%	8.57%	17.93%
Djibouti	197.29%	179.69%	86.95%	179.69%
Dominican Republic	127.48%	112.14%	53.11%	112.14%
Ecuador	74.65%	65.88%	31.15%	65.88%
Egypt, Arab Rep.	170.63%	150.12%	63.26%	150.12%
El Salvador	48.63%	43.61%	20.40%	43.61%
Equatorial Guinea	266.82%	243.24%	115.92%	243.24%
Eswatini	42.93%	38.75%	15.22%	38.75%
Ethiopia	914.16%	805.02%	371.17%	805.02%
Gabon	118.23%	106.41%	56.24%	106.41%
Gambia, The	1345.47%	1197.51%	587.26%	1197.51%
Ghana	210.35%	188.62%	72.25%	188.62%
Guatemala	131.83%	115.89%	55.14%	115.89%
Guinea	1174.62%	1050.76%	496.94%	1050.76%
Guinea-Bissau	283.34%	254.19%	129.43%	254.19%
Haiti	1008.94%	898.02%	435.37%	898.02%
Honduras	67.20%	60.80%	31.03%	60.80%
India	585.28%	527.12%	268.06%	527.12%
Iran, Islamic Rep.	39.68%	33.91%	15.30%	33.91%
Jordan	74.11%	64.60%	32.69%	64.60%
Kenya	336.03%	311.08%	177.61%	311.08%
Lebanon	67.74%	60.24%	33.38%	60.24%
Lesotho	89.58%	78.08%	29.63%	78.08%
Liberia	490.72%	437.58%	221.12%	437.58%
Libya	99.72%	86.30%	36.66%	86.30%
Madagascar	417.01%	367.20%	165.06%	367.20%
Malawi	493.40%	432.89%	194.62%	432.89%

Mali	483.29%	420.70%	176.21%	420.70%
Mauritania	273.93%	246.63%	131.56%	246.63%
Mauritius	173.99%	150.65%	76.09%	150.65%
Mexico	112.26%	99.44%	51.94%	99.44%
Morocco	112.89%	101.59%	52.48%	101.59%
Mozambique	420.65%	370.42%	166.19%	370.42%
Namibia	43.22%	38.24%	14.98%	38.24%
Nepal	868.62%	770.34%	326.22%	770.34%
Nicaragua	51.54%	45.85%	21.22%	45.85%
Niger	680.99%	587.10%	245.58%	587.10%
Nigeria	506.26%	460.77%	219.63%	460.77%
Pakistan	402.92%	351.76%	166.50%	351.76%
Paraguay	102.82%	89.61%	37.32%	89.61%
Peru	110.23%	95.40%	39.32%	95.40%
Rwanda	313.36%	278.46%	129.63%	278.46%
Sao Tome and Principe	124.55%	113.46%	56.99%	113.46%
Senegal	269.12%	242.51%	119.16%	242.51%
Sierra Leone	479.73%	428.42%	216.88%	428.42%
South Africa	83.63%	76.01%	37.32%	76.01%
Sri Lanka	397.17%	348.94%	183.49%	348.94%
Sudan	157.07%	139.90%	64.52%	139.90%
Syrian Arab Republic	173.02%	158.74%	82.63%	158.74%
Tajikistan	357.52%	310.26%	130.06%	310.26%
Tanzania	397.58%	357.44%	167.72%	357.44%
Togo	611.16%	545.92%	254.28%	545.92%
Tunisia	66.46%	58.72%	27.83%	58.72%
Turkey	107.91%	95.60%	51.43%	95.60%
Venezuela, RB	25.19%	22.64%	11.65%	22.64%
Yemen, Rep.	635.34%	545.82%	223.14%	545.82%
Zambia	199.20%	179.70%	74.84%	179.70%
Zimbabwe	120.03%	113.43%	92.69%	113.43%

Table SR8. Average Cost per Capita by Country Income Category (2019 US\$): Sensitivity Analysis on % of symptomatic cases tested

	Scenario 1	Scenario 4	Scenario 14	Scenario 49
Average Cost per Capita by Country Income Category (2019 US\$): 20% of Symptomatic Cases Tested				
Low Income Countries (LIC)	49.81	37.18	20.77	44.12
Lower-Middle Income Countries (LMIC)	62.64	47.09	28.00	56.30
Upper-Middle Income Countries (UMIC)	85.05	60.62	36.41	74.74
Average Cost per Capita by Country Income Category (2019 US\$): 40% of Symptomatic Cases Tested				
Low Income Countries (LIC)	51.00	38.07	21.26	45.16
Lower-Middle Income Countries (LMIC)	65.63	49.34	29.31	58.93
Upper-Middle Income Countries (UMIC)	89.40	63.83	38.25	78.53
Average Cost per Capita by Country Income Category (2019 US\$): 60% of Symptomatic Cases Tested				
Low Income Countries (LIC)	52.19	38.97	21.74	46.21
Lower-Middle Income Countries (LMIC)	68.63	51.59	30.63	61.56
Upper-Middle Income Countries (UMIC)	93.74	67.03	40.09	82.32

Average Cost per Capita by Country Income Category (2019 US\$): 80% of Symptomatic Cases Tested				
Low Income Countries (LIC)	53.39	39.86	22.23	47.25
Lower-Middle Income Countries (LMIC)	71.62	53.85	31.94	64.19
Upper-Middle Income Countries (UMIC)	98.09	70.24	41.93	86.11
Average Cost per Capita by Country Income Category (2019 US\$): 100% of Symptomatic Cases Tested				
Low Income Countries (LIC)	54.58	40.75	22.72	48.30
Lower-Middle Income Countries (LMIC)	74.62	56.10	33.25	66.82
Upper-Middle Income Countries (UMIC)	102.44	73.44	43.77	89.90

Supplemental Material Methods

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Supplement S1. Epidemiological model

S1.1 Parameters used in epidemiological model

Figure S1.1.1 Flow diagram showing compartments and flows in the epidemiological model.

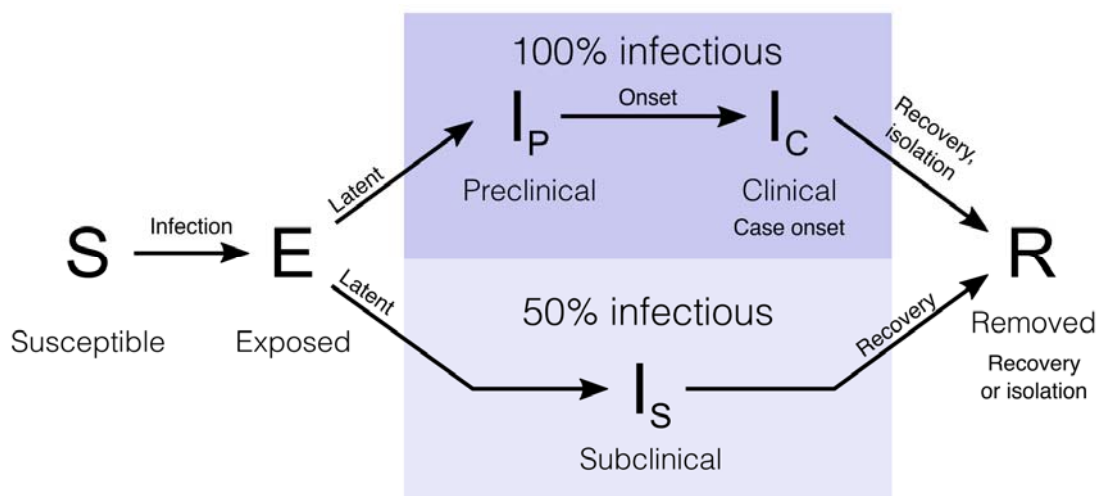


Table S1.1.1 General model parameters

Parameter	Description	Value	Reference
d_E	Latent period (E to I _P and E to I _S ; days)	Gamma distribution ($\mu=4.0$, $k=4$)	¹
d_P	Duration of preclinical infectiousness (I _P to I _C ; days)	Gamma distribution ($\mu=2.4$, $k=4$)	¹
d_C	Duration of clinical infectiousness (I _C to R; days)	Gamma distribution ($\mu=3.2$, $k=3.7$)	²
d_S	Duration of subclinical infectiousness (I _S to R; days)	Gamma distribution ($\mu=7.0$, $k=4.0$)	Assumed
	Incubation period (E to I _C ; days)	$d_E + d_P$; mean 6.4 days	Derived
	Serial interval (days)	$d_E + (y_i(d_P + d_C) + (1 - y_i)d_S)/2$; mean approximately 7 days	Derived
u	Susceptibility to infection on contact	Calculated from R_0	Derived
y_i	Probability of clinical symptoms on infection for age group i	Estimated from case distributions across 6 countries	³
f	Relative infectiousness of subclinical cases	50%	Assumed
c_{ij}	Number of age- j individuals contacted by an age- i individual per	Country-specific contact matrix	⁴

	day		
N_i	Number of age- i individuals	Demographic data	⁵
Δt	Time step for discrete-time simulation	0.25 days	
	Delay from onset to hospitalisation (days)	Gamma distribution ($\mu=7.0$, $k=5.0$)	
	Duration of hospitalisation in non-ICU bed, severe case (days)	Gamma distribution ($\mu=14.6$, $k=5.0$)	⁶
	Duration of hospitalisation in non-ICU bed, critical case (before ICU bed; days)	Gamma distribution ($\mu=6.0$, $k=5.0$)	⁷⁻¹³
	Duration of hospitalisation in ICU bed, critical case (after non-ICU bed; days)	Gamma distribution ($\mu=9.6$, $k=5.0$)	⁷⁻¹³
	Delay from onset to death (days)	Gamma distribution ($\mu=22$, $k=10$)	^{14,15}

Table S1.1.2 Age-specific hospitalisation and fatality risk. From ¹⁶.

Age group	Case-fatality risk	% of cases hospitalised	% of hospital patients needing ICU
0-9	0.00%	0.0%	30%
1-10	0.09%	0.8%	30%
20-29	0.10%	0.8%	30%
30-39	0.12%	1.0%	30%
40-49	0.23%	1.9%	30%
50-59	0.68%	5.4%	30%
60-69	1.87%	15.1%	30%
70-79	4.14%	33.3%	30%
80+	7.68%	61.8%	30%

S1.2 Scenarios

The epidemiological model uses data from 92 low- and middle-income countries. For each country, the model produces estimates on the number of cases, hospitalisations, number of days in hospital for severe cases (general ward) and critical cases (intensive care unit), and deaths for 57 distinct epidemiological scenarios [16].

For this study, four epidemiological scenarios were chosen out of the set of 57 possible scenarios. Scenario 1 represents an unmitigated epidemic. The other three scenarios were chosen because they represent a variety of plausible policy options (scenarios 4, 14 and 49). Descriptions of the scenarios are presented below.

Table S1.2.1 Scenario Descriptions

Scenario 1	Unmitigated epidemic
Scenario 4	The whole population is covered in this intervention scenario. The intervention is triggered by daily incidence reaching 1 per 10,000. The intervention includes self-isolation of symptomatic persons for duration of symptoms, modelled as an additional reduction in contacts among symptomatic people of 75 %.The intervention includes distancing measures that reduce contacts at school by 20 %.The intervention includes distancing measures that reduce contacts at work by 20 %.The intervention includes distancing measures that reduce contacts in other settings by 20 %.The intervention includes distancing measures that reduce contacts in the home setting by 0%. There is no difference in intervention by age.
Scenario 14	The whole population is covered in this intervention scenario. The intervention is triggered by daily incidence reaching 1 per 10,000. The intervention includes self-isolation of symptomatic persons for duration of symptoms, modelled as an additional reduction in contacts among symptomatic people of 25 %.The intervention includes distancing measures that reduce contacts at school by 60 %.The intervention includes distancing measures that reduce contacts at work by 60 %.The intervention includes distancing measures that reduce contacts in other settings by 60 %.The intervention includes distancing measures that reduce contacts in the home setting by 0 %. There is no difference in intervention by age.
Scenario 49	49.The intervention is temporary lockdown which leads to 100 % of the population reducing their contacts through school, home, work and other settings by 100 %, 0 %, 37.5 % and 37.5 % respectively for whilst in lockdown. Lockdown occurs for the first 30 days. After lockdown is lifted 100 % of the population reducing their contacts through school, home, work and other settings by 20 %, 0 %, 20 % and 20 % respectively for whilst not in lockdown

S1.3 The number of cases

The total number of expected cases, deaths, and days of hospitalisation in ICU and general ward per country per scenario used in this study are in the table below [16].

Table S1.3.1 Number of cases, deaths, and days of hospitalisation per country per scenario

Country	Scenario	Total Number of Cases	Total Number of ICU bed days	Total Number of Non-ICU Bed Days	Total Number of Deaths
Afghanistan	1	12,218,383.50	1,644,757.00	3,068,969.00	102,556.50
Afghanistan	4	9,128,640.00	1,124,521.50	2,096,065.00	69,979.50
Afghanistan	14	5,057,916.50	659,168.00	1,228,499.50	40,910.50
Afghanistan	49	10,687,758.50	1,379,971.50	2,571,195.50	85,767.00
Angola	1	10,568,601.50	1,337,285.50	2,495,053.00	82,996.50
Angola	4	7,951,658.50	958,470.50	1,790,227.00	59,579.00
Angola	14	3,787,000.00	480,525.00	904,767.50	29,918.00
Angola	49	9,243,635.50	1,153,108.50	2,151,983.50	71,542.50
United Arab Emirates	1	3,070,769.50	350,542.50	651,357.50	21,779.50
United Arab Emirates	4	2,177,762.50	214,356.00	402,281.50	13,375.50
United Arab Emirates	14	1,024,344.50	89,813.50	167,419.00	5,562.50
United Arab Emirates	49	2,602,624.00	273,597.50	513,621.00	17,056.00
Argentina	1	16,773,844.50	7,129,191.50	13,331,842.50	443,779.00
Argentina	4	12,167,825.00	4,923,903.50	9,183,093.00	306,424.50
Argentina	14	7,206,744.00	3,179,286.50	5,930,434.50	197,212.00
Argentina	49	14,559,346.00	6,161,078.00	11,508,389.50	383,318.00
Burundi	1	3,825,576.00	487,746.00	912,820.50	30,294.00
Burundi	4	2,875,191.50	343,198.50	643,374.00	21,457.50
Burundi	14	1,563,193.50	192,616.50	359,761.00	11,941.00
Burundi	49	3,360,357.50	416,410.00	783,449.00	25,958.50
Benin	1	3,987,007.50	610,334.00	1,140,852.50	37,966.50
Benin	4	3,027,030.50	436,070.50	813,543.50	27,098.50
Benin	14	1,617,554.00	243,858.00	455,765.00	15,180.50
Benin	49	3,517,493.00	523,439.50	980,737.50	32,600.50
Burkina Faso	1	6,855,948.00	954,394.50	1,781,199.00	59,384.50
Burkina Faso	4	5,231,105.00	692,106.50	1,290,564.50	42,964.50
Burkina Faso	14	2,954,321.00	421,062.50	787,440.50	26,089.50
Burkina Faso	49	6,035,205.50	826,512.00	1,546,412.50	51,439.50
Bangladesh	1	57,227,126.50	14,236,787.50	26,575,364.00	885,268.50
Bangladesh	4	43,270,144.00	10,038,443.00	18,753,926.00	623,994.50
Bangladesh	14	23,696,468.50	5,910,527.00	11,038,186.50	366,350.50
Bangladesh	49	50,407,176.00	12,324,088.50	23,001,526.50	766,395.00
Bahrain	1	547,191.50	80,485.50	150,131.00	5,024.50

Bahrain	4	391,589.50	50,957.50	94,643.50	3,172.50
Bahrain	14	197,184.50	23,694.50	43,975.00	1,460.00
Bahrain	49	468,646.00	64,898.00	121,082.00	3,992.00
Bolivia	1	3,881,885.00	929,770.50	1,734,888.50	57,656.00
Bolivia	4	2,855,102.00	614,416.00	1,146,287.00	38,054.00
Bolivia	14	1,246,487.00	279,998.50	519,996.50	17,368.00
Bolivia	49	3,364,052.00	778,136.00	1,449,732.50	48,330.00
Brazil	1	76,815,441.00	27,418,042.50	51,183,618.50	1,705,997.00
Brazil	4	56,285,085.00	18,283,101.50	34,119,544.00	1,139,191.50
Brazil	14	30,752,013.00	10,628,491.00	19,851,592.50	658,619.00
Brazil	49	66,729,481.50	23,242,138.50	43,395,705.00	1,445,675.00
Botswana	1	765,573.00	159,460.50	296,628.50	9,918.00
Botswana	4	565,035.50	107,208.00	199,542.00	6,659.50
Botswana	14	305,081.50	61,841.00	114,201.00	3,788.50
Botswana	49	662,701.50	134,417.50	250,989.00	8,333.50
Central African Republic	1	1,542,576.00	227,256.00	422,653.00	14,107.50
Central African Republic	4	1,168,850.50	158,951.50	297,690.50	9,899.50
Central African Republic	14	696,606.50	102,635.00	192,340.00	6,435.00
Central African Republic	49	1,353,904.00	194,598.50	363,300.50	12,130.00
Chile	1	7,194,690.00	3,077,838.50	5,737,576.50	191,424.00
Chile	4	5,194,730.50	2,043,884.50	3,820,076.00	126,898.00
Chile	14	3,037,288.00	1,252,044.50	2,330,419.00	77,706.50
Chile	49	6,244,492.50	2,596,331.50	4,850,755.50	161,525.00
Cote d'Ivoire	1	8,535,011.50	1,316,578.00	2,457,105.50	82,052.50
Cote d'Ivoire	4	6,298,091.50	916,128.00	1,708,562.00	57,155.50
Cote d'Ivoire	14	2,781,975.00	429,891.00	803,017.00	26,661.00
Cote d'Ivoire	49	7,403,108.50	1,119,330.00	2,085,969.00	69,716.00
Cameroon	1	8,729,175.00	1,249,335.00	2,335,084.00	77,781.00
Cameroon	4	6,604,562.00	889,631.00	1,661,757.00	55,432.00
Cameroon	14	3,552,194.00	503,335.50	939,579.50	31,264.50
Cameroon	49	7,690,769.50	1,078,672.50	2,014,896.00	67,062.00
Congo, Dem. Rep.	1	28,914,534.50	4,131,602.50	7,713,653.50	257,149.00
Congo, Dem. Rep.	4	21,729,089.00	2,925,815.50	5,459,743.00	181,724.50
Congo, Dem. Rep.	14	10,339,604.50	1,480,493.00	2,755,736.00	91,222.50
Congo, Dem. Rep.	49	25,274,207.00	3,537,679.50	6,601,660.50	219,628.00
Congo, Rep.	1	1,819,209.50	284,222.00	531,531.00	17,714.00
Congo, Rep.	4	1,380,686.00	201,095.00	376,298.50	12,564.00
Congo, Rep.	14	828,849.00	128,923.50	241,162.00	8,084.50

Congo, Rep.	49	1,603,300.00	245,240.00	457,933.50	15,290.00
Colombia	1	18,341,207.00	6,156,013.50	11,493,003.50	382,744.50
Colombia	4	13,426,478.00	4,130,466.00	7,696,118.00	256,667.50
Colombia	14	7,192,837.50	2,342,406.50	4,372,127.00	144,932.50
Colombia	49	15,964,752.50	5,231,315.00	9,754,859.00	325,054.00
Comoros	1	290,557.00	47,011.00	87,852.50	2,911.50
Comoros	4	215,334.50	32,916.00	61,230.50	2,047.00
Comoros	14	114,051.50	18,550.50	34,354.00	1,129.00
Comoros	49	252,887.00	40,321.50	75,628.00	2,512.00
Cabo Verde	1	181,545.00	41,378.50	77,437.00	2,565.50
Cabo Verde	4	128,006.00	26,548.00	49,137.00	1,638.00
Cabo Verde	14	67,260.50	14,657.00	27,550.00	904.50
Cabo Verde	49	153,456.00	33,984.50	63,202.50	2,102.00
Costa Rica	1	1,822,572.50	652,845.00	1,218,193.50	40,619.00
Costa Rica	4	1,326,970.50	428,626.50	799,723.50	26,658.50
Costa Rica	14	745,696.00	252,692.50	470,210.00	15,640.50
Costa Rica	49	1,578,679.00	549,464.00	1,023,618.50	34,173.50
Cuba	1	4,423,054.50	2,120,624.00	3,955,835.50	131,915.50
Cuba	4	3,216,773.00	1,414,337.00	2,640,812.00	87,972.00
Cuba	14	1,810,327.00	857,054.50	1,601,201.00	53,185.50
Cuba	49	3,831,103.00	1,804,660.00	3,363,770.00	111,899.50
Djibouti	1	343,723.00	73,381.50	136,983.50	4,544.00
Djibouti	4	261,053.50	51,856.50	97,124.00	3,227.50
Djibouti	14	142,168.00	30,426.50	55,879.50	1,876.50
Djibouti	49	302,937.00	63,302.00	118,347.50	3,926.00
Dominican Republic	1	3,807,776.50	1,127,809.00	2,105,556.50	70,140.00
Dominican Republic	4	2,808,434.50	765,172.00	1,422,811.50	47,526.00
Dominican Republic	14	1,562,725.00	456,252.50	850,089.00	28,342.50
Dominican Republic	49	3,315,475.00	964,871.00	1,796,265.00	59,882.00
Algeria	1	14,034,752.50	3,466,814.50	6,462,517.50	215,452.50
Algeria	4	9,901,969.50	2,171,943.50	4,050,558.50	135,157.00
Algeria	14	5,054,134.00	1,144,758.00	2,139,220.50	70,839.50
Algeria	49	11,937,307.00	2,835,057.50	5,295,541.50	175,988.50
Ecuador	1	6,238,253.50	1,828,486.50	3,416,054.50	113,769.50
Ecuador	4	4,681,265.50	1,256,086.50	2,337,135.50	77,960.00
Ecuador	14	2,586,022.00	739,506.00	1,376,652.00	45,789.00
Ecuador	49	5,480,200.00	1,567,059.00	2,923,489.50	97,213.50
Egypt, Arab Rep.	1	32,689,306.00	7,149,997.50	13,352,307.50	444,818.00

Egypt, Arab Rep.	4	23,251,249.50	4,594,336.00	8,576,020.00	285,393.00
Egypt, Arab Rep.	14	11,840,378.50	2,461,238.50	4,607,142.50	152,674.00
Egypt, Arab Rep.	49	27,975,740.50	5,946,558.50	11,123,014.50	370,198.00
Eritrea	1	1,155,784.50	209,554.50	391,035.00	13,020.50
Eritrea	4	871,719.50	146,793.00	273,048.00	9,126.00
Eritrea	14	463,730.00	85,068.00	156,997.50	5,297.00
Eritrea	49	1,011,765.50	180,018.50	336,576.50	11,223.50
Ethiopia	1	37,424,354.50	6,123,829.50	11,438,760.00	380,821.00
Ethiopia	4	28,272,226.50	4,318,604.50	8,066,304.00	268,718.00
Ethiopia	14	14,996,879.50	2,457,011.50	4,593,451.50	152,670.50
Ethiopia	49	32,804,209.50	5,277,772.50	9,861,570.50	328,539.50
Gabon	1	752,439.50	127,913.00	239,230.50	7,959.50
Gabon	4	572,425.50	89,835.00	168,146.00	5,614.00
Gabon	14	347,308.00	58,094.50	109,709.00	3,636.00
Gabon	49	664,127.50	110,378.00	206,161.50	6,867.50
Ghana	1	10,378,959.00	1,826,469.00	3,406,631.50	113,607.50
Ghana	4	7,713,893.50	1,273,479.00	2,379,059.00	79,389.50
Ghana	14	3,423,372.00	602,269.50	1,120,060.00	37,243.50
Ghana	49	9,039,576.00	1,557,543.50	2,901,100.00	96,752.50
Guinea	1	4,258,486.00	700,272.50	1,311,263.50	43,626.50
Guinea	4	3,197,000.00	509,156.50	950,868.50	31,664.00
Guinea	14	1,702,114.50	304,197.50	565,934.00	18,715.50
Guinea	49	3,718,928.00	614,330.50	1,144,140.00	38,187.50
Gambia, The	1	787,667.00	120,449.50	224,341.50	7,490.50
Gambia, The	4	592,870.50	88,337.00	163,947.00	5,442.50
Gambia, The	14	324,941.50	53,736.50	101,076.00	3,349.50
Gambia, The	49	686,599.00	104,927.00	196,707.00	6,559.00
Guinea-Bissau	1	646,616.00	100,305.50	186,821.00	6,207.50
Guinea-Bissau	4	490,671.00	72,272.00	135,491.00	4,505.50
Guinea-Bissau	14	284,320.50	45,433.50	83,768.50	2,782.00
Guinea-Bissau	49	569,959.50	87,200.50	163,160.00	5,405.50
Equatorial Guinea	1	471,118.00	62,021.00	116,073.50	3,858.00
Equatorial Guinea	4	359,112.50	44,812.00	83,461.50	2,771.50
Equatorial Guinea	14	194,873.50	25,338.00	47,642.00	1,593.50
Equatorial Guinea	49	416,196.50	53,836.00	100,579.00	3,348.50
Guatemala	1	5,931,816.00	1,188,377.50	2,215,138.50	73,895.00
Guatemala	4	4,445,955.00	809,410.50	1,509,951.00	50,397.50
Guatemala	14	2,471,211.50	477,647.50	888,300.00	29,575.50

Guatemala	49	5,200,461.00	1,004,988.50	1,873,662.50	62,445.50
Honduras	1	3,368,666.00	711,831.50	1,328,438.50	44,068.00
Honduras	4	2,554,279.00	498,194.50	928,828.50	30,884.00
Honduras	14	1,508,914.50	311,765.50	579,275.50	19,367.50
Honduras	49	2,966,095.00	611,292.00	1,145,329.00	38,068.50
Haiti	1	3,844,733.00	864,007.50	1,611,689.00	53,684.00
Haiti	4	2,891,883.50	602,645.50	1,127,804.50	37,538.50
Haiti	14	1,628,745.00	363,202.00	678,225.00	22,680.00
Haiti	49	3,378,437.50	746,954.00	1,392,144.50	46,506.50
India	1	485,771,554.00	134,139,960.00	250,304,012.50	8,338,437.50
India	4	365,933,321.50	93,048,830.00	173,656,181.50	5,785,606.50
India	14	217,279,232.00	58,353,362.00	108,949,367.00	3,620,179.00
India	49	427,295,820.50	115,025,840.50	214,808,061.50	7,154,678.00
Iran, Islamic Rep.	1	27,824,797.00	7,261,103.00	13,561,427.50	451,739.50
Iran, Islamic Rep.	4	19,593,066.00	4,553,642.50	8,499,919.50	282,846.00
Iran, Islamic Rep.	14	11,174,742.50	2,592,113.50	4,837,163.50	161,457.50
Iran, Islamic Rep.	49	23,673,028.50	5,957,133.50	11,119,019.00	370,270.00
Iraq	1	13,378,016.00	2,160,705.50	4,036,576.50	134,703.50
Iraq	4	10,055,987.00	1,513,885.00	2,832,294.00	94,396.50
Iraq	14	5,444,675.50	850,809.00	1,586,860.50	52,768.00
Iraq	49	11,745,266.50	1,852,021.00	3,459,984.50	115,381.50
Israel	1	3,220,231.50	1,398,523.50	2,612,412.50	86,885.00
Israel	4	2,318,309.00	960,045.00	1,794,150.50	59,726.50
Israel	14	1,417,351.00	644,261.00	1,206,315.50	39,883.00
Israel	49	2,790,877.00	1,206,535.00	2,251,874.50	74,860.00
Jordan	1	3,230,120.50	545,182.00	1,014,537.00	33,793.00
Jordan	4	2,403,684.50	360,587.00	671,528.00	22,395.50
Jordan	14	1,441,001.50	226,240.50	421,434.00	14,019.50
Jordan	49	2,802,081.50	455,065.50	851,418.00	28,348.50
Kenya	1	17,932,717.50	3,334,486.00	6,220,435.00	207,231.00
Kenya	4	13,972,380.00	2,685,062.50	5,015,623.00	166,727.00
Kenya	14	8,920,886.50	1,777,160.50	3,304,638.00	110,213.50
Kenya	49	15,940,230.00	3,027,794.00	5,654,038.00	188,428.00
Cambodia	1	5,249,630.00	1,075,358.00	2,009,206.50	67,003.00
Cambodia	4	3,735,696.50	699,366.00	1,307,951.50	43,432.50
Cambodia	14	1,491,662.00	285,706.00	532,484.00	17,649.50
Cambodia	49	4,455,701.50	883,329.50	1,656,497.50	55,016.50
Kuwait	1	1,365,100.50	250,497.00	468,191.50	15,520.50

Kuwait	4	927,501.50	153,854.00	289,037.50	9,618.00
Kuwait	14	463,836.00	72,077.00	134,599.00	4,499.00
Kuwait	49	1,135,226.00	198,574.50	372,262.50	12,352.50
Lebanon	1	2,473,141.50	849,633.00	1,578,978.00	52,778.00
Lebanon	4	1,838,520.50	596,389.00	1,111,151.00	36,992.00
Lebanon	14	1,166,531.50	410,943.00	767,150.00	25,627.50
Lebanon	49	2,165,967.50	736,594.00	1,374,880.00	45,888.00
Liberia	1	1,679,614.00	288,953.00	537,754.50	17,919.00
Liberia	4	1,277,408.00	204,826.00	383,901.50	12,778.00
Liberia	14	740,784.00	127,259.00	237,192.00	7,905.00
Liberia	49	1,478,591.00	249,999.00	464,731.00	15,427.50
Libya	1	2,278,126.50	480,466.00	897,001.00	29,872.50
Libya	4	1,632,674.50	312,685.50	585,736.00	19,495.50
Libya	14	836,827.00	167,080.50	312,036.00	10,330.00
Libya	49	1,947,756.50	401,240.50	748,905.50	24,938.00
Sri Lanka	1	8,020,343.00	3,408,469.50	6,355,545.00	211,681.00
Sri Lanka	4	5,916,153.00	2,373,553.00	4,436,366.50	147,651.50
Sri Lanka	14	3,594,781.50	1,558,313.00	2,903,474.50	96,594.00
Sri Lanka	49	7,016,699.00	2,945,770.00	5,508,073.00	183,971.50
Lesotho	1	696,741.00	145,159.00	271,320.50	9,016.50
Lesotho	4	508,495.00	95,194.00	178,041.00	5,963.00
Lesotho	14	229,199.00	44,271.50	82,771.50	2,796.00
Lesotho	49	600,007.00	121,390.50	224,865.00	7,490.00
Morocco	1	13,242,616.50	4,386,423.50	8,186,000.00	272,409.00
Morocco	4	9,819,052.50	3,059,153.50	5,703,002.00	190,014.00
Morocco	14	5,899,932.00	1,973,055.50	3,680,791.50	122,030.50
Morocco	49	11,587,125.00	3,784,741.00	7,071,203.00	235,508.50
Madagascar	1	9,150,387.00	1,448,349.50	2,707,202.50	90,125.50
Madagascar	4	6,782,766.00	1,015,311.50	1,897,325.50	63,300.50
Madagascar	14	3,564,206.50	563,427.50	1,049,184.00	35,009.50
Madagascar	49	7,966,524.50	1,244,623.50	2,321,257.00	77,440.00
Mexico	1	46,024,528.50	13,801,739.50	25,788,652.50	858,167.00
Mexico	4	34,417,215.50	9,459,831.00	17,652,017.50	588,526.00
Mexico	14	21,097,465.50	6,179,136.00	11,554,982.50	384,123.00
Mexico	49	40,449,264.50	11,850,318.50	22,128,971.50	737,192.50
Mali	1	6,261,538.50	750,361.50	1,399,912.50	46,770.00
Mali	4	4,479,076.50	497,581.50	928,693.00	30,937.00
Mali	14	2,225,009.00	265,778.50	494,221.50	16,416.00

Mali	49	5,359,818.00	623,713.50	1,164,621.00	38,817.00
Mozambique	1	10,132,075.50	1,434,436.00	2,675,563.50	89,192.00
Mozambique	4	7,529,591.00	1,000,297.00	1,869,916.50	62,413.00
Mozambique	14	3,939,631.00	555,317.50	1,035,085.50	34,251.00
Mozambique	49	8,820,156.50	1,230,586.50	2,293,159.50	76,324.00
Mauritania	1	1,535,219.00	254,585.50	475,932.50	15,814.50
Mauritania	4	1,165,275.50	182,691.50	339,829.50	11,333.00
Mauritania	14	707,749.50	121,283.50	227,135.00	7,523.50
Mauritania	49	1,353,942.00	221,412.00	412,271.50	13,722.50
Mauritius	1	486,885.50	209,370.00	390,331.50	13,047.50
Mauritius	4	351,304.50	138,424.00	258,993.50	8,630.00
Mauritius	14	214,209.50	88,073.00	165,625.00	5,463.00
Mauritius	49	422,540.50	176,489.00	329,162.50	11,015.50
Malawi	1	6,206,020.50	853,281.00	1,590,558.50	52,895.50
Malawi	4	4,609,105.50	597,183.50	1,114,078.50	37,180.00
Malawi	14	2,414,871.50	329,973.00	616,215.00	20,405.50
Malawi	49	5,394,534.00	731,214.50	1,362,680.00	45,337.50
Namibia	1	805,968.50	113,124.50	211,467.00	7,031.50
Namibia	4	594,974.50	78,583.00	146,712.50	4,861.00
Namibia	14	271,679.50	36,560.50	68,778.50	2,296.50
Namibia	49	696,764.50	95,833.50	179,065.50	5,974.50
Niger	1	7,479,840.50	911,995.00	1,704,345.00	56,835.50
Niger	4	5,361,960.00	604,501.50	1,131,297.50	37,570.50
Niger	14	2,656,777.50	323,438.50	603,880.50	20,051.50
Niger	49	6,407,713.00	758,280.50	1,417,828.00	47,137.00
Nigeria	1	67,998,172.00	10,931,386.50	20,404,287.00	679,437.50
Nigeria	4	51,622,542.50	7,976,219.00	14,878,213.00	495,446.50
Nigeria	14	28,071,652.50	4,656,256.00	8,692,204.50	289,283.50
Nigeria	49	59,789,002.00	9,541,919.50	17,807,958.50	593,371.50
Nicaragua	1	2,235,573.00	500,811.00	937,662.50	31,193.00
Nicaragua	4	1,671,927.50	340,380.50	632,680.50	21,123.50
Nicaragua	14	917,568.00	190,082.50	355,496.00	11,913.00
Nicaragua	49	1,954,965.00	422,935.50	790,201.00	26,307.50
Nepal	1	9,915,594.50	2,499,733.50	4,665,603.00	155,338.50
Nepal	4	7,426,283.00	1,746,579.00	3,269,303.00	108,873.50
Nepal	14	3,596,042.00	931,577.50	1,736,856.00	57,692.50
Nepal	49	8,680,618.50	2,156,185.00	4,028,305.50	134,340.50
Oman	1	1,535,261.00	176,798.50	329,421.00	10,993.00

Oman	4	1,072,384.00	107,046.00	199,923.00	6,631.00
Oman	14	551,427.00	50,614.00	93,722.50	3,132.50
Oman	49	1,289,638.50	138,700.50	258,894.00	8,678.00
Pakistan	1	71,833,290.50	13,106,615.00	24,490,690.50	816,437.00
Pakistan	4	53,017,172.50	8,893,216.00	16,571,105.50	551,824.00
Pakistan	14	29,435,591.50	5,229,562.50	9,784,165.00	324,959.50
Pakistan	49	62,541,662.00	10,974,825.00	20,499,024.50	682,425.00
Panama	1	1,517,972.50	471,387.00	879,487.50	29,338.50
Panama	4	1,105,635.50	311,636.50	581,917.50	19,376.00
Panama	14	599,862.50	178,411.50	335,181.00	11,120.50
Panama	49	1,313,913.50	396,995.50	740,170.50	24,635.00
Peru	1	11,655,014.00	3,620,110.00	6,750,234.00	224,803.00
Peru	4	8,460,494.50	2,403,019.00	4,479,917.00	148,873.00
Peru	14	4,169,860.50	1,246,737.00	2,324,155.00	77,271.50
Peru	49	10,081,293.50	3,039,427.50	5,677,001.50	188,946.00
Paraguay	1	2,401,204.50	602,571.50	1,122,937.50	37,455.50
Paraguay	4	1,771,743.00	398,632.00	744,466.50	24,878.00
Paraguay	14	880,973.50	208,728.50	389,898.50	12,896.50
Paraguay	49	2,085,255.00	508,236.50	946,491.00	31,507.00
West Bank and Gaza	1	1,594,003.50	226,570.50	422,739.00	14,105.00
West Bank and Gaza	4	1,189,222.50	151,665.50	281,435.00	9,406.50
West Bank and Gaza	14	712,802.50	95,452.50	176,325.50	5,948.50
West Bank and Gaza	49	1,387,924.50	190,382.00	355,232.00	11,799.00
Qatar	1	899,032.50	113,926.50	212,464.50	7,071.00
Qatar	4	641,023.00	70,589.50	132,073.50	4,377.50
Qatar	14	266,723.50	26,536.00	49,248.00	1,647.50
Qatar	49	766,587.00	89,823.50	168,594.50	5,584.50
Rwanda	1	4,260,092.00	653,278.50	1,221,703.50	40,608.00
Rwanda	4	3,212,134.50	457,874.00	855,829.50	28,478.00
Rwanda	14	1,749,170.00	255,902.00	479,833.50	16,021.50
Rwanda	49	3,746,403.00	557,316.50	1,041,050.00	34,717.00
Saudi Arabia	1	11,941,083.50	2,049,485.00	3,823,720.50	127,556.50
Saudi Arabia	4	8,911,360.50	1,384,909.50	2,587,572.50	86,282.50
Saudi Arabia	14	5,395,467.50	824,158.50	1,538,146.50	51,054.00
Saudi Arabia	49	10,445,557.00	1,719,131.00	3,203,677.50	106,843.00
Sudan	1	14,419,983.00	2,514,130.50	4,680,808.50	155,985.00
Sudan	4	10,877,482.50	1,772,405.50	3,314,864.00	110,203.50
Sudan	14	5,777,423.00	1,008,371.50	1,878,300.50	62,797.00

Sudan	49	12,629,479.00	2,164,740.50	4,038,214.50	134,408.50
Senegal	1	5,506,929.50	943,941.00	1,765,632.50	58,633.50
Senegal	4	4,152,655.50	688,535.00	1,284,545.00	42,863.00
Senegal	14	2,285,377.00	427,813.00	800,324.00	26,502.50
Senegal	49	4,809,000.50	828,513.50	1,548,749.50	51,440.50
Sierra Leone	1	2,630,770.00	424,739.50	793,709.50	26,428.50
Sierra Leone	4	1,994,333.00	307,273.00	574,350.00	19,119.50
Sierra Leone	14	1,158,003.00	191,212.00	360,302.00	12,060.50
Sierra Leone	49	2,319,759.00	370,961.50	690,722.50	22,966.50
El Salvador	1	2,258,281.50	726,963.50	1,354,593.00	45,160.50
El Salvador	4	1,664,921.50	490,165.50	916,503.50	30,630.00
El Salvador	14	908,668.00	289,893.50	538,904.50	17,905.50
El Salvador	49	1,965,853.00	619,690.50	1,156,953.50	38,540.00
Somalia	1	5,054,908.00	722,092.50	1,346,267.50	44,904.50
Somalia	4	3,796,053.50	508,883.00	947,770.50	31,691.00
Somalia	14	1,969,685.00	281,476.00	522,971.00	17,450.00
Somalia	49	4,408,720.50	619,059.00	1,154,447.00	38,523.50
South Sudan	1	3,696,526.00	575,956.50	1,078,140.00	35,884.00
South Sudan	4	2,762,595.00	406,328.00	758,511.00	25,346.00
South Sudan	14	1,282,595.00	203,062.00	381,821.00	12,566.00
South Sudan	49	3,220,523.50	493,716.50	922,740.50	30,649.50
Sao Tome and Principe	1	72,283.50	11,231.50	20,945.00	696.00
Sao Tome and Principe	4	54,913.00	8,013.50	15,109.50	500.00
Sao Tome and Principe	14	29,481.50	4,448.00	8,484.00	283.50
Sao Tome and Principe	49	63,572.00	9,662.00	17,970.50	606.50
Eswatini	1	363,364.00	62,143.50	115,928.00	3,869.00
Eswatini	4	266,346.00	40,923.50	76,890.50	2,558.00
Eswatini	14	119,567.50	18,886.00	35,996.50	1,187.00
Eswatini	49	313,533.00	51,987.50	96,273.50	3,204.00
Seychelles	1	35,263.00	12,022.50	22,569.50	746.00
Seychelles	4	25,064.00	7,926.50	14,905.00	495.50
Seychelles	14	14,434.00	4,800.50	8,982.50	294.50
Seychelles	49	30,440.50	10,024.50	18,709.50	625.00
Syrian Arab Republic	1	5,792,480.00	989,564.50	1,847,430.00	61,580.00
Syrian Arab Republic	4	4,370,151.50	718,417.00	1,339,837.50	44,443.00
Syrian Arab Republic	14	2,590,708.00	461,948.50	861,860.00	28,637.00
Syrian Arab Republic	49	5,101,506.50	858,728.00	1,601,689.50	53,348.50
Chad	1	5,065,942.50	601,091.00	1,124,428.00	37,284.50

Chad	4	3,620,549.50	399,236.00	745,414.50	24,835.00
Chad	14	1,795,297.50	213,052.50	398,405.50	13,124.00
Chad	49	4,330,613.50	500,212.50	933,773.00	31,055.00
Togo	1	2,738,321.50	409,696.00	766,658.50	25,515.50
Togo	4	2,084,481.50	294,394.50	549,644.00	18,293.50
Togo	14	1,117,765.50	165,863.50	310,016.00	10,260.50
Togo	49	2,416,837.50	353,371.50	660,994.00	21,999.00
Tajikistan	1	2,980,380.50	506,624.00	946,025.50	31,461.00
Tajikistan	4	2,132,996.50	334,988.50	624,270.50	20,882.50
Tajikistan	14	1,073,616.50	173,478.00	325,632.50	10,814.50
Tajikistan	49	2,558,536.50	423,792.00	791,527.50	26,444.00
Tunisia	1	4,156,065.00	1,421,020.00	2,652,235.00	88,351.50
Tunisia	4	2,993,242.50	934,481.50	1,744,116.00	58,013.50
Tunisia	14	1,711,642.00	556,560.50	1,039,231.00	34,717.50
Tunisia	49	3,578,598.00	1,197,555.50	2,241,228.00	74,470.50
Turkey	1	31,029,721.00	11,408,352.00	21,265,807.50	708,020.00
Turkey	4	23,141,897.50	7,967,971.50	14,847,503.50	495,399.50
Turkey	14	14,342,055.00	5,342,495.00	9,982,584.00	331,482.50
Turkey	49	27,262,980.00	9,879,607.50	18,427,321.50	614,391.00
Tanzania	1	19,439,044.50	2,891,250.00	5,398,275.50	180,022.50
Tanzania	4	14,683,606.50	2,076,715.50	3,872,581.00	129,155.00
Tanzania	14	7,943,080.00	1,196,374.50	2,231,611.50	74,239.50
Tanzania	49	17,106,351.50	2,514,752.00	4,689,457.00	156,667.50
Uganda	1	14,035,584.50	2,241,331.50	4,179,978.50	139,292.00
Uganda	4	10,795,699.00	1,767,713.00	3,302,956.50	109,887.00
Uganda	14	9,634,472.00	1,547,767.00	2,892,963.50	96,319.50
Uganda	49	12,625,196.50	2,044,288.00	3,816,799.50	126,941.00
Uruguay	1	1,326,201.50	679,333.50	1,267,820.00	42,256.00
Uruguay	4	938,231.00	445,262.00	828,683.00	27,689.50
Uruguay	14	516,148.00	261,647.50	487,979.00	16,297.00
Uruguay	49	1,141,786.50	570,625.00	1,062,322.00	35,429.00
Venezuela, RB	1	10,135,488.00	3,272,693.50	6,112,276.00	203,631.50
Venezuela, RB	4	7,385,224.00	2,226,216.00	4,152,468.50	138,283.50
Venezuela, RB	14	4,478,616.50	1,444,018.50	2,687,084.50	89,718.00
Venezuela, RB	49	8,782,756.00	2,799,109.50	5,232,723.50	173,968.50
Yemen, Rep.	1	8,978,939.50	1,189,341.00	2,223,058.50	74,107.50
Yemen, Rep.	4	6,443,445.50	752,402.00	1,407,658.50	46,808.50
Yemen, Rep.	14	3,134,621.00	389,461.00	723,166.50	23,984.50

Yemen, Rep.	49	7,619,708.50	969,122.50	1,816,360.50	60,463.00
South Africa	1	20,484,691.50	4,996,026.50	9,320,556.00	310,571.50
South Africa	4	15,232,036.50	3,438,007.00	6,410,413.00	213,792.00
South Africa	14	8,795,217.00	2,079,588.50	3,890,084.50	129,416.00
South Africa	49	17,929,452.50	4,284,328.50	7,988,411.00	266,130.00
Zambia	1	5,908,589.50	719,278.00	1,341,163.00	44,602.50
Zambia	4	4,464,221.00	514,499.50	966,758.00	32,042.50
Zambia	14	2,130,687.00	259,718.00	486,323.50	16,191.50
Zambia	49	5,177,648.00	620,034.50	1,154,007.00	38,561.00
Zimbabwe	1	4,572,303.50	991,498.50	1,852,341.50	61,683.50
Zimbabwe	4	3,484,742.00	817,788.00	1,524,034.50	50,874.50
Zimbabwe	14	3,275,359.00	779,772.50	1,450,085.50	48,299.00
Zimbabwe	49	4,110,615.00	926,563.00	1,728,563.00	57,739.50

Supplemental S2. Parameters and process used in health resource and costing model

S2.1. Summary

We summarise here the main parameters used in the estimates of health resources and costing. Further details and references are then provided in the following sections.

In summary, there are four steps in our calculations:

1. Calculation of unit costs per activity for three base countries: Ethiopia (low-income country or 'LIC'), Pakistan (lower-middle income country or 'LMIC') and South Africa (upper-middle income country or 'UMIC')
2. Extrapolation of unit costs in base countries to calculate unit costs across 84 LICs, LMICs and UMICs
3. Calculation of total costs per country using country-specific unit costs, modelled data on the number of cases, hospitalisations and deaths, as well as other epidemiological and economic assumptions
4. Calculation of country-specific per capita costs, as well as per capita costs as a proportion of gross domestic product (GDP) per capita and various measures of health expenditure per capita

S2.2 Calculation of unit costs per activity for three base countries

S2.2.1 General Approach

A full economic costing was carried out over a one-year time horizon. Costs were constructed using a bottom-up ingredients-based technique. The costing was carried out from a health systems perspective and included both direct (e.g. medicines) and indirect costs (e.g. facility overheads). No above-service delivery costs were included.

The eighty-four countries chosen met three inclusion criteria: 1) be classified as low-income, lower-middle income or upper-middle income by the World Bank [17], 2) be included in the list of 92 countries for which epidemiological modelling data was available from Pearson et al (2020) [16], and 3) have recent available GDP per capita data in order to carry out cost extrapolation between countries [17].

S2.2.2 Intervention costs

We used official WHO guidance to identify areas related to critical preparedness, readiness and response actions for COVID-19 to define a set of interventions involved in a national response to the pandemic. This guidance identifies 6 priority areas of work and is further sub-divided into 13 activities.

- Emergency response mechanisms at the national level
- Risk communication and community engagement
- Case finding, contact tracing and management
- Surveillance
- Public health measures
- Case management

For the first five areas of work we considered only WHO guidance to define the resource use. For case management costs we assumed less resource-intensive activities that we felt were more plausible in low- and middle-income settings ('real-world'). Assumptions on 'real world' resource use were based on the clinical expertise of members of the research team and are detailed below.

Following this guidance, we generated a list of unit costs to be brought together with the COVID epidemiological model to estimate resource needs, as detailed in Table S2.2.

Table S2.2.2.1 Intervention description and unit costs

Activity	Activity unit costs
1.a. Emergency Response Mechanisms: National level	Per country per day
1.b. Emergency Response Mechanisms: Training of health staff	One-off per site
2. Risk communication & community engagement	Per country per day
3.a. Case finding, contact tracing and management: Contact tracing	Per person contacted
3.b. Case finding, contact tracing and management: Quarantine of contacts	Per person quarantined
4.a. Surveillance: Case notification	Per positive case
4.b. Surveillance: Reporting (national level)	Per country per week
5. Public health measures: Hygiene education	Per education campaign per month
6. Screening and diagnosis	Per person screened and tested
7.a. Case Management: Home-based care	Per person requiring home-based care
7.b. Case Management: Hospital-based (severe case)	Per day of hospitalisation (severe case)
7.c. Case Management: Hospital-based (critical case)	Per day of hospitalisation (critical case)
7.d. Case Management: Death	Per COVID-related death

S.2.2.3. Defining Inputs, Costs per Input and Quantities of Inputs

For each of the abovementioned activities we used an ingredients based costing to identify a series of inputs (e.g. junior-level government worker day). For each input we estimated a number of units (e.g. three days of work) and a country-specific price. The costs of each input were identified using a

range of sources, according to availability of recent primary cost data and appropriateness of cost estimates to the COVID pattern of care. See the table below.

Table S2.2.3.1 Quantities and Unit Costs per Input per Activity per Country

Component	Number of Units per Input	Unit Cost per Inputs		
		Ethiopia	Pakistan	South Africa
1. a. Emergency Response Mechanisms: National level				
Working day (junior level govt)	10	\$ 12.27	\$ 13.07	\$ 194.66
Working day (senior level govt)	10	\$ 17.29	\$ 23.94	\$ 256.72
Meeting/ training costs per person per day	20	\$ 13.18	\$ 20.44	\$ 159.17
Total:		\$ 559.26	\$ 778.90	\$ 7,697.16
1. b. Emergency Response Mechanisms: Training of health staff				
Working day (health care workers)	250	\$ 4.93	\$ 10.43	\$ 97.58
Working day (junior level govt)	10	\$ 12.27	\$ 13.07	\$ 194.66
Working day (senior level govt)	1	\$ 17.29	\$ 23.94	\$ 256.72
Meeting/ training costs per person per day	261	\$ 13.18	\$ 20.44	\$ 159.17
Total:		\$ 4,813.58	\$ 8,096.53	\$ 68,141.36
2. Risk communication & community engagement				
Working day (junior level govt)	3	\$ 12.27	\$ 13.07	\$ 194.66
Working day (senior level govt)	2	\$ 17.29	\$ 23.94	\$ 256.72
Media costs per day	1	\$ 2.74	\$ 4.58	\$ 36.00
Total:		\$ 74.14	\$ 91.67	\$ 1,133.44
3. a. Case finding, contact tracing and management: Contact tracing				
Working day (junior level govt)	0.1	\$ 12.27	\$ 13.07	\$ 194.66
Contact tracing household visit	0.33	\$ 2.08	\$ 3.02	\$ 13.68
Contact tracing phone call	0.67	\$ 2.34	\$ 0.34	\$ 3.31
Total:		\$ 3.48	\$ 2.54	\$ 26.23
3. b. Case finding, contact tracing and management: Quarantine of contacts				
Working day (health care workers)	0.1	\$ 4.93	\$ 10.43	\$ 97.58
Working day (junior level govt)	0.1	\$ 12.27	\$ 13.07	\$ 194.66
Total:		\$ 1.72	\$ 2.35	\$ 29.22
4. a. Surveillance: Case notification				
Working day (health care workers)	0.1	\$ 4.93	\$ 10.43	\$ 97.58
Working day (junior level govt)	0.1	\$ 12.27	\$ 13.07	\$ 194.66
Total:		\$ 1.72	\$ 2.35	\$ 29.22
4. b. Surveillance: Reporting (national level)				
Working day (health care workers)	0.5	\$ 4.93	\$ 10.43	\$ 97.58
Working day (junior level govt)	0.1	\$ 12.27	\$ 13.07	\$ 194.66
Total:		\$ 3.69	\$ 6.52	\$ 68.26
5. Public health measures: Hygiene education				
Working day (junior level govt)	2	\$ 12.27	\$ 10.43	\$ 97.58
Working day (senior level govt)	1	\$ 17.29	\$ 13.07	\$ 194.66
Media costs per day	1	\$ 2.74	\$ 4.58	\$ 36.00
Total:		\$ 44.58	\$ 38.51	\$ 425.83
6. Screening and diagnosis				
Ambulance trip	0.0001	\$ 4.80	\$ 9.51	\$ 60.41
Isolation pod/ diagnostic visit	2	\$ 0.49	\$ 0.49	\$ 7.97
Outpatient visit oral history	1	\$ 3.57	\$ 0.47	\$ 8.02
Outpatient visit physical exam	1	\$ 3.57	\$ 0.47	\$ 8.02

Outpatient visit specimen collection	1	\$ 4.88	\$ 1.09	\$ 17.15
COVID19 test (PCR)	1	\$ 23.98	\$ 23.98	\$ 23.98
Total:		\$ 36.97	\$ 26.98	\$ 73.12
7.a. Case Management: Home-based care				
Home-based care bed-day	5	\$ 0.94	\$ 0.61	\$ 11.65
Community-based care via GP	2	\$ 9.11	\$ 4.71	\$ 44.16
Total:		\$ 22.90	\$ 12.45	\$ 146.57
7.b. Case Management: Hospital-based (severe case)				
Inpatient ward bed-day (severe)	1	\$ 29.90	\$ 31.54	\$ 96.66
<i>Diagnostics</i>				
Pulse oximetry	0.125	\$ 0.00	\$ 0.00	\$ 0.00
Chest X-ray	0.125	\$ 27.35	\$ 2.79	\$ 21.86
Full blood count	0.125	\$ 2.37	\$ 2.29	\$ 24.28
Blood urea and electrolyte test	0.125	\$ 4.20	\$ 2.53	\$ 2.87
C-reactive protein test	0.125	\$ 2.34	\$ 0.32	\$ 5.15
HIV test	0.125	\$ 4.38	\$ 3.87	\$ 17.13
COVID19 test (PCR)	0	\$ 23.98	\$ 23.98	\$ 23.98
Malaria test	0.125	\$ 0.19	\$ 0.19	\$ 0.19
Haemoglobin test	0.125	\$ 2.29	\$ 2.29	\$ 2.29
Total:		\$ 35.29	\$ 33.32	\$ 105.88
7.c. Case Management: Hospital-based (critical case)				
Inpatient ward bed-day (critical)	0.33	30.65	32.29	97.41
ITU bed-day	0.67	\$ 104.48	\$ 101.99	\$ 662.71
<i>Additional resourcing per COVID-related complication</i>				
Acute respiratory distress syndrome (ARDS)	0.47	\$ 22.46	\$ 22.46	\$ 22.46
Acute kidney injury days	0.04	\$ 10.60	\$ 10.60	\$ 10.60
Acute cardiac injury days	0.06	\$ 46.25	\$ 46.25	\$ 46.25
Liver dysfunction days	0.06	\$ 89.32	\$ 89.32	\$ 89.32
Pneumothorax days	0.01	\$ 6.66	\$ 6.77	\$ 7.02
Hospital-acquired pneumonia days	0.05	\$ 18.85	\$ 18.85	\$ 18.85
Bacteraemia days	0.01	\$ 32.55	\$ 32.55	\$ 32.55
Urinary tract infection days	0.01	\$ 9.03	\$ 9.03	\$ 9.03
Septic shock days	0.05	\$ 0.64	\$ 0.67	\$ 0.75
<i>Diagnostics</i>				
Pulse oximetry	10	\$ 0.00	\$ 0.00	\$ 0.00
Chest X-ray	10	\$ 27.35	\$ 2.79	\$ 21.86
Full blood count	10	\$ 2.37	\$ 2.29	\$ 24.28
Blood urea and electrolyte test	10	\$ 4.20	\$ 2.53	\$ 2.87
C-reactive protein test	10	\$ 2.34	\$ 0.32	\$ 5.15
Venous blood gas test	10	\$ 4.23	\$ 4.23	\$ 4.23
HIV test	0.1	\$ 4.38	\$ 3.87	\$ 17.13
COVID19 test (PCR)	0	\$ 23.98	\$ 23.98	\$ 23.98
Malaria test	0.1	\$ 0.19	\$ 0.19	\$ 0.19
Haemoglobin test	0.1	\$ 2.29	\$ 2.29	\$ 2.29
Total:		\$ 505.56	\$ 221.18	\$ 1,081.94
7.d. Case Management: Death				
Body Bag	1	\$ 64.52	\$ 64.52	\$ 64.52
Total:		\$ 64.52	\$ 64.52	\$ 64.52

S.2.2.4 Quantities

Planning and Management Activities (Activities 1-5)

Quantities of working days required for planning and management activities were estimated from expert consultation as part of the Diseases Control Priorities project. For other activities, quantities were estimated based on requirements for similar activities for tuberculosis (TB) such as contact tracing from the VALUE TB study and previous studies in South Africa (more below).

Diagnosis and Clinical Management (Activities 6-7)

The number of days per patient in general ward and in ICU was set at 8 and 10 respectively, and was set to match the assumptions in the epidemiological model [16, 19, 20]. Following expert clinician advice we assumed that one-third of critical patient bed days would be treated the general ward and two-thirds in the ICU.

The likelihood of additional COVID-related complications (per day) were estimated using evidence on the clinical course of COVID from patients in Wuhan, China¹⁷, as were assumptions on the duration of symptoms¹⁸ [21]. The number of diagnostic tests per hospitalisation was carried out in consultation with expert clinicians in essential critical care.

S.2.2.5 Input unit costs

S2.2.5.1 Estimation of non-bed-day costs (Pakistan)

An ingredients-based approach was used to calculate most of the service costs and prices for Pakistan. The data used was collected as part of the Disease Control Priorities 3-Universal Health Coverage (DCP3-UHC) project. For other countries primary data from the TB studies was used (see below).

For Pakistan, staff-related costs were constructed using federal-level pay scales. For most outputs, the number of minutes of staff required per activity were estimated via expert opinion obtained from clinicians working in the Health Planning, System Strengthening & Information Analysis Unit (HPSIU) in the Ministry of National Health Services Regulations and Coordination of Pakistan. For outputs where this was unavailable, health economists agreed a plausible assumed value.

Drug regimens were costed using resource use data obtained through expert opinion (HPSIU) and a number of price sources. An assessment of strengths and weaknesses of different price sources was conducted and hierarchy of sources was established. The primary source of price data was the Sindh Health Department Procurement Price list. If a price was unavailable, the Federal Wholesale Price List for Generic Medicines was used as a second option. As a last resort, private sector market prices were used.

Cost on supplies and equipment were similarly constructed. Resource use was determined through expert opinion (HPSIU) and price source hierarchy established. The primary source was the Medical Emergency Resilience Fund 2019-2020, and a secondary source was private sector market prices.

For all countries, for additional diagnostic and radiology costs (beyond those available from the TB data) were estimated using available literature and market prices. We assessed strengths and weaknesses of different price sources. For example, we used the 'Costing and Pricing of Services in Private Hospitals of Lahore: Summary Report' as our primary source as it contained a methodological appendix that suggested that an ingredients-based approach consistent with ours was followed. If some prices were unavailable we used user fees from the Pakistan Institute of Medical Sciences, procurement prices from the Medical Emergency Resilience Fund procurement prices and user fees from the Aga Khan University Hospital. Space costs were estimated using data from budget documents from the Federal government (Islamabad Capital Territory Health Infrastructure PC-1).

Oxygen therapy costs per bed-day were calculated by estimating the number of cylinders consumed in 24 hours at different flow rates, assumed to be 10L per minute in the general ward and 30L per minute in the ICU. Cylinder duration (hours) was estimated by dividing pressure by the number of litres per minute, assuming a standard cylinder size of 4.6kg, filled at 1,900 psi pressure [22]. Cost per cylinder was obtained from the South African online catalogue of a manufacturer that is active in both South Africa and Pakistan [23].

S2.2.5.2 Estimation of non-bed-day costs (Ethiopia and South Africa)

For Ethiopia the main source of cost data was the VALUE TB study. Cost data collected from a health provider perspective to estimate the economic costs of TB-related health services. Full costs of health services were estimated, reflecting their implementation in the 'real world' rather than using a 'per protocol' costing approach. Cost data collection was retrospective, over a one-year period to minimize the risk of bias due to seasonality. Resource use was measured in the VALUE TB study using both top-down and bottom-up methods wherever possible, to allow for comparison. The costs included in the current cost model reflected an average of top-down and bottom-up costs by site.

For South Africa, we used primary data from the XTEND trial (nurses and lay health workers)¹⁹. This was updated using more recent data on contact tracing and update prices collected on an on-going trial of TB preventative therapy (WHIP₃TB) (ClinicalTrials.gov, 2020).

Some of the COVID-19 interventions were outside the scope of the VALUE TB, XTEND, and WHIP₃TB studies. Values for which a primary unit cost was partially or entirely unavailable from Value TB are listed in the Table below. For these interventions, resource use from Pakistan (DCP) was then used with local prices (see list below).

Table S.2.2.5.3.1 Inputs for which unit costs were estimated for South Africa and Ethiopia using resource use from DCP

Planning & coordination activities
Working day (mid-level facility)
Working day (junior level govt)
Working day (senior level govt)
Meeting/ training costs per day
Media costs per day

Health hotline (day)
Infection control
Ambulance trip
Isolation pod/ diagnostic visit
Deep clean
Home-based care
Home-based care bed-day
community-based care via GP
Inpatient treatment
Inpatient ward bed-day including PPE (normative scenario)
ICU bed-day, including PPE (normative scenario)
Severe case ward bed-day, including PPE
Critical case ward bed-day, including PPE
ITU bed-day ('real-world scenario')
Body disposal
Additional resourcing per COVID related complication
Acute respiratory distress syndrome (ARDS)
Acute kidney injury
Acute cardiac injury
Liver dysfunction
Pneumothorax
Hospital-acquired pneumonia
Bacteraemia
Urinary tract infection
Septic shock
Investigations (lab tests)
Pulse oximetry
Venous blood gas
Mid-stream urine test
CoVID confirmatory lab test (PCR)
Malaria
Haemoglobin

Where costs were applied from Pakistan health care inputs were classified as either tradeable, as in the case of medical equipment and supplies for diagnostic tests and procedures, and non-tradeable, including non-medical supplies, capital and overhead costs. For tradable inputs, where country-specific price estimates were not available from primary data or from the published literature, the estimate from Pakistan was applied to other countries. For non-tradable inputs, the estimate from Pakistan was adjusted by an amount reflecting the difference in the two countries' GDP (PPP). The rationale behind this approach is that, while exchange rate may be influenced by government policy, PPP seeks to equalise the purchasing power of different currencies and, as such, may better reflect differentials in salaries and other non-tradable prices across countries.

Table S2.2.5.4 Relative GDP adjustment factors

	Exchange rate (US\$)	GDP per capita by country (US\$ PPP)	Relative GDP (PPP)				
			Pakistan	South Africa	Kenya	India	Ethiopia
Pakistan	155.00	5,567.06	1.00	0.41	0.87	0.72	2.75
South Africa	32.26	2,022.14	2.46	1.00	3.73	1.76	6.77
Kenya	76.92	7,762.88	0.62	0.25	1.00	0.45	1.71
India	104.17	3,467.56	1.39	0.57	1.18	1.00	3.84
Ethiopia	16.95	13,686.88	0.36	0.15	0.45	0.26	1.00

S2.2.5.5 Estimation of bed-day costs (all countries)

We took an ingredients approach to estimating the costs of general ward and ICU ward bed days, as these were major cost drivers in our cost model. We estimated the plausible number of nursing hours per bed day in an LMIC setting through consultation with members of the research team who have expertise in critical care in LMICs. In ICU the assumption of nurse to patient ratio would be 1:1; in the general ward the ratio would be 1:6 during the day time and 1:20 in the night.

To understand the full range of inputs required we obtained the underlying costing data set provided by the authors of a recent primary costing of critical carer²⁰. The paper reports the results of a detailed activity-based costing in a hospital in Karachi, disaggregated by phase of care. We used the cost data for the ward stay phase, removing any supplies or equipment specific to the surgery, to estimate the average generic costs of a bed-day.

All bed-day costs were compared to and validated against available country-specific estimates from the published literature and from ongoing research and WHO CHOICE (see Table S2.4). Rapid literature searches were conducted on the Medline, Embase and EconLit databases on 8th and 9th April 2020 to identify records reporting on the costs of ICU care in each of the study countries (see table below).

Table S2.2.5.5.1 Comparison of bed-day costs by setting

	Unit cost (2019 US\$)		Source
	Extrapolated	From literature	
Kenya	362.49	349.25	(Lalani et al., 2018)
India	512.44	585.80	(Mathai et al., 2015)
South Africa	1240.96	1644.27	(Mahomed and Mahomed, 2019)

We estimated the additional costs of ICU beds compared to standard hospital beds using an ingredients-based approach to cost the equipment and supplies not present in standard hospital wards. We used the procurement price of equipment and assumed depreciation over ten (ventilators and suction pumps) or five years (all other equipment). Supply costs included central and arterial lines, ventilator tubing, and sedatives.

S2.2.5.6 COVID specific costs

Finally, we calculated the costs of personal protective equipment (PPE) per health worker per day (see Table below) and allocated a cost per PPE per minute to clinical staff. We also calculated costs of hygiene per bed day. We estimated the costs of PPE and hygiene supplies using a list of necessary supplies from a COVID-related budget from the Ministry of Health of Pakistan, which included local prices sourced by the Aga Kahn University. This was complemented for other countries using the WHO's Essential Supplies Forecasting Tool (ESFT) [7]. We divided supplies into single-use and disposable. We determined plausible quantities and useful life for supplies following clinical guidelines and expert opinion.

Table S2.2.5.6.1 PPE costs per general ward bed day and per ICU bed day

Supply	Price US\$	Useful life (days)	Quantity per day	Total per member of staff per day US\$	Assumptions
PPE for General Ward					
Single Use					
Surgical Gowns	0.20	1	1	0.20	
Nitrile Gloves	0.05	1	10	0.45	
Latex Gloves	0.04	1	10	0.39	
Disposable Head	0.03	1	4	0.10	
Shoe Covers	0.02	1	4	0.06	
Surgical Masks	0.08	1	10	0.77	
Reusable					
Goggles	11.61	90	1.5	0.19	Assuming half a day for washing
Gum Boots	19.35	90	1.5	0.32	Assuming half a day for washing
TOTAL				2.50	
PPE for ICU					
Single Use					
N-95 Masks	0.84	1	4	3.35	
Disposable apron	0.20	1	1	0.20	
Nitrile Gloves	0.05	1	10	0.45	
Latex Gloves	0.04	1	10	0.39	
Disposable Head	0.03	1	4	0.10	
Shoe Covers	0.02	1	4	0.06	
Surgical Masks	0.08	1	10	0.77	
Reusable					
Face Shields	27.81	5	1.5	8.34	Assuming half a day for washing

Goggles	11.61	90	1.5	0.19	Assuming half a day for washing
Gum Boots	19.35	90	1.5	0.32	Assuming half a day for washing
TOTAL				14.19	

Table S2.2.5.6.2 Hygiene costs per General Ward and ICU bed day

Supply	Price USD	Useful life (days)	Quantity per day	Total per ICU bed per day USD	Assumptions
Single Use					
Hand Sanitizers	47.97	1	0.05	2.40	100ml use per day, price assumed to refer to bottle of 2000ml
Biohazard Bags	0.23	1	1	0.23	
Disposable bed sheets	1.94	1	1	1.94	
Disposable Tissue Boxes	0.65	1	1	0.65	1 box per day, price assumed to refer to 1 box
Disposable Tissue rolls	0.35	1	1	0.35	1 roll per day, price assumed to refer to 1 roll
Disinfectants (1L Dettol)	3.23	1	0.25	0.81	250ml used per day, price refers to bottle of 1000ml
Liquid Soaps (250ml Dettol bottles)	1.74	1	0.2	0.35	50ml used per day, price refers to bottle of 250ml
Ethanol (1L bottles)	16.13	1	0.1	1.61	100ml used per day, price refers to bottle of 1000ml
Liquid Bleach	2.58	1	0.25	0.65	250ml used per day, price assumed to refer to bottle of 1000ml
Reusable					
Waste Bins	15.03	90	1	0.17	
Mackintosh bed sheets	9.68	90	1	0.11	
Mops	2.58	90	1	0.03	
Dusters	0.32	90	1	0.00	
TOTAL				9.28	

Oxygen supplementation therapy is the main form of treatment for COVID 19. There are different methods of oxygen delivery which utilise different types of supplies, equipment and require different average levels of oxygen flow. We calculated costs for 6 types of oxygen delivery techniques and assumed a distribution across severe and critical patients according to members of our research team with clinical expertise in critical care in LMICs. See Table below.

Table S2.2.5.6.3

Normative recommendations		Real-world' scenario		
Severe case	Critical case	Severe case	Critical case	
Severe pneumonia (15% of COVID cases)	Acute respiratory distress syndrome (5% of COVID cases)	Severe pneumonia (15% of COVID cases)	Acute respiratory distress syndrome (5% of COVID cases)	
General ward	ICU	General ward	General ward only	ICU

<i>Supplemental oxygen management type</i>					
% ventilator	0%	100%	0%	0%	50%
% CPAP	0%	0%	0%	0%	25%
% high-flow nasal cannula	0%	0%	0%	0%	25%
% non-rebreather mask	25%	0%	25%	100%	0%
% nasal cannula	50%	0%	50%	0%	0%
% high-concentration mask	25%	0%	25%	0%	0%
% Patients in pathway	100%	100%	100%	33%	67%

S2.3 Extrapolation of unit costs in base countries to calculate unit costs across 84 LICs, LMICs and UMICs

We used the unit costs obtained in our three base countries to extrapolate unit costs to other LICs, LMICs and UMICs. We grouped countries according to income group. Costs for LICs were extrapolated using unit costs from Ethiopia, costs for LMICs were extrapolated from the unit costs from Pakistan, and those for UMICs from the unit costs from South Africa.

In order to carry out the extrapolation, each cost ingredient for each of the unit costs was classified as a tradeable good, non-tradeable good, or staff cost.

Tradeable goods are generally defined as those that can easily be traded in the international market and include goods such as medical or other supplies and medications. The unit costs for our three base countries were initially converted from each local currency into 2019 US\$ using market exchange rates. To convert the tradeable good from the base country (e.g. Ethiopia) to a 'second' country (e.g. Afghanistan) we apportioned the percentage of the unit cost that was composed of tradeable goods in 2019 US\$ from the base country to the second country.

Non-tradeable goods include buildings, heavy machinery, and other equipment. To convert these costs from a base country to a second country we used purchasing power parity (PPP) conversion rates. We multiplied the proportion of the unit cost that was defined as non-tradeable (in 2019 US\$) by the ratio of the 2019 GDP per capita (adjusted for PPP) of the second country, divided by the 2019 GDP per capita (adjusted for PPP) of the base country. Data on GDP per capita (adjusted for PPP) can be found in the World Bank database [17].

To convert staff costs from a base country to a second country we used conversion rates from Serje et al (2018) [18]. Serje et al (2018) use regression analysis on a dataset containing wages from health workers of different skill levels for 193 countries in order to predict wages by country income level relative to GDP per capita. We used the multiples per GDP per capita presented in the paper in order to convert the staff wages from the base country to the second country. See the table from Serje et al (2018) below.

Table S2.3.1 Health worker earnings as a multiple of GDP per capita (Serje et al 2018)

World bank income categories	Health worker cadre	Average earnings index (multiple of GDP per capita)
High-income countries	Physicians	1.9
	Nurses and midwives	1.5
	Other health workers	0.9
Upper-middle income countries	Physicians	2.7
	Nurses and midwives	2.2
	Other health workers	1.3
Lower-middle income countries	Physicians	5.1
	Nurses and midwives	4.2
	Other health workers	2.4
Lower-income countries	Physicians	7.8
	Nurses and midwives	6.4
	Other health workers	3.7
Global	Physicians	4.4
	Nurses and midwives	3.6
	Other health workers	2.1

S2.4 Calculation of total costs per country using country-specific unit costs, modelled data on the number of cases, hospitalisations and deaths, as well as other epidemiological and economic assumptions

The unit cost in each of the 84 countries was used to calculate the total costs per activity per country. The table below explains the quantities that those unit costs were multiplied by in order to calculate the total costs per country.

Table S2.4.1

Activity	Unit Type	Quantities per country	Value	Source
1.a. Emergency Response Mechanisms: National level	Per country per day	Number of working days per year	260	Assumption
1.b. Emergency Response Mechanisms: Training of health staff	One-off per site	Total number of clinical sites *	Variable per Country	Calculated by assuming one site for every 200 hospital beds available in the country [24]
2. Risk communication & community engagement	Per country per day	Number of calendar days per year	365	N/A
3.a. Case finding, contact tracing and management: Contact tracing	Per person contacted	Total number of COVID19 cases *	Variable by country	See Table S1.3.1
		% cases that are symptomatic *	69%	[25]
		% of symptomatic cases tested *	10%	Assumption
		Average number of contacts per COVID19-positive case	7	[26]
3.b. Case finding, contact tracing and management: Quarantine of contacts	Per person quarantined	Total number of COVID19 cases *	Variable by country	See Table S1.3.1
		% cases that are symptomatic *	69%	[25]
		% of symptomatic cases tested *	10%	Assumption
		Average number of contacts per COVID19-positive case	7	[26]
4.a. Surveillance: Case notification	Per positive case	Total number of COVID19 cases *	Variable per Country	See Table S1.3.1
		% cases that are symptomatic *	69%	[25]
		% of symptomatic cases tested *	10%	Assumption
4.b. Surveillance: Reporting (national level)	Per country per day	Total number of clinical sites *	Variable per Country	Calculated by assuming one site for every 200 hospital beds available in the country [24]
		Weeks per year	52	N/A

5. Public health measures: Hygiene education	Per education campaign	Months per year	12	N/A
6. Screening and diagnosis	Per person screened and tested	(Total number of COVID 19 cases *	Variable per Country	See Table S1.3.1
		% of cases requiring hospitalisation *	18.50%	[16, 19]
		Number of people tested per positive case) +	11.31	See Table 2.4.2
		(Total number of COVID 19 cases *	Variable per Country	See Table S1.3.1
		% cases that are symptomatic *	69%	[25]
		% of symptomatic cases tested *	10%	Assumption
		Number of people tested per positive case)	11.31	See Table 2.4.2
7.a. Case Management: Home-based care	Per person requiring home-based care	Proportion of borderline mild-to-severe cases	10%	Assumption
7.b. Case Management: Hospital-based (severe case)	Per day of hospitalisation (severe case)	Average number of days of hospitalisation for severe cases	8	[16, 20]
7.c. Case Management: Hospital-based (critical case)	Per day of hospitalisation (critical case)	Average number of days of hospitalisation for critical cases	10	[16, 19]
7.d. Case Management: Death	Per COVID-related death	Total number of deaths from COVID 19	Variable per Country	See Table S1.3.1

Table 2.4.2. Test positivity rate by country and average

Country	% of positive tests	Source
South Africa	0.169	[27]
Kenya	0.103	[26]
Ethiopia	0.0739	[28]
India	0.0612	[29]
Pakistan	0.0351	[30]
Average	0.08844	

S2.5 Calculation of country-specific per capita costs, as well as per capita costs as a proportion of gross domestic product (GDP) per capita and various measures of health expenditure per capita.

Total costs per country were used to calculate the COVID-19-related costs per capita per country per scenario by dividing the total costs by the population of the country [17]. The cost per capita was then calculated as a proportion of GDP per capita [17] and three measures of health expenditure per capita [31]: 1) total health expenditure including out-of-pocket payments, 2) total health expenditure excluding out-of-pocket payments, and 3) government health spending per capita. Data on GDP per capita and health expenditure per capita per country can be found in the table below.

S.2.5.1 GDP, Health Spending and Government Health Spending

Country	Country income classification	Total population per country	Gross Domestic Product per Capita (Nominal) (US\$)	Total Health Spending per Capita (including out-of-pocket spending) (US\$)	Total Health Spending per Capita (excluding out-of-pocket spending) (US\$)	Government Health Spending per Capita (US\$)
Afghanistan	LIC	37,172,386	\$ 520.90	\$ 57.25	\$ 101.56	\$ 2.94
Albania	UMIC	2,866,376	\$ 5,268.85	\$ 271.54	\$ 428.99	\$ 112.30
Algeria	UMIC	42,228,429	\$ 4,114.72	\$ 260.41	\$ 340.84	\$ 176.27
American Samoa	UMIC	55,465	\$ 11,466.69	\$ -	\$ -	\$ -
Andorra	HIC	77,006	\$ 42,029.76	\$ 3,834.73	\$ 5,433.69	\$ 1,884.00
Angola	LMIC	30,809,762	\$ 3,432.39	\$ 95.22	\$ 128.75	\$ 42.03
Antigua and Barbuda	HIC	96,286	\$ 16,726.98	\$ 623.11	\$ 823.69	\$ 377.32
Argentina	UMIC	44,494,502	\$ 11,683.95	\$ 955.20	\$ 1,106.11	\$ 710.94
Armenia	UMIC	2,951,776	\$ 4,212.07	\$ 358.84	\$ 648.24	\$ 59.04
Aruba	HIC	105,845	\$ 25,630.27	\$ -	\$ -	\$ -
Australia	HIC	24,992,369	\$ 57,373.69	\$ 5,002.36	\$ 5,949.99	\$ 3,416.98
Austria	HIC	8,847,037	\$ 51,461.95	\$ 4,688.28	\$ 5,575.29	\$ 3,399.49
Azerbaijan	UMIC	9,942,334	\$ 4,721.18	\$ 268.16	\$ 479.78	\$ 53.53
Bahamas, The	HIC	385,640	\$ 32,217.87	\$ 1,835.23	\$ 2,343.88	\$ 915.06
Bahrain	HIC	1,569,439	\$ 24,050.76	\$ 1,099.36	\$ 1,407.05	\$ 674.61
Bangladesh	LMIC	161,356,039	\$ 1,698.26	\$ 34.22	\$ 58.82	\$ 6.14
Barbados	HIC	286,641	\$ 17,949.28	\$ 1,163.84	\$ 1,689.63	\$ 534.05
Belarus	UMIC	9,485,386	\$ 6,289.94	\$ 317.99	\$ 431.83	\$ 195.40
Belgium	HIC	11,422,068	\$ 47,518.64	\$ 4,149.39	\$ 4,807.43	\$ 3,489.87
Belize	UMIC	383,071	\$ 4,884.74	\$ 303.60	\$ 373.04	\$ 201.37
Benin	LIC	11,485,048	\$ 901.54	\$ 30.40	\$ 43.62	\$ 6.24
Bermuda	HIC	63,968	\$ 85,748.07	\$ -	\$ -	\$ -
Bhutan	LMIC	754,394	\$ 3,243.23	\$ 91.34	\$ 109.72	\$ 67.55
Bolivia	LMIC	11,353,142	\$ 3,548.59	\$ 213.02	\$ 272.71	\$ 139.95
Bosnia and Herzegovina	UMIC	3,323,929	\$ 6,065.67	\$ 443.78	\$ 571.07	\$ 314.14
Botswana	UMIC	2,254,126	\$ 8,258.64	\$ 379.92	\$ 399.86	\$ 212.50
Brazil	UMIC	209,469,33	\$ 8,920.76	\$ 1,015.93	\$ 1,458.48	\$ 337.53

		3				
British Virgin Islands	HIC	29,802	\$ -	\$ -	\$ -	\$ -
Brunei Darussalam	HIC	428,962	\$ 31,628.33	\$ 630.63	\$ 662.61	\$ 598.65
Bulgaria	UMIC	7,024,216	\$ 9,272.63	\$ 612.48	\$ 906.19	\$ 309.69
Burkina Faso	LIC	19,751,535	\$ 715.12	\$ 40.94	\$ 53.79	\$ 16.42
Burundi	LIC	11,175,378	\$ 271.75	\$ 18.46	\$ 24.10	\$ 5.38
Cabo Verde	LMIC	543,767	\$ 3,635.41	\$ 159.07	\$ 200.46	\$ 90.33
Cambodia	LMIC	16,249,798	\$ 1,510.32	\$ 77.67	\$ 123.16	\$ 16.94
Cameroon	LMIC	25,216,237	\$ 1,533.74	\$ 64.47	\$ 109.27	\$ 8.60
Canada	HIC	37,058,856	\$ 46,232.99	\$ 4,458.21	\$ 5,109.89	\$ 3,274.29
Cayman Islands	HIC	64,174	\$ 81,124.51	\$ -	\$ -	\$ -
Central African Republic	LIC	4,666,377	\$ 475.72	\$ 16.36	\$ 23.41	\$ 2.43
Chad	LIC	15,477,751	\$ 728.34	\$ 31.69	\$ 51.06	\$ 5.98
Channel Islands	HIC	170,499	\$ 74,462.65	\$ -	\$ -	\$ -
Chile	HIC	18,729,160	\$ 15,923.36	\$ 1,190.55	\$ 1,604.50	\$ 696.10
China	UMIC	1,392,730,000	\$ 9,770.85	\$ 398.33	\$ 541.36	\$ 231.09
Colombia	UMIC	49,648,685	\$ 6,667.79	\$ 340.37	\$ 408.97	\$ 215.85
Comoros	LMIC	832,322	\$ 1,415.26	\$ 59.00	\$ 102.15	\$ 8.59
Congo, Dem. Rep.	LIC	84,068,091	\$ 561.78	\$ 20.52	\$ 28.20	\$ 2.51
Congo, Rep.	LMIC	5,244,363	\$ 2,147.77	\$ 70.38	\$ 105.37	\$ 29.75
Costa Rica	UMIC	4,999,441	\$ 12,027.37	\$ 888.85	\$ 1,085.68	\$ 664.48
Cote d'Ivoire	LMIC	25,069,229	\$ 1,715.53	\$ 67.57	\$ 94.70	\$ 17.41
Croatia	HIC	4,089,400	\$ 14,909.69	\$ 884.49	\$ 1,020.36	\$ 692.08
Cuba	UMIC	11,338,138	\$ 8,821.82	\$ 970.65	\$ 1,070.70	\$ 869.70
Curacao	HIC	159,849	\$ 19,567.89	\$ -	\$ -	\$ -
Cyprus	HIC	1,189,265	\$ 28,159.30	\$ 1,634.43	\$ 2,368.67	\$ 689.75
Czech Republic	HIC	10,625,695	\$ 23,078.57	\$ 1,321.62	\$ 1,520.18	\$ 1,082.12
Denmark	HIC	5,797,446	\$ 61,350.35	\$ 5,565.59	\$ 6,328.77	\$ 4,681.91
Djibouti	LMIC	958,920	\$ 3,082.54	\$ 70.19	\$ 88.28	\$ 32.13
Dominica	UMIC	71,625	\$ 7,691.35	\$ 419.37	\$ 541.60	\$ 269.47
Dominican Republic	UMIC	10,627,165	\$ 8,050.63	\$ 414.18	\$ 598.97	\$ 189.38
Ecuador	UMIC	17,084,357	\$ 6,344.87	\$ 504.78	\$ 709.13	\$ 258.41
Egypt, Arab Rep.	LMIC	98,423,595	\$ 2,549.13	\$ 130.99	\$ 212.18	\$ 38.38
El Salvador	LMIC	6,420,744	\$ 4,058.25	\$ 293.87	\$ 373.69	\$ 189.45
Equatorial Guinea	UMIC	1,308,974	\$ 10,261.76	\$ 281.37	\$ 486.31	\$ 66.16
Eritrea	LIC	...	\$ 811.38	\$ 29.89	\$ 47.54	\$ 8.73
Estonia	HIC	1,320,884	\$ 23,266.35	\$ 1,185.33	\$ 1,454.24	\$ 893.89
Eswatini	LMIC	1,136,191	\$ 4,145.97	\$ 220.59	\$ 242.42	\$ 152.88
Ethiopia	LIC	109,224,559	\$ 772.31	\$ 27.52	\$ 37.82	\$ 7.60

Faroe Islands	HIC	48,497	\$ 55,822.91	\$ -	\$ -	\$ -
Fiji	UMIC	883,483	\$ 6,266.97	\$ 179.91	\$ 217.04	\$ 114.97
Finland	HIC	5,518,050	\$ 50,152.34	\$ 4,117.26	\$ 4,955.28	\$ 3,185.11
France	HIC	66,987,244	\$ 41,463.64	\$ 4,263.36	\$ 4,679.31	\$ 3,534.15
French Polynesia	HIC	277,679	\$ 14,323.82	\$ -	\$ -	\$ -
Gabon	UMIC	2,119,275	\$ 7,952.53	\$ 220.35	\$ 269.96	\$ 142.32
Gambia, The	LIC	2,280,102	\$ 716.12	\$ 20.93	\$ 25.87	\$ 3.89
Georgia	UMIC	3,731,000	\$ 4,717.14	\$ 308.03	\$ 479.29	\$ 112.59
Germany	HIC	82,927,922	\$ 47,603.03	\$ 4,714.26	\$ 5,299.28	\$ 3,991.60
Ghana	LMIC	29,767,108	\$ 2,202.31	\$ 67.51	\$ 93.04	\$ 25.89
Gibraltar	HIC	33,718	\$ -	\$ -	\$ -	\$ -
Greece	HIC	10,727,668	\$ 20,324.25	\$ 1,510.67	\$ 2,029.49	\$ 917.64
Greenland	HIC	56,025	\$ 48,181.87	\$ -	\$ -	\$ -
Grenada	UMIC	111,454	\$ 10,640.50	\$ 516.42	\$ 814.79	\$ 213.49
Guam	HIC	165,768	\$ 35,712.56	\$ -	\$ -	\$ -
Guatemala	UMIC	17,247,807	\$ 4,549.01	\$ 241.35	\$ 370.09	\$ 89.82
Guinea	LIC	12,414,318	\$ 878.60	\$ 37.46	\$ 56.10	\$ 4.61
Guinea-Bissau	LIC	1,874,309	\$ 777.97	\$ 39.05	\$ 52.88	\$ 17.28
Guyana	UMIC	779,004	\$ 4,979.00	\$ 192.27	\$ 259.68	\$ 113.32
Haiti	LIC	11,123,176	\$ 868.34	\$ 37.72	\$ 53.47	\$ 5.79
Honduras	LMIC	9,587,522	\$ 2,500.11	\$ 199.55	\$ 289.38	\$ 91.61
Hong Kong SAR, China	HIC	7,451,000	\$ 48,675.62	\$ 312.58	\$ 312.58	\$ 197.84
Hungary	HIC	9,768,785	\$ 16,161.98	\$ 942.59	\$ 1,222.53	\$ 620.82
Iceland	HIC	353,574	\$ 73,191.12	\$ 5,063.61	\$ 5,917.79	\$ 4,127.35
India	LMIC	1,352,617,328	\$ 2,009.98	\$ 62.72	\$ 103.22	\$ 15.95
Indonesia	LMIC	267,663,435	\$ 3,893.60	\$ 111.55	\$ 153.20	\$ 49.90
Iran, Islamic Rep.	UMIC	81,800,269	\$ 5,627.75	\$ 415.39	\$ 576.54	\$ 226.49
Iraq	UMIC	38,433,600	\$ 5,834.17	\$ 152.64	\$ 272.44	\$ 32.24
Ireland	HIC	4,853,506	\$ 78,806.43	\$ 4,758.59	\$ 5,376.76	\$ 3,429.35
Isle of Man	HIC	84,077	\$ 80,989.17	\$ -	\$ -	\$ -
Israel	HIC	8,883,800	\$ 41,715.03	\$ 2,837.14	\$ 3,488.89	\$ 1,773.23
Italy	HIC	60,431,283	\$ 34,483.20	\$ 2,738.71	\$ 3,371.50	\$ 2,039.36
Jamaica	UMIC	2,934,855	\$ 5,354.24	\$ 296.25	\$ 362.59	\$ 179.41
Japan	HIC	126,529,100	\$ 39,289.96	\$ 4,233.03	\$ 4,802.47	\$ 3,538.21
Jordan	UMIC	9,956,011	\$ 4,241.79	\$ 223.54	\$ 286.09	\$ 141.34
Kazakhstan	UMIC	18,276,499	\$ 9,812.60	\$ 262.01	\$ 355.18	\$ 154.04
Kenya	LMIC	51,393,010	\$ 1,710.51	\$ 66.21	\$ 84.56	\$ 23.95
Kiribati	LMIC	115,847	\$ 1,625.29	\$ 188.05	\$ 188.22	\$ 115.62
Korea, Dem. People's Rep.	LIC	25,549,819	\$ -	\$ -	\$ -	\$ -

Korea, Rep.	HIC	51,635,256	\$ 31,362.75	\$ 2,043.86	\$ 2,724.68	\$ 1,209.04
Kosovo	UMIC	1,845,300	\$ 4,302.28	\$ -	\$ -	\$ -
Kuwait	HIC	4,137,309	\$ 33,994.41	\$ 1,068.32	\$ 1,240.44	\$ 896.20
Kyrgyz Republic	LMIC	6,315,800	\$ 1,281.36	\$ 72.88	\$ 114.85	\$ 28.50
Lao PDR	LMIC	7,061,507	\$ 2,542.49	\$ 55.21	\$ 80.86	\$ 17.89
Latvia	HIC	1,926,542	\$ 17,860.62	\$ 874.20	\$ 1,263.72	\$ 477.60
Lebanon	UMIC	6,848,925	\$ 8,269.79	\$ 662.13	\$ 874.91	\$ 345.18
Lesotho	LMIC	2,108,132	\$ 1,299.15	\$ 85.52	\$ 101.67	\$ 54.57
Liberia	LIC	4,818,977	\$ 677.32	\$ 68.31	\$ 100.60	\$ 9.73
Libya	UMIC	6,678,567	\$ 7,241.70	\$ -	\$ 114.62	\$ -
Liechtenstein	HIC	37,910	\$ 165,028.25	\$ -	\$ -	\$ -
Lithuania	HIC	2,789,533	\$ 19,153.41	\$ 987.95	\$ 1,307.45	\$ 648.12
Luxembourg	HIC	607,728	\$ 116,639.89	\$ 6,271.44	\$ 6,975.98	\$ 5,092.72
Macao SAR, China	HIC	631,636	\$ 87,208.54	\$ -	\$ -	\$ -
Madagascar	LIC	26,262,368	\$ 527.50	\$ 24.12	\$ 29.51	\$ 11.49
Malawi	LIC	18,143,315	\$ 389.40	\$ 29.59	\$ 32.96	\$ 8.30
Malaysia	UMIC	31,528,585	\$ 11,373.23	\$ 361.52	\$ 497.44	\$ 182.47
Maldives	UMIC	515,696	\$ 10,330.62	\$ 1,047.84	\$ 1,247.99	\$ 760.31
Mali	LIC	19,077,690	\$ 899.66	\$ 29.79	\$ 40.30	\$ 9.41
Malta	HIC	483,530	\$ 30,098.28	\$ 2,327.78	\$ 3,137.27	\$ 1,469.08
Marshall Islands	UMIC	58,413	\$ 3,788.16	\$ 851.34	\$ 928.00	\$ 448.16
Mauritania	LMIC	4,403,319	\$ 1,188.83	\$ 46.77	\$ 70.58	\$ 17.14
Mauritius	UMIC	1,265,303	\$ 11,238.69	\$ 553.10	\$ 819.47	\$ 243.98
Mexico	UMIC	126,190,788	\$ 9,673.44	\$ 461.79	\$ 648.25	\$ 240.81
Micronesia, Fed. Sts.	LMIC	112,640	\$ 3,568.29	\$ 386.69	\$ 396.86	\$ 107.66
Moldova	LMIC	3,545,883	\$ 3,227.31	\$ 171.19	\$ 250.43	\$ 83.53
Monaco	HIC	38,682	\$ 185,741.28	\$ 2,939.84	\$ 3,147.43	\$ 2,338.81
Mongolia	LMIC	3,170,208	\$ 4,121.73	\$ 140.71	\$ 191.18	\$ 79.75
Montenegro	UMIC	622,345	\$ 8,844.24	\$ 531.73	\$ 659.80	\$ 398.90
Morocco	LMIC	36,029,138	\$ 3,237.88	\$ 171.45	\$ 254.80	\$ 80.33
Mozambique	LIC	29,495,962	\$ 498.96	\$ 19.21	\$ 20.68	\$ 10.25
Myanmar	LMIC	53,708,395	\$ 1,325.95	\$ 62.11	\$ 108.06	\$ 12.48
Namibia	UMIC	2,448,255	\$ 5,931.45	\$ 402.76	\$ 433.84	\$ 249.29
Nauru	UMIC	12,704	\$ 9,888.89	\$ 1,012.35	\$ 1,024.03	\$ 614.59
Nepal	LIC	28,087,871	\$ 1,033.91	\$ 45.45	\$ 70.65	\$ 8.44
Netherlands	HIC	17,231,017	\$ 53,024.06	\$ 4,742.03	\$ 5,285.06	\$ 3,839.93
New Caledonia	HIC	284,060	\$ 12,579.60	\$ -	\$ -	\$ -
New Zealand	HIC	4,885,500	\$ 41,945.33	\$ 3,745.22	\$ 4,253.65	\$ 2,945.76
Nicaragua	LMIC	6,465,513	\$ 2,028.89	\$ 188.16	\$ 248.79	\$ 115.43
Niger	LIC	22,442,948	\$ 413.98	\$ 22.68	\$ 35.96	\$ 5.51

Nigeria	LMIC	195,874,740	\$ 2,028.18	\$ 79.34	\$ 139.01	\$ 10.33
North Macedonia	UMIC	2,082,958	\$ 6,083.72	\$ 327.84	\$ 443.93	\$ 208.40
Northern Mariana Islands	HIC	56,882	\$ 23,258.68	\$ -	\$ -	\$ -
Norway	HIC	5,314,336	\$ 81,697.25	\$ 7,477.90	\$ 8,563.66	\$ 6,365.95
Oman	HIC	4,829,483	\$ 16,415.16	\$ 648.28	\$ 686.61	\$ 577.88
Pakistan	LMIC	212,215,030	\$ 1,482.40	\$ 39.58	\$ 65.40	\$ 11.04
Palau	HIC	17,907	\$ 15,859.43	\$ 1,674.09	\$ 1,916.07	\$ 1,000.51
Panama	HIC	4,176,873	\$ 15,575.07	\$ 1,040.67	\$ 1,326.08	\$ 682.70
Papua New Guinea	LMIC	8,606,316	\$ 2,730.27	\$ 55.15	\$ 59.48	\$ 38.61
Paraguay	UMIC	6,956,071	\$ 5,821.81	\$ 327.24	\$ 451.12	\$ 168.93
Peru	UMIC	31,989,256	\$ 6,941.24	\$ 316.44	\$ 405.95	\$ 202.75
Philippines	LMIC	106,651,922	\$ 3,102.71	\$ 129.43	\$ 199.25	\$ 40.83
Poland	HIC	37,978,548	\$ 15,420.91	\$ 809.01	\$ 994.64	\$ 563.89
Portugal	HIC	10,281,762	\$ 23,407.91	\$ 1,800.86	\$ 2,300.63	\$ 1,194.94
Puerto Rico	HIC	3,195,153	\$ 31,651.35	\$ -	\$ -	\$ -
Qatar	HIC	2,781,677	\$ 68,793.78	\$ 1,827.06	\$ 1,983.29	\$ 1,491.39
Romania	UMIC	19,473,936	\$ 12,301.19	\$ 476.37	\$ 575.21	\$ 372.46
Russian Federation	UMIC	144,478,050	\$ 11,288.87	\$ 469.13	\$ 659.06	\$ 267.17
Rwanda	LIC	12,301,939	\$ 772.94	\$ 48.08	\$ 51.14	\$ 16.29
Samoa	UMIC	196,130	\$ 4,183.41	\$ 227.15	\$ 254.14	\$ 173.50
San Marino	HIC	33,785	\$ 48,494.55	\$ 3,012.79	\$ 3,578.91	\$ 2,421.99
Sao Tome and Principe	LMIC	211,028	\$ 2,001.14	\$ 105.13	\$ 120.28	\$ 41.94
Saudi Arabia	HIC	33,699,947	\$ 23,338.96	\$ 1,147.33	\$ 1,311.91	\$ 777.91
Senegal	LMIC	15,854,360	\$ 1,521.95	\$ 52.61	\$ 79.84	\$ 18.19
Serbia	UMIC	6,982,084	\$ 7,246.73	\$ 494.42	\$ 694.68	\$ 286.79
Seychelles	HIC	96,762	\$ 16,433.94	\$ 596.92	\$ 609.36	\$ 572.88
Sierra Leone	LIC	7,650,154	\$ 533.99	\$ 86.31	\$ 122.17	\$ 9.64
Singapore	HIC	5,638,676	\$ 64,581.94	\$ 2,462.39	\$ 3,230.00	\$ 1,342.62
Sint Maarten (Dutch part)	HIC	40,654	\$ -	\$ -	\$ -	\$ -
Slovak Republic	HIC	5,447,011	\$ 19,442.71	\$ 1,178.74	\$ 1,388.90	\$ 941.10
Slovenia	HIC	2,067,372	\$ 26,123.97	\$ 1,834.16	\$ 2,054.30	\$ 1,325.87
Solomon Islands	LMIC	652,858	\$ 2,137.69	\$ 106.34	\$ 111.23	\$ 73.62
Somalia	LIC	15,008,154	\$ 314.54	\$ -	\$ -	\$ -
South Africa	UMIC	57,779,622	\$ 6,374.03	\$ 428.18	\$ 461.36	\$ 230.06
South Sudan	LIC	10,975,920	\$ 1,119.65	\$ -	\$ -	\$ -
Spain	HIC	46,723,749	\$ 30,370.89	\$ 2,389.89	\$ 2,959.31	\$ 1,702.51
Sri Lanka	UMIC	21,670,000	\$ 4,102.48	\$ 153.10	\$ 229.83	\$ 65.97
St. Kitts and Nevis	HIC	52,441	\$ 19,275.42	\$ 930.77	\$ 1,410.18	\$ 401.81

St. Lucia	UMIC	181,889	\$ 10,566.05	\$ 489.76	\$ 728.28	\$ 205.70
St. Martin (French part)	HIC	37,264	\$ -	\$ 66.14	\$ 66.14	\$ 29.95
St. Vincent and the Grenadines	UMIC	110,210	\$ 7,361.40	\$ 250.22	\$ 301.51	\$ 192.06
Sudan	LMIC	41,801,533	\$ 977.27	\$ 152.02	\$ 264.36	\$ 29.62
Suriname	UMIC	575,991	\$ 6,234.04	\$ 356.05	\$ 433.74	\$ 246.99
Sweden	HIC	10,183,175	\$ 54,608.36	\$ 5,710.59	\$ 6,581.11	\$ 4,768.65
Switzerland	HIC	8,516,543	\$ 82,796.55	\$ 9,835.96	\$ 12,743.65	\$ 6,174.88
Syrian Arab Republic	LIC	16,906,283	\$ 2,032.62	\$ -	\$ 35.51	\$ -
Tajikistan	LIC	9,100,837	\$ 826.62	\$ 55.70	\$ 92.49	\$ 15.93
Tanzania	LIC	56,318,348	\$ 1,050.68	\$ 35.50	\$ 43.27	\$ 14.42
Thailand	UMIC	69,428,524	\$ 7,273.56	\$ 221.92	\$ 248.80	\$ 173.40
Timor-Leste	LMIC	1,267,972	\$ 2,035.53	\$ 79.89	\$ 86.99	\$ 44.55
Togo	LIC	7,889,094	\$ 679.26	\$ 38.77	\$ 58.32	\$ 7.77
Tonga	UMIC	103,197	\$ 4,364.02	\$ 203.15	\$ 225.45	\$ 133.87
Trinidad and Tobago	HIC	1,389,858	\$ 17,129.91	\$ 1,063.83	\$ 1,490.22	\$ 561.62
Tunisia	LMIC	11,565,204	\$ 3,447.51	\$ 256.50	\$ 358.85	\$ 145.27
Turkey	UMIC	82,319,724	\$ 9,370.18	\$ 468.65	\$ 545.82	\$ 367.62
Turkmenistan	UMIC	5,850,908	\$ 6,966.64	\$ 422.85	\$ 745.03	\$ 78.40
Turks and Caicos Islands	HIC	37,665	\$ 27,142.23	\$ 1,578.44	\$ 1,578.44	\$ 601.94
Tuvalu	UMIC	11,508	\$ 3,700.71	\$ 507.35	\$ 510.73	\$ 428.80
Uganda	LIC	42,723,139	\$ 642.78	\$ 37.61	\$ 52.77	\$ 6.23
Ukraine	LMIC	44,622,516	\$ 3,095.17	\$ 141.19	\$ 217.91	\$ 59.88
United Arab Emirates	HIC	9,630,959	\$ 43,004.95	\$ 1,323.12	\$ 1,568.76	\$ 958.96
United Kingdom	HIC	66,488,991	\$ 42,943.90	\$ 3,958.02	\$ 4,556.39	\$ 3,175.33
United States	HIC	327,167,434	\$ 62,794.59	\$ 9,869.74	\$ 10,963.97	\$ 8,077.93
Uruguay	HIC	3,449,299	\$ 17,277.97	\$ 1,379.10	\$ 1,618.66	\$ 988.73
Uzbekistan	LMIC	32,955,400	\$ 1,532.37	\$ 135.11	\$ 205.70	\$ 62.32
Vanuatu	LMIC	292,680	\$ 3,123.89	\$ 109.81	\$ 119.06	\$ 59.16
Venezuela, RB	UMIC	28,870,195	\$ 16,054.49	\$ -	\$ 445.83	\$ -
Vietnam	LMIC	95,540,395	\$ 2,566.60	\$ 122.84	\$ 177.59	\$ 58.27
Virgin Islands (U.S.)	HIC	106,977	\$ 35,938.02	\$ -	\$ -	\$ -
West Bank and Gaza	LMIC	4,569,087	\$ 3,198.87	\$ -	\$ -	\$ -
Yemen, Rep.	LIC	28,498,687	\$ 944.41	\$ 72.04	\$ 130.36	\$ 7.34
Zambia	LMIC	17,351,822	\$ 1,539.90	\$ 56.54	\$ 63.40	\$ 21.65
Zimbabwe	LMIC	14,439,018	\$ 2,147.00	\$ 93.94	\$ 113.90	\$ 43.69

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