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LDC GRADUATION AND THE WTO: ASSITING LDCS TO ADDRESS THE TRADE-RELATED IMPLICATIONS OF GRADUATION FROM LDC STATUS

HEALTH IMPACT OF THE COVID-19 PANDEMIC ON GRADUATING LDCS[1]

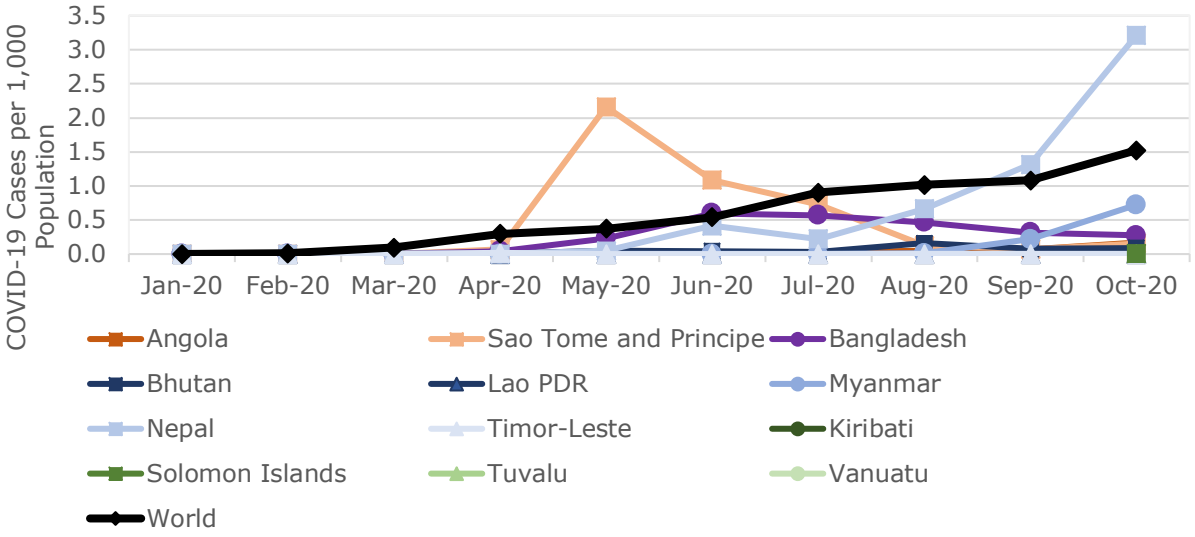
1 December 2020

[1] The report builds on the analysis carried out in the report "Trade impacts of LDC graduation" issued by WTO in May 2020. It was prepared by Pascale R. Leroueil, The William Davidson Institute at the University of Michigan, under the auspices of the EIF-WTO Project on LDC Graduation. The author would like to like to thank Erika Beidelman, Amanda Dee Moreno Hernandez, Prince Mujumbe and Dana Gorodetsky. The report is without prejudice to the positions of members in the WTO. It is subject to further revisions depending on comments received.

A. Overview of the evolution of the pandemic in twelve graduating LDCs

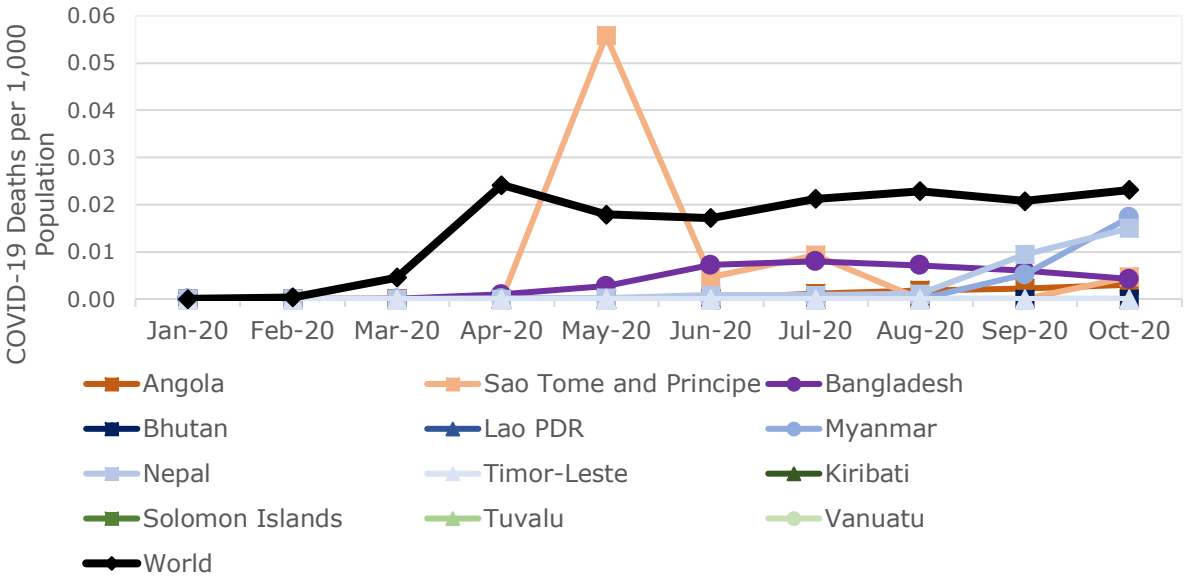
The impact of Covid-19 has varied based on region. Figure 1 shows the reported progression of Covid-19 cases from January 2020 to October 2020. Most of the twelve graduating LDCs remain well below the weighted world average of Covid-19 cases per 1,000 population. Indeed, several of the Pacific region countries (Kiribati, Tuvalu and Vanuatu) have no documented cases to date. Sao Tome and Principe, Bangladesh and Nepal have all seen Covid-19 case numbers above the weighted world average since January. However, only Nepal remains above the weighted world average of cases as of October 2020. Of the countries that have already reported a Covid-19 case, Bangladesh is the only graduating LDC that is experiencing a downward trend in cases. This is not unexpected given that the weighted world average is also increasing. However, it is an important reminder that it is unlikely we have seen the peak infection rates for many of these countries. **Figure 2** shows the progression of Covid-19 related deaths from January 2020 to October 2020. Only five of the twelve graduating LDCs have reported deaths so far (Angola, Sao Tome and Principe, Bangladesh, Nepal and Myanmar). Again, the countries in the Pacific region appear to be the least directly affected by the virus. Although the weighted world average of deaths attributed to Covid-19 has remained relatively stable over the course of the past four months (~0.02 Covid-19 deaths per 1,000 population), deaths related to Covid-19 are increasing in several countries (Angola, Sao Tome and Principe, Myanmar and Nepal). Myanmar and Nepal are seeing the largest increases in Covid-19 deaths, mirroring the trends apparent in **Figure 1.**

Figure 1. COVID-19 Cases per 1,000 Population from January 2020 to October 2020.



Note: Regions are distinguished by color (oranges = Africa; blues = Asia; greens = Pacific).[1] Notes that Kiribati, Tuvalu and Vanuatu have not reported a Covid-19 case.

Figure 2. Covid-19 Deaths per 1,000 population from January 2020 to October 2020.



Note: Regions are distinguished by color (oranges = Africa; purples/blues = Asia; greens = Pacific).[1] Note that only Angola, Sao Tome and Principe, Bangladesh, Nepal and Myanmar have reported deaths.

Covid-19 is a global pandemic and is not yet under control. Although most of the twelve graduating LDCs have not experienced high levels of Covid-19 cases and deaths, it is important to recognize that this highly communicable disease has not yet been contained. There are significant global efforts underway to develop vaccines against the disease. However, the timeline of the development, testing, scale-up and distribution of the vaccines is still uncertain. Without consistent efforts across the world to mitigate the spread of the disease, graduating LDCs that have thus far avoided high numbers of Covid-19 related cases and deaths may be in a different position between now and when a vaccine has been deployed.

Health expenditure varies significantly across the twelve graduating LDCs. Healthcare expenditure and life expectancy are highly correlated: as health expenditure increases, life expectancy increases.[2] Health expenditure is also correlated with national income.[2] As such we might expect countries in similar economic states, such as the twelve graduating LDCs, to have a comparable health expenditure as a proportion of GDP. The first column in Table 1 shows health expenditure as a percent of GDP for each country in 2017. Not surprisingly, most of these values are similar to each other, and comparable to what is seen in middle-income countries (5.38% GDP). The exceptions are Kiribati and the Tuvalu, both Pacific region countries that spend disproportionately more on health. Indeed, both are closer to spending by high-income countries on health (12.49% GDP). In general, we can assume that countries that consistently invest more in their health systems are more likely to have the infrastructure, systems and people required to respond to a health challenge such as Covid-19.

Individuals in those graduating LDCs that rely heavily on out-of-pocket expenditure are likely to be most at risk. Health systems that rely more heavily on public health spending tend to provide better protection to individuals within the heath system.[3] This is because patients from lower economic tiers are less likely to face relatively high payments at the point of service that may prevent or discourage them from seeking care. The second column in Table 1 shows the out-of-pocket expenditure for each of the twelve graduating LDCs relative to their current health expenditure. Out-of-pocket expenditure in high- and middle-income countries represent an average of 13.63% and 36.27% of health expenditure (2017), respectively. Again, these values should not be examined in a vacuum, but in general the out-of-pocket expenditure in those countries in the Pacific region are significantly lower than the high and middle-income averages presented. This suggests that, at least in the short term,

individuals in those countries would be unlikely to bear a significant portion of unexpected healthcare costs. In contrast, countries in the Asia region, with the exception of Bhutan, have significantly higher out-of-pocket expenditures than the high- and middle-income averages presented. This means individuals in these countries would likely be asked to bear a significant portion of unexpected healthcare costs, which tends to have a disproportionately negative effect on individuals in the lower economic tiers.

Table 1. Health expenditure across the twelve graduating LDCs relative to high- and middle-income countries for 2017.[4]

	Health Expenditure, % GDP	Out-of-Pocket Expenditure, % of Health Expenditure
High Income Countries	12.5	13.6
Middle Income Countries	5.4	36.3
Angola	2.8	34.1
Sao Tome and Principe	6.2	13.8
Bangladesh	2.3	73.9
Bhutan	3.2	13.3
Lao PDR	2.5	46.2
Myanmar	4.7	76.2
Nepal	5.6	57.8
Timor-Leste	3.9	8.3
Kiribati	10.8	0.1
Solomon Islands	4.7	5.4
Tuvalu	17.1	0.5
Vanuatu	3.3	9.0

High-level metrics suggest that the health systems of some of the twelve graduating LDCs are more prepared to handle effect of Covid-19. There is no perfect way to measure the strength of a health system. However, there are some indices and metrics used for high-level assessments. The first is the Service Coverage Index, which measures the coverage of essential health services in a given country on a 1 to 100 (best) scale. This is Indicator 3.8 under the UN's Sustainable Development Goals (SDGs).[5] We would expect those countries that have scores closer to 100 to be more prepared to dispense essential health services, such as a Covid-19 vaccine, to a large portion of their population. As shown in the first column of Table 2, the scores for the twelve graduating LDCs range from 39.6 in Angola to 62.5 in Bhutan. A second index, the Healthcare Access and Quality Index, was developed by the Institute for Health Metrics and Evaluation (IHME) to assess personal healthcare access and quality. Again, country scores range from 1 to 100 (best). We would expect those countries that have scores closer to 100 to have health systems that can handle basic care under normal conditions. Taken one step further, we might also expect that countries with scores closer to 100 are better prepared to handle basic care under abnormal conditions, such as the Covid-19 pandemic. As shown in the second column of Table 2 the scores for the twelve graduating LDCs range from 26.5 in Kiribati to 47.6 in Bangladesh. The third, fourth and fifth column of Table 2 show the ratio of nurses & midwives, physicians and hospital beds per 1,000 population for each of the twelve graduating LDCs. These metrics are often used as proxies for the availability of trained healthcare staff and healthcare resources within a country. While there are caveats, larger ratios are generally considered better. There is significant variation in the metric ratios across the countries, with both positive and negative outliers. For example, Tuvalu's metric ratios are comparable to the average of the middle-income countries, while Angola's metric ratios are significantly lower. Overall, there is no clear trend at the regional level for the two indices or the three metrics. However, there is variation at the country level and that suggests some of the twelve

graduating LDCs are better prepared (e.g. Tuvalu, Kiribati) than others (e.g. Bangladesh, Myanmar) to deliver healthcare during and after the Covid-19 pandemic.

Table 2. High-level metrics for assessing strength of country health system.

	Service Coverage Index (2017)	Healthcare Access and Quality Index (2016)	Nurses & Midwives per 1,000 population	Physicians per 1,000 population	Hospital Beds per 1,000 population
High Income Countries	*NA*	90.1	10.9	3.1	4.2
Middle Income Countries	*NA*	68.8	2.7	1.4	2.4
Angola	39.6	33.4	0.4	0.2	0.8
Sao Tome and Principe	54.6	39.3	1.9	0.1	2.9
Bangladesh	48.2	47.6	0.4	0.6	0.8
Bhutan	62.5	47.3	1.9	0.4	1.7
Lao PDR	50.7	36.6	1.0	0.4	1.5
Myanmar	60.7	41.6	1.0	0.7	0.9
Nepal	48.0	40.0	3.1	0.7	0.3
Timor-Leste	52.4	43.4	1.7	0.7	5.9
Kiribati	41.2	26.5	3.8	0.2	1.9
Solomon Islands	47.4	32.4	2.2	0.2	1.4
Tuvalu	*NA*	*NA*	4.3	0.9	5.6
Vanuatu	48.4	32.4	1.4	0.2	1.7

Note: Service Coverage Index (UN SDG Indicator 3.8) that measures coverage of essential health services (unitless scale from 1 to 100 (best)). Healthcare Access and Quality Index (IHME) uses 32 causes of death from which death should not occur in the presence of effective care to approximate personal healthcare access and quality (unitless scale from 1 to 100 (best)). Ratio of physicians, nurses & midwives and hospital beds to population (World Bank) are often used as proxies for the availability of trained healthcare staff, healthcare resources.

B. Health-related responses adopted by the governments of the graduating LDCs

Governments responded to Covid-19 in all countries for which we had data. UNICEF constructed a database of country government responses since the start of the Covid-19 pandemic.[6] In brief, the database segments government responses into three categories: closures and containment *(c)*; economic measures *(e)*; and health measures *(h).* Under each of these categories, specific government measures are defined. The degree of the government measure is scored on a 0 to 4 scale, where 0 is no measure and 4 is the most extreme form of the measure. **Figure 3** summarizes the measures taken by the governments of nine of the twelve graduating LDCs. Unfortunately, there was no data available for Sao Tome and Principe, Kiribati and Tuvalu. By March, each of the nine graduating LDCs had put in place short term measures. School Closings, Restrictions on Gatherings and International Travel Controls appeared consistently as early responses to the pandemic. Most countries seemed to have largely maintained or increased their restriction levels from March to October, suggesting that governments continue to view Covid-19 as a threat.

Figure 3. Short-term government responses to Covid-19 from January 2020 to October 2020 for 9 of the 12 graduating LDCs.[6]

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Angola	C1_School Closing	0	0	3	3	3	3	3	3	3	2
	C2_Workplace Closing	0	0	3	2	2	2	2	2	2	2
	C3_Cancel Public Events	0	0	2	2	2	2	2	2	2	1
	C4_Restriction on Gathering	0	0	4	4	3	3	4	4	4	4
	C5_ Close Public Transportation	0	0	2	1	1	1	1	1	1	1
	C6_Stay at Home Requirements	0	0	2	2	1	1	2	2	1	1
	C7_Restrictions on Internal Movements	0	0	2	2	2	2	2	2	2	2
	C8_International Travel Controls	0	2	4	4	4	4	4	4	2	2
	E1_Income Support	0	0	0	1	1	1	1	0	0	0
	E2_Debt Contract Relief	0	0	0	2	2	0	0	1	0	1
	H1_Public Information Campaigns	0	0	1	1	2	2	2	2	2	2
	H2_Testing Policy	0	1	1	2	2	2	2	2	2	2
	H3_Contact Tracing	0	0	0	0	0	0	1	1	1	1
	H6_Facial Covering	0	0	0	3	3	3	4	4	4	4

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Lao PDR	C1_School Closing	0	0	3	3	2	0	0	0	0	1
	C2_Workplace Closing	0	0	3	3	2	0	0	2	2	2
	C3_Cancel Public Events	0	0	2	2	2	2	0	1	1	1
	C4_Restriction on Gathering	0	0	4	4	3	2	0	0	0	0
	C5_ Close Public Transportation	0	0	2	2	0	0	0	0	0	0
	C6_Stay at Home Requirements	0	0	2	2	0	0	0	0	0	0
	C7_Restrictions on Internal Movements	0	0	2	2	0	0	0	0	0	0
	C8_International Travel Controls	0	0	4	4	4	2	2	3	3	3
	E1_Income Support	0	0	0	0	1	1	0	2	2	0
	E2_Debt Contract Relief	0	0	0	2	2	2	1	1	1	0
	H1_Public Information Campaigns	0	0	2	2	2	2	1	2	2	2
	H2_Testing Policy	0	0	1	1	1	1	1	2	2	2
	H3_Contact Tracing	0	0	0	2	2	2	2	2	2	2
	H6_Facial Covering	0	4	4	4	4	4	4	4	1	4

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Solomon Islands	C1_School Closing	0	0	3	3	0	0	0	0	0	0
	C2_Workplace Closing	0	0	2	2	2	2	2	2	2	2
	C3_Cancel Public Events	0	0	1	1	1	1	1	1	1	1
	C4_Restriction on Gathering	0	0	0	0	0	0	0	0	0	0
	C5_ Close Public Transportation	0	0	0	0	0	0	0	0	0	1
	C6_Stay at Home Requirements	0	0	0	0	0	0	0	0	0	0
	C7_Restrictions on Internal Movements	0	0	1	1	1	1	1	1	1	1
	C8_International Travel Controls	0	3	3	3	3	3	4	3	4	4
	E1_Income Support	0	0	2	2	2	0	0	0	0	0
	E2_Debt Contract Relief	0	0	0	0	0	0	1	1	1	1
	H1_Public Information Campaigns	0	0	2	2	2	2	2	2	2	2
	H2_Testing Policy	0	0	0	0	0	0	0	0	1	1
	H3_Contact Tracing	0	0	0	0	0	0	0	0	0	0
	H6_Facial Covering	0	0	0	0	0	0	0	0	0	0

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Bangladesh	C1_School Closing	0	0	3	3	3	3	3	3	3	3
	C2_Workplace Closing	0	0	3	3	1	1	3	3	3	3
	C3_Cancel Public Events	0	0	2	2	2	2	2	2	2	2
	C4_Restriction on Gathering	0	0	4	4	3	4	4	4	4	4
	C5_ Close Public Transportation	0	0	2	2	1	1	1	1	1	1
	C6_Stay at Home Requirements	0	0	1	2	1	2	2	2	2	2
	C7_Restrictions on Internal Movements	0	0	2	2	0	2	2	2	2	2
	C8_International Travel Controls	1	1	3	3	3	3	3	3	3	3
	E1_Income Support	0	0	0	1	0	0	0	0	0	0
	E2_Debt Contract Relief	0	0	1	2	2	2	2	2	2	2
	H1_Public Information Campaigns	2	2	2	2	2	2	2	2	2	2
	H2_Testing Policy	0	0	2	2	2	2	2	2	2	2
	H3_Contact Tracing	1	1	1	1	1	1	1	1	1	1
	H6_Facial Covering	0	0	0	0	4	4	4	4	4	4

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Myanmar	C1_School Closing	0	0	3	3	3	3	2	3	3	3
	C2_Workplace Closing	0	0	2	3	2	2	2	2	3	3
	C3_Cancel Public Events	0	0	2	2	2	2	2	2	2	2
	C4_Restriction on Gathering	0	0	3	4	4	4	4	3	4	3
	C5_ Close Public Transportation	0	0	0	2	2	2	2	1	1	1
	C6_Stay at Home Requirements	0	0	0	2	2	2	2	2	3	3
	C7_Restrictions on Internal Movements	0	0	0	2	2	2	2	2	2	2
	C8_International Travel Controls	0	1	3	3	3	3	3	3	4	4
	E1_Income Support	0	0	0	1	0	0	0	0	0	1
	E2_Debt Contract Relief	0	0	0	0	0	0	0	0	0	2
	H1_Public Information Campaigns	0	0	2	2	2	2	2	2	2	2
	H2_Testing Policy	0	0	2	2	2	2	2	2	2	3
	H3_Contact Tracing	0	0	1	1	1	1	1	1	1	2
	H6_Facial Covering	0	0	0	0	4	4	4	4	4	4

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Timor-Leste	C1_School Closing	0	0	3	3	2	2	2	2	2	2
	C2_Workplace Closing	0	0	2	2	0	0	0	0	0	0
	C3_Cancel Public Events	0	0	2	2	0	0	0	0	0	0
	C4_Restriction on Gathering	0	0	4	4	0	0	0	0	0	0
	C5_ Close Public Transportation	0	0	2	0	0	0	0	0	0	0
	C6_Stay at Home Requirements	0	0	1	1	1	0	0	0	0	0
	C7_Restrictions on Internal Movements	0	0	0	0	0	0	0	0	0	0
	C8_International Travel Controls	0	2	3	4	4	4	4	4	4	4
	E1_Income Support	0	0	0	0	2	2	2	2	1	1
	E2_Debt Contract Relief	0	0	1	2	2	2	0	0	0	0
	H1_Public Information Campaigns	1	1	2	2	2	2	2	2	2	2
	H2_Testing Policy	0	0	2	2	2	2	2	3	3	3
	H3_Contact Tracing	0	0	2	2	2	2	2	2	2	2
	H6_Facial Covering	0	0	0	2	2	2	2	2	2	3

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Bhutan	C1_School Closing	0	0	3	3	3	3	2	3	2	2
	C2_Workplace Closing	0	0	2	2	2	2	2	3	2	2
	C3_Cancel Public Events	0	0	2	2	2	2	1	2	2	2
	C4_Restriction on Gathering	0	0	4	4	4	4	3	4	3	3
	C5_ Close Public Transportation	0	0	1	1	1	1	0	2	1	1
	C6_Stay at Home Requirements	0	0	1	1	1	1	1	3	2	2
	C7_Restrictions on Internal Movements	0	0	2	2	2	2	2	2	2	2
	C8_International Travel Controls	1	1	4	4	4	4	3	3	3	3
	E1_Income Support	0	0	0	1	1	1	2	2	2	0
	E2_Debt Contract Relief	0	0	0	2	2	2	2	2	2	2
	H1_Public Information Campaigns	2	2	2	2	2	2	2	2	2	2
	H2_Testing Policy	0	1	1	2	2	2	2	2	2	2
	H3_Contact Tracing	0	0	2	2	2	2	2	2	2	2
	H6_Facial Covering	0	0	1	1	1	1	2	4	4	4

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Nepal	C1_School Closing	0	0	3	3	3	3	3	3	3	2
	C2_Workplace Closing	0	0	3	3	2	2	3	2	2	1
	C3_Cancel Public Events	0	0	2	2	2	2	1	2	2	2
	C4_Restriction on Gathering	0	0	4	4	4	4	4	3	3	3
	C5_ Close Public Transportation	0	0	2	2	2	2	2	2	1	1
	C6_Stay at Home Requirements	0	0	2	2	2	2	2	2	2	1
	C7_Restrictions on Internal Movements	0	0	2	2	2	2	1	2	2	1
	C8_International Travel Controls	1	2	4	4	4	4	4	4	3	3
	E1_Income Support	0	0	1	1	1	1	1	1	1	1
	E2_Debt Contract Relief	0	0	2	2	2	2	1	1	1	1
	H1_Public Information Campaigns	2	2	2	2	2	2	2	2	2	2
	H2_Testing Policy	1	1	1	1	1	1	2	2	2	1
	H3_Contact Tracing	2	2	2	2	2	2	2	2	2	1
	H6_Facial Covering	0	0	0	0	0	0	0	4	4	4

Country	Government Measure	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Vanuatu	C1_School Closing	0	0	3	3	0	0	0	0	0	0
	C2_Workplace Closing	0	0	2	2	2	2	2	0	0	0
	C3_Cancel Public Events	0	0	2	2	2	2	2	0	0	0
	C4_Restriction on Gathering	0	0	4	4	4	4	4	0	0	0
	C5_ Close Public Transportation	0	0	1	1	1	1	1	0	0	0
	C6_Stay at Home Requirements	0	0	1	1	1	1	1	0	0	0
	C7_Restrictions on Internal Movements	0	0	2	1	1	1	1	0	0	0
	C8_International Travel Controls	0	0	4	4	4	4	4	4	4	4
	E1_Income Support	0	0	0	1	1	1	0	0	0	0
	E2_Debt Contract Relief	0	0	0	0	0	1	1	1	1	1
	H1_Public Information Campaigns	0	0	2	2	2	2	2	2	2	2
	H2_Testing Policy	0	0	1	1	1	1	1	1	1	1
	H3_Contact Tracing	0	0	1	1	1	1	1	1	1	1
	H6_Facial Covering	0	0	0	0	0	0	0	0	0	0

Note: (Orange = African Region; Blue = Asian Region; Green = Pacific Region). The degree of the government measure is on a scale of 0 (white, no measure) to 4 (dark, most extreme form of measure). Detailed descriptions of each measure can be found in the reference.

To date, there is not much publicly available information on the medium- to long-term measures of the graduating LDCs, although it is very likely that the countries are incorporating what they have seen with Covid-19 over the last 9-12 months into their medium- to long-term plans. However, we limited our research to publicly available sources, such as newspaper articles and press releases, so it is unlikely we captured the full picture. Furthermore, it seems likely that even those countries with relatively low Covid-19 case numbers and deaths are observing what is happening in other countries and are incorporating the lessons learned into their medium- and long-term planning.

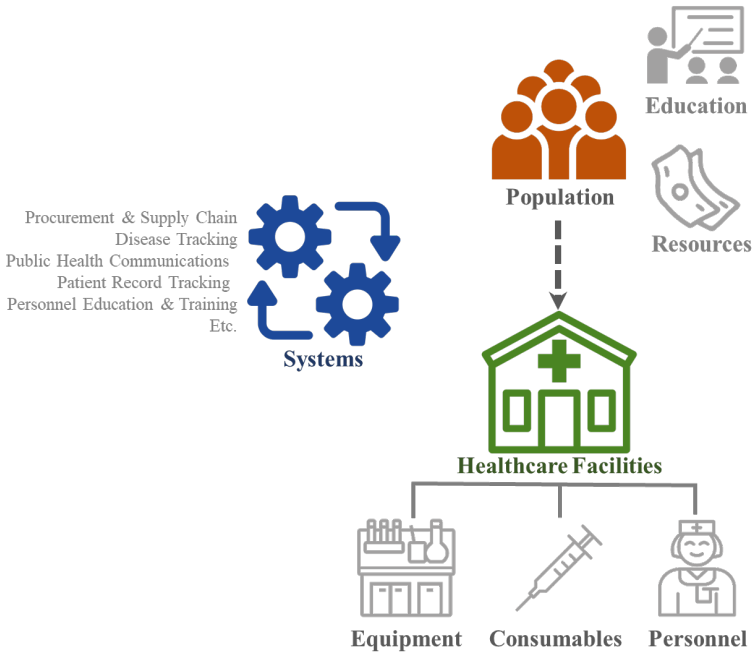
The information that is available on the medium to long-term measures of the graduating LDCs suggests a focus on systems and healthcare personnel. At a very basic level, a healthcare system is a collection of things, people and systems (Figure 4). However, the 'things' (e.g. equipment, consumables) are often prioritized over the people and systems. From an incentive standpoint, this makes sense since things are tangible and easy to produce or procure relative to people and systems. Unfortunately, a well-equipped healthcare system without trained personnel and functional systems to help the people and things interact effectively and efficiently rarely produces quality care.[7] This is why it is particularly encouraging to see that many of the medium and long-term responses we were able to identify seemed focused on improving systems and healthcare personnel. While some countries may have been considering these investments before the emergence of Covid-19, the disease seems to have catalyzed them into action. The focus of these measures can be divided into three areas:

1. **Increased use of remote systems for care and training.** Bangladesh is introducing a mobile platform to upskill health providers serving remote areas, thereby increasing access to more healthcare services.[8] Nepal recently approved home-based abortions provided through an outreach model and telemedicine.[9] Kiribati initiated a telehealth project that connects its four hospitals to a centralized health information database and communications system.[10] Both Tuvalu and the Solomon Islands are working with Family Planning Australia to strengthen their health system including delivery of remote training.[11]

2. **Increased focus on developing pandemic response plans.** Although Covid-19 is the pandemic most on our minds, pandemics are a continuous threat. Several of the twelve graduating LDCs have taken steps to prepare for the next pandemic. For example, Angola, with support from WHO, has started building local capacity in case management, risk communication, epidemiological surveillance, logistics and biosafety.[12] Bhutan is introducing palliative care to their healthcare system in response to what they have seen elsewhere.[13] They are also developing contingency plans in case their Covid-19 cases surge, although presumably those plans would also be largely applicable to future pandemics.[14]

3. **Increased investment in the overall health system.** Addressing the healthcare needs of a population during a pandemic can stretch the capabilities and capacity of any health system. For some countries, Covid-19 has highlighted existing weaknesses in their health systems that, at least in the long term, will need to be addressed. The Angolan government invested money in ventilators, biosecurity kits and thermometers.[12] Myanmar secured a $30 million loan from the Asian Development Bank to finance upgrades to its healthcare facilities, and to support human resources within its health system.[15] The government of the Solomon Islands has announced its intention to strengthen its healthcare system[11], including upgrading some of its intensive care units.[16] In addition, they are increasing investments in training for healthcare staff in waste management, hospital infection control and transport.[16]

Figure 4. A health system that withstands shocks like Covid-19 requires significant investment in the equipment, consumables and people involved, as well as the systems that help these interact effectively and efficiently.



C. Impact of the health-related measures on the containment of the virus

While each of the twelve graduating LDCs has taken their own approach to addressing the spread and treatment of Covid-19, several themes surfaced during our research. Importantly, this is unlikely to be a comprehensive view of the actions taken by the countries given that our research was limited to publicly available sources. Nonetheless, our findings were consistent with expected government responses to a disease like Covid-19. The best practices identified below would ideally be shared across the twelve graduating LDCs.

1. **Implement systems to provide honest, timely and transparent communication about the disease, its impact and the actions taken.** A dangerous and fast-spreading disease like Covid-19 requires quick action on the part of both governments and their public. The government must have an accurate view of the situation to implement policy (e.g. school closures) and deploy resources efficiently (e.g. test kits), and the public must understand what steps they should take in light of the disease (e.g. wearing masks). These concepts should be at the heart of any public health response.[17] However, it is non-trivial as it requires a significant amount of information to be transferred accurately and quickly between government groups, and between the government and the public. Several of the twelve graduating LDCs deployed systems specifically aimed at increasing the accuracy and speed of information transfer. For example, Bangladesh created a clear coordination structure between local and national level government groups to ensure the effective implementation of recommendations and guidelines.[18] To facilitate communication with the public, Bangladesh also established a web-based portal and mobile phone application to provide daily Covid-19 updates on the state of the pandemic and nearby health and testing facilities.[18] This was in keeping with their stated goal of providing clear information on what services are available, and whether infection control was in place.[19] Bhutan credited its relative success in stemming the spread of Covid-19 to its decision to ground its actions in scientific evidence and principles of public health, including providing accurate and timely information to its people.[12]

2. **Invest in resources to reduce transmission and improve treatment.** Health systems require personnel, systems and physical assets to function. In response to Covid-19, several of the twelve graduating LDCs made investments in both things and people. In Bhutan, the Health Ministry set up 54 clinics across the country to enhance surveillance and serve as a buffer to Covid-19. Bhutan also invested in an app to help surveillance teams perform contact tracing.[20] Timor-Leste invested in infection control and case management training for healthcare workers, emergency responders and rapid response teams. They also trained their staff to use the web-based Covid-19 surveillance portal created by the WHO.[21] While no investments specific to Covid-19 by Angola and Tuvalu were found, the disease prompted Angola to increase their overall health budget[12] and Tuvalu to reaffirm its commitment to preventative care.[11]

3. **Identify existing resources that can be used to address current gaps.** Sometimes health systems do not have ready access to the resources they need to meet surges in demand. In those cases, it may be necessary to reallocate existing resources or look elsewhere. Angola, Bangladesh, Myanmar and Nepal were able to identify resources within their country that could be used to supplement what the health system had available. Angola's Health Ministry bolstered the number of available health personnel by using a civil requisitions law that forced retired health personnel to report for duty.[12] Bangladesh leveraged university labs and life science students to increase the country's testing capacity.[22] Myanmar transformed a private football stadium into a temporary hospital to care for Covid-19 patients who were asymptomatic or who had mild cases.[23] Nepal, when faced with a shortage of ICU care in the capital, turned several hotels and home care service buildings into ICUs for those people that could afford the price of lodging.[24] At least one of the twelve graduating LDCs looked outside its borders for available resources: the government of Angola welcomed 260 doctors from Cuba to strengthen its healthcare force.[12]

4. **Ensure that healthcare resources are available to all populations within the country.** One of the consistent challenges in healthcare is ensuring that there is equitable access to care.[25] In general, people in rural areas and/or those in the lower economic tiers have less access to care than those in urban areas and/or those in higher economic tiers.[26] Several of the twelve graduating LDCs took steps to reduce the inequity of Covid-19 related care. In Angola, the government expanded field hospitals and research hospitals outside of the capital to better serve these people in the provinces.[12] In addition, public health specialists from the capital traveled to remote areas of the country to educate the people about the disease.[12] In Bangladesh, Covid-19 testing facilities were expanded in districts outside of major cities. [22] In Myanmar, the government focused its efforts by investing funds in health facilities that served vulnerable groups such as those that are part of the minority population.[15] The Nepalese government also de-medicalized abortion to reduce the burden on the healthcare system[9], which likely increased access to abortion in areas where hospitals were overburdened by Covid-19.

5. **Support the health and mental well-being of healthcare workers.** Healthcare workers have faced a disproportionate burden on their health and mental well-being during the Covid-19 pandemic.[27] Recognizing their importance in fighting the disease, Bangladesh, Nepal, Bhutan and Timor-Leste have implemented measures to help offset this burden. Bangladesh provided frontline responders with supplemental insurance and incentives for their continued work.[28] In Nepal, insurance companies introduced a Covid-19 insurance scheme free to government employees, including government healthcare workers.[29] Bhutan implemented a work schedule to reduce the spread of disease among healthcare workers while providing them rest. Specifically, healthcare care workers alternate between two weeks of work, and two weeks of quarantine.[13] Bhutan has also mobilized a National Mental Health Response Team comprised of clinical psychiatrists, clinical psychologists and counselors to combat what they see as a looming mental health crisis. Both Bhutan[30] and Timor-Leste[31] have established mental health hotlines.

Although not specifically targeted to them, access to mental health care is available to the healthcare workers.

D. Summary of key learnings from COVID-19 response in the health sector in graduating LDCs

The long-term consequences of Covid-19 infections may put significant strain on the health systems of the twelve graduating LDCs. The emergence of Covid-19 has likely had both direct and indirect impacts on health in the twelve graduating LDCs**.** The direct impacts, such as the increased need for testing and the treatment of Covid-19 positive patients are relatively easy to quantify. However, we suspect that there are indirect impacts of Covid-19 related to the prevention, diagnosis and treatment of other health conditions. Unfortunately, we are unaware of any quantitative data for the twelve graduating LDCs, but data from other countries suggest that delays in care due to Covid-19 are likely to have a significant impact on country health systems.[32–34] For example, a patient that would otherwise need only a basic treatment regimen may require hospitalization if their treatment was delayed for any reason (e.g. lack of available healthcare personnel; fear of going to a clinic during a pandemic). Importantly, these types of delays have impacts across the entire healthcare value chain, from the procurement of health commodities to the delivery of service. Early reports suggest that Covid-19 may have longer-term impacts on the health of some of those that have been infected. Examples include inflammation of the heart, acute kidney disease and depression.[35] Given the uncertainty in the scope and magnitude of the long-term effects, it is difficult to say what the impact on the country health systems will be. However, long-term effects like the ones mentioned above would increase the need for specialized personnel, equipment and medication. Note that we would expect those countries with relatively more Covid-19 cases to experience an increased long-term burden on their health system.

The purchase, distribution and administration of the eventual vaccine is likely to be a challenge throughout the world, including in the twelve graduating LDCs. Although it is still uncertain when a vaccine against Covid-19 will be broadly available, it is important that all countries begin planning for its eventual arrival. Practically speaking, this means planning for the purchase, distribution and administration of the vaccine. While coverage for childhood vaccines across the twelve LDCs is relatively high, vaccinating an entire country over a relatively short time-period presents new challenges. Indeed, even if the vaccine itself is provided free of charge to these countries, there are other ancillary costs that the countries will likely face related to equipment (e.g. cold-chain equipment), consumables (e.g. syringes, needles) and personnel (e.g. nurse overtime). The total cost of vaccinating a person will ultimately be a function of the vaccine presentation deployed in each county since it dictates the storage requirements (e.g. +20°C vs -80°C), administration requirements (e.g. nurse vs. community health worker) and dose requirements (e.g. 1 dose vs. 2 doses). While it is true that much of the infrastructure needed to deploy any vaccine is likely already in place, there are some scenarios where a relatively large infrastructure investment would be needed. For example, a Covid-19 vaccine that needs to be stored at -80°C may require countries to purchase ultra-cold freezers to store the vaccines. In addition to the direct costs of vaccinating a person, countries will also need to consider the cost of educating the public about the importance of the vaccine and the logistics of receiving it. Even in countries that have low vaccine hesitancy, new vaccines are likely to face increased scrutiny by the public, particularly in countries largely spared from the direct effects of Covid-19. Regardless of what the eventual vaccine presentation looks like, a country-wide vaccination campaign against Covid-19 would likely represent a large and unplanned cost to each of the twelve graduating LDCs.[36]

Building health systems that can withstand 'shocks' like Covid-19 requires an investment in time and money. There is an important tradeoff between a healthcare system's ability to withstand 'shocks' and the system's overall cost. In general, the greater the ability of a health system to withstand a shock like a pandemic, the more it will cost to run the health system. This is because a health system that can withstand shocks necessarily has access to a buffer stock of consumables (e.g. personal protection equipment), equipment (e.g. PCR machines to help diagnose patients who have Covid-19) and people (e.g. maintaining enough people on staff such that there is capacity available, if needed). *Access to excess anything carries a cost.* For countries like the twelve graduating LDCs, that cost of maintaining excess capacity for a low-frequency, high-severity event like Covid-19 was likely too high. This should not be surprising since it was also too high for most developed countries.[37] Whether the

cost-benefit calculation is different today than it was in January 2020 is unclear. However, what is clear is that building health systems that can withstand the shocks of pandemics like Covid-19 will take time and money. Unfortunately, the twelve graduating LDCs may not have the flexibility to dedicate sufficient amounts of either before their intended graduation date.

Given the potential health impact of Covid-19, it may make sense to carefully review the graduation for the LDCs. As alluded to above, there is still significant uncertainty around the costs of preventing, treating and vaccinating against Covid-19. Given that the disease is still not under control and continues to cross borders, decisions that reduce the ability of the twelve graduating LDCs to respond appropriately to the disease do not seem prudent.

Most of the twelve graduating LDCs have thus far seen fewer cases and deaths related to Covid-19 than the global average. However, the disease is not yet controlled and the long-term implications of infection are not known. This, in addition to the eventual need to deploy an as-of-yet undefined vaccine countrywide, means that the ultimate cost of Covid-19 to these countries is still uncertain. Given this, it seems prudent to refrain from taking actions that might reduce their ability to respond appropriately to the disease. In the meantime, efforts should be made to share best practices across countries.

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