COVID-19 Net Health Impact Calculator User Guide (version 1)

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The Center for Global Development is working on a project to help policymakers minimize the indirect health impacts of the COVID-19 pandemic. We built this COVID-19 net health impact calculator to be a practical tool. Our calculator offers a simple heuristic framework for taking and examining a broad health systems perspective on the COVID-19 response. The appropriate use of the calculator and its outputs can help quantify the net health impact of responses using a "whole of health" approach, and therefore it can contribute to effective policymaking. Needless to say, however, the better the data that goes into the calculator, the better the "answers" it offers.

We are continuing to make a number of refinements to the tool and will release updates to it as and when we make them. Please contact Damian Walker (damiangwalker@gmail.com) with errors or suggestions for further improvements, or feel free to adapt and share.

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Before using

The file is in format .xlsm, which is Excel's macro-enabled format. Macros need to be enabled by the user for the interactive functions of the file to work properly.

Brief description of each sheet

1. Home sheet

This sheet gives an overview of the file and a description of the different sheets with which the user can interact.

Action required: This is where the user selects the country or group of countries of interest from the drop-down menu in cell G23.

Imperial College London's report on the global impact of COVID-19 considered 202 countries or territories. The 2017 Global Burden of Disease (GBD) includes 195 countries and territories. Between the two sources, there are 188 overlapping countries and territories which we include in the tool. We use the World Bank geographic regions (East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa, North America, South Asia, and sub-Saharan Africa) and income categories, and (low, lower-middle, upper-middle, low- and middle, and high) regions. We also use the six WHO regions: African Region, Region of the Americas, South-East Asia Region, European Region, Eastern Mediterranean Region, and Western Pacific Region. Finally, we have added some other regions, such as the Commonwealth and Sahel (defined as Senegal, Mauritania, Mali, Burkina Faso, Niger, Nigeria, Chad, Sudan and Eritrea).

Warning: The cells highlighted in light green show where the user can input their own data. In the sheets that contain formulas (*Home*, *Results*, *COVID19* and scenario sheets), the user should not input data anywhere except in the light green cells, at the risk of creating errors in the file.

2. Results sheet

The Results sheet shows the:

- COVID-19 health effects of a range of scenarios
- non-COVID 19 health effects derived from Global Burden of Disease estimates (see below for further details) for the selected scenarios, where the non-COVID-19 health effects are the

difference between an assumed increase in deaths (e.g. malaria) and a reduction in deaths (e.g. transport injuries)

- net health benefit of selected scenarios, where net health benefits are the difference between COVID-19 deaths averted and excess non-COVID 19 deaths.

Action required: This is where the user selects the source of the COVID-19 predictions from the drop-down menu in cell C14. Currently the only option is the Imperial estimates, we have put placeholders for the LSHTM and WHO's AFRO estimates; the user can also enter their own estimates from other models or to explore a "what if" scenario. The corresponding results are then automatically populated in the tables and charts beneath.

Action required: This is also where the user selects the health metric of interest from the drop-down menu in cell C15. Currently the choice is between deaths or years of life lost (YLLs).

Action required: And this is where the user selects the two scenarios she or he would like to compare from the drop-down menu in cells C16 and C17. When using WHO's AFRO estimates, only one scenario is available and will therefore be automatically selected; this appears to be the difference between containment measures and a failure of containment measures.

Action required: Finally, to generate the non-COVID-19 health effect estimates, the user clicks on the corresponding button, which will create a new scenario sheet (see below) to be populated.

As in the COVID-19 and scenario sheets, the user can save their results by clicking "Save results" in cell D3. This will copy-paste the values from the current scenario sheet to a new worksheet.

3. Scenario sheets

After being generated in the Results sheet, the scenario sheet will take the name of the corresponding scenario.

We use the most recent (2017 estimates published in 2019) Global Burden of Disease (GBD) estimates produced by the Institute for Health Metrics and Evaluation to model potential excess deaths due to disruption in services from the COVID-19 response. The 2017 GBD effort classified

causes of death or disability into four levels. At level 1, there are three large cause groupings: communicable, maternal, and neonatal conditions and nutritional deficiencies; non-communicable diseases; and injuries. At level 2 there are 22 disease and injury categories. The finest level of detail in causes is provided at levels 3 (n=169) and 4 (n=293). We use level 2 (see Box 1 below for the full list), which includes 22 disease and injury categories in this model. Note that a focus on mortality (including years of life lost and health-adjusted life expectancy) results in the sense organ diseases category (e.g. blindness and vision impairment) being dropped as it does not result in any deaths.

Box 1. Level 2 GBD cause names

1. HIV/AIDS and sexually transmitted infections
2. Respiratory infections and tuberculosis
3. Enteric infections
4. Neglected tropical diseases and malaria
5. Other infectious diseases
6. Maternal and neonatal disorders
7. Nutritional deficiencies
8. Neoplasms
9. Cardiovascular diseases
10. Chronic respiratory diseases
11. Digestive diseases
12. Neurological disorders
13. Mental disorders
14. Substance use disorders
15. Diabetes and kidney diseases
16. Skin and subcutaneous diseases
17. Sense organ diseases
18. Musculoskeletal disorders
19. Other non-communicable diseases
20. Transport injuries
21. Unintentional injuries
22. Self-harm and interpersonal violence

In each scenario sheet, the user can enter estimated intensity and duration of the scenario on indirect health effects. By default, the intensity parameters are set equal to zero percent and the duration equal to 100 percent (12 months). The user can either enter these estimates for the total rows (where row 7 is transport and unintentional injuries which we expect to go down as a consequence of policies, and row 6 is all other causes which we expect to go up) or separately for each cause of mortality (rows 10-30). For example, users might select a 10 percent increase in mortality to reflect a relatively low impact, 25 percent for a medium impact, or 50 percent for a high impact. Although it is too early to know how the stringency of the policies implemented by countries affect non-COVID-19 deaths, the epidemic modeling suggests that stringency measures are positively correlated with COVID-19 deaths averted. We think it reasonable to hypothesize a positive relationship between policy stringency and excess non-COVID deaths.

Warning: As a reminder to users, we have coloured cells 7 E&F, 28 E&F and 29 E&F green to indicate evidence suggests a reduction in mortality due to injuries—but it is necessary for the user to enter a negative sign before any assumed intensity value, e.g. -50%.

In terms of duration, similarly, users can select a value across all causes or vary it by cause. Given that pandemic models such as Imperial's assume that suppression strategies will need to be maintained in some manner until vaccines or effective treatments become available to avoid the risk of later outbreaks (possibly 18 months), in the best case scenario, we suggest users always include as one scenario a duration of at least 18 months when using the Imperial estimates of COVID-19 deaths. By contrast, estimates by LSHTM and more recent WHO's AFRO only go as long at 12 months.

Warning: It is important to ensure that the calculation of non-COVID-19 deaths uses the same time frame as the estimates of COVID-19 deaths.

The tool also allows users to examine changes over time. For example, one might imagine that the disruption dissipates over time as efforts to mitigate it are put in place. Thus, users could assume that there's a 20% percent increase in mortality, gradually decreasing back to pre-COVID-19 levels over 18 months.

Of course, as and when better data become available the user can use that to improve these estimates. Until that point the user is encouraged to use informed guesstimates based on a

combination of what has been observed from previous epidemic outbreaks and natural disasters; the results of modeling studies such as this for malaria and this for maternal and child health (see Appendix 1 for a work-in-progress list of potential resources which we plan to update as and when new results are published); and local data from, for example, district health and program managers and advocacy groups.

Going back to the Results sheet, the user can see a summary view of net health benefits once indirect health effects have been generated for the two scenarios selected.

Warning: The Template sheet is a standard sheet from which other scenario sheets are generated. It must not be deleted or altered by the user.

4. COVID-19 sheet

The COVID-19 sheet shows the health effects for a range of policy scenarios in terms of number of deaths (Table 1) and YLL (Table 2). The two tables on the right-hand side of the sheet (columns I to L) allows the user to compare the different scenarios against each other by choosing a comparator scenario in column J. Other cells are updated automatically based on the information entered in the Home sheet and Results sheet.

Above, we have described the range of options for estimates of COVID-19 deaths. However, because none of the COVID-19 models we use here has estimated YLLs, once the source of the mortality estimates has been selected, we do some additional calculations to produce estimates of YLLs.

To distribute estimated COVID-19 by age category we use the data in Table 1.

Table 1. Assumed age distribution of COVID-19 deaths

	Age band in years									
Country grouping	0-9	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	> 90
LMIC	0%	0%	1%	2%	4%	13%	30%	30%	15%	5%
HIC	0%	0%	0%	1%	3%	7%	15%	25%	33%	17%

While recent headlines suggest COVID-19 is killing far more young people in LMICs, we could not find reliable data on the age of COVID-19 deaths in these countries. Therefore, until such data are available, we use data from China.

For high-income countries, we use the data reported in the spreadsheet tool developed by Andy Briggs. This tool includes data from the UK, US, Canada, Norway, and Israel. This version of the tool takes the average across these five countries and applies it to all HICs.

For each age category, the proportion of deaths from COVID-19 was then multiplied by life expectancy in years at that age, derived from the abridged GBD 2017 Life Tables, to obtain the number of YLLs.

For non-COVID-19, deaths we simply take the accompanying YLL data from the 2017 GBD; therefore no additional adjustments are necessary.

List of potential refinements

1. Currently we report point estimates, but there's a lot of uncertainty in the results. The Imperial and LSHTM estimates provide uncertainty intervals (indeed, the country reports released by LSHTM thus far only report results as the interquartile range and 95% intervals), but WHO's AFRO estimates do not report uncertainty beyond best and worst case estimates for the group of 47 countries in the region. The GBD estimates include uncertainty intervals too. We plan to use these additional data to provide uncertainty intervals for our results.
2. We plan to incorporate disability- or quality-adjust the life year. While the former is straightforward for the non-COVID health effects as we can take from the GBD outputs, it will require more discussion for the COVID health effects. It is clear from the emerging evidence that victims of COVID-19 tend to be both older and to have comorbidities (whereas excess non-COVID mortality will disproportionately affect younger age groups). The tool developed by Andy Briggs not only adjusts for age, as we do borrowing from his approach, but also adjusts for comorbidities. We will explore what's possible, with a particular focus on LMICs.
3. Currently the tool does not adjust for the timing of the non-COVID excess mortality. While COVID deaths, as well as mortality due to injuries, will be averted today, we need to be more thoughtful about the timing of the predicted non-COVID excess mortality. For example, mortality due to a lack of emergency or urgent care (e.g. maternal hemorrhage) is different from death due to a

lack of preventive measures such as rotavirus vaccination (with a lag albeit only months to no more than a few years), which is different again from death due to a lack of hepatitis b vaccination (with a lag of two to three decades). We plan to include the option to discount future deaths and years of life.

4. We will explore how to incorporate the health effects of the global recession too. And the effects on human capital in combination with school closures.
5. We will consider the merits of incorporating values of statistical lives (VSLs) or statistical life years (VSLYs). Estimates of these have recently been generated here.

Appendix 1. List of reports that have reported, or estimated the potential, health effects of COVID-19 using the GBD level 2 causes as an organizing framework

Level 1 causes	Level 2 causes	Main findings	Geographical focus
Communicable, maternal, neonatal, and nutritional diseases	HIV/AIDS and sexually transmitted infections	excess adult HIV deaths of over 500,000, around a 100% increase	SSA
	Respiratory infections and tuberculosis	three-month lockdown and a protracted 10-month restoration could lead to an additional 1.4 million TB deaths during this time between 2020-2025.	
	Enteric infections		
	Neglected tropical diseases and malaria	Malaria: excess malaria deaths could approach 400,000, a more than 100% increase	SSA
	Other infectious diseases	Immunization: benefits outweigh the risks of Covid spread during RI visits > 100:1 (up to 549:1).	All LMICs
	Maternal and neonatal disorders	Excess mortality (selection of results): 3 month low/med/high disruption: 126k child, 6k maternal/224K child, 11k maternal/578k child, 28k maternal; 6 month low/med/high disruption: 253k child, 12k maternal/447K child, 22k maternal/1.16M child, 57K maternal; 12 month low/med/high disruption: 507K child, 24K maternal/894K child, 43k maternal/2.3M child, 113K maternal	118 LMICs
	Nutritional deficiencies	number of people in acute hunger could double from 135m to 265 million	
Non-communicable diseases	Neoplasms	Delay of six months in surgery for incident cancers would mitigate 43% of life years gained by hospitalization of an equivalent volume of admissions for community acquired COVID-19. This rises to 62% when considering resource-adjusted life-years gained	UK
	Cardiovascular diseases		
	Chronic respiratory diseases		
	Digestive diseases		
	Neurological disorders		
	Mental disorders		
	Substance use disorders		
	Diabetes and kidney diseases		

	Skin and subcutaneous diseases		
	Sense organ diseases		
	Musculoskeletal disorders		
	Other non-communicable diseases		
Injuries	Transport injuries		
	Unintentional injuries		
	Self-harm and interpersonal violence	For every 3 months the lockdown continues, an additional 15 million cases of gender-based violence are expected 64% decline in murder	114 LMICs South Africa
	All causes	Data from the National Health Mission showed declines in inpatient, outpatient, and emergency care fell for all diseases, both infectious and non-communicable	India
	Elective surgery	The best estimate was that 28,404,603 operations would be cancelled or postponed during the peak 12 weeks of disruption due to COVID-19. Most would be operations for benign disease (90.2%). The overall 12-week cancellation rate would be 72.3%. Globally, 81.7% of benign surgery, 37.7% of cancer surgery, and 25.4% of elective Caesarean sections would be cancelled or postponed.	Global