

COVID-19 Essential Supplies Forecasting Tool

Frequently Asked Questions (FAQ)

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General Questions

What are the key characteristics of COVID-19-ESFT?

- The WHO COVID-19 Essential Supplies Forecasting Tool (COVID-19 ESFT) is meant to help countries forecast essential supplies for their COVID-19 response including personal protective equipment (e.g., masks and gloves), biomedical equipment for case management (e.g., ventilators and oxygen concentrators), diagnostic reagents and equipment, essential drugs for supportive care, and consumable medical supplies.
- The tool is best suited for estimating essential supply needs over a short period (12 weeks or fewer) but can be used for longer.
- COVID-19-ESFT does not quantify or account for resources already available locally or those pending delivery. When using the ESFT to inform procurement, we recommend factoring in resources already available locally and only including the additional resources required in the forecast.
- This tool is updated regularly so users should [monitor the website](#) for the latest release version.

Is COVID-19-ESFT an epidemiologic model?

- COVID-19-ESFT is not meant to be used as an epidemiological model. Overall patient numbers are used primarily for forecasting bulk essential supply needs. In the absence of a dedicated epidemiologic model that can provide case forecasts, the tool has simple exponential growth and Susceptible-Infectious-Removed (SIR) case forecast options built-in.
- Inputs such as doubling rates, clinical attack rates, contact rates and reproduction number are based on available information shared by experts and academic groups, generalized to fit ongoing trends in global disease burden.

What is the basis of the assumptions used in COVID-19-ESFT?

- Assumptions for the volume of patient testing, equipment use, staffing needs, infrastructure required, and oxygen demand have been informed by clinical guidance, current practice, and international standards.
- In some instances, publicly available World Bank or WHO reference datasets are used for the input of estimates.
- Users have the ability to change many assumptions and inputs to fit their own particular context.
- Assumptions are subject to change as new data are presented.

FEATURED ESFT v2.0 UPDATES

- ✓ **Visibility of tool is improved** by grouping together key assumptions within a dedicated Input tab.
- ✓ **Option to edit key assumptions** for improved ability to tailor the tool to local settings including modification of inputs related to patient and case severity, healthcare workers and staff, infrastructure, labs and testing, and oxygen and equipment use.
- ✓ **Further alignment** with WHO tools such as incorporation of the SIR approach to estimating patient numbers as seen within the Adaptt Surge calculator.
- ✓ **Improved User Dashboard** that provides improved graphs and visualizations for better understanding and interpretation of quantification results.

Featured ESFT v3.0 Updates

- ✓ Users can specify the percent of critical patients receiving invasive mechanical ventilation and those receiving non-invasive ventilation. More detailed oxygen breakouts are visible on the 'User Dashboard'
- ✓ A new tab has been added ('Commodities by Week') that breaks out the total commodity need into the need required each week to assist with more granular supply planning
- ✓ Four blank and unlocked tabs have been added for users to manipulate as needed

Getting Started

How can I get started with this tool?

- Download the tool [here](#) or [here](#) (same tool, both links updated at the same time).
- Review this document for a brief overview of the tool's functionality, limitations and user guidance.
- Open the model and go to the **Disclaimer** tab. Please read and select "I understand" from the menu before proceeding. The tool will not function if this is left unchecked.
- Read the **Tool Overview** tab become familiar with the model's layout and capabilities.

What are the key tabs I need to interact with to correctly use the tool?

- The **Inputs** tab contains a wide range of assumptions that will drive the model's formulas.
- The **User Dashboard** tab is set-up to estimate the upcoming COVID-19 infections, determine the forecast period, and select the testing strategy to be modelled. Scroll down to review the high-level outputs in visualizations and see the detailed results tables.
- Refer to the **Equipment List & Usage** tab for equipment use assumptions, unit cost pricing, and the drug and consumables lists.

What do I need in order to use this tool to forecast essential supplies for my needs?

- We suggest that users collaborate with key experts referencing up-to-date sources in order to populate inputs in the model. In particular, related to –
 - **Infections and growth rate** – information on the projected growth of the epidemic, ideally from available epidemiological models tailored to an individual country's context.
 - **Personal protective equipment (PPE)** – information on daily PPE usage by patients and the staff with whom COVID-19 patients are in contact.
 - **Laboratory tests** – information on the types and quantity of platforms available for running COVID-19 tests, their operating hours, and capacity available for COVID-19 testing.
 - **Biomedical equipment** – information about availability of power, oxygen and the ability to intubate and support the use of biomedical equipment for COVID-19 clinical management.
 - **Health workforce** – information on the number of health workers and staff available to respond to COVID-19, both to provide inpatient care, screening and triage, conduct laboratory tests, maintain the biomedical equipment, transport patients in emergency vehicles and provide cleaning services.
 - **Bed availability** – information on the number of beds available for severe and critical care patients.

Inputs Tab

How can I model the COVID-19 essential supplies needs for a specific population?

- If the user is looking to model needs at a country level, select the country name from the drop down menu. The estimated 2020 population will appear listed in grey.
- Countries are listed with the names as reported in World Bank datasets.
- To model needs at a sub-national level or for a specific sub-group or population, toggle the 'Manual Entry' radio button and then enter the population of choice in the cell appearing below.

There are many editable health system inputs, how do they work and what if I do not know what to enter?

- A user can choose to either automatically use all default reference values by check marking the box for the user to use default values or to manually enter the values.
- All parameters pertaining to patients and case severity, healthcare workers and staff, hospital infrastructure, labs and testing, and oxygen use are available for user editing.

What are the contents within the Patient and Case Severity section?

- The user can choose to define the distribution of patient case severity by entering the proportions of mild, moderate, severe and critical patients. The proportion of critical cases will always be auto-calculated for the sum total to equal 100%.
- The user can define the length of stay by case severity as entered in the number of weeks. Mild and moderate cases are considered home-based isolation while severe and critical are assumed to be hospitalized.
- Case fatality rates are used for the purpose of calculating the number of active cases (i.e., not recovered or deceased).

How should I make use of the inputs under the Health Care Workers and Staff section?

- Among those staff providing care to COVID-19 patients, the proportion that are providing care to inpatients and the proportion conducting screening and triage will serve as important determinants for supply quantification.
- The tool provides default estimates of health care workers (HCWs) based on WHO and World Bank databases. The user inputs the proportion of HCWs not allocated to COVID-19, and the proportion that is available for inpatient care and for screening/triage of suspected cases.
- PPE and hygiene items such as soap and hand sanitizer is forecasted based on the number of HCWs, biomedical engineers, informal caregivers, cleaners, ambulance personnel and lab technicians available in the country and in contact with COVID-19 patients.
- The “HCWs Needed Each Week” graph on the **User Dashboard** illustrates the number of HCWs for inpatient and screening/triage needed each week. The curve flattens when the available number of HCWs in the country is reached.
- The **HCW & Staff** tab presents numbers in tabular form over the forecasted weeks of HCW needed each week by setting and patient type.

What is the importance of the Hospital Infrastructure section?

- Bed availability is estimated based on number of reported beds per capita in each country using a World Bank reference dataset or can be manually entered.
- Availability of beds for inpatient COVID-19 care is based on additional inputs assuming the proportion of beds for severe and critical patients, respectively.
- Biomedical equipment is estimated based on the number of beds needed and available to provide inpatient care to severe and critical patients.
- The user is able to enter specific details in the **Equipment List & Usage** tab about the quantity of items needed per patient or per bed (depending on the item) and whether it is shared among patients/beds or for their exclusive use.
- The **User Dashboard** contains a graph with Total Inpatient Admissions over the forecast period constrained by bed availability as well as a graph that illustrates the weekly number of inpatient beds filled by severe and critical patients. This graph illustrates how inpatients are capped by the number of available beds. If a patient is not able to be admitted, the biomedical equipment for case management is not forecasted. Under this graph there is a key highlighting the week that the bed cap is reached for severe and critical patients.

How does a user forecast tests for COVID-19?

- The Max Tests per Day Module on the **Inputs** tab assists in estimating the maximum tests per day that can be run based on existing capacity in the country. Editable assumptions include existing lab infrastructure, the operating hours, the number of days per week the system is operational, and the % capacity dedicated to COVID-19 testing.
- The Max Tests per Day Module considers high-throughput conventional platforms, near-patient PCR machines, and manual real-time PCR platforms.
- Users can override the calculated max testing capacity per day by entering any value into the ‘User Input Maximum # Tests per Day’.
- A graph on the **User Dashboard** illustrates the total testing volume over the forecasting period, capped by testing capacity. Another graph illustrated the total testing volume if there were unlimited testing capacity. Results are broken down by the number tested who were suspected but negative, diagnosed mild/moderate, diagnosed severe/critical, or were tested upon hospital discharge to confirm recovery.
- The **Equipment List & Usage** tab includes a diagnostics section with an itemized list and estimated prices.
- The **Patients** tab includes a table with testing details by patient type by week.

How does a user estimate the oxygen needs for COVID-19 case management?

- The *Oxygen Use* section of the **Inputs** tab allows the user to specify the O₂ Flow rate per Bed in liters per minute (LPM). Severe patients are assumed to require 5-15 LPM (with 10 selected as the reference value). Critical patients are assumed to need 30 LPM (this is editable by the user), and users are able to specify the percentage of critical patients who need invasive mechanical ventilation and those who need non-invasive mechanical ventilation.
- The **Equipment List & Usage** tab provides a list of biomedical equipment, accessories and consumables for case management in the following categories: monitoring, oxygen therapy, airway management and intubation, mechanical ventilation, non-invasive ventilation, IV infusion, blood chemistry, imaging, ICU, and oxygen delivery devices.
- Some items require user input to specify the appropriate equipment based on the country context. For example, the power source might be primarily through a concentrator, cylinder, or pipe supply. The user will select the most appropriate and input the corresponding price into the equipment table.
- The **User Dashboard** high-level results table includes the estimate of oxygen need (m³ per day) at max capacity for the overall forecast.

How does a user estimate the necessary drugs and consumables for patient case management?

- A detailed list of drugs needed for managing COVID-19 patients is available in the **Equipment List & Usage** tab, including cold chain-dependent and controlled drugs.
- A list of consumable medical supplies that would be packaged together for the full care of 40 severe/critical patients is available in the **Equipment List & Usage** tab below the drugs table; it includes an itemized list of 30 consumable products needed for patient care such as IV catheters, syringes and safety boxes. These are estimated as the quantity required to manage 40 severe/critical patients.

User Dashboard

How do I estimate the expected number of cases per week?

The *Define Infections and Growth Rate* section of the User Dashboard allows the user to input basic epidemiological parameters to forecast infections over a specified length of time. The user selects the cumulative case estimation method and attack rate.

What is the preferred Cumulative Case Estimation Method?

COVID-19-EFST is not an epidemiologic model. There are built-in case estimation methods that can be used in the absence of a dedicated epidemiologic model, but a contextualized, sophisticated epidemiologic model is preferential. Forecasted weekly cumulative case estimates from an epidemiologic model can be entered by selecting the 'Manual Entry' option.

Exponential Growth

- Exponential growth is an automated way to calculate the number of cases over time based on two elements, disease doubling times and clinical attack rates, informed by current trends shared by experts and academic groups:
 - *Doubling time*: the estimated number of days it takes for the number of cases to double. This will essentially serve as a basic way to model the speed at which the epidemic growth curve develops over time.
 - *Clinical attack rate*: the proportion of the population estimated to contract the disease and present with clinical symptoms. This will essentially serve as an upper limit to the total number of cases possible within a population.
- Exponential growth may be best suited for estimating short forecast periods, of about six weeks or less, in the early stages of an outbreak. For longer forecast periods or more established outbreaks, cases would not be expected to continue to increase exponentially.

SIR Model

- The Susceptible-Infectious-Removed (SIR) model is a basic compartmental model commonly used in infectious disease epidemiology. The population is divided into three compartments, Susceptible, Infectious, and Removed, and transmission parameters are specified to define the rate at which persons move between stages. The SIR model here has a simple deterministic structure, with transmission parameters specified either by the reference values provided (*hover over reference cells to view citations*) or those entered by the user.
- Parameter inputs have been informed by consultation with expert groups, peer-reviewed literature, and reference databases. Key parameter inputs include the following:
 - *Infectious period*: the average number of days during which an infected person is likely to transmit the virus to susceptible persons. Modifications to this parameter may have a large impact on the forecasted epidemiologic curve. It is advisable to consult an infectious disease epidemiologist to appropriately set this parameter.
 - *Current cumulative cases no longer infectious (Recovered or Dead Cases)*: the total number of cases no longer infectious is used to estimate the initial number of infectious cases in the SIR model by subtracting those no longer infectious from the total cumulative cases. If unknown, the cumulative case count one infectious period prior to today can be used.
 - *Current contacts per person per day*: the average number of other people that one person encounters per day. Country-specific reference values are provided based on a study that operationally defined a contact as either physical contact or a nonphysical contact.
 - *Probability of infection per contact*: the average likelihood or risk that a susceptible becomes infected when contacting an infectious person.
 - *Reproduction number*: the average number of secondary cases generated from a single infected case. For the initial stage of the SIR, the basic reproduction number is estimated to be 2.35.
 - The transmission parameters are related via the following formula. Thus, specifying any three of the parameters will allow the fourth to be calculated.
 - $\text{Reproduction number} = (\text{Infectious period}) * (\text{Contacts per person per day}) * (\text{Probability of infection per contact})$.
- Users can choose to alter SIR parameters over time for up to five different time-dependent periods, or 'stages'. Each stage is defined by its start date and either anticipated reproduction number or contacts per person per day.
- After selecting input values for the transmission parameters, the SIR model details can be viewed in the 'SIR Model Patient Calcs' tab, although no additional input is needed here.

Manual Entry

- User-defined patient numbers can be entered into the tool via the manual entry selection.
- If the user has access to an epidemiological model that projects cumulative patient case load over time, they are encouraged to manually input those predicted weekly cases within the ESFT.
- Once "Manual Entry" is selected in the Cumulative Case Estimation Method dropdown menu, the user should click the "Jump to Manual Case Estimation" link that appears and enter the weekly predicted cumulative case load estimates on the **Patient Calcs** tab.

How do the inputs for determining the forecast period work?

- These inputs are found under ‘Determine Forecast Period’ in the **User Dashboard** tab.
- ‘Number of weeks to forecast equipment for’ allow users to enter the total number of weeks the tool is quantifying supply needs over. A user is informed of the maximum forecast period, based on modelled case load scenario, in this prompt, and selects several weeks that falls within the forecast period. The first week corresponds to one week from the day the forecast is generated.
- “Delivery lead time until shipments received” allows users to enter a lag time of up to one week in order to account for any delay of shipment to the country destination.

What should I choose as the testing strategy option?

- There are two available testing strategy options including “All Suspected Cases” and “Targeted”.
- *All Suspected Cases*: this testing strategy assumes that tests will be administered to all presenting suspected cases. Based on guidance, the default assumption is that for every positive COVID-19 case detected there will be 10 negative tests, but this is an editable assumption.
- *Targeted*: this testing strategy assumes that all suspected cases will be tested until 1,000 cumulative cases are reached. From this point forward, tests are only provided for the proportion of cases classified as severe and critical, plus an additional user-defined buffer on top to allow testing of vulnerable populations at-risk.
- For more information on testing strategy, please refer to the [WHO Laboratory testing strategy recommendations](#).

What is the Testing Algorithm and how do I use it?

- Users can modify the testing algorithm implemented within their region or country of choice to model the context as applicable.
- Test parameters are editable by changing the number of tests administered by patient type and testing point
 - *For diagnosis*: refers to use of laboratory tests to diagnose patients
 - *For release*: refers to use of laboratory tests to confirm a negative result

Where do I find the high-level results of the forecast?

- Visualizations on case load over time, inpatient cases over time, health workers over time by setting, lab tests, and forecast supply costs are visible under the inputs on the **User Dashboard** tab.
- A high-level summary of the forecasted results is available underneath the visualizations.
- Weekly breakdowns of health workforce and patient loads are available underneath the high-level results.

Where do I find the full quantification of supplies that COVID-19-ESFT estimates?

- The full supply forecast is available in a table underneath the weekly breakdowns of health workforce on the **User Dashboard** tab.
- Within the table, various supplies are quantified for personal protective equipment, diagnostics, hygiene, drugs and consumables, and biomedical equipment.

Where did the \$USD cost values come from and can I modify the line item costs?

- Each line item in the detailed equipment quantification has an estimated cost listed in \$USD.
- These costs are price estimates that were available to WHO at the time the tool was designed and should be considered as reference prices subject to change due to market volatility.
- Any price may be modified as needed by the user in the **Equipment List & Usage** tab column H next to the item, should users decide more accurate pricing information is available or if costs have changed over time.

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