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MODELLING ESTIMATES FOR BERMUDA USING COVID-SIM

ABOUT COVID-SIM

- A planning tool for those who are concerned about the spread of the new coronavirus SARS-CoV-2 which causes the disease called COVID-19
- NOT a tool to predict the exact course of the pandemic within a country
- A deterministic SEIR model [Susceptible, Exposed, Infected, Recovered/Removed]
    - Based on differential equations
    - Results/output must be understood as **average** values
- The results, when using same or similar parameters and considering differences in model structure, are comparable.

- Freely available online with a dashboard display to facilitate user interaction (http://covidsim.eu [Version 1.1])
- Input parameters used in the model are based on available publications and best estimates used in the modelling work on COVID-19 to date but can be adapted to explore various scenarios.
    - *For Bermuda:*
        - *Worst Case Scenario: R of 2.4*
        - *Better Case Scenario: R of 2.4 with Interventions*
    - *Parameters provided within presentation*
    - *Equations available at: http://version-1.1.covidsim.eu/assets/Model_description_Version_1.1.pdf*

SUMMARY OF ESTIMATES

	Worst Case Scenario	Better Case (Intervention) Scenario
Infections	56224	3577
Hospitalizations	1658	101
ICU Admissions	414	25
Deaths	264	15

PARAMETERS

Adapted from: Modelling the Potential Health Impact of the COVID-19 Pandemic on a Hypothetical European Country *[See CovidSIM Help]* and PAHO (Pan-American Health Organization) Guidance

Population	Value(s) used	Further details
Population size	0.064 million	Based on Bermuda Population Projections, Department of Statistics
Initial infections	8	# of confirmed cases with samples obtained during the first week of known introduction of COVID-19 in Bermuda
Infections from outside the population per day	0	Default value/Not modeled– can be adjusted for future estimates/forecasts as more data becomes available

Durations	Value(s) used	Further details
Simulation duration	365 days	1 year
Latency period	4 days	Default value - Determines the average duration of the latency period. This is the initial period of an infection during which the infected individual is not likely to spread the infection to others.
Prodromal period	1 day	Default value - Determines the average duration of the period which immediately follows the latency period. During this period, some patients may show mild and untypical symptoms. It is assumed that infected individuals can spread the virus to others during the prodromal period.
Early infective period	5 days	Default value - Determines the period which follows the prodromal period. This is typically the period during which clear symptoms occur and during which cases infect others, [the same duration for the infectiousness is used for individuals who do not develop symptoms] At the end of this period, individuals will move to the late infectious period.
Late infective period	5 days	Default value - Determines the period which follows the early infective period. This is typically the period during which individuals are less infective as they recover from the disease.
Hospitalization	14 days	Recommended by PAHO – length of stay in hospital
ICU admission	21 days	Recommended by PAHO – length of stay in intensive care
Number of Erlang stages	16	Default value - Determines the variability of the duration of the course of disease periods (assuming an Erlang distribution). Using 16 stages, the standard deviation of the symptomatic period is 25% of its mean duration.

Severity	Value(s) used	Further details
Infections which will lead to sickness	67%	This figure is still uncertain – used the same estimate as per modelling by Imperial College London [ICL] at "two thirds of cases being sufficiently symptomatic to self-isolate"
Sick patients seek medical help (including telephone and internet consultations)	50%	Recommended by PAHO and based on medical consultations for influenza-like illness (ILI). During a pandemic there might be a shift away from face-to-face consultations with health workers, so that some of these consultations may be either telephone or internet-based. This parameter is not used for determining subsequent outcomes like hospitalizations and deaths. Assumed that cases only seek medical help once.
Sick patients are hospitalized	4.4%	Estimate [ICL] - Determines the percentage of sick cases who are hospitalized. *(range of 3%-5%)*
Hospitalized cases need intensive care (ICU admission)	25%	Estimate - Determines the percentage of hospitalized cases who will be admitted to an intensive care unit (ICU).
Sick patients die from the disease	0.7%	Recommended by PAHO - Determines the percentage of sick cases who die from the disease. *(range of 0.3%-1%)*

Contagiousness *The contagiousness during the symptomatic period (which is between the prodromal period and the late infective period) is basically calculated from the basic reproduction number and from the average duration of the symptomatic period (estimated at 10 days). This contagiousness is then used as the 100% reference to calculate the contagiousness during the prodromal period and late infective period*	Value(s) used	Further details
Annual average of the reproductive number	2.4	2.4 as recommended to monitor for Worst Case Scenario
Amplitude of the seasonal fluctuation of the reproductive number	0	Default value/Not modeled – high level of uncertainty, unknown seasonality effect
Day when the seasonal reproductive number reaches its maximum	0	Default value/Not modeled – high level of uncertainty, unknown seasonality effect
Relative contagiousness in the prodromal period	50%	Default value - Determines how contagious cases are during their prodromal period. A value of 50% is used here estimating that that individuals in their prodromal period are only half as contagious as in symptomatic period. This has biological plausibility as while there is similarity in viral loads between asymptomatic and symptomatic COVID-19 patients, it would be expected that those who are fully symptomatic (with a cough etc.) would be more likely to transmit infection
Relative contagiousness in the late infective period	50%	Default value - Determines how contagious cases are during their late infective period. A value of 50% is used here estimating that individuals in their late infective period are only half as contagious as in their symptomatic period.

Detection ***Detection of COVID-19 in an apparently free population by random SARS-CoV-2 tests in patients with Influenza-Like Illness (ILI)***	Value(s) used	Further details
Detection in ILI patients who seek medical help	0	Default value/Not modeled– can be adjusted for future estimates/forecasts
Detection in hospitalized ILI	0	Default value/Not modeled– can be adjusted for future estimates/forecasts
Detection in patients who died from ILI	0	Default value/Not modeled– can be adjusted for future estimates/forecasts

Case Isolation	Value(s) used	Further details
Probability that a sick patient is isolated	50%	Recommended by PAHO
Maximum capacity of isolation wards	9 per 10,000	Estimate - Determines how many cases can be isolated in a population. Only sick cases who seek medical help can be isolated in this simulation/model. For the time during which this intervention is switched on, severe cases are immediately isolated when they show symptoms (i.e. at the end of their prodromal period and the beginning of their symptomatic period). They will be isolated until the end of their symptomatic period. Isolated cases are completely prevented from spreading the infection. Please note that these are rather optimistic assumptions; in reality, isolation may frequently occur at a later stage of the infection, and cases will occupy the isolation units much longer than their infective period. If the number of sick cases exceeds the isolation capacity which is determined by this parameter, the surplus number of them cannot be isolated, but will be sent into home isolation.
Contact reduction for cases in the home isolation	75%	Recommended by PAHO
Begin of case isolation measures (day)	1	Policy of all cases to isolate upon symptom onset
Duration of case isolation measures (days)	365	Equal to the length of the simulation/model - Determines how long the isolation measures are performed, not how long a single case is isolated. Cases are always isolated until the end of their symptomatic period.

General Contact Reduction	Value(s) used	Further details
General contact reduction	33%	Suggested value of between modest and intensified level of measures being adopted - Determines what percentage of contacts are prevented in the general population. This summarizes a wide variety of different interventions: social/physical distancing; personal hygiene measures (hand washing etc.) and wearing of face masks to effectively reduce their contacts; school closures and restrictions on mass gatherings and travel may be restricted within and between countries
Contact reduction begins (day)	1	Assumes contact reduction ongoing
Contact reduction duration (days)	365	Equal to the length of the simulation/model - Determines how long the contact reduction lasts