Table 1. Transmission model parameters

	Units	Default value	Range examined in sensitivity analyses (uniform distribution)	Reference and Notes
Epidemiological				
Population size of Greater Toronto Area	Number	6,196,731	N/A	Projected estimate from 2016 census (1, 2) and a 1% annual change as per the United Nations Urbanization Prospects (3), and using the Census Metropolitan Area of Toronto (4).
R_0	Number	2.4	1.4-3.0	Range of estimates from modeling studies of outbreaks within and outside China, and on the diamond princess cruise ship (5-9). The lower bound was based on the lower bound estimate of R_0 from the WHO report of outbreaks in China (10). Systematic review and meta-analysis of studies of R_0 suggest that R_0 estimates have stablied in the range of 2-3 in more recent studies (11). Our default estimate of 2.4 was consistent with the assumption used in other modeling studies (12).
Incubation period	Days	5.2	3-9	Pooled analysis of 181 confirmed cases with identifiable exposure and symptom onset estimated an median incubation of 5.2 days.(13) We further extracted point (mean or median) estimates of incubation period from a list identified of studies in China and Singapore to inform the range estimates (5, 14-23)
Duration of latent infection	Days	2	1-3	Assumption based on the relatively short incubation period (5.2 days) and serial interval (4.4 days) of COVID-19; other models have used latent period of 3 days (24)
Duration of subclinical infectiousness	Days	3	2-6	Calculated based on the incubation period and the assumption on the duration of latent infection.
Duration of symptomatic infectiousness	Days	7	5-10	Based on duration of upper respiratory tract viral shedding among individuals with symptoms (25)

Serial interval	Days	NA	3.1-7.5	(5, 23, 26, 27). No default estimate was used, as serial interval was not used as an input parameter; only the range estimates were used for internal parameter validation (detailed in the Methods section).
Initial seeding	% of total population	0.0032%	0.0011-0.0048%	Assumption
Clinical				
Proportion diagnosed with COVID-19 who required hospitalization	%	10	6-20	As of March 23rd, 10% of confirmed cases in Canada were hospitalized (28) Data on 55,924 confirmed cases in China suggested that 19.9% of confirmed cases were severe including 6.1% in critical conditions (19). We therefore assumed that a range of 6%-20% of detected cases would require hospitalization in GTA. Indeed, the Toronto Public Health has reported 18 (6.4%) hospitalized cases out of 280 confirmed cases of COVID-19 as of March 24th (29).
Proportion infected with COVID-19 who were diagnosed	%	NA	41-69	Proportion infected who were diagnosed was not directly used as an input parameter; but indirectly – to calculate the proportion infected who required hospitalization (detailed below). Analyses on data from China as well as on Japan citizens returning from the repatriation flights revealed that 31%-59% of infected cases may not be detected due to asymptomatic infections or mild symptoms (30-32). We therefore assumed a default estimate of 55% (midpoint of the range) for proportion of infected cases that were detected.
Proportion infected with COVID-19 who required hospitalization	%	5.5	2.4-14	We calculated the proportion of infected individuals who require hospitalization using the proportion of detected cases which require hospitalization, and multiply by the proportion of infected cases which may be detected.
Proportion hospitalized who require ICU care	%	33	30-52	As of March 25th, 33% of hospitalized cases in the Toronto Public Health Unit required ICU (29). Similarly, as of March 23rd, 40% of hospitalized cases in Canada required ICU care (28). Based on data of 55,924 confirmed cases in China, cases with critical conditions and thus may require ICU care comprise 30% of confirmed cases with severe or critical

				conditions (19). Of 1590 hospitalized patients across 575 hospitals in China, 254 were of severe conditions, of whom 52% required ICU care or invasive ventilation (15). We did not estimate proportion of ICU patients among all hospitalized patients in China as many patients were hospitalized for isolation purpose only rather than due to disease severity in the settings of China.
Duration of hospital stay	days	12	10-13	Among 1032 hospitalized patients who did not require ICU care acoss 552 hospitals in China, their median length of hospital stay at the end of study follow-up was 12 (IQR: 10-13) days (16). This estimate was consistent with the estimates on length of hospital stay among discharged COVID patients (regardless of ICU stay) in China and Europe (14, 16, 17, 33-35).(refs)
Duration of ICU stay	days	8	5-13	There is limited data on length of ICU stay prior to transfer to to the medicine ward for post-ICU recovery. Of 23 ICU patients in Wuhan, who have been discharged to the medicine ward from the ICU, their median length of stay in ICU was 8 (IQR: 5-13) days (36).
Case-fatality proportion among those in ICU care	%	38%	17-62	Of 1590 hospitalized patients across 575 hospitals in China, 131 patients required ICU care or invasive ventilation, of whom 50 (38%) died (15). We also extracted estimates from several studies in China and in Europe regarding the crude mortality among ICU patients which ranged from 17-62% (16, 19, 34, 35, 37-40).
Case-fatality proportion among those diagnosed	%	NA	0.8-4.24	No default estimate was used, as case-fatality proportion among diagnosed was not used as an input parameter; only the range estimates were used for internal parameter validation (detailed in the Methods section). Our estimates of the case-fatality proportion among those diagnosed were informed by a range of evidence as shown below, taken into consideration of the uncertainty and heterogeneity in the estimates by geographic location and age:

				As of March 23rd, 2091 cases were reported in Canada with 23 death, indicating a crude case fatality of 1.1% (28). Using crude age-specific case-fatality among all confirmed cases in China (41), and adjusted for the age distribution of confirmed cases in Canada as of March 23rd (28), we obtained an overall crude case fatality of 2.5% in Canada. Estimates of case-fatality rate amomg confirmed cases after adjusting for time-lag to death ranged from 0.8% in China excluding Hubei province, 3.48% in China overall, and 4.24% in other countries and regions (42). Analyses using data of cases on Diamond Prince ship estimated an infection fatality rate of 0.5% and case fatality rate of 1.1% after adjusting for time lag to death, and standardizing the age to approximate the age distribution among confirmed cases in China (43).

Abbreviations: ICU: intensive care unit; NA: not applicable.

References

1. Statistics Canada. Census profile, 2016 census - Toronto [Census metropolitan area], Ontario and Ontario [Province] 2020 [Available from: https://www12.statcan.gc.ca/census-recensement/2016/dp-pd/prof/details/page.cfm?Lang=E&Geo1=CMACA&Code1=535&Geo2=PR&Code2=35&Data=Count&SearchText=Toronto&SearchType=Begins&SearchPR=01&TABID=1&B1=All.
2. World Population Review. Toronto population 2020 2020 [Available from: https://worldpopulationreview.com/world-cities/toronto-population/.
3. United Nations DoEaSA, Population Division,. World urbanization prospects 2018: highlights. 2019.
4. Statistics Canada. Census metropolitan area of Toronto, Ontario 2020 [Available from: https://www12.statcan.gc.ca/census-recensement/2011/as-sa/fogs-spg/Facts-cma-eng.cfm?LANG=Eng&GK=CMA&GC=535.
5. Li Q, Guan X, Wu P, Wang X, Zhou L, Tong Y, et al. Early transmission dynamics in Wuhan, China, of novel coronavirus-infected pneumonia. The New England journal of medicine. 2020.
6. Zhang S, Diao MY, Yu W, Pei L, Lin Z, chen D. Estimation of the reproductive number of novel coronavirus (COVID-19) and the probable outbreak size on the Diamond Princess cruise ship: a data-driven analysis. International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases. 2020;93(April):201-4.
7. Jung SM, Akhmetzhanov AR, Hayashi K, Linton NM, Yang Y, Yuan B, et al. Real-time estimation of the risk of death from novel coronavirus (COVID-19) infection: inference using exported cases. Journal of clinical medicine. 2020;9:523.
8. Zhao S, Cao P, Gao D, Zhuang Z, Chong MKC, Cai Y, et al. Epidemic growth and reproduction number for the novel coronavirus disease (COVID-19) outbreak on the Diamond Princess cruise ship from January 20 to February 19, 2020: a preliminary data-driven analysis. Social Science Research Network preprint. 2020.
9. Shen M, Peng Z, Xiao Y, Zhang L. Modelling the epidemic trend of the 2019 novel coronavirus outbreak in China. bioRxiv. 2020.
10. Statement on the meeting of the International Health Regulations (2005) Emergency Committee regarding the outbreak of novel coronavirus (2019-nCoV) [press release]. Geneva, Switzerland, Jan 23, 2020 2020.
11. Liu Y, Gayle AA, Wilder-Smith A, Rocklöv J. The reproductive number of COVID-19 is higher compared to SARS coronavirus. J Travel Med. 2020;27(2):taaa021.
12. Ferguson NM, Laydon D, Nedjati-Gilani G, Imai N, Ainslie K, Baguelin M, et al. Impact of non-pharmaceutical interventions (NPIs) to reduce COVID19 mortality and healthcare demand. 2020.
13. Lauer SA, Grantz KH, Bi Q, Jones FK, Zheng Q, Meredith HR, et al. The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application. Annals of internal medicine. 2020.
14. Fan Z, Chen L, Li J, Tian C, Zhang Y, Huang S, et al. Clinical features of COVID-19-related liver damage. medRxiv. 2020.
15. Guan WJ, Liang WH, Zhao Y, Liang HR, Chen ZS, Li YM, et al. Comorbidity and its impact on 1,590 patients with COVID-19 in China: a nationwide analysis. medRxiv. 2020.
16. Guan WJ, Ni ZY, Hu Y, Liang WH, Ou CQ, He JX, et al. Clinical characteristics of coronavirus disease 2019 in China. The New England journal of medicine. 2020.

17. Liu L, Gao JY, Hu WM, Zhang XX, Guo L, Liu CQ, et al. Clinical characteristics of 51 patients discharged from hospital with COVID-19 in Chongqing, China. medRxiv. 2020.
18. Tian S, Hu N, Lou J, Chen K, Kang X, Xiang Z, et al. Characteristics of COVID-19 infection in Beijing. The Journal of infection. 2020.
19. World Health Organization. Report of the WHO-China joint mission on coronavirus disease 2019 (COVID-19). 2020.
20. Xu XW, Wu XX, Jiang XG, Xu KJ, Ying LJ, Ma CL, et al. Clinical findings in a group of patients infected with the 2019 novel coronavirus (SARS-Cov-2) outside of Wuhan, China: retrospective case series. BMJ (Clinical research ed). 2020;368:m606.
21. You C, Deng Y, Hu WM, Sun J, Lin Q, Zhou F, et al. Estimation of the time-varying reproduction number of COVID-19 outbreak in China. medRxiv. 2020.
22. Backer JA, Klinkenberg D, Wallinga J. Incubation period of 2019 novel coronavirus (2019-nCoV) infections among travellers from Wuhan, China, 20-28 January 2020. Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin. 2020;25(5).
23. Tindale LC, Coombe M, Stockdale JE, Garlock ES, Lau WYV, Saraswat M, et al. Transmission interval estimates suggest pre-symptomatic spread of COVID-19. medRxiv. 2020.
24. Lin Q, Zhao S, Gao D, Lou Y, Yang S, Musa SS, et al. A conceptual model for the coronavirus disease 2019 (COVID-19) outbreak in Wuhan, China with individual reaction and governmental action. International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases. 2020;93:211-6.
25. Wolfel R, Corman VM, Guggemos W, Seilmaier M, Zange S, Muller MA, et al. Virological assessment of hospitalized cases of coronavirus disease 2019. medRxiv. 2020.
26. Nishiura H, Linton NM, Akhmetzhanov AR. Serial interval of novel coronavirus (COVID-19) infections. International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases. 2020.
27. Zhao S, Gao D, Zhuang Z, Chong MKC, Cai Y, Ran J, et al. Estimating the serial interval of 1 the novel coronavirus disease 2 (COVID-19): a statistical analysis using the public data in Hong Kong

3 from January 16 to February 15, 2020. medRxiv. 2020.
28. Government of Canada. Coronavirus disease (COVID-19): outbreak update 2020 [Available from: https://www.canada.ca/en/public-health/services/diseases/2019-novel-coronavirus-infection.html.
29. City of Toronto. COVID-19 2020 [Available from: https://www.toronto.ca/home/covid-19/.
30. Qiu J. Covert coronavirus infections could be seeding new outbreaks: Nature; 2020 [Available from: https://www.nature.com/articles/d41586-020-00822-x.
31. Nishiura H, Kobayashi T, Suzuki A, Jung SM, Hayashi K, Kinoshita R, et al. Estimation of the asymptomatic ratio of novel coronavirus infections (COVID-19). International journal of infectious diseases : IJID : official publication of the International Society for Infectious Diseases. 2020.
32. Wang C, Liu L, Hao X, Guo H, Wang Q, Huang J, et al. Evolving epidemiology and impact of non-pharmaceutical interventions on the outbreak of coronavirus disease 2019 in Wuhan, China. medRxiv. 2020.

33. Xiao K, Huang M, Zhan F, Wang J, Yi Q, Zhu F, et al. Epidemiological and clinical features of 197 patients infected with 2019 novel coronavirus in Chongqing, China:a single center descriptive study. The Lancet Microbe Preprint. 2020.
34. Wang D, Hu B, Hu C, Zhu F, Liu X, Zhang J, et al. Clinical characteristics of 138 hospitalized patients with 2019 novel coronavirus-infected pneumonia in Wuhan, China. Jama. 2020.
35. Spiteri G, Fielding J, Diercke M, Campese C, Enouf V, Gaymard A, et al. First cases of coronavirus disease 2019 (COVID-19) in the WHO European Region, 24 January to 21 February 2020. Euro surveillance : bulletin Europeen sur les maladies transmissibles = European communicable disease bulletin. 2020;25(9).
36. Zhang GQ, Hu C, Luo LJ, Fang F, Chen YF, Li JG, et al. Clinical features and treatment of 221 patients with COVID-19 in Wuhan, China. Lancet Infect Dis Preprint. 2020.
37. Yang X, Yu Y, Xu J, Shu H, Xia J, Liu H, et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. The Lancet Respiratory medicine. 2020.
38. Wu Z, McGoogan JM. Characteristics of and important lessons from the coronavirus disease 2019 (COVID-19) outbreak in China: summary of a report of 72 314 cases from the Chinese Center for Disease Control and Prevention. Jama. 2020.
39. Huang C, Wang Y, Li X, Ren L, Zhao J, Hu Y, et al. Clinical features of patients infected with 2019 novel coronavirus in Wuhan, China. Lancet (London, England). 2020;395(10223):497-506.
40. Zhou W, Liu Y, Tian D, Wang C, Wang S, Cheng J, et al. Potential benefits of precise corticosteroids therapy for severe 2019-nCoV pneumonia. Signal transduction and targeted therapy. 2020;5:18.
41. Worldometer. Age, sex, existing conditions of COVID-19 cases and deaths 2020 [updated Feb 29, 2020. Available from: https://www.worldometers.info/coronavirus/coronavirus-age-sex-demographics/.
42. Wilson N, Kvalsvig A, Barnard LT, Baker MG. Case-fatality risk estimates for COVID-19 calculated by using a lag time for fatality. Emerg Infect Dis. 2020.
43. Russell TW, Hellewell J, Jarvis C, van Zandvoort K, Abbott S, Ratnayake R, et al. Estimating the infection and case fatality ratio for COVID-19 using age-adjusted data from the outbreak on the Diamond Princess cruise ship. medRxiv. 2020.