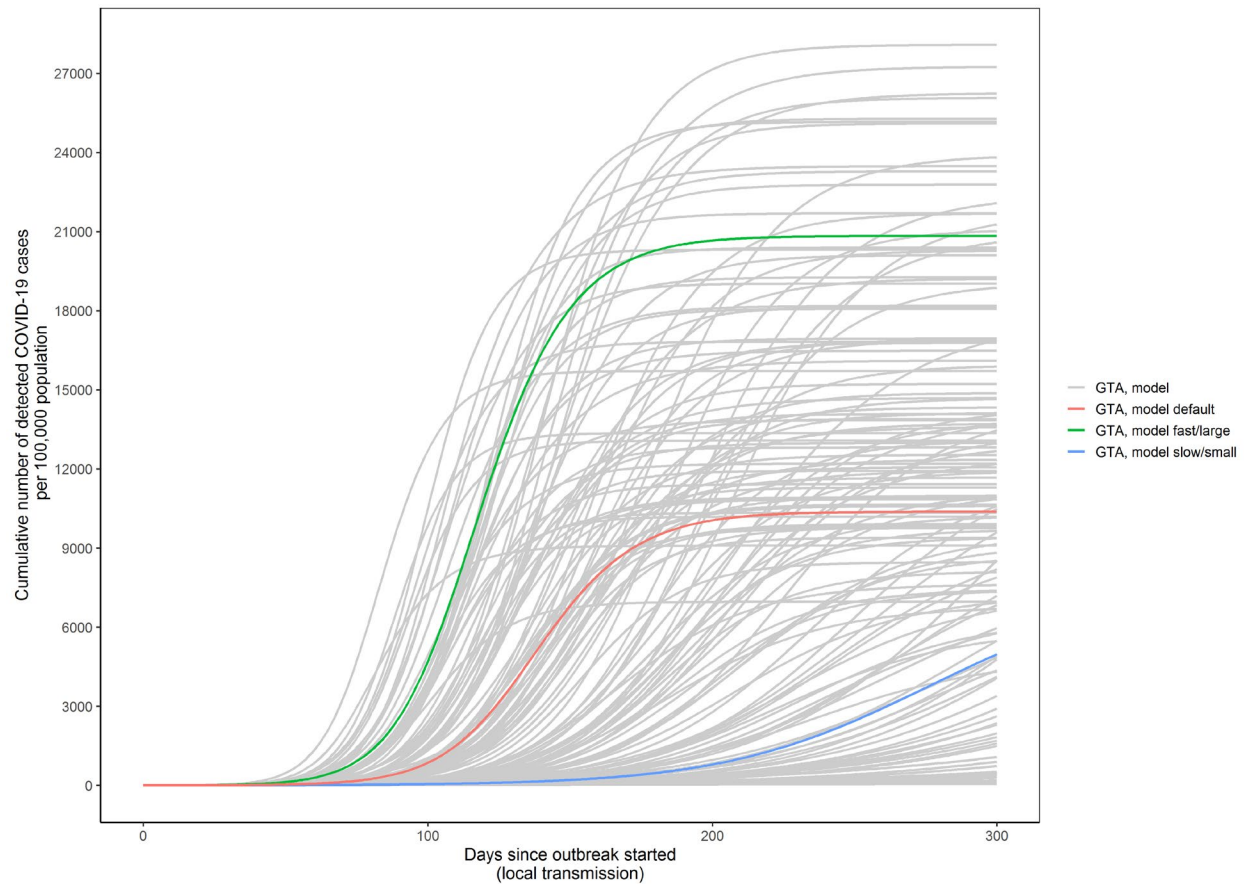# Appendix 2: (as supplied by the authors)

Figures

Appendix 2 Figure 2.1. Cumulative detected cases per 100,000 population across simulated epidemic scenarios. Model outputs from the sampled range of parameters in Table 1 which meet the model constraints are shown for detected cases as solid lines. The model output for the fast/large epidemic is shown in green and slow/small epidemic in blue, selected as the upper and lower quartile of peak incidence, respectively, within the first 300 days. The default (solid red line) depicts the default scenario (Table 1). Simulated timeline begins at the start of the 'seeding' of the population with 0.0011-0.0048% of the population already infected with SARS-Cov-2.

A)

B)

C)
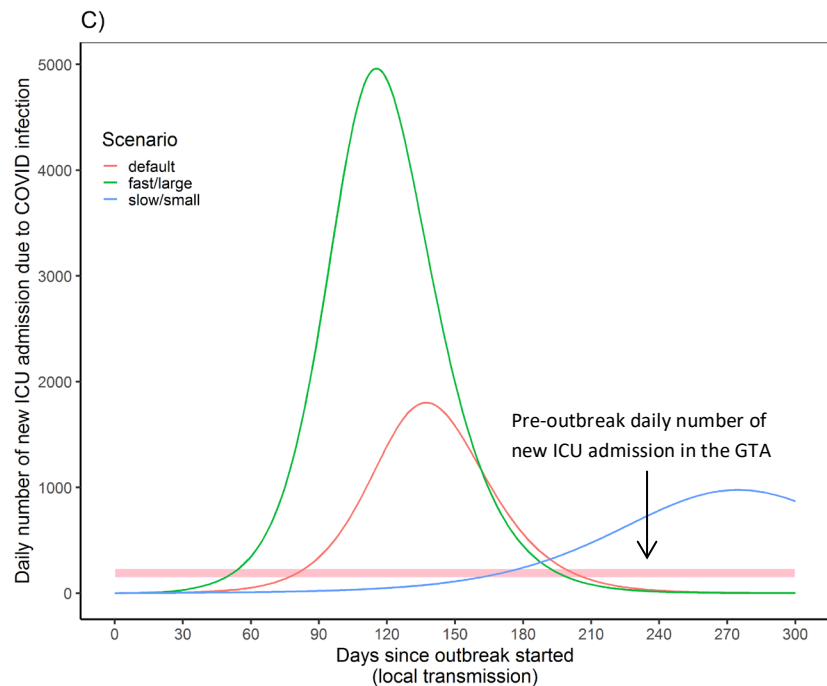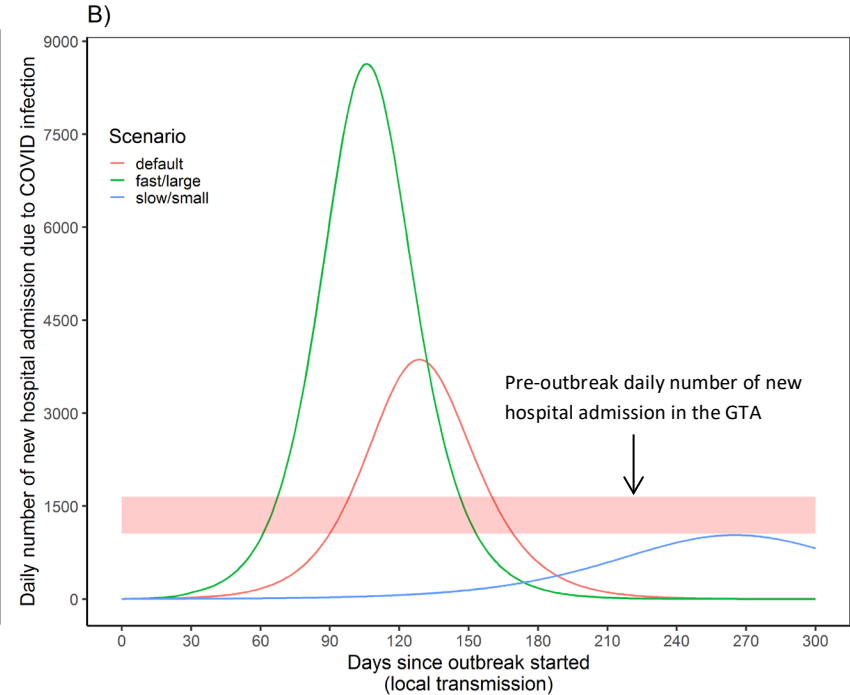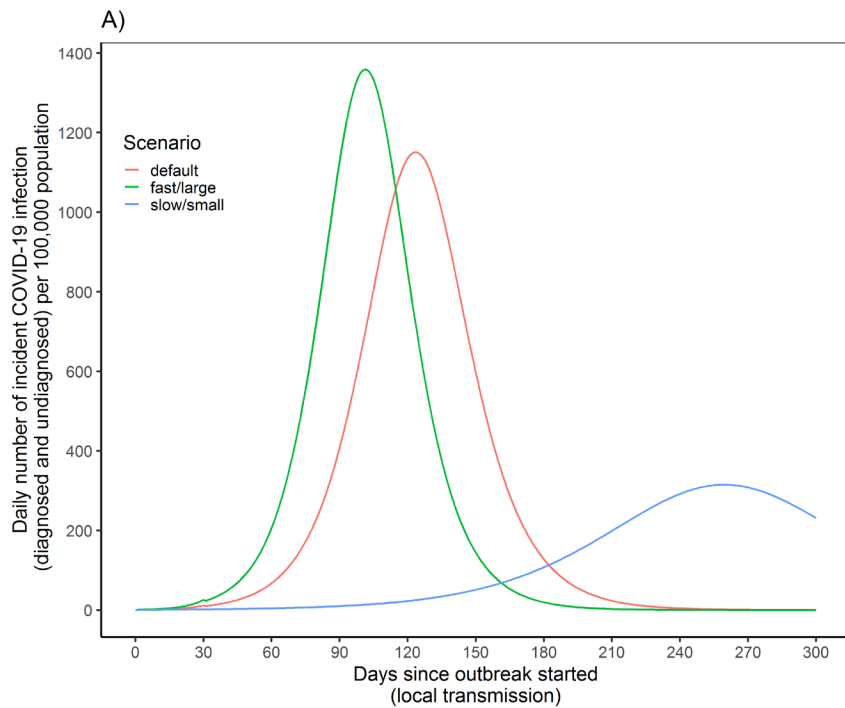
Appendix 2 Figure 2.2. Incident epidemic curves and health-care needs in the Greater Toronto Area across three scenarios: default, fast/large, slow/small epidemics. (A) modeled incidence of infection (diagnosed and undiagnosed) for the GTA; (B) modeled daily number of hospital admissions for individuals with COVID-19 alongside pre-outbreak data on the daily median number of hospital admissions between March-August 2019 in the GTA; (C) modeled daily number of ICU admissions alongside pre-outbreak data on the daily median number of ICU admissions between March-August 2019 in the GTA. The pink horizontal bars in (B) and (C) represent the minimum of the lower inter-quantile range and maximum of upper inter-quantile range of the daily number of new admissions between March and August in 2019. The fast/large and slow/small epidemic scenarios are selected based on the upper and lower quartile of peak incidence, respectively. All three scenarios (default, fast/large, and slow/small) assume that physical distancing started on 2020-03-17 and reduced contact rates by 20%, but has not increased nor decreased thereafter; and that the proportion of individuals with non-severe COVID-19 who self-isolate (e.g. via diagnosis of confirmed/suspected COVID-19) has not changed over the course of the epidemic. Abbreviations: GTA: greater Toronto area; ICU:
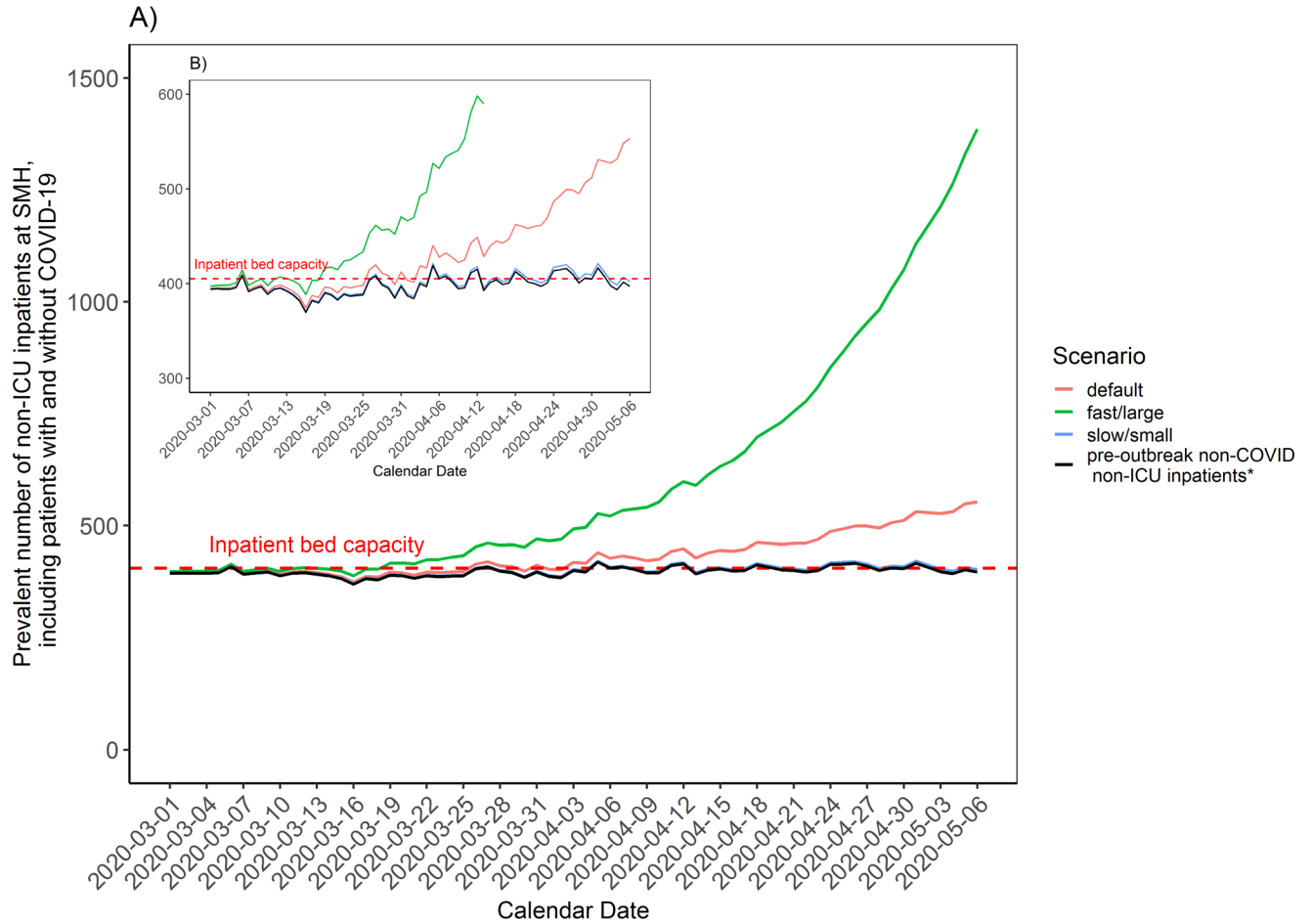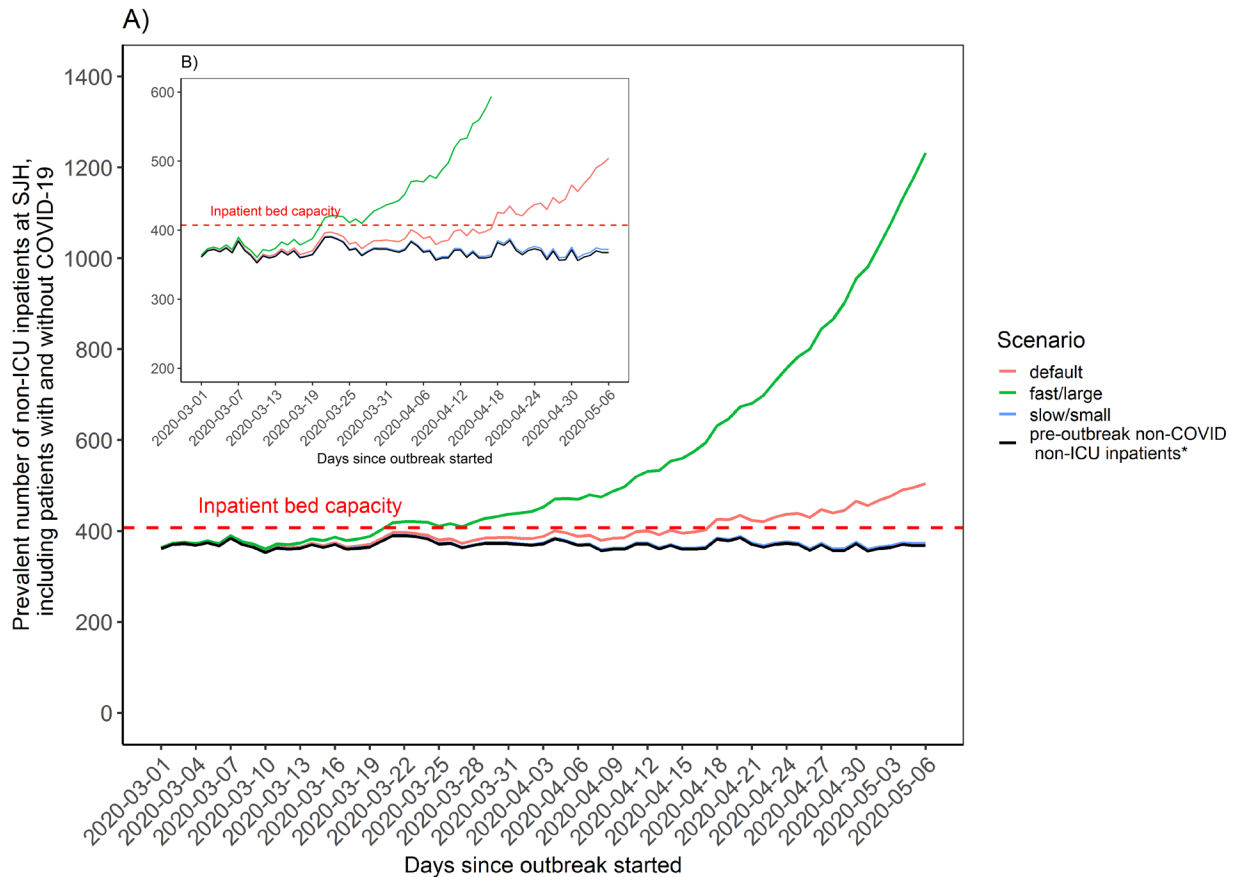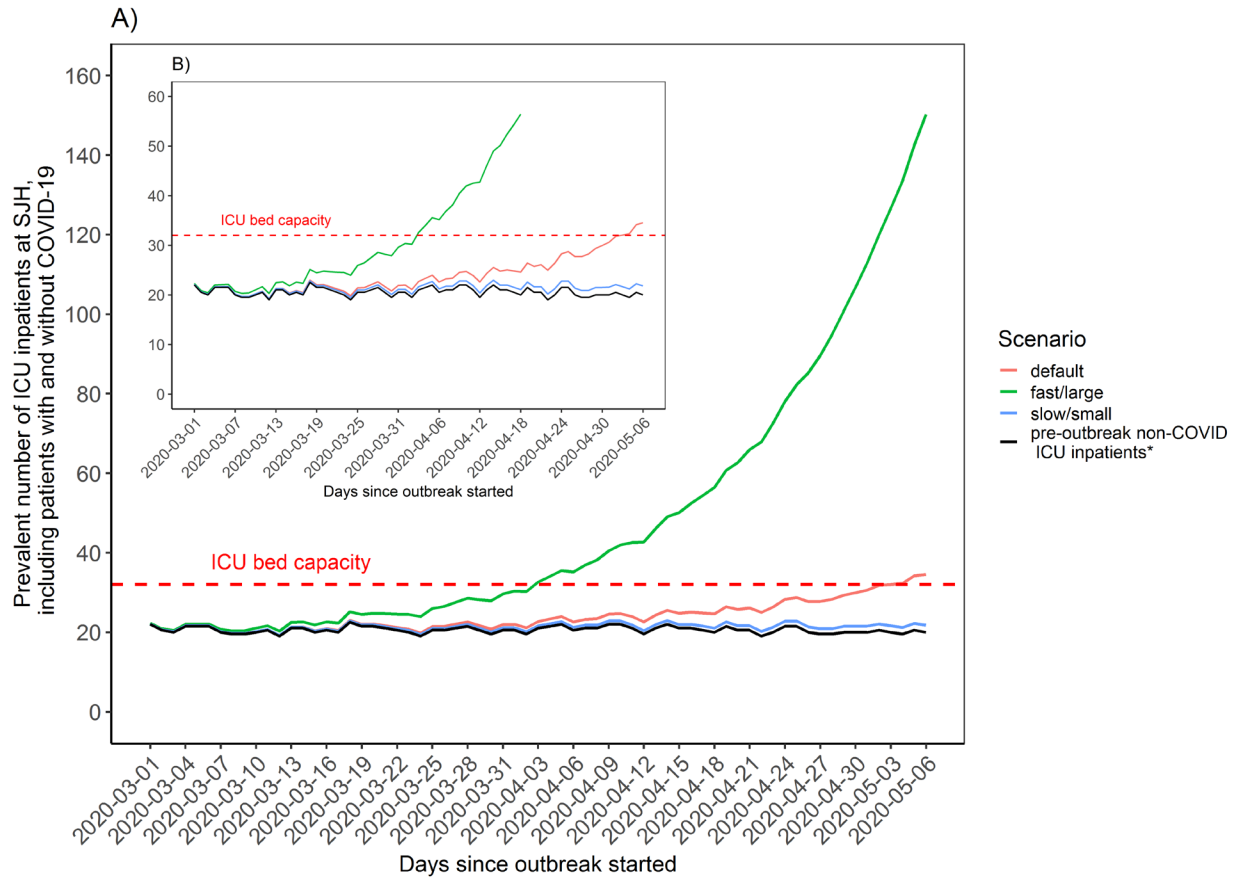
Appendix 2 Figure 2.3. Estimated surge and capacity for non-ICU hospitalization at St. Michael's Hospital in the Greater Toronto Area. (A) Modeled number of non-ICU inpatients (including inpatients with and without COVID-19) and corresponding pre-outbreak baseline (non-COVID) number of non-ICU inpatients per day over 90 days. *Estimated using the median number of non-ICU inpatients at SMH between March – June, 2014-2019. (B) Same information as (A) but the y-axis ranged between 300-700. Estimates assume that distribution of non-ICU hospital admissions for patients with COVID-19 follows the pre-outbreak catchment of all non-ICU admissions across acute care hospitals in the GTA (March – August 2019), such that St. Michael's Hospital receives 4.5% of all non-ICU hospital admissions. All three scenarios (default, fast/large, and slow/small) assume that physical distancing started on 2020-03-17 and reduced contact rates by 20%, but has not increased nor decreased; and that the proportion of individuals with non-severe COVID-19 who self-isolate (e.g. via diagnosis of confirmed/suspected COVID-19) has not changed over the course of the epidemic. Abbreviations: ICU: intensive care unit; SMH: St. Michael's Hospital.
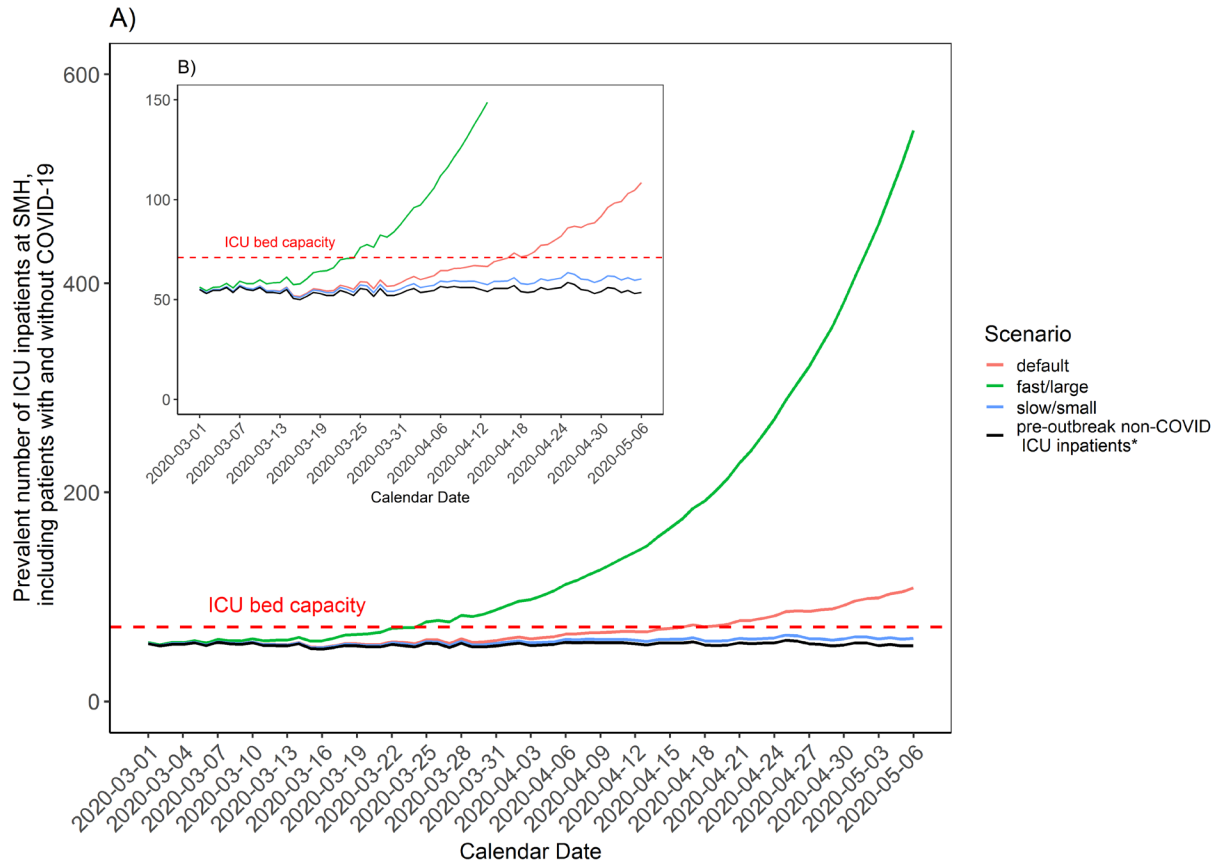
Appendix 2 Figure 2.4. Estimated surge and capacity for ICU care at St. Michael's Hospital in the Greater Toronto Area. (A) Modeled number of ICU inpatients (including inpatients with and without COVID-19) and corresponding pre-outbreak baseline (non-COVID) number of ICU inpatients. *Estimated using the median number of ICU inpatients at SMH between March – June, 2014-2019. (B) Same information as (A) but the y-axis ranged between 300-700. Estimates assume that distribution ICU admissions for patients with COVID-19 follows the pre-outbreak catchment of all ICU admissions across acute care hospitals in the GTA (March – August 2019), such that St. Michael's Hospital receives 8.7% of all ICU hospital admissions. All three scenarios (default, fast/large, and slow/small) assume that physical distancing started on 2020-03-17 and reduced contact rates by 20%, but has not increased nor decreased; and that the proportion of individuals with non-severe COVID-19 who self-isolate (e.g. via diagnosis of confirmed/suspected COVID-19 or without) has not changed over the course of the epidemic. Abbreviations: ICU: intensive care unit; SMH: St. Michael's Hospital.

Appendix 2 Figure 2.5. Estimated surge and capacity for non-ICU hospitalization at St. Joseph's Hospital in the Greater Toronto Area. (A) Modeled number of non-ICU inpatients (including inpatients with and without COVID-19) and corresponding pre-outbreak baseline (non-COVID) number of non-ICU inpatients per day over 90 days. *Estimated using the median number of non-ICU inpatients at SJH between March – June, 2014-2019. (B) Same information as (A) but the y-axis ranged between 200-600. Estimates assume that distribution of non-ICU hospital admissions for patients with COVID-19 follows the pre-outbreak catchment of all non-ICU admissions across acute care hospitals in the Greater Toronto Area (March – August 2019), such that SJH receives 4.0% of all non-ICU hospital admissions. All three scenarios (default, fast/large, and slow/small) assume that physical distancing started on 2020-03-17 and reduced contact rates by 20%, but has not increased nor decreased; and that the proportion of individuals with non-severe COVID-19 who self-isolate (e.g. via diagnosis of confirmed/suspected COVID-19) has not changed over the course of the epidemic. Abbreviations: ICU: intensive care unit; SJH: St. Joseph's Hospital.

Appendix 2 Figure 2.6. Estimated surge and capacity for ICU care at St. Joseph's Hospital (SJH) in the Greater Toronto Area. (A) Modeled number of ICU inpatients (including inpatients with and without COVID-19) and corresponding pre-outbreak baseline (non-COVID) number of ICU inpatients. *Estimated using the median number of ICU inpatients at SJH between March – June, 2014-2019). (B) Same information as (A) but the y-axis ranged between 0-60. Estimates assume that distribution ICU admissions for patients with COVID-19 follows the pre-outbreak catchment of all ICU admissions across acute care hospitals in the Greater Toronto Area (March – August 2019), such that SJH receives 2.3% of all ICU hospital admissions. All three scenarios (default, fast/large, and slow/small) assume that physical distancing started on 2020-03-17 and reduced contact rates by 20%, but has not increased nor decreased; and that the proportion of individuals with non-severe COVID-19 who self-isolate (e.g. via diagnosis of confirmed/suspected COVID-19 or without) has not changed over the course of the epidemic. Abbreviations: ICU: intensive care unit; SJH: St. Joseph's Hospital.
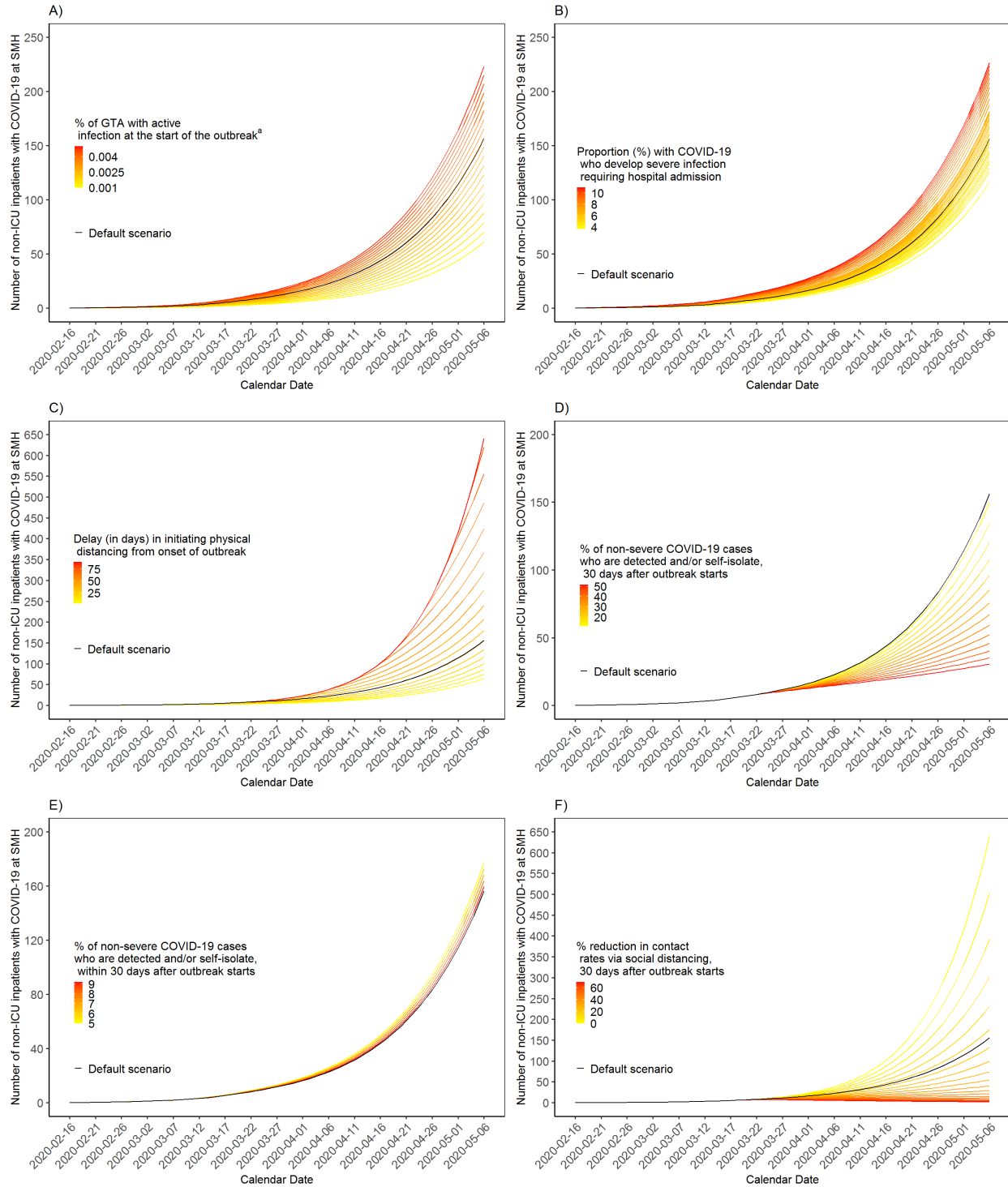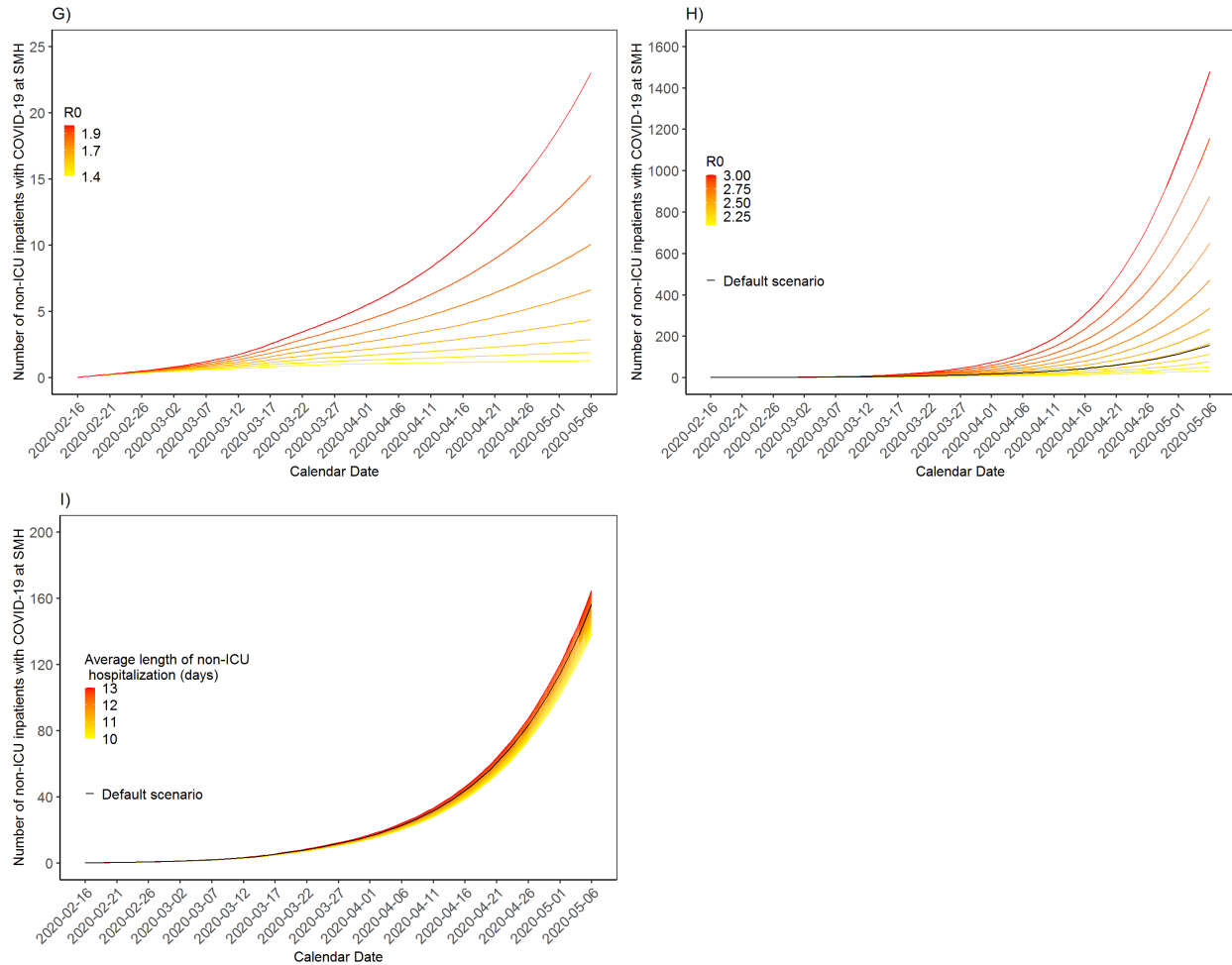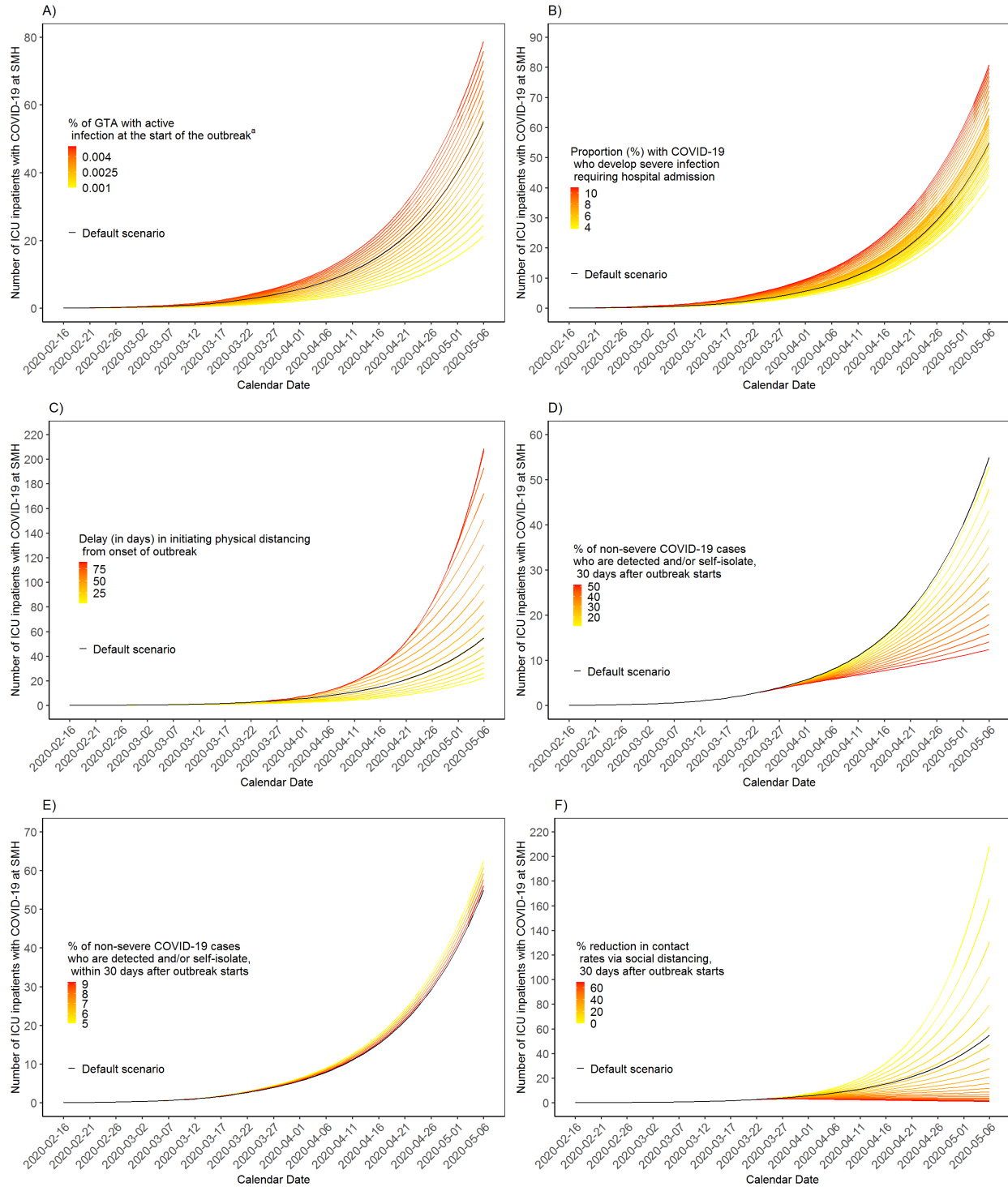
Appendix 2 Figure 2.7. One-way sensitivity analyses using default epidemic scenario for prevalence of non-ICU inpatients with COVID-19 at St. Michael's Hospital. The influence of (A) seeding (proportion of population already infected with COVID-19 just at the start of the outbreak); and (B) clinical severity (proportion of individuals infected with COVID-19 who require hospitalization); (C) earlier or later initiation of physical distancing (from start of outbreak to 60 days after outbreak started); and (D) proportion of individuals with non-severe COVID-19 who are diagnosed and/or self-isolate, 30 days after outbreak starts (e.g. due to increase capacity in testing in the community); (E) proportion of individuals with non-severe COVID-19 who are diagnosed and/or self-isolate, within 30 days since outbreak starts; (F) proportion reduction in contact rates via social distancing, 30 days after outbreak starts (e.g. due to increase capacity in testing in the community); (G) R0 (1.4-1.9); (H) R0 (2.0-3.0); and (I) Average length of non-ICU hospitalization (days). Abbreviations: ICU: intensive care unit; SMH: St Michael's Hospital; GTA: Greater Toronto Area.

A) Number of ICU inpatients with COVID-19 at SMH vs Calendar Date

% of GTA with active infection at the start of the outbreak[a]
- 0.004
- 0.0025
- 0.001

— Default scenario

B) Number of ICU inpatients with COVID-19 at SMH vs Calendar Date

Proportion (%) with COVID-19 who develop severe infection requiring hospital admission
- 10
- 8
- 6
- 4

— Default scenario

C) Number of ICU inpatients with COVID-19 at SMH vs Calendar Date

Delay (in days) in initiating physical distancing from onset of outbreak
- 75
- 50
- 25

— Default scenario

D) Number of ICU inpatients with COVID-19 at SMH vs Calendar Date

% of non-severe COVID-19 cases who are detected and/or self-isolate, 30 days after outbreak starts
- 50
- 40
- 30
- 20

— Default scenario

E) Number of ICU inpatients with COVID-19 at SMH vs Calendar Date

% of non-severe COVID-19 cases who are detected and/or self-isolate, within 30 days after outbreak starts
- 9
- 8
- 7
- 6
- 5

— Default scenario

F) Number of ICU inpatients with COVID-19 at SMH vs Calendar Date

% reduction in contact rates via social distancing, 30 days after outbreak starts
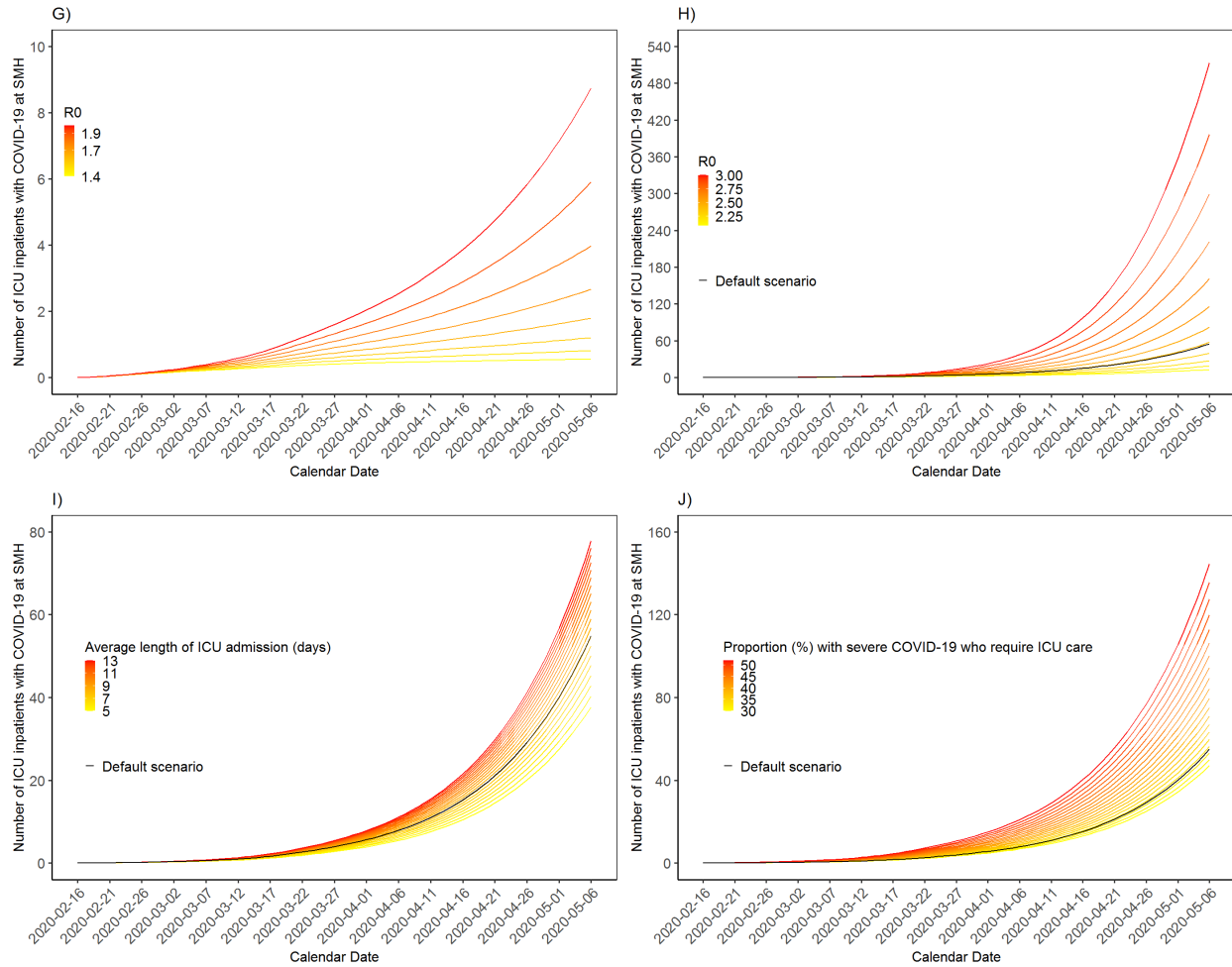- 60
- 40
- 20
- 0

— Default scenario

Appendix 2 Figure 2.8. One-way sensitivity analyses using default epidemic scenario for prevalence of ICU inpatients with COVID-19 at St. Michael's Hospital. The influence of (A) seeding (proportion of population already infected with COVID-19 just at the start of the outbreak); and (B) clinical severity (proportion of individuals infected with COVID-19 who require hospitalization); (C) earlier or later initiation of physical distancing (from start of outbreak to 60 days after outbreak started); (D) proportion of individuals with non-severe COVID-19 who are diagnosed and/or self-isolate, 30 days after outbreak starts (e.g. due to increase capacity in testing in the community); (E) proportion of individuals with non-severe COVID-19 who are diagnosed and/or self-isolate; within 30 days since outbreak starts; (F) proportion reduction in contact rates via social distancing, 30 days after outbreak starts (e.g. due to increase capacity in testing in the community); (G) R0 (1.4-1.9); (H) R0 (2.0-3.0); (I) average length of ICU admission (days); and (J) proportion of individuals with severe COVID-19 who require ICU care. Note that the y-axis scales for figures are different. Abbreviations: ICU: intensive care unit; SMH: St Michael's Hospital; GTA: Greater Toronto Area.

Appendix 2: Tables

Appendix 2 - Table 2.1. Comparison of parameter values for selected epidemic scenarios.

	Unit	Scenario*		
		Fast/Large	Default	Slow/Small
Epidemiological				
R0	Number	2.5	2.4	1.8
Incubation period	Days	4.7	5.2	5.6
Duration of latent infection	Days	1.6	2.0	2.8
Duration of subclinical infectiousness	Days	3.1	3.2	2.9
Duration of symptomatic infectiousness	Days	6.0	7.0	7.0
Duration of infectiousness period	Days	9.1	10.2	9.9
Serial interval	Days	6.2	4.4	5.2
Initial seeding	% of total population	0.0040	0.0032	0.0026
Clinical				
Proportion diagnosed with COVID-19 who required hospitalization	%	19.6	10.0	9.2
Proportion infected with COVID-19 who were diagnosed	%	53.2	55.0	57.8
Proportion infected with COVID-19 who required hospitalization	%	10.4	5.5	5.3
Proportion hospitalized who require ICU care	%	35.9	33.0	46.4
Duration of hospital stay	Days	12.1	12.0	12.1
Duration of ICU stay	Days	7.2	8.0	10.0
Case-fatality proportion among those in ICU care	%	22.6	38.0	34.8

* The fast/large epidemic and slow/small epidemic were selected as the upper and lower quartiles of peak incidence, respectively, within the first 300 days. The default scenario used the default parameter set as shown in Table 1.

Abbreviation: ICU: intensive care unit

Appendix 2 Table 2.2. Peak number of daily incident and prevalent non-ICU and ICU inpatients with COVID-19 within 300 days of a simulated outbreak in the Greater Toronto Area

Measures	Among selected scenarios**			Across 153 constrained epidemics***		
	Fast/Large	Default	Slow/Small	Median	Lower Quartile	Upper Quartile
Peak number of daily new hospital admissions*	8638	3865	1032	3445	1348	5660
Peak number of daily new ICU admissions	4962	1802	976	2112	967	3952
Peak number of non-ICU inpatients	74988	32368	7152	21853	10189	38502
Peak number of ICU inpatients	25733	7418	5551	7739	2454	17651
Proportion of population infected by day-300, %	71.6	71.1	33.7	66.5	35.6	77.9

*All new hospital admissions, which include patients who remain in non-ICU beds, and patients who are subsequently admitted to the ICU.

**The fast/large epidemic and slow/small epidemic were selected as the upper and lower quartiles of peak incidence, respectively, within the first 300 days. The default scenario used the default parameter set as shown in Table 1.

***Among 200 simulated epidemics, 153 met the constraints using the observed data for Lombardy, Italy and Hong Kong, China (corresponding data points at day 30 since outbreak started were used as upper and lower bounds, respectively to constrain the epidemics).

Abbreviation: ICU: intensive care unit.