UPDATE: March 27, 2020

For Unity Health Toronto IPAC Dr. Matthew Muller & Dr. Mark Downing

Prepared by: *Research Group in Mathematical Modeling and Program Science @ MAP Centre for Urban Health Solutions & Unity Health Toronto **Decision Support**

*Huiting Ma, Kristy Yiu, David Landsman, Linwei Wang, Sharmistha Mishra

MODELING FOR SMH & SJH PANDEMIC (SURGE) PLANNING

Aims (Phase 1, SMH & SJH)

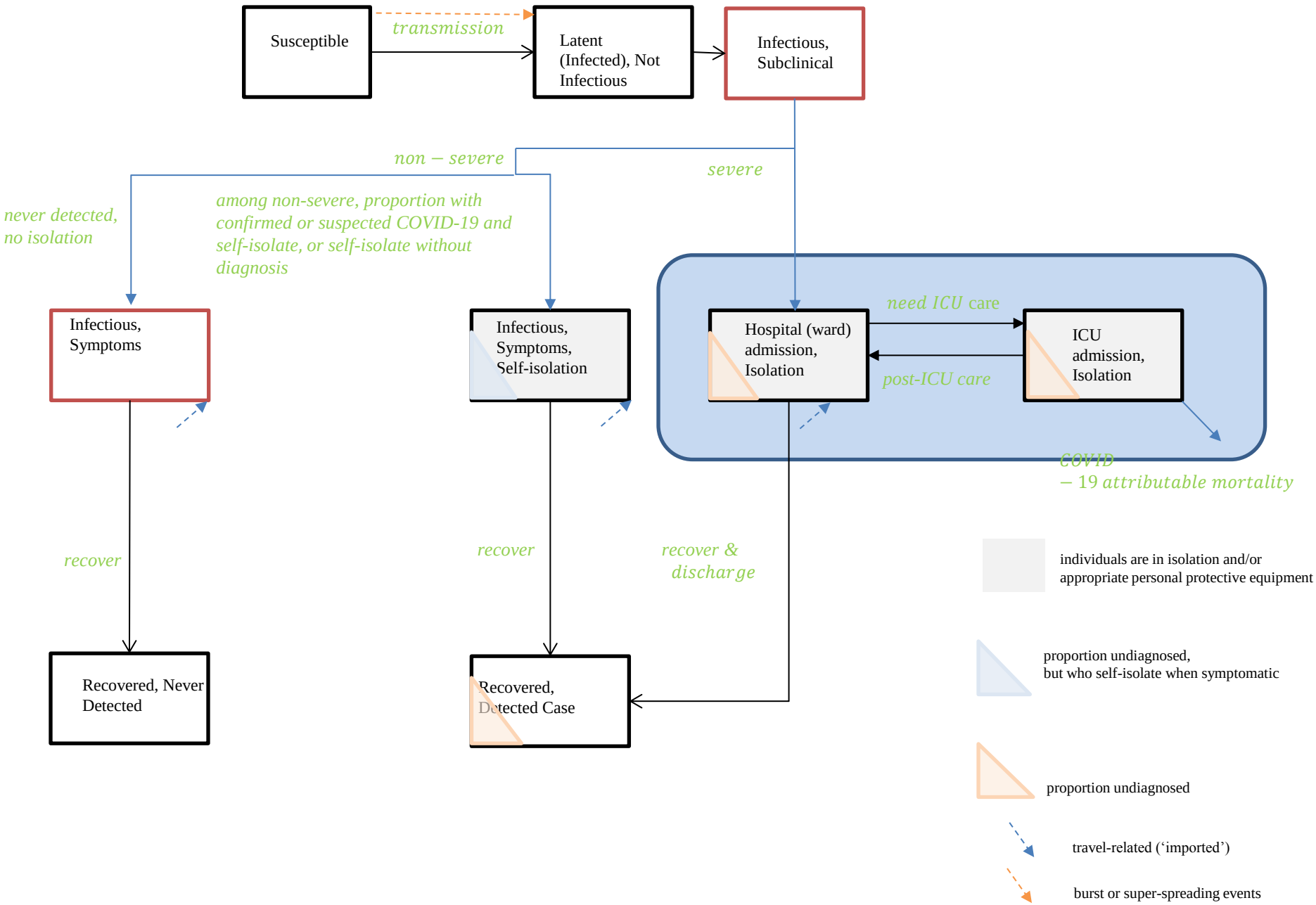
Project best, default, and worst case scenarios for SMH surge trajectory & volume due to COVID-19 in:

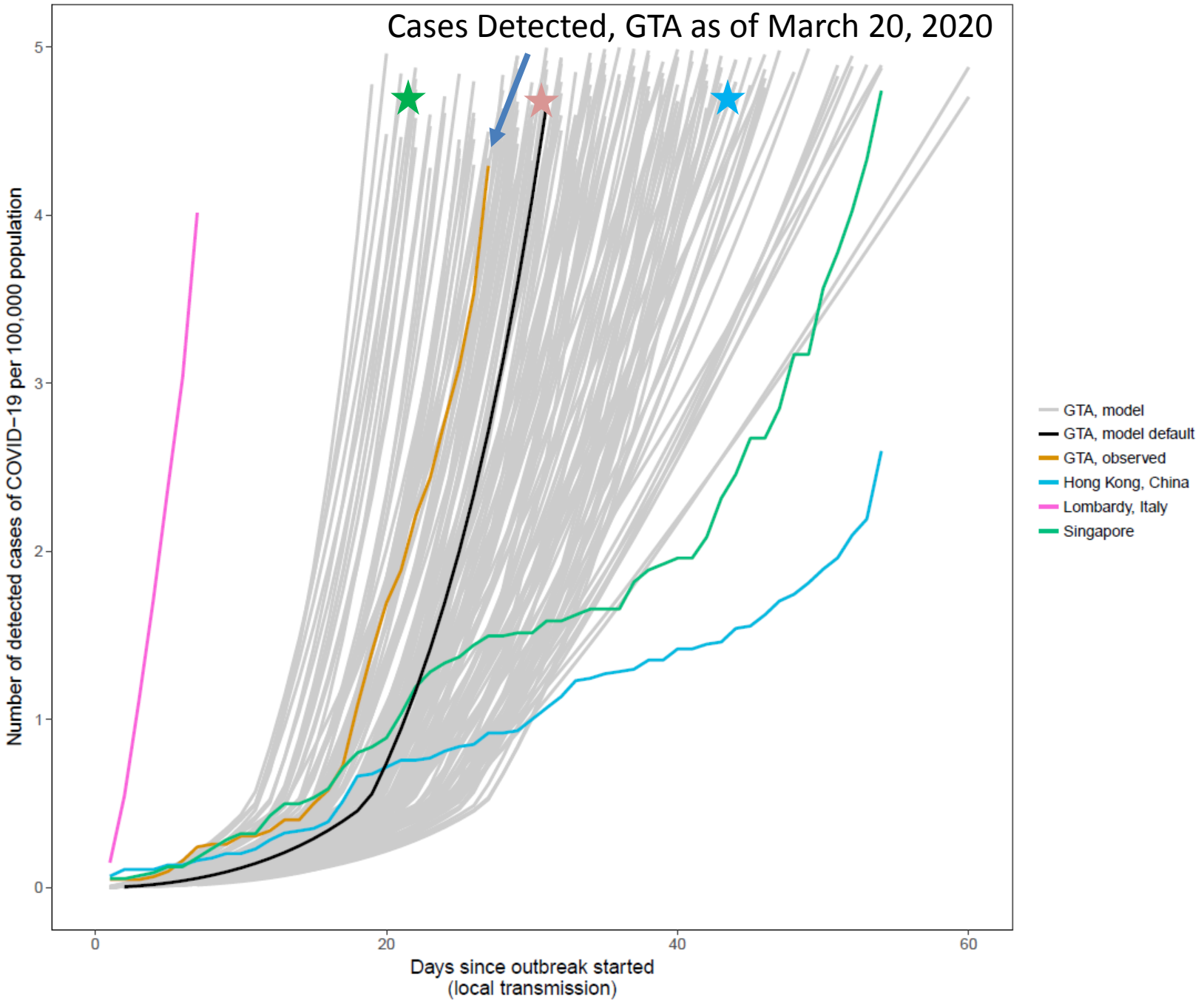
- in-patient (non-ICU admissions)
- ICU days
- ER visits, COVID-19 assessment clinic
- PPE

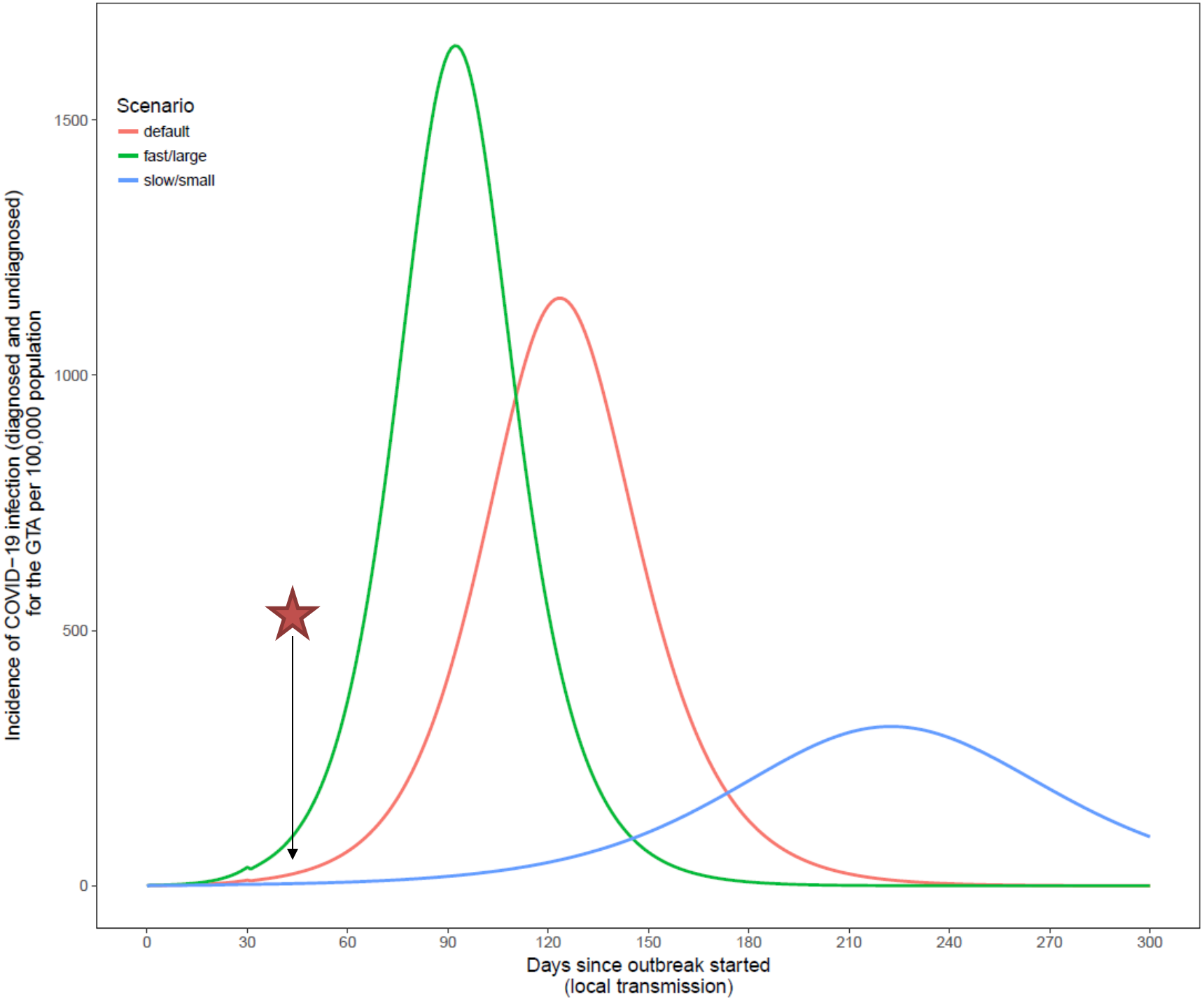
current update

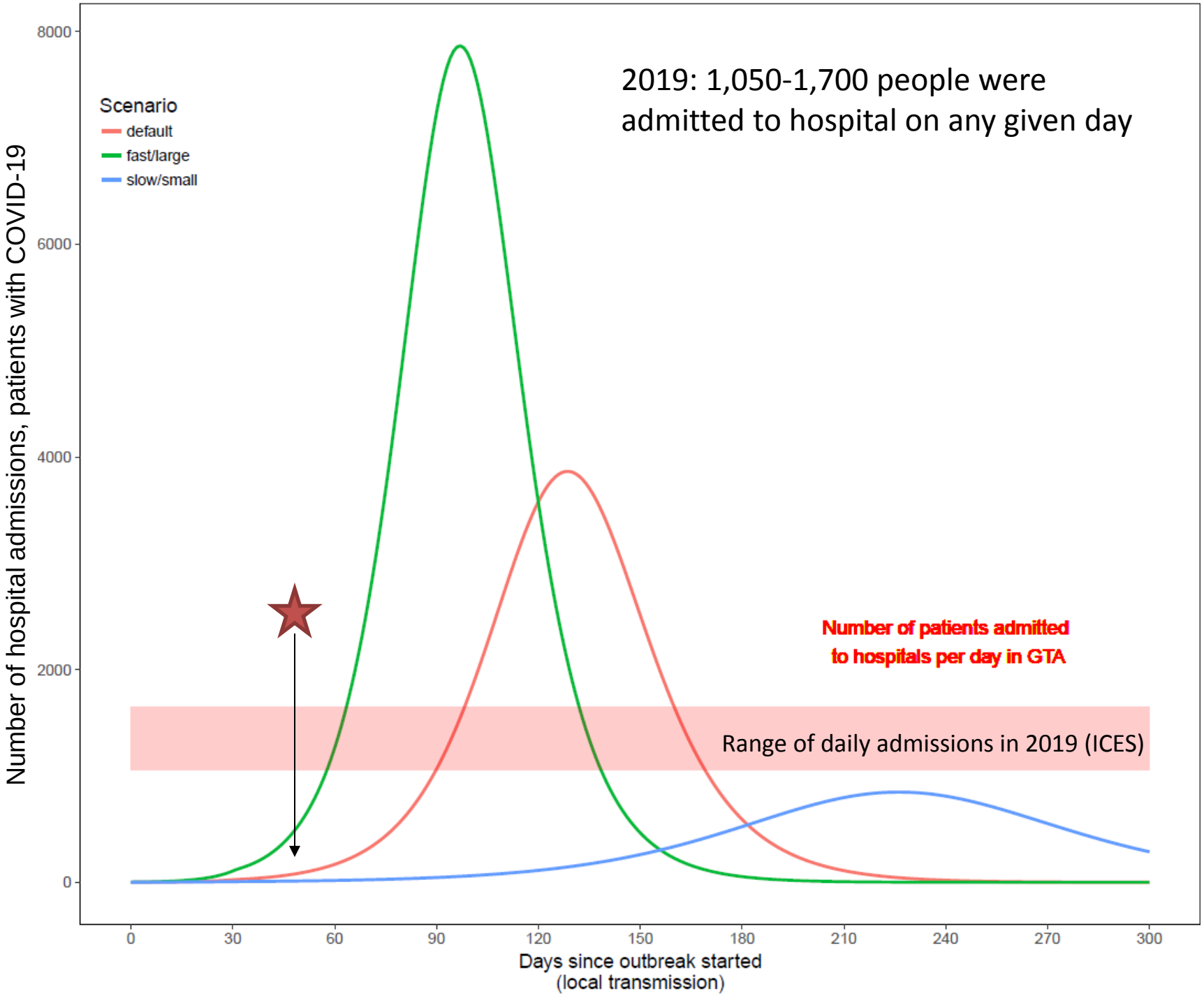
Model Overview

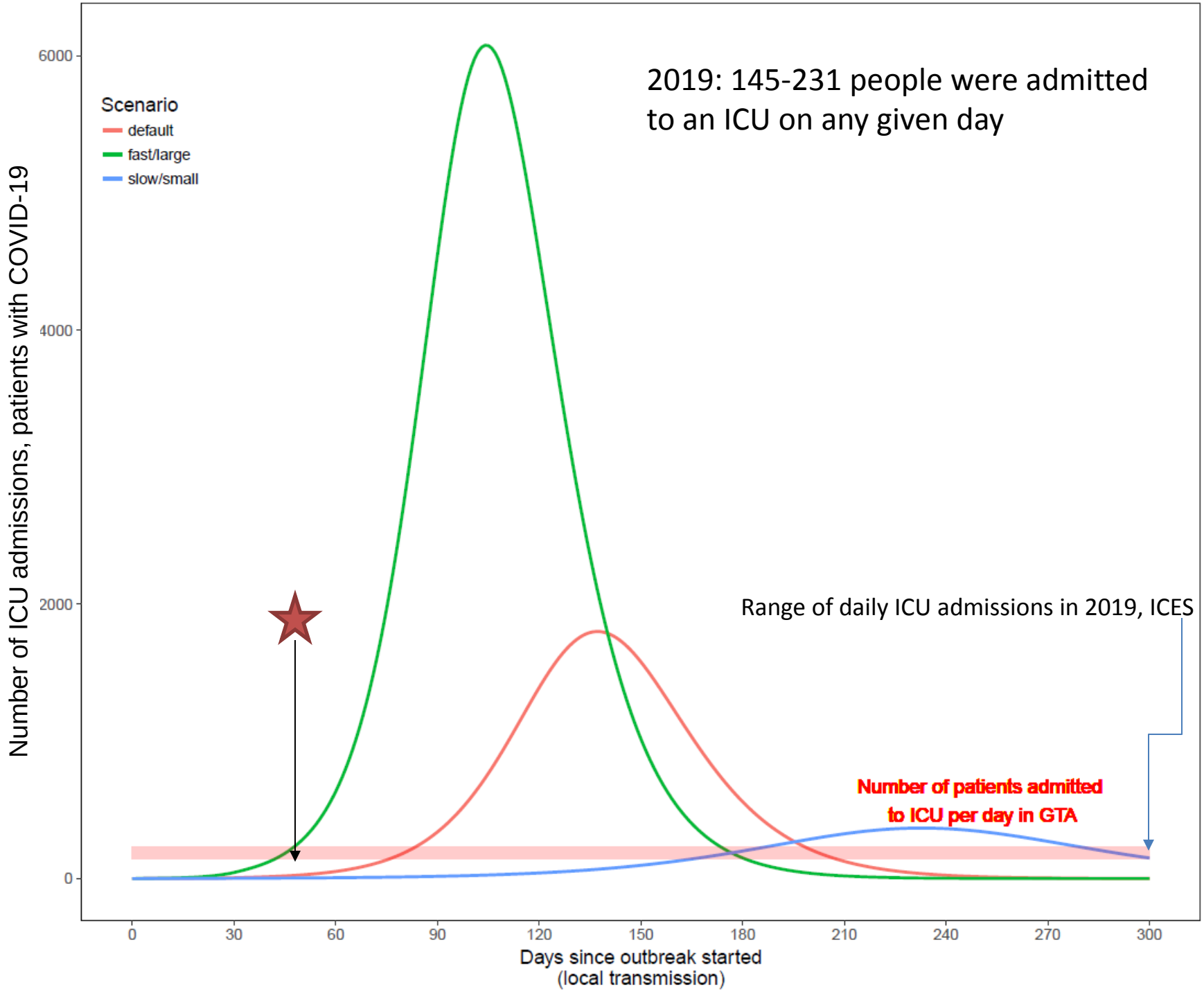
- Mechanistic community transmission model for GTA with inpatient trajectory
- Not meant to forecast but provide range of scenarios
  - comprehensive synthesis of biological and clinical parameters based on papers/reports, and range of R_0 based modeling across COVID19 outbreaks
  - internal validity checks
  - update includes scenario analyses and ongoing work
  - ICES estimates & hospital-specific data inputs from **Decision Support**


Susceptible
transmission
Latent (Infected), Not Infectious
Infectious, Subclinical
non – severe
severe
never detected, no isolation
among non-severe, proportion with confirmed or suspected COVID-19 and self-isolate, or self-isolate without diagnosis
Infectious, Symptoms
Infectious, Symptoms, Self-isolation
need ICU care
Hospital (ward) admission, Isolation
ICU admission, Isolation
post-ICU care
COVID – 19 attributable mortality
recover
recover
recover & discharge
Recovered, Never Detected
Recovered, Detected Case
individuals are in isolation and/or appropriate personal protective equipment
proportion undiagnosed, but who self-isolate when symptomatic
proportion undiagnosed
travel-related (‘imported’)
burst or super-spreading events


Cases Detected, GTA as of March 20, 2020
Number of detected cases of COVID−19 per 100,000 population
0
1
2
3
4
5
0
20
40
60
Days since outbreak started
(local transmission)
GTA, model
GTA, model default
GTA, observed
Hong Kong, China
Lombardy, Italy
Singapore


Scenario
default
fast/large
slow/small
Incidence of COVID−19 infection (diagnosed and undiagnosed)
for the GTA per 100,000 population
1500
1000
500
0
0
30
60
90
120
150
180
210
240
270
300
Days since outbreak started
(local transmission)

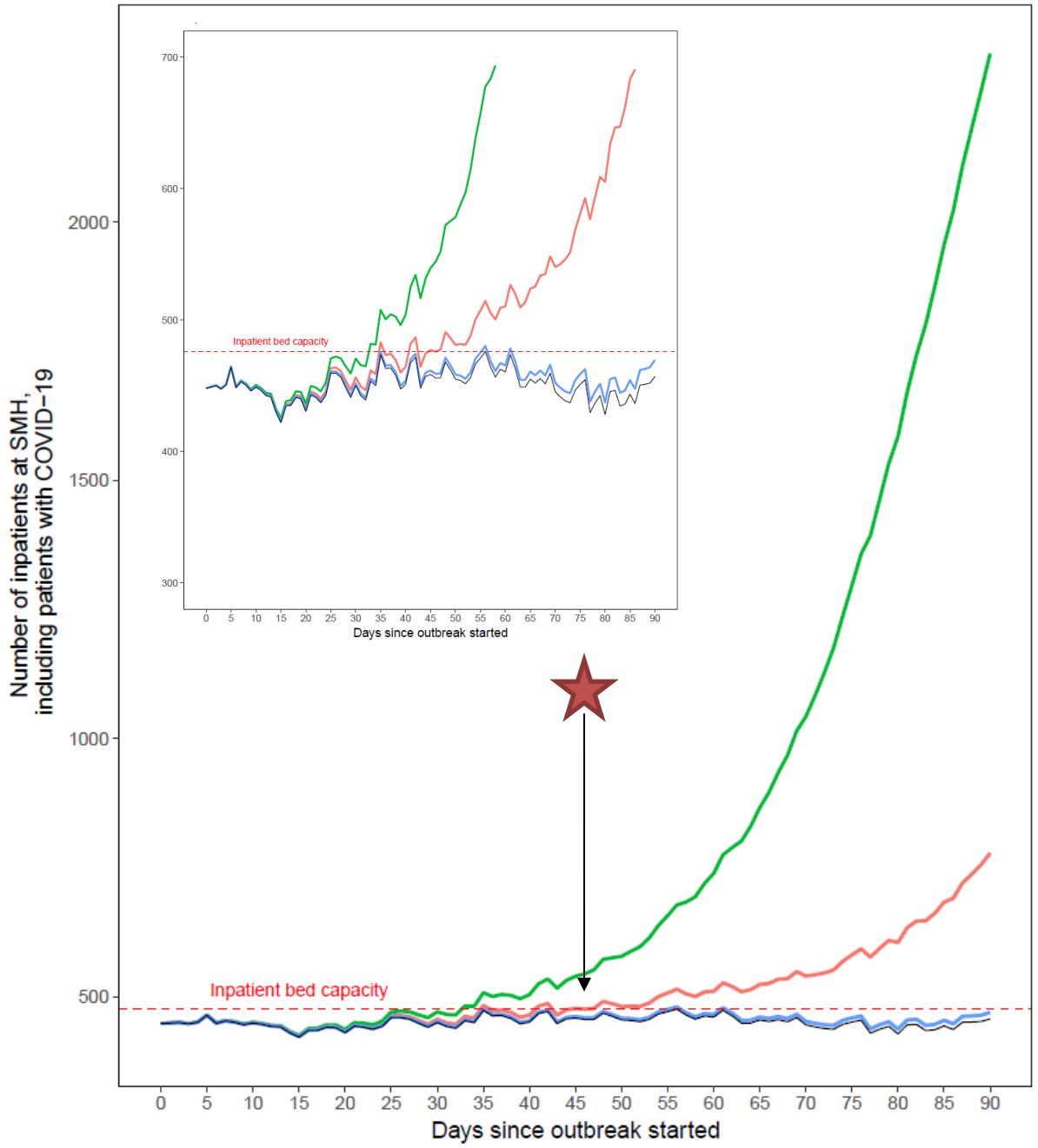

2019: 1,050-1,700 people were admitted to hospital on any given day
Scenario
default
fast/large
slow/small
Number of patients admitted to hospitals per day in GTA
Range of daily admissions in 2019 (ICES)
Number of hospital admissions, patients with COVID-19
8000
6000
4000
2000
0
0
30
60
90
120
150
180
210
240
270
300
Days since outbreak started
(local transmission)


2019: 145-231 people were admitted to an ICU on any given day
Scenario
default
fast/large
slow/small
Number of ICU admissions, patients with COVID-19
6000
4000
2000
0
Range of daily ICU admissions in 2019, ICES
Number of patients admitted to ICU per day in GTA
0
30
60
90
120
150
180
210
240
270
300
Days since outbreak started (local transmission)

St. Michael's Hospital
Daily census of non-ICU inpatients, including COVID-19

if no change in baseline admissions

*physical distancing began 30 days into the local outbreak and reduced rates of contact by 20%
*no increase in testing / diagnosis capacity

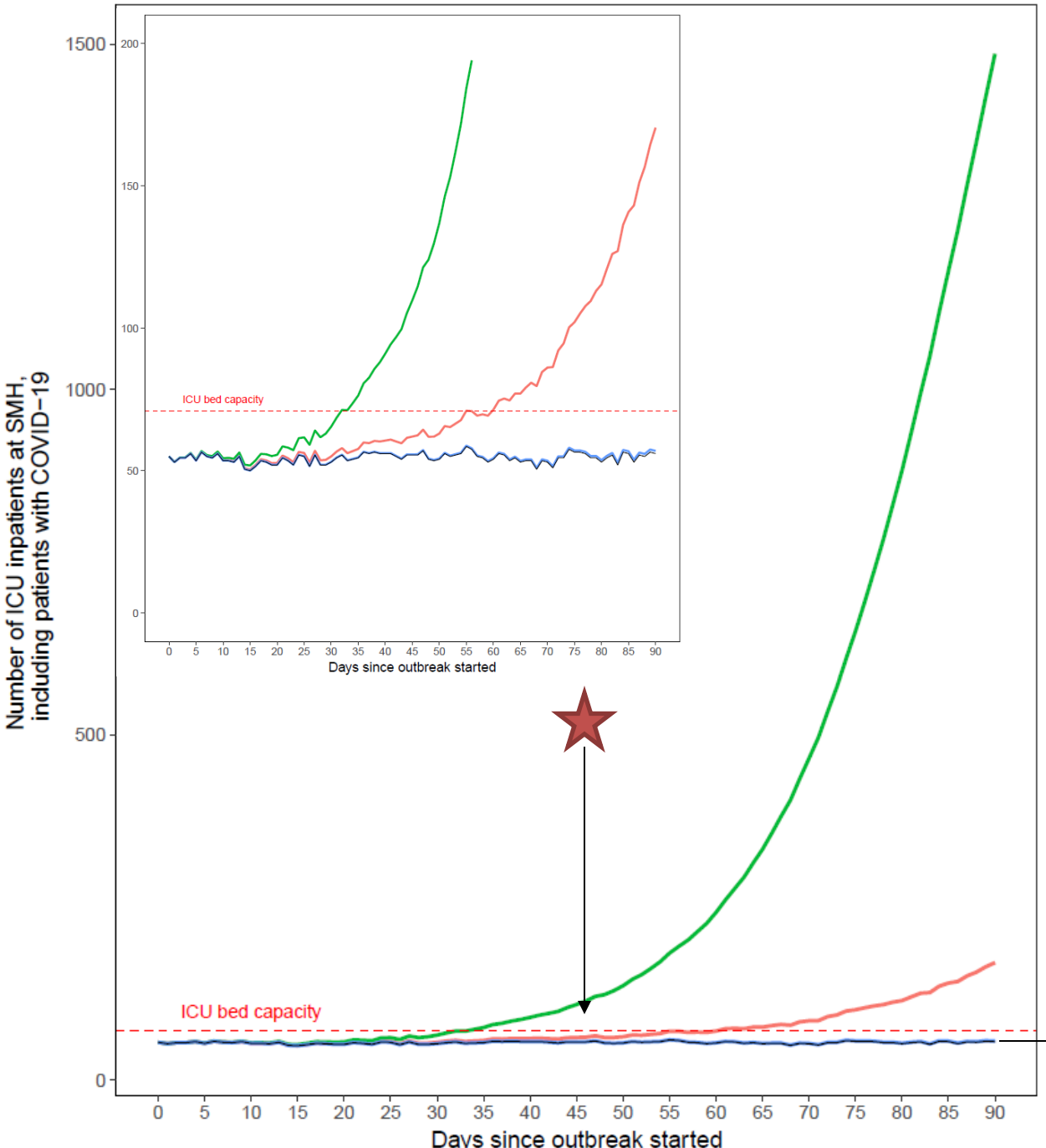


SMH: 4.5% (95% CI: 4.4,4.6) of all non-ICU admissions in GTA (ICES data)

St. Michael's Hospital
Daily census of ICU inpatients, including COVID-10

if no change in baseline admissions

*physical distancing began 30 days into the local outbreak and reduced rates of contact by 20%
*no increase in testing / diagnosis capacity



Scenario
default
fast/large
slow/small

SMH: 8.7% (95% CI: 8.4,9.0) of all ICU admissions in GTA (ICES data)

pre-outbreak median (March-June, 2014-2019)

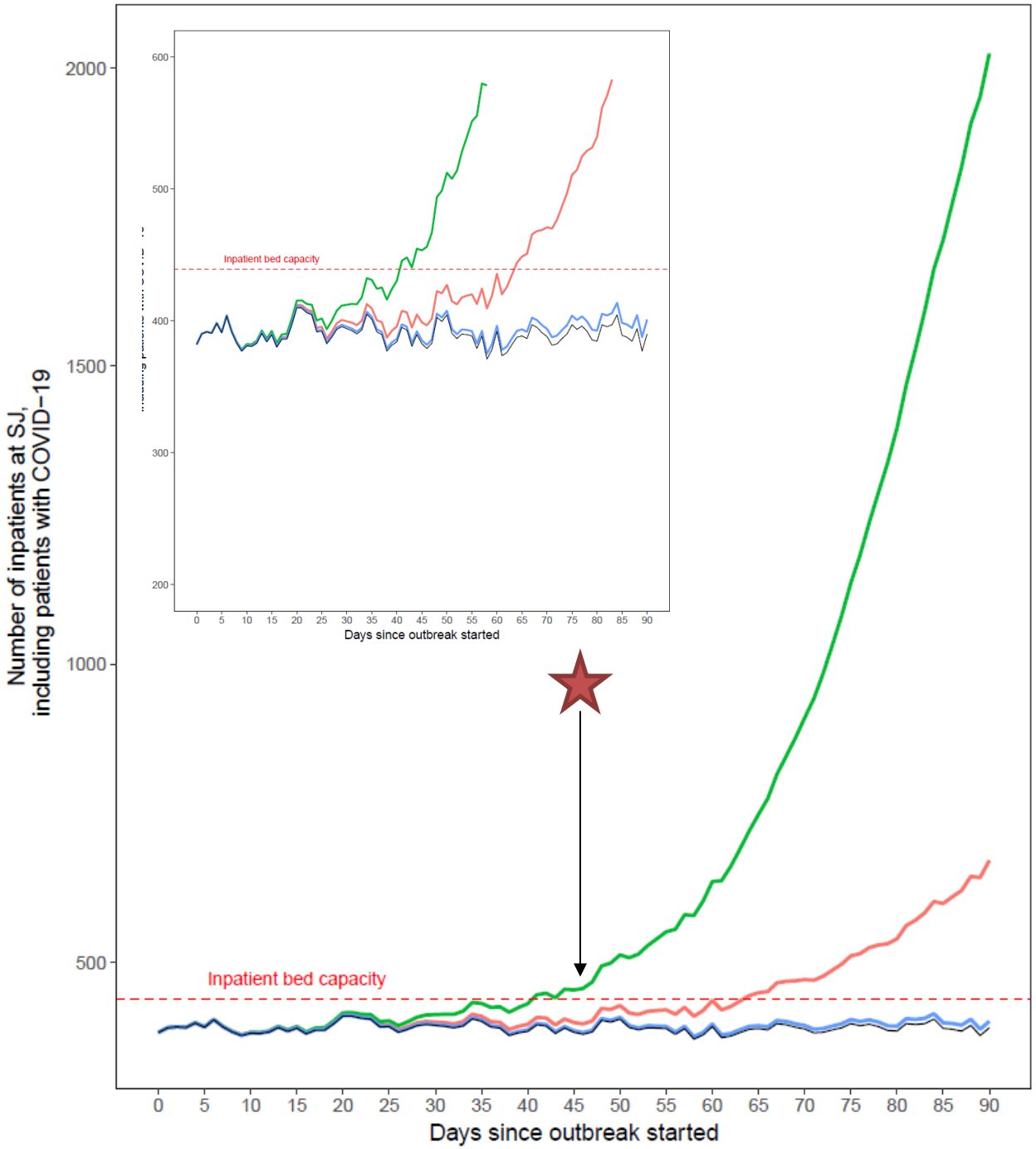
Estimated census for inpatients with COVID-19, St. Michael's Hospital for next 6 weeks

Week	ICU	Non-ICU
1 (next week)	2 (1-3)	8 (5-10)
2	4 (3-5)	13 (11-15)
3	7 (6-8)	22 (20-23)
4	12 (11-14)	35 (34-36)
5	21 (18-23)	59 (57-62)
6	33 (30-35)	93 (91-96)

*currently between days 35-45 of the outbreak (since local transmission started)

*physical distancing began 30 days into the local outbreak and reduced rates of contact by 20%

*no increase in testing / diagnosis capacity



St. Joseph's Hospital
Daily census of non-ICU inpatients, including COVID-19

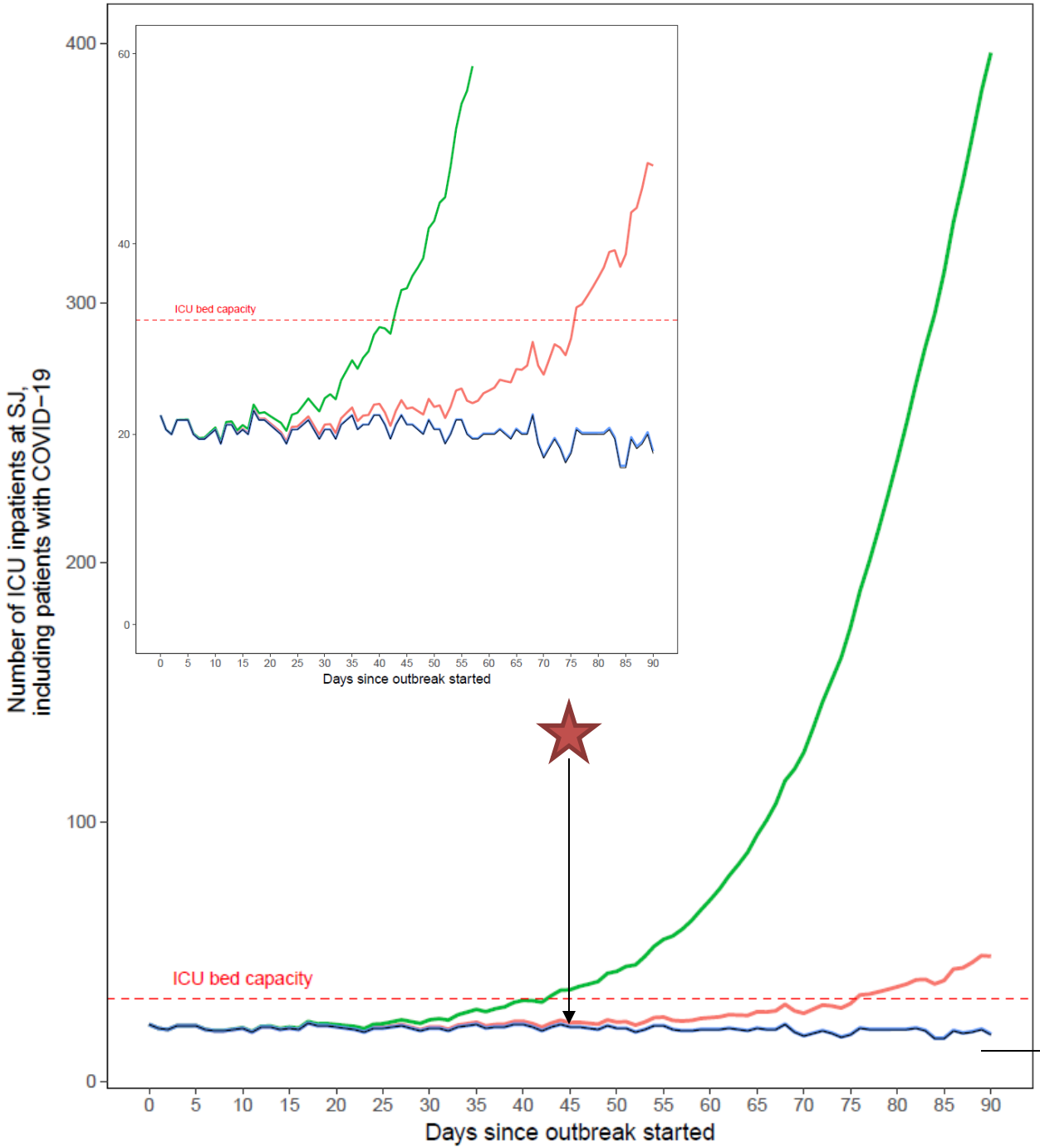
if no change in baseline admissions

*physical distancing began 30 days into the local outbreak and reduced rates of contact by 20%
*no increase in testing / diagnosis capacity

Scenario
- default
- fast/large
- slow/small

SJH: 3.9% (95% CI: 3.8,4.0) of all non-ICU admissions in GTA (ICES data)

pre-outbreak median (March-June, 2014-2019)



St. Joseph's Hospital
Daily census of ICU inpatients, including COVID-19

if no change in baseline admissions

*physical distancing began 30 days into the local outbreak and reduced rates of contact by 20%
*no increase in testing / diagnosis capacity

Scenario
- default
- fast/large
- slow/small

SJH: 2.3% (95% CI: 2.1,2.5) of all ICU admissions in GTA (ICES data)

Estimated census for inpatients with COVID-19, St. Joseph's Hospital for next 6 weeks

Week	ICU	Non-ICU
1 (next week)	1 (0-2)	7 (6-8)
2	1 (1-2)	11 (10-12)
3	2 (2-4)	19 (18-20)
4	3 (2-5)	30 (28-33)
5	5 (4-6)	51 (50-53)
6	8 (7-10)	81 (78-83)

*currently between days 35-45 of the outbreak (since local transmission started)

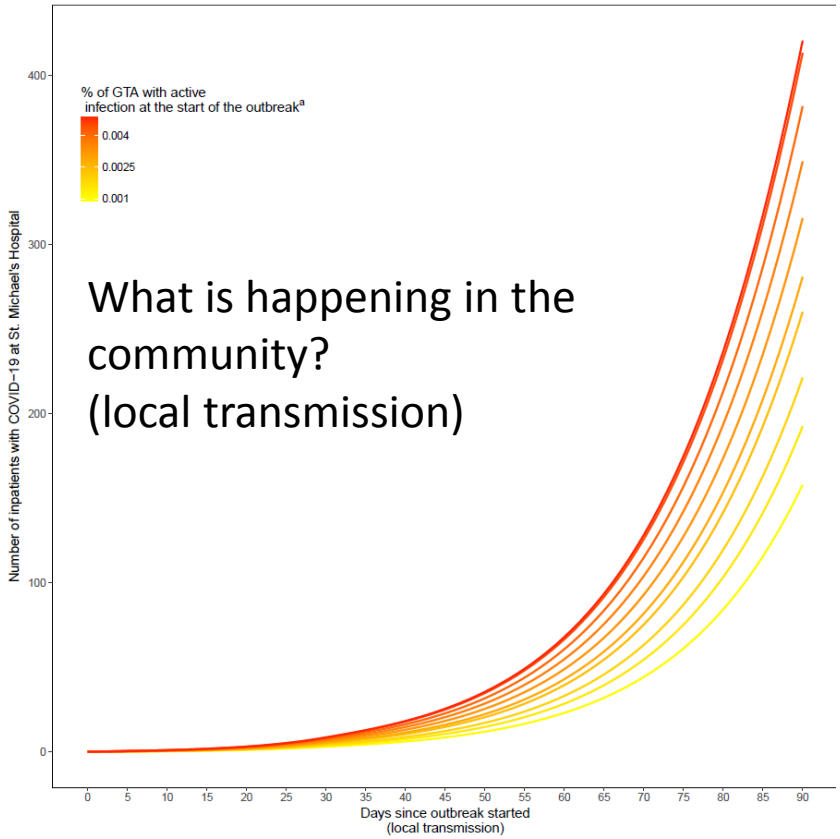
*physical distancing began 30 days into the local outbreak and reduced rates of contact by 20%

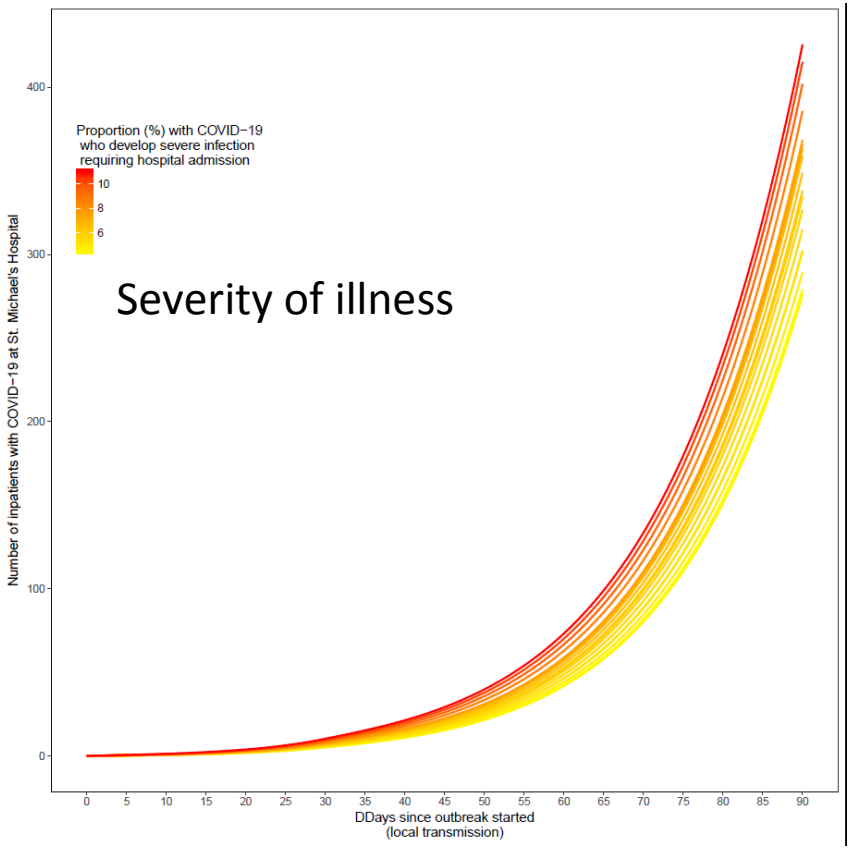
*no increase in testing / diagnosis capacity

Main sources of uncertainty in anticipated hospitalizations

St. Michael's Hospital

Daily census of non-ICU inpatients per day



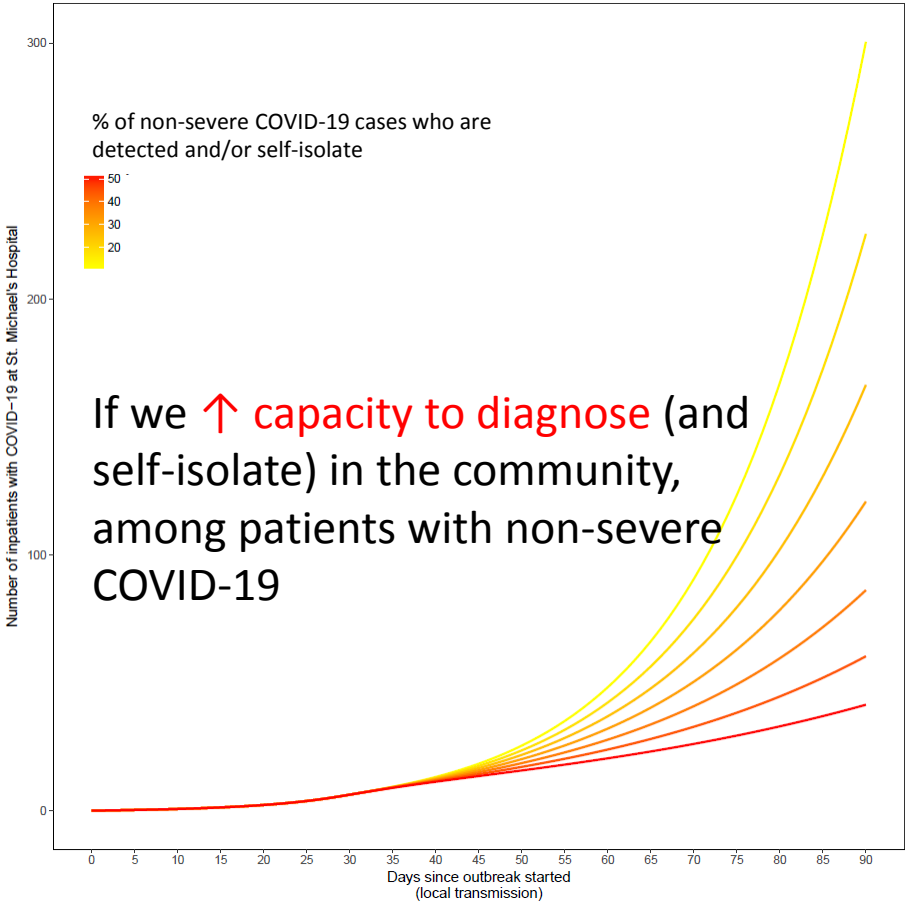


What is happening in the community more influential than our uncertainty around severity of illness

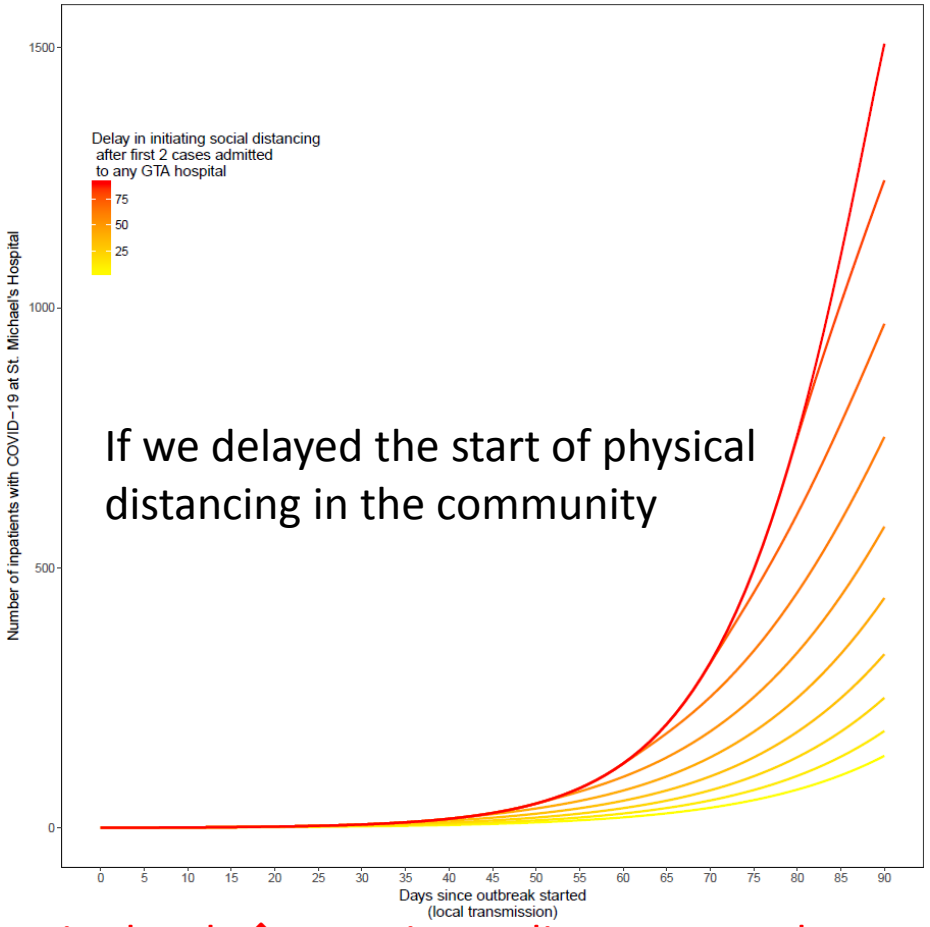
Main sources of uncertainty: strategies underway

St. Michael's Hospital

Daily census of non-ICU inpatients per day



If we ↑ capacity to diagnose (and self-isolate) in the community, among patients with non-severe COVID-19



If we delayed the start of physical distancing in the community

Given limits on physical distancing at community-level, ↑ capacity to diagnose may be critical to flattening the curve and dampen hospital & ICU surge

physical distancing = 20% ↓ contacts per person