

Georgia Tech Covid-19 Epidemic Assessment for Fall 2020: Risks, Mitigation Strategies, and Recommendations

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Technical References:

Asymptomatic transmission: Park, Cornforth, Dushoff & Weitz (Epidemics, 2020) & medrxiv 2020.03.09.20033514v1
R0 estimation: Park et al. (J. Roy. Soc. Inter, in press) medrxiv: 2020.01.30.20019877v3)
Georgia epidemic forecasting: Beckett et al. medrxiv & https://weitzgroup.github.io/MAGEmodel_covid19_GA/
Shield Immunity: Weitz et al., Nature Medicine (2020) & medrxiv 10.1101/2020.04.01.20049767v1)

Risk-Assessment Dashboard

Collaborative GT-Stanford-ABiL dashboard: <https://covid19risk.biosci.gatech.edu/>

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Covid-19:

A global pandemic with acute effects in GA

Georgia Overall COVID-19 Status

Below you will find information reported to DPH on the total number of COVID-19 tests, confirmed COVID-19 cases (PCR positive), ICU admissions, hospitalizations, and deaths attributed to COVID-19. These data are based on available information at the time of the report and may not reflect all cases or tests performed in Georgia.

Confirmed COVID-19 Cases	Deaths	Hospitalizations	ICU Admissions
95,516	2,860	11,775	2,429

Georgia Overall COVID-19 Status

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Confirmed Cases	Deaths	Hospitalizations	ICU Admissions
116,926	3,001	13,259	2,621

Between July 6-13, Georgia has experienced:

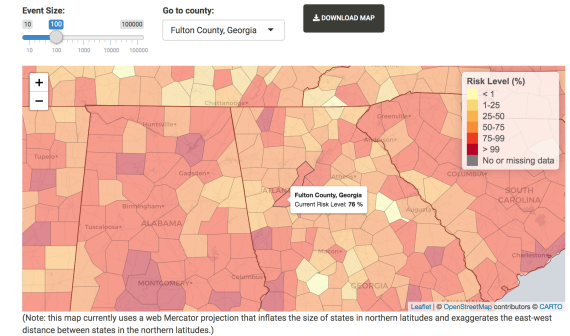
- ~17% of total reported cases since inception of epidemic.
- ~11% of total hospitalizations
- ~7% of ICU admissions
- ~5% of fatalities

Note: severe cases/fatalities lag multiple weeks behind case reports

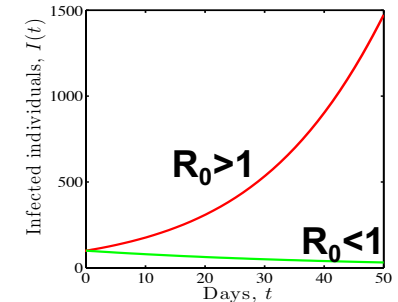
Takeaway: This is a critical phase of the epidemic; a default mode of 'face-to-face learning' is not feasible, science should guide the decision-making process and policies at GT.

Covid-19 and Education Restart: Risks

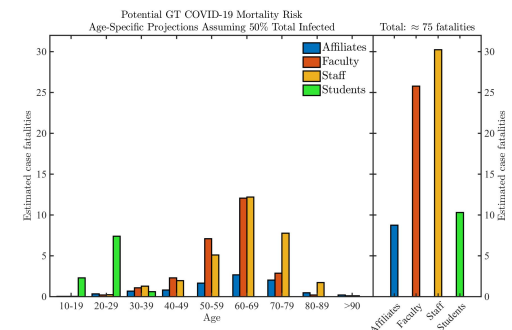
Risk of Classroom Exposure: What are the chances that one (or more) individuals in a classroom will have Covid-19?



Risk of a Large Outbreak: What is the risk that an imported case will lead to a large epidemic outbreak in the GT student, staff, and faculty community?

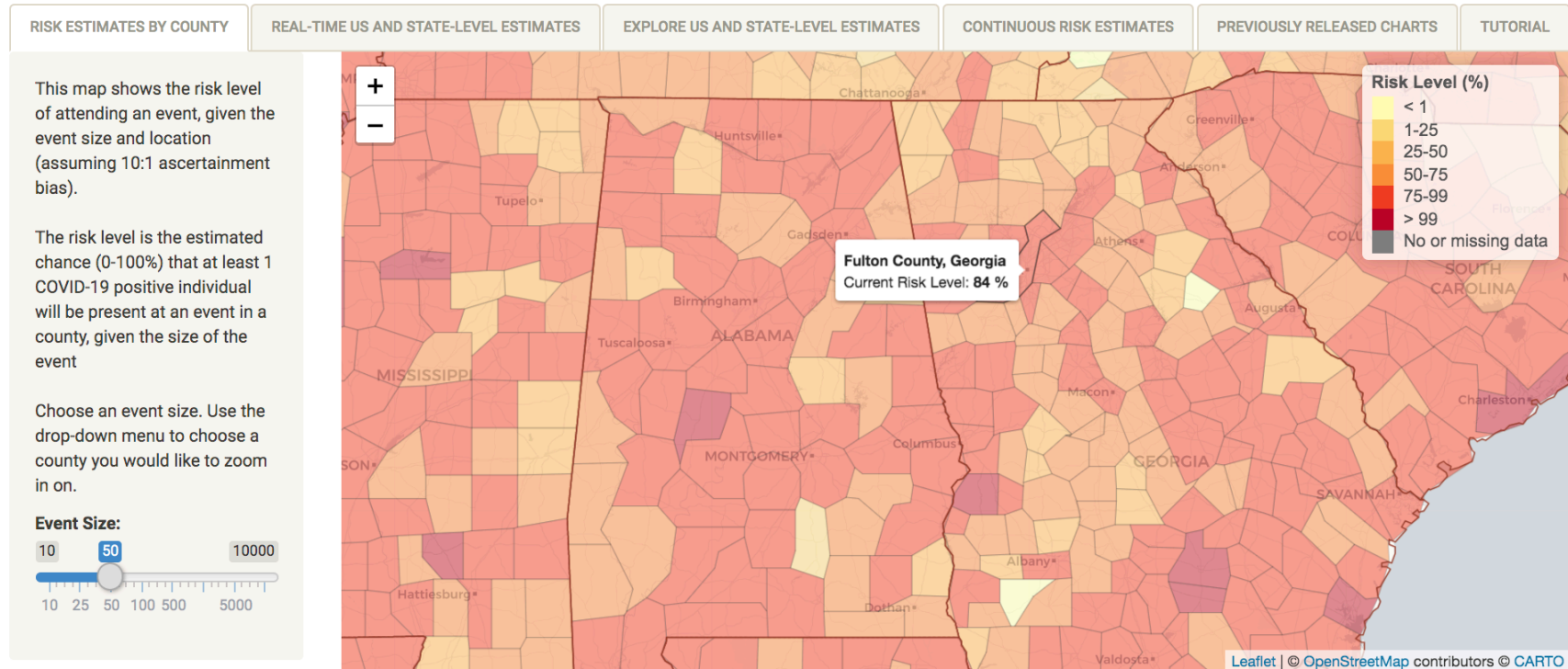


Risk of Severe Outcomes: In the event of a large epidemic outbreak, how might a Covid-19 outbreak impact the campus community?



Risk of Exposure: Classrooms and Gatherings

COVID-19 Event Risk Assessment Planning Tool



(Note: This map uses a Web Mercator projection that inflates the area of states in northern latitudes. County boundaries are generalized for faster drawing.)



Covid-19 Risk Assessment Calculator (joint w/Prof. Clio Andris and ABiL)

Caveat: This site is receiving many *tens* of thousands of users a day and we are upgrading resources to accommodate.

<https://covid19risk.biosci.gatech.edu/>

Risk of Exposure: Classrooms and Gatherings

Large gatherings are problematic for multiple reasons:

- Increased likelihood that someone in a group has Covid-19 (perhaps asymptotically).
- More potential interactions to spread, i.e., the number of 'contacts' scales with n^2 (where n is the group size).
- Harder to contact trace; close contacts in a gathering are not easy to reconstruct.

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Risk assessment:

Risk that one (or more) individuals has Covid-19 is $1-(1-p)^n$ where p is the circulating infection rate (we estimate from cases x ascertainment bias)

Mitigation steps:

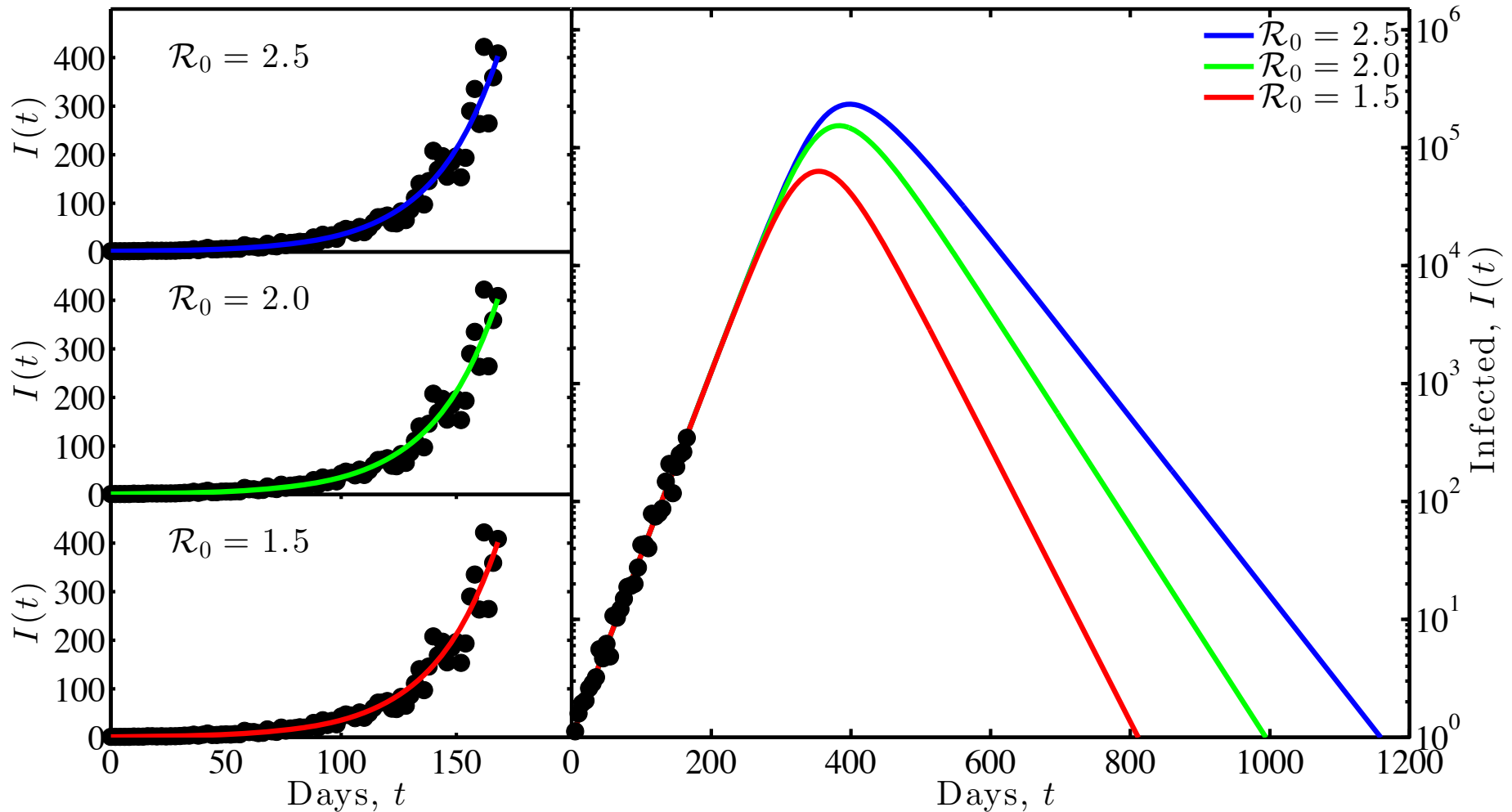
1. Reduce group sizes whenever possible (in and out of class).

Example: Classroom of 25 has ~60% chance one or more have Covid-19.

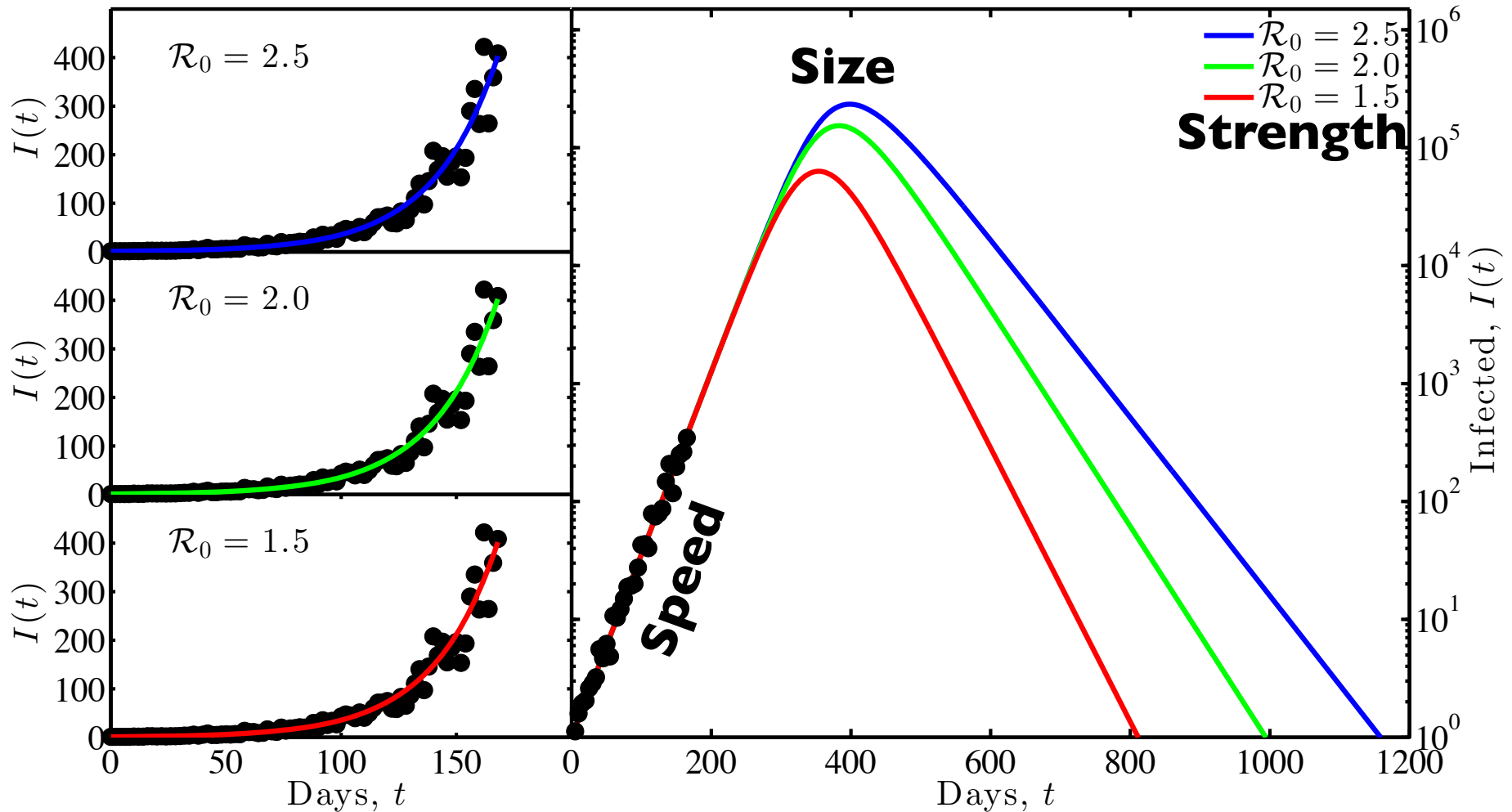
2. Mask wearing enforced in all buildings that have common spaces, even when alone (all teaching policies should be clear that individuals w/out masks cannot be in a lab/class/bldg).

3. The safe modality for teaching right now is: **online**; until risks diminish, testing is initiated.

Risk of a Large Outbreak: Epidemic 'Forecasts'



Risk of a Large Outbreak: Epidemic 'Forecasts'



Conditions for epidemic growth

$$\mathcal{R}_0 \equiv \overbrace{\beta}^{\text{infections per time}} \times \overbrace{T_I}^{\text{infectious period}}$$

Where infections per time, β , is a product of:

- Contacts by infectious individuals per unit time
- Probability of contact with a susceptible (S_0/N)
- Probability that the contact transmits the disease

Conditions for epidemic growth also suggest opportunities for **control**

$$\mathcal{R}_0 \equiv \overbrace{\beta}^{\text{infections per time}} \times \overbrace{T_I}^{\text{infectious period}} \quad \text{Hospitalization \& treatment}$$

Where infections per time, β , is a product of:

- Contacts by infectious individuals per unit time
- Probability of contact with a susceptible (S_0/N)
- Probability that the contact transmits the disease

Contact tracing & targeted isolation

Quarantine, travel control, closures, & shield immunity

Process engineering & PPE (masks)

Risk of a Large Outbreak: Outcomes and Mitigation

Reducing the effective ‘strength’ R_{eff} in a campus environment is helped by:

- Mask wearing compliance.
- Widespread testing and rapid return of test information to initiate responses.
- Minimizing large group interactions, esp. indoors
- Rapid contact tracing, e.g. person A can infect person B and person B can show symptoms at/before person A (!!!). Pre-symptomatic transmission can be reduced by contact tracing.

‘Final size’ estimates of >50% plausible.

Mitigation steps:

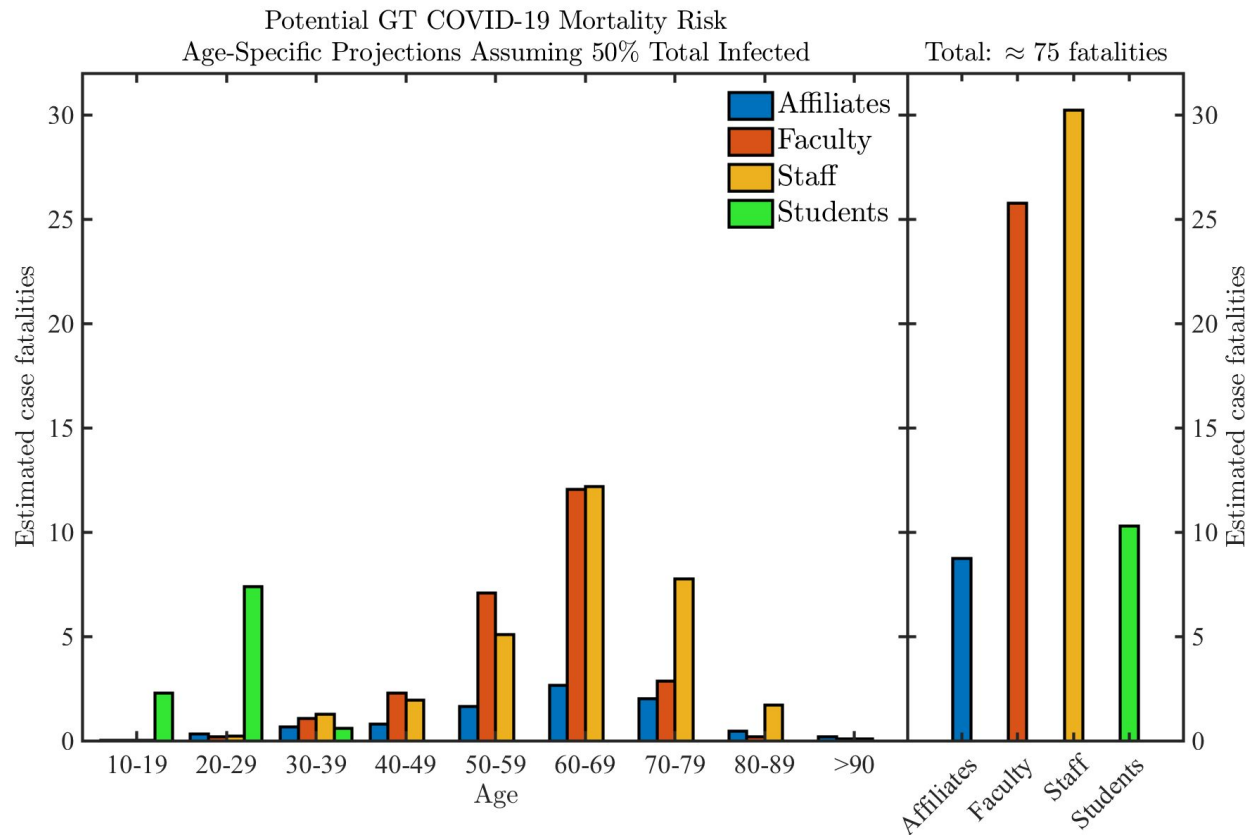
1. Rapid testing/return of information is key.

<24 hr turnaround essential to break chains of transmission (aim for <48 hrs in all cases).

2. Symptom checks insufficient; estimates are that 50% or transmission via mild/asymptomatic route, and likely even higher in younger populations. Assume you/others are infected; act accordingly.

3. 80-20 rule suggests bulk of transmission due to ‘super-spreading’ events (avoid gatherings)

Risk of Severe Outcomes: A Community of Students, Staff, and Faculty



Take-away: this scenario is based on an unmitigated epidemic; and highlights the need for action-taking. Assumes 50% infection of the community, with age-stratified risk, but not including co-morbidity information; data on age distributions from GT Institutional Research and Planning. Analysis based on Imperial College London analysis of age-stratified risk.

Risk of Severe Outcomes:

A Community of Students, Staff, and Faculty

Covid-19 has many kinds of severe outcomes:

- Lung damage (perhaps ‘silently’).
- Long-term health problems (breathing, and damage to other tissue function).
- Extended hospitalization.
- Increased fatality with age.

Take-away: Per-capita, staff and faculty are at greater risk, but students can also have severe outcomes; strategy should be to take steps to reduce transmission.

Mitigation steps:

1. Operate as liberally as possible with respect to HR decisions on remote teaching.
2. Consider reducing in-person interactions whenever possible, shift-work, reducing density
3. Baseline $R_0 \sim 3$ implies need $>67\%$ aggregate reduction to halt an initial outbreak.
4. We are all in this together: protect each person to protect us all.

Covid-19 and Education Restart: Take-aways and Recommendations

Testing:

Consider arrival testing for all community members until complete; reducing the size of initial outbreak, and using contact tracing for follow-up (with pool this could take ~10 days).

Mask-wearing:

Enforceable inside buildings, i.e., students asked to leave a room/building if necessary and return to dorm to get mask (aim for ~100% compliance). Increased distribution of disposable masks around campus.

Teaching Modality:

Online should be the default mode; hybrid can include occasional face-to-face interactions and increase as conditions warrant (17 state motion implies that ICE guidance may soon not be operative).

Essential Interactions and Risk:

Reduce indoor classes/gatherings/meetings whenever possible, find an equivalent substitute, protect and inform essential workers (often hardest hit); devise plans to protect and respect the entire campus community.

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Questions?



Thank you:

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