Time to go back to school? Using agent-based modeling to inform COVID-19 decision making

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Covasim[†]

Covasim is an agent-based COVID-19 model built to explore reopening scenarios

- **Infections:** Age-specific COVID-19 dynamics

- **Person-to-person contacts:**
  - Depends on age and setting[‡]
  - Contacts can change day-by-day

- **Interventions:**
  - Setting-specific countermeasures
  - Testing, tracing, diagnosis & quarantine
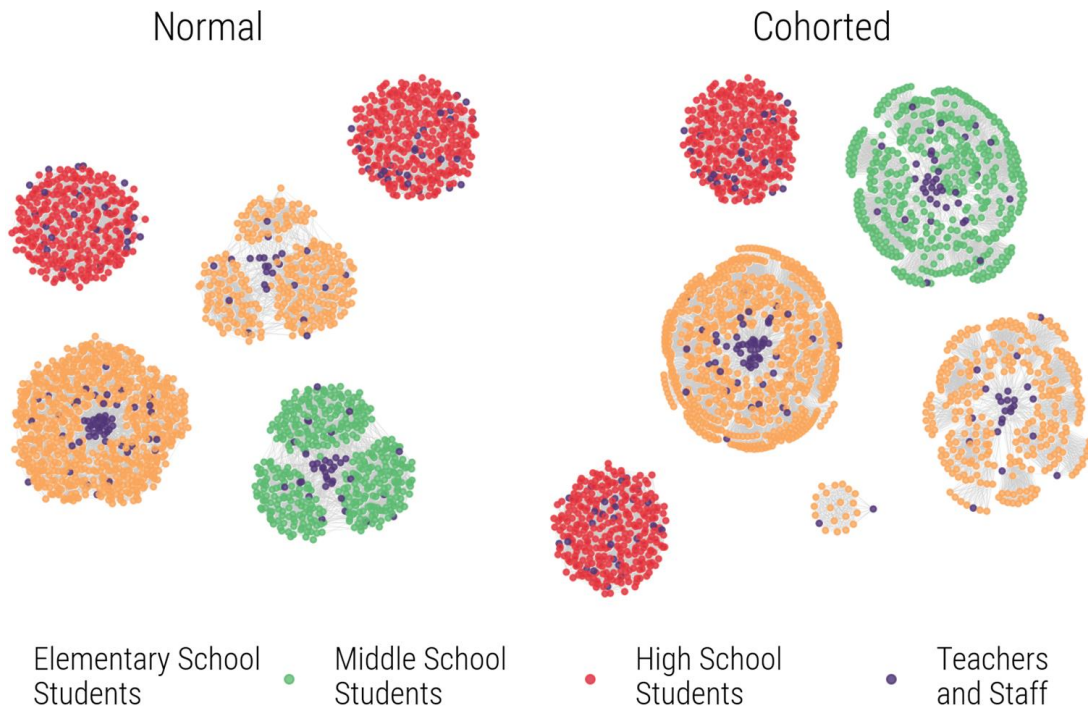 - Configurable delays in test & trace

SynthPops[‡]

Schematics by Mandy Izzo, IDM
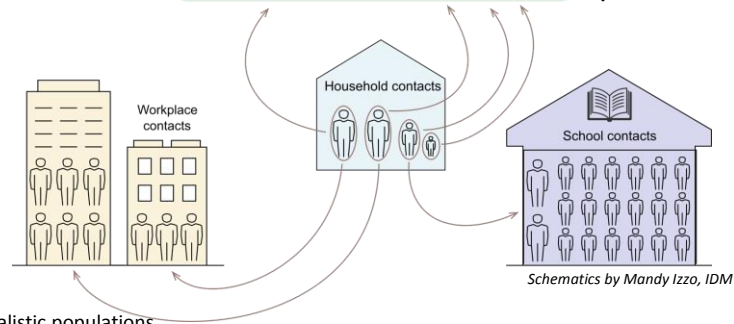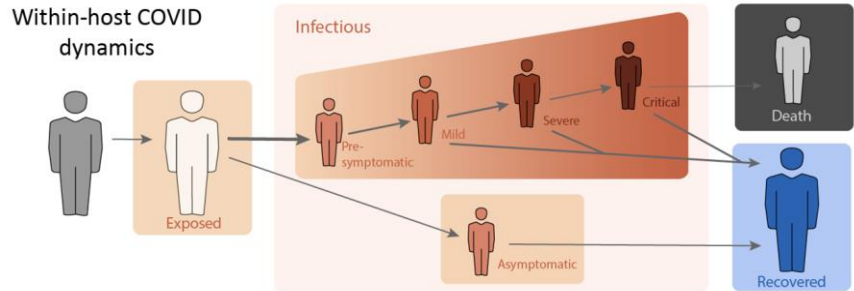
Non-pharmaceutical interventions (NPI): physical distancing, hand hygiene, masks, and ventilation.
† Model code available at: covasim.org
‡ A contact network of agents was constructed using SynthPops (synthpops.org), a model to generate contact networks of realistic populations, with data on age, households, and activity patterns from census and BLS statistics for King County from 2015-2019. Age-mixing patterns are used for the US to construct contacts within households, schools, workplaces, long-term care facilities, and the general community.

Detailed School Networks

- Context: Seattle, King County, WA

- Feedback from area schools on feasible scenarios

- **Interventions:**

  - Non-pharmaceutical interventions (NPIs)
  - school scheduling and cohorting
  - Diagnostic screening and testing of students and staff

- **Goal:** What is the potential benefit of interventions?

Normal   Cohorted

Elementary School Students   Middle School Students   High School Students   Teachers and Staff

What happens outside of schools is even more important than what happens inside.

As background transmission increases, our ability to reduce epidemic growth decreases and the educational "cost" increases.
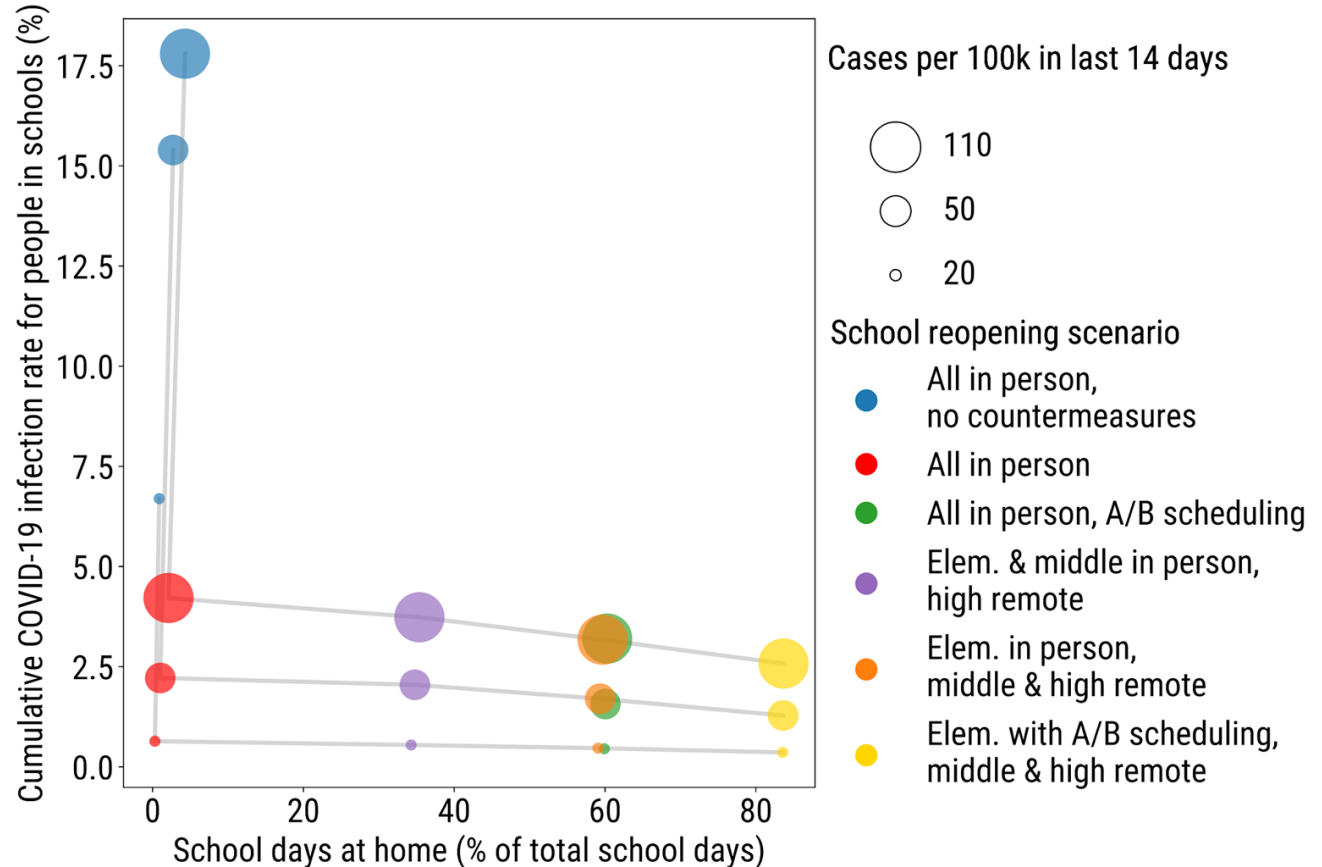
School reopening scenarios

1. Full schedule, no countermeasures

➤ *5d in-person, unchecked growth*

2. Full schedule

➤ *5d in-person*

3. Hybrid scheduling

➤ *A & B groups in-person 2d per week*

4. Phased-in scheduling

➤ *K-5 [†] 5d in-person, others remote*

5. All remote

➤ *Continued remote learning for all*

[†] Compared to adults 20-64, children 0-9 and 10-19 are assumed to be 33% and 66% as susceptible, see Zhang, *Science*, 2020.

Diagnostic screening scenarios

■ No diagnostic screening

□ PCR one week prior, 1d delay

□ Weekly antigen for teachers & staff, PCR f/u

■ Fortnightly antigen, no f/u

■ Fortnightly antigen, PCR f/u

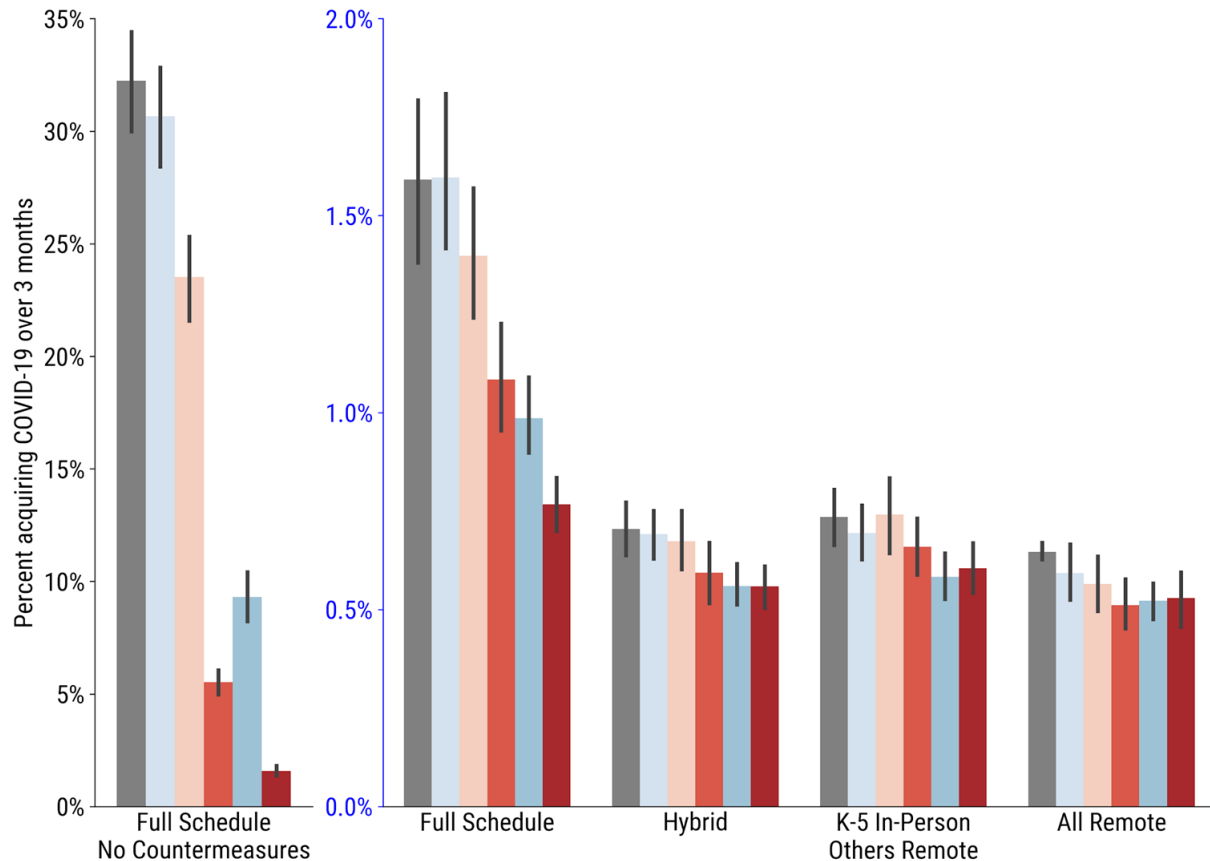■ Fortnightly PCR, 1d delay

■ Weekly antigen, PCR f/u

■ Weekly PCR, 1d delay

■ Daily PCR, no delay

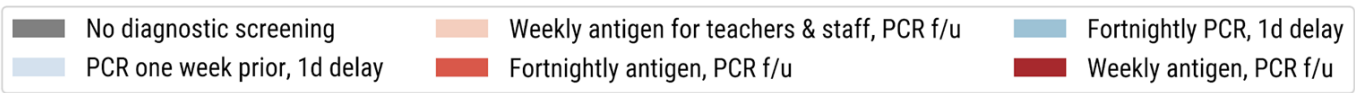Scenarios outlined in black are included in these slides, see report for others.
* Antigen tests are less reliable. Positives can isolate without PCR follow-up (f/u) or seek PCR confirmation with 3-day lag.

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Students, Teachers, and Staff

Bars indicate % of school populations acquiring COVID-19 *from any source* during first 3 months of school

Key Findings

1. No zero-risk scenario

2. Countermeasures are effective

3. Hybrid & K-5 phase-in are not much riskier than all remote

4. Dx screening is helpful only when there are infections to catch

Legend:
- No diagnostic screening
- PCR one week prior, 1d delay
- Weekly antigen for teachers & staff, PCR f/u
- Fortnightly antigen, PCR f/u
- Fortnightly PCR, 1d delay
- Weekly antigen, PCR f/u

Countermeasures include symptom screening, NPIs (25% reduction), and contact tracing.

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Takeaways

- Our results continue to underscore the importance of decreasing community transmission.

- In-person learning is not zero-risk, but symptom screening and other countermeasures are highly effective in this analysis.

- Returning elementary school students first poses lower epidemic risk (due to their reduced susceptibility) and higher benefit.

- We may be able to employ a phased-in approach to in person learning and avoid epidemic growth.

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