Strategies to support the COVID-19 response in LMICs

A virtual seminar series
Modeling and forecasting COVID-19

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"All **models** are wrong, but some are **useful**“
- George Box

But useful for what?
• **Theory** – How do disease systems likely behave under certain conditions?

• **Strategic Modeling** – How will intervention X work given conditions Y? Broadly, what are the critical scenarios we should be planning for?

• **Inference** – What do observed trends tell us about the nature of the disease and the effectiveness of our control measures?

• **Forecasting** – What is the likely future course of the epidemic?
• **Theory** – How do disease systems likely behave under certain conditions?

• **Strategic Modeling** – How will intervention $X$ work given conditions $Y$? Broadly, what are the critical scenarios we should be planning for?

• **Inference** – What do observed trends tell us about the nature of the disease and the effectiveness of our control measures?

• **Forecasting** – What is the likely future course of the epidemic?
The ensemble forecast combines models unconditional on particular interventions being in place with those conditional on certain social distancing measures continuing. To ensure consistency, only models with 4-week-ahead forecasts ahead are included in the ensemble.

Data last updated on Tue, 16 Jun 2020 16:59:10 GMT.
Visualizations use D3, see the supported browsers here. The source is licensed MIT.
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Approach

PLANNING SCENARIOS NOT FORECASTS

• Focus on scenarios relevant to planning decisions.
• Use rough approximations given best knowledge of disease dynamics, current situation and severity.
  • differences more informative than absolutes
• Use a pipelined approach to ease integration of new knowledge and comparison of models
Scenario Modeling Pipeline

Model Seeding
- seeding infections

Epidemic Generation
- epidemic assumptions, observed counts, intervention scenarios
- infection counts

Hospitalization and Outcomes
- infection fatality rate
- relative hospitalization
- health outcomes

Report Generation
1. **Continued Stay-at-Home Measures with Declining Adherence:** Continuation of measures currently in place in Maryland, with declining adherence, ending December 31, 2020

2. **Maryland Strong Roadmap to Recovery:** Current measures, followed by stages 1 and 2 of the Maryland Strong Roadmap to Recovery, ending December 31, 2020

3. **Self isolation (SI) and Household (HH) quarantine:** Current measures, followed by 90% compliant self isolation and household quarantine

4. **SI, HH, Delayed Manual Contact Tracing:** Current measures, followed by 90% compliant self isolation, household quarantine, and delayed manual contact tracing of non-household contacts

5. **SI, HH, Delayed Manual Contact Tracing + Social distancing:** Current measures, followed by 90% compliant self isolation and household quarantine, delayed manual contact tracing of non-household contacts, and maintained social distancing

6. **HH, Manual Contact Tracing + Social distancing:** Current measures, followed by 90% compliance self isolation and household quarantine and manual contact tracing of non-household contacts and maintained social distancing
ICU Bed Needs

PLANNING SCENARIO – NOT A FORECAST
Does any of this translate to international settings, particularly LMICs?
Case Study: Bangladesh

Source: IEDCR
Are the data there?

Model Seeding → Epidemic Generation → Hospitalization and Outcomes → Report Generation

- International flight data
- External epidemics
- Epidemic assumptions, observed counts, intervention scenarios
- Infection fatality rate relative hospitalization
- Seeding infections
- Infection counts
- Health outcomes
Are the data there?

Model Seeding

International flight data
External epidemics

Epidemic Generation

epidemic assumptions, observed counts, intervention scenarios

Hospitalization and Outcomes

infection fatality rate
relative hospitalization

Report Generation

seeding infections
infection counts
health outcomes
Are the data there?

International flight data
External epidemics

Model Seeding

Epidemic Generation

seeding infections

infection counts

Hospitalization and Outcomes

infection fatality rate
relative hospitalization

health outcomes

Report Generation

epidemic assumptions,
observed counts,
intervention scenarios
Consider the outcomes

International flight data
External epidemics

Model Seeding → seeding infections

Epidemic Generation → epidemic assumptions, observed counts, intervention scenarios

Hospitalization and Outcomes → infection fatality rate
relative hospitalization

Health outcomes → Report Generation
What is the point of giving a forecast?

Do we accomplish anything by just telling people things are going to be bad?
Are the scenarios practical?

Source: Dhaka Tribune
Projections of COVID-19 epidemics in LMIC countries

Authors: Carl A.B. Pearson*, Kevin van Zandvoort, Christopher Jarvis, Nicholas Davies, Francesco Cencetti, CMMID nCov working group, Mark Jit & Rosalind M Eggo*.

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The impact of COVID-19 and strategies for mitigation and suppression in low- and middle-income countries

Patrick G. T. Walker1,*, Charles Whittaker1,*, Oliver J Watson1,2,*, Marc Baguelin1,3, Peter Winskill1, Arra... See all authors and affiliations
The impact of COVID-19 and strategies for mitigation and suppression in low- and middle-income countries

Patrick G. T. Walker\textsuperscript{1,4,*}, Charles Whittaker\textsuperscript{1,*}, Oliver J Watson\textsuperscript{1,2,*}, Marc Baguelin\textsuperscript{1,3}, Peter Winskill\textsuperscript{1}, Arra...
A Maternal deaths per month

- Baseline deaths
- Additional deaths

B Child deaths per month

- Baseline deaths
- Additional deaths due to reduced coverage of interventions
- Additional deaths due to wasting

Source: Robertson et al 2020 Lancet Global Health
Source: Takahashi et al 2015 Science
Conclusions

• Models can be useful
• Consider differences in settings
• Consider indirect effects
Johns Hopkins Infectious Disease Dynamics
• Elizabeth C. Lee
• Kyra H. Grantz
• Hannah R. Meredith
• Qifang Bi
• Joshua Kaminsky
• Stephen A. Lauer
• Justin Lessler
• Shaun A. Truelove

University of Utah
• Lindsay T. Keegan

Developers Without Affiliation
• Sam Shah
• Josh Wills

University of Florida
• Derek Cummings
• Bingyi Yang
• Angkana T. Huang