

Understanding the epidemiology of COVID-19 and the effectiveness of non- pharmaceutical interventions

Development Policy and COVID-19 eSeminar Series

April 14, 2020

9:00 AM ET

The epidemiology of COVID-19 and the effectiveness of non-pharmaceutical interventions

- The WB has re-oriented much of staff efforts to countering effects of the pandemic
- It will be useful to review epidemiological models that predict the future course of illness, and the estimated effectiveness of various interventions to lower transmission
- Seminar discuss the epidemiology of the SARS-CoV-2 virus, and the effectiveness of strategies to reduce the spread in a population

Brief overview of key terminology

- Reproduction number, R_0 – the average number of secondary infections resulting from an initial infected person
 - Basic R_0 – maximum epidemic potential of a pathogen
 - Effective R_0 – depends on population's susceptibility and interventions – including changing rates of contact
- Latent period – Time (days) from infection to onset of infectiousness
- Infectious period – Average time (days), a person is infectious
 - Serial interval – Time between onset of symptoms in index case and onset of symptoms in their contacts
- Seasonal forcing – Amplitude of seasonal variation in transmission
- Case fatality ratio – number of deaths/total number of people diagnosed for a certain period of time
 - Infection fatality ratio – accounts for asymptomatic and undiagnosed infections
- Health system features: hospital beds, staffing, ICU beds, duration of treatment/stay, key equipment: oxygen, ventilators, personal protective equipment (PPE)
- Non-pharmaceutical interventions (NPIs): type, compliance/enforcement, duration

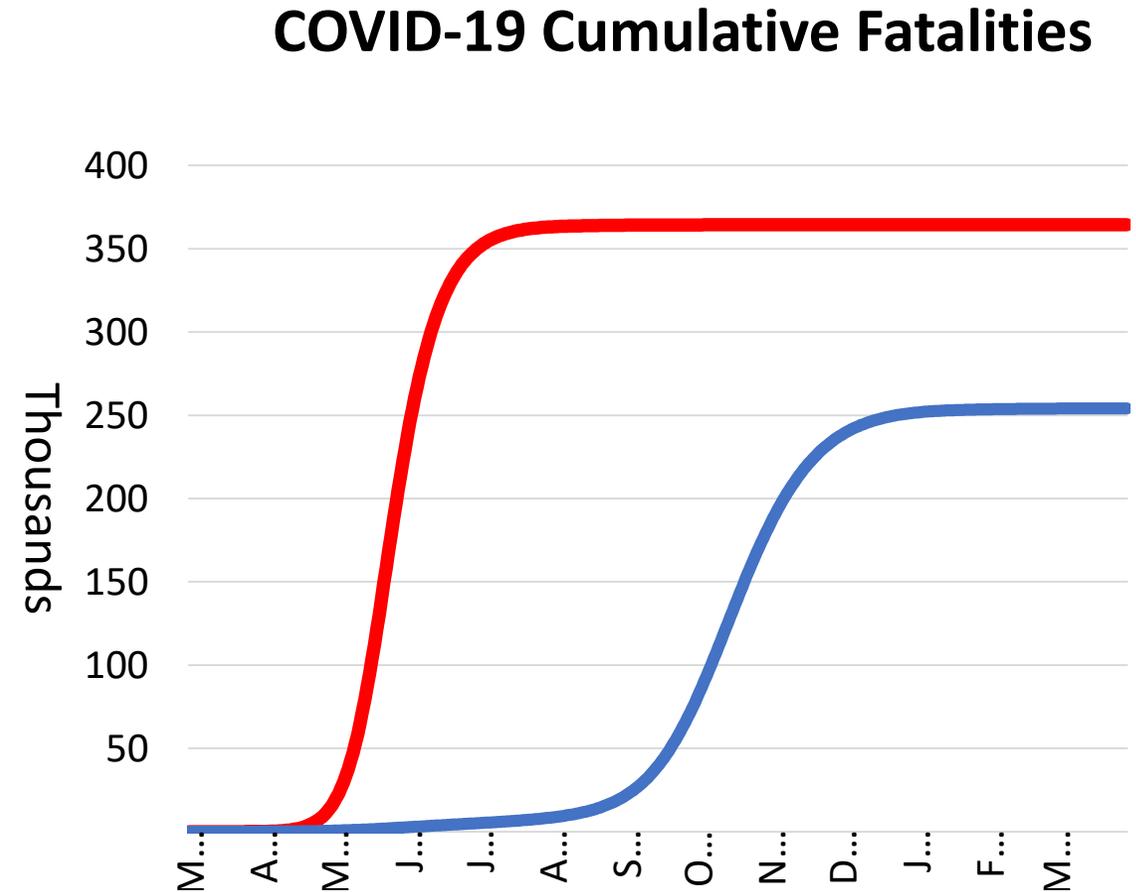
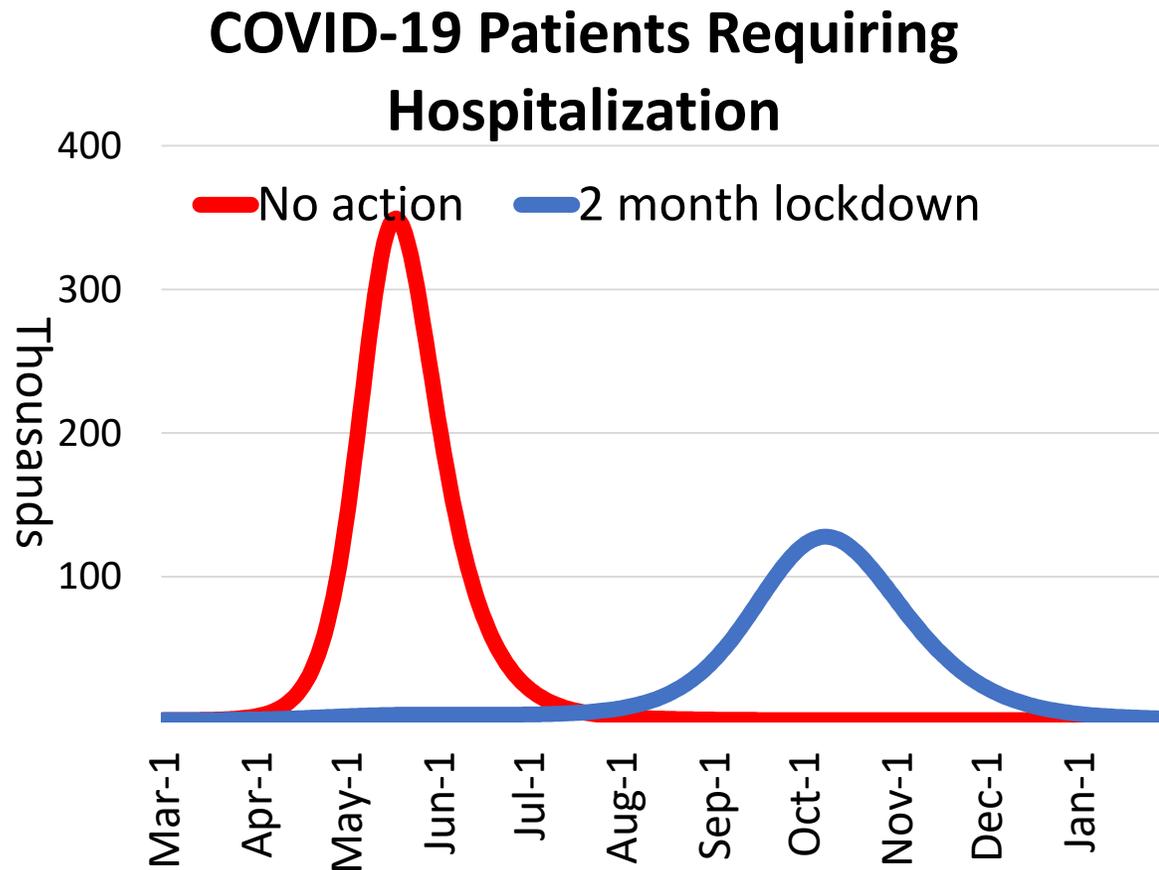
Many types of NPIs

- Various categories of NPIs, all attempt to reduce transmission of virus
- Surveillance
 - Test, trace, isolate
- Trade and travel restrictions
 - Visa restrictions, traveler screening, forced traveler quarantine, border closure to people or goods
- Quarantine
 - Of existing cases in household, of entire regions
- Social distancing
 - Ban on public gathering, public transport ban, school/business closure, stay-at-home orders
- Hygiene recommendation/enforcement
 - Preventive behavior promotion, facemask recommendation/mandate
- Effectiveness will depend on numerous factors: duration and compliance/enforcement of NPI, epidemiological factors (R_0 , latency, etc.)

Online resources for epidemiological modeling and projections

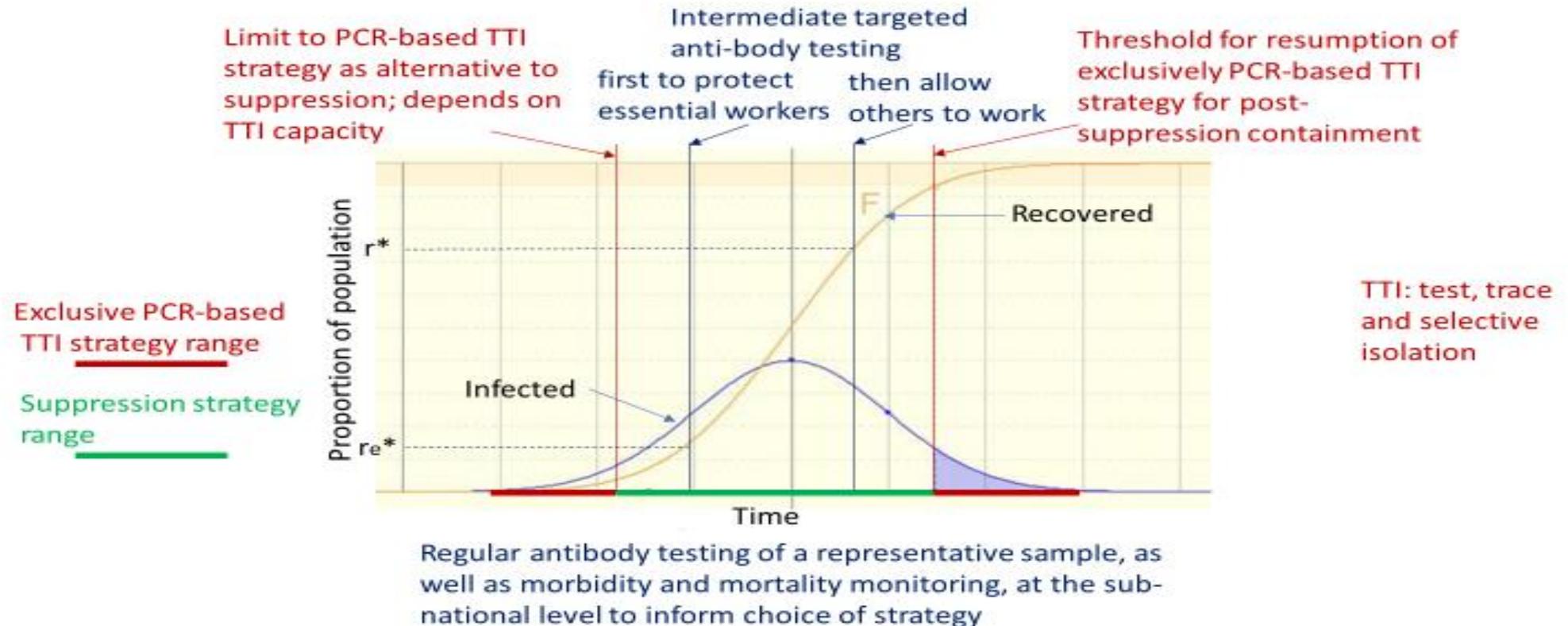
- Review in [blog post](#).
- WB, International Decision Support Initiative (IDSI), Gates Foundation and WHO have developed partnership to review and compare all models.
- [Imperial College COVID-19 Response Team provides estimates](#) under 5 scenarios, from unmitigated to early suppression strategy.
 - Online appendix provides country-level estimates with further possibility to adjust some parameters such as baseline R_0 and the intensity of social distancing measures.
- [University of Basel COVID-19 scenarios](#): online tool allowing to run your own projections and enter country-specific numbers. Intuitive, flexible, but users will have to closely calibrate parameter estimates to data. Age structure of the population is preloaded for each country.
- [Institute for Health Metrics and Evaluation \(IHME\)](#): Projections available now for US and European countries. African countries coming soon and collaboration with WB for regularly updated projections for countries with WB COVID-19 financing. Scenario projected assumes current social distancing measures maintained. Not based on S-I-R model but model that fits the empirically observed COVID-19 population death rate curves.

Example of NPI effectiveness: Effects of 2 months lock-down in a large middle income country (as projected by a WB team using the U of Basel tool)



Central role of testing: effectiveness of NPIs depends on information available ([de Walque, Friedman, Gatti, and Mattoo](#))

Figure 1. When the PCR Assay and the Antibody Test Are Most Useful



Outline of e-seminar

- Patrick Walker and Azra Ghani, Imperial College COVID-19 Response team:
 - Underpinnings of model and its main predictions
 - How are the effectiveness of NPIs modeled?
 - What are the main policy recommendations?
 - Specific issues for low and middle-income countries: age structure of the population, multigenerational households, crowded habitat (slums), and difficulty to enforce social distancing measures with people living in the informal sector.
- David Wilson and Marelize Gorgens (World Bank HNP):
 - Trade-off: need to curb coronavirus, but pressure to reopen economies
 - Key considerations: (i) epidemic force; (ii) capacity to manage reduced measures; (iii) population health; (iv) public health capability; (v) health system capacity; (vi) national decision-making capability; and (vii) technological innovations.