



COVID-19 Summary

Vol. 18 October 29, 2020

MIT ILP UPDATES // COVID-19 RELATED

This is a very brief collection of current resources and information from MIT’s Industrial Liaison Program covering a range of issues related to COVID-19 and is offered to help us all navigate during this ongoing unprecedented and disruptive time.

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UPCOMING EVENTS

MIT ILP WEBINARS

See: https://ilp.mit.edu/search/event?f%5B0%5D=event_type_term%3A24

MONDAY, 2 NOVEMBER, 10:30 AM – 12:00 PM: HUMANIZING DRUG DEVELOPMENT

MIT Corporate Relations / ILP

Agenda: <https://ilp.mit.edu/attend/humanizing-drug-development>

THURSDAY, 5 NOVEMBER, 11:00 AM – 1:00 PM: LOW POWER / EDGE COMPUTING

MIT Corporate Relations / ILP

Agenda: <https://ilp.mit.edu/attend/low-powered-edge-computing>

TUESDAY, 10 NOVEMBER, 1:00-2:00 PM: LET'S FIX DIGITAL HEALTHCARE

CSAIL

Speaker: Prof. Harold Thimbleby, See Change Fellow in Digital Health, Swansea University in Wales

Related to new book: *Fix IT: How to solve the problems of digital healthcare*

<https://www.csail.mit.edu/event/lets-fix-digital-healthcare>

<https://mit.zoom.us/j/93316272563>

THURSDAY, 12 NOVEMBER 12, 5:00-6:30 PM: STORY SLAM: TALES FROM THE BENCH AND BEYOND

McGovern Institute, <https://bcs.mit.edu/news-events/events/story-slam-theses-bench-and-beyond>

Register: <https://mcgovern.mit.edu/mcgovern-20/storyslam/>

Students, postdocs and faculty share tales from the bench and beyond

PROJECTS, INITIATIVES, RESEARCH

NEW MODELS FOR CLIMATE AND HEALTH

Technology & Policy Program, <https://tpp.mit.edu/>

MIT Joint Program on the Science and Policy of Global Change, <https://globalchange.mit.edu/>

https://www.biogen.com/en_us/stories/healthandclimate.html

https://www.biogen.com/en_us/healthy-climate-healthy-lives.html

<https://idss.mit.edu/news/biogen-sponsors-tpps-research-to-policy-engagement-initiative/>

“If climate change mitigation efforts are designed with people in mind, they can meaningfully improve public health and reduce the burden of disease,” said [Noelle Eckley Selin, Ph.D., Director of the MIT Technology and Policy Program](#).

To that end, Biogen will work with the [MIT Technology and Policy Program](#) and the [MIT Joint Program on the Science and Policy of Global Change](#) to support the creation of new models of how different climate actions impact human health. The insights will be used to bridge research-to-policy gaps, influence policy decisions and advance training of the next generation of scientists and leaders for far-reaching impact.

“Biogen’s collaboration will inject an exciting new facet into our work: inclusion of human health and well-being as key new considerations in decision-making regarding the best pathways forward to address the global climate challenge,” Dr. Selin said....

BIOGEN:

...Collaborating to advance the science and set new targets – We will work with renowned institutions to use data science and predictive analytics to drive strategies to mitigate climate and health impacts from climate change as well as influence policy and improve health outcomes, particularly for the world’s most vulnerable populations.

The collaboration with the MIT Joint Program on the Science and Policy of Global Change and the MIT Technology and Policy Program will support the creation of new models of how different climate actions impact human health. The insights will be used to bridge research-to-policy gaps, influence policy decisions and advance training of the next generation of scientists and leaders for far-reaching impact.

ENGINEERING SYSTEMS LABORATORY (ESL)

Faculty Director: [Prof. Olivier de Weck](#)

<https://systems.mit.edu/>

Related MIT News story: <https://news.mit.edu/2020/covid-19-modeling-1006>

The ESL studies the underlying principles and methods for designing complex socio-technical systems that involve a mix of architecture, technologies, organizations, policy issues, and complex networked operations. Our focus is on aerospace and other systems critical to society such as product development, manufacturing, and large scale infrastructures.

[Strategic Engineering Research](#) Group

[System Architecture](#) Group

[System Safety and Cybersecurity](#) Group

[Systems Engineering Advancement Research Initiative](#) (SEArI)

Handling the COVID-19 crisis: Toward an agile model-based systems approach

[Olivier de Weck \(Aero/Astro\)](#), Daniel Krob, Li Lefei, Pao Chuen Lui, Antoine Rauzy, Xinguo Zhang

Systems Engineering, Volume 23, Issue 5, September 2020, Pages 656-670,

First published: 27 August 2020 <https://doi.org/10.1002/sys.21557>

The COVID-19 pandemic has caught many nations by surprise and has already caused millions of infections and hundreds of thousands of deaths worldwide. It has also exposed a deep crisis in modeling and exposed a lack of systems thinking by focusing mainly on only the short term and thinking of this event as only a health crisis. In this paper, authors from several of the key countries involved in COVID-19 propose a holistic systems model that views the problem from a perspective of human society including the natural environment, human population, health system, and economic system. We model the crisis theoretically as a feedback control problem with delay, and partial controllability and observability. Using a quantitative model of the human population allows us to test different assumptions such as detection threshold, delay to take action, fraction of the population infected, effectiveness and length of confinement strategies, and impact of earlier lifting of social distancing restrictions. Each conceptual scenario is subject to 1000+ Monte-Carlo simulations and yields both expected and surprising results. For example, we demonstrate through computational experiments that maintaining strict confinement policies for longer than 60 days may indeed be able to suppress lethality below 1% and yield the best health outcomes, but cause economic damages due to lost work that could turn out to be counterproductive in the long term. We conclude by proposing a hierarchical Computerized, Command, Control, and Communications (C4) information system and enterprise architecture for COVID-19 with real-time measurements and control actions taken at each level.

C3.AI DIGITAL TRANSFORMATION INSTITUTE – MIT PROJECTS

<https://c3dti.ai/research/projects/>

The C3.ai Digital Transformation Institute is a research consortium dedicated to accelerating the benefits of artificial intelligence for business, government, and society. The Institute engages the world's leading scientists to conduct research and train practitioners in the new Science of Digital Transformation, which operates at the intersection of artificial intelligence, machine learning, cloud computing, internet of things, big data analytics, organizational behavior, public policy, and ethics.

Pandemic Resilient Urban Mobility: Learning Spatiotemporal Models for Testing, Contact Tracing, and Reopening Decisions

Prof. [Saurabh Amin](#) (CEE, ORC), Prof. [Patrick Jaillet](#) (EECS, ORC), Prof. Jitendra Malik (UC Berkeley)

This project focuses on the design of actionable information and effective intervention strategies to support safe mobilization of economic activity and reopening of mobility services in urban systems....

Toward analytics-based clinical and policy decision support to respond to the COVID-19 pandemic

Prof. [Dimitris Bertsimas](#) (Sloan, ORC), Prof. [Alexandre Jacquillat](#) (Sloan, ORC)

... In this project, we develop automated, interpretable, and scalable decision-making systems based on machine learning and artificial intelligence (ML/AI) to support clinical practices and public policies as they respond to the COVID-19 pandemic...

Reinforcement Learning to Safeguard Schools and Universities Against the COVID-19 Outbreak

Prof. [Munther Dahleh](#) (EECS, IDSS), Prof. [Anette Hosoi](#) ([School of Engineering](#), MechE, IDSS), Prof. Mengdi Wang (Princeton)

...In this proposal, we seek to develop analytical methods for modeling and mitigating the COVID-19 situation based on students' location and symptom data collected via mobile apps...

Machine Learning Based Vaccine Design and HLA Based Risk Prediction for Viral Infections

Prof. [David Gifford](#) (EECS, [Biological Engineering](#))

We will develop and apply new methods for vaccine design and viral disease severity prediction based upon our recent developments in the prediction of the presentation of viral antigens by Class I and Class II MHC complexes...

Targeted Interventions in Networked and Multi-Risk SIR Models: How to Unlock the Economy During a Pandemic

Prof. [Asuman Ozdaglar](#) (EECS; [Schwarzman College of Computing](#); [LIDS](#), [IDSS](#)), Prof. [Daron Acemoglu](#) (Economics & [Sloan School](#)), Francesca Parise (Postdoc, LIDS)

The main objective of the proposed research is to study optimal lockdown and testing policies for the containment of disease spread in networked environments...

STUDENT PROJECT: TECH MASKS

Will Archer, MIT '21

<https://techmasks.square.site/>

As the COVID-19 pandemic developed, I thought about different ways I could help others through this time. The idea of producing face masks that support food banks hit two goals at once - face mask availability helps as many people as possible follow public health guidelines and food banks can help bridge the gap for those facing food and job insecurity.

I am happy to announce that officially licensed masks with MIT's logo and Tim the Beaver are now available. All profits from the mask sales will be donated to The Greater Boston Food Bank, a non-profit dedicated to fighting hunger in Eastern Massachusetts.

The ongoing pandemic has put enormous stress on the nationwide network of food banks - they need our help now more than ever.

MIT Logo Face Mask,

<https://techmasks.square.site/product/mit-logo-face-mask/1?cs=true>

Tim the Beaver Face Mask,

<https://techmasks.square.site/product/tim-the-beaver-face-mask/2?cs=true>

Masks for safety, money for food

MIT senior Will Archer puts his entrepreneurial skills to work while raising funds for a local food bank.

Kate S. Petersen | School of Engineering | MIT Schwarzman College of Computing /MIT News

Publication Date: October 21, 2020, <https://news.mit.edu/2020/tech-masks-for-safety-money-for-food-1021>

When the Covid-19 pandemic began, electrical engineering and computer science major Will Archer wondered, “How can I help people who are being hurt by the pandemic more than I am?”

He took note of calls for support from local food banks as Covid-19-related food insecurity became an escalating burden for many vulnerable people. And he started brainstorming ways to contribute.

Archer, now an MIT senior, found his answer when he was looking to buy an MIT-themed face mask online and realized there were likely many students searching for the same thing. He then had a realization: He could begin producing MIT-branded face masks and donate all the proceeds to local food banks.

Archer started working on the project in late May. “I’ve never done anything like this before, so it was a lot of research,” he says.

He worked out the logistics of securing a licensing agreement with MIT, finding a manufacturer of good-quality masks, and researching business structures while simultaneously working a full-time summer internship at Bose, where he investigated product software vulnerabilities and tested new security protocols. By early July, he was able to launch Tech Masks, an unofficial source of MIT-branded face masks that donates all proceeds to The Greater Boston Food Bank.

This fall semester, Archer continues to manage Tech Masks and says the products have been popular. “The pandemic is one of the most impactful events to happen in my lifetime,” said Archer. “I felt I needed to find a way to help.”

PAPERS, ARTICLES, PRESENTATIONS, TALKS’

MIT PRESS: RAPID REVIEWS: COVID-19

RRC19 is published by The MIT Press with generous support from the Patrick J. McGovern Foundation and edited by a team from UC Berkeley

<https://rapidreviewscovid19.mitpress.mit.edu/>

<https://rapidreviewscovid19.mitpress.mit.edu/reviewapproach>

Rapid Reviews: COVID-19 is an open-access overlay journal that accelerates peer review of COVID-19-related research preprints to advance new and important findings, and prevent the dissemination of false or misleading scientific news.

The editors, led by Professor Stefano Bertozzi and based at UC Berkeley, approach COVID-19 and its wide-ranging effects from a multidisciplinary and global perspective, reviewing papers from the fields of medicine; public health; the physical, biological, and chemical sciences; engineering; social sciences and the humanities.

Public Health: Reviews of “College campuses and COVID-19 mitigation: clinical and economic value” (example)

<https://rapidreviewscovid19.mitpress.mit.edu/pub/yip1lofx/release/1>

More public health reviews: <https://rapidreviewscovid19.mitpress.mit.edu/public-health>

This is a comprehensive model that covers a timely topic; however, the many estimations that went into the model, as well as the use of “contact-hours” as a key parameter, may make the conclusions subject to uncertainty.

- [Biological and Chemical Sciences](#) Reviews
- [Medical Sciences](#) Reviews
- [Physical Sciences & Engineering](#) Reviews
- [Humanities & Social Sciences](#) Reviews

MODELING / PHYSICS: SUPERSPREADING EVENTS WITHOUT SUPERSPREADERS: USING HIGH ATTACK RATE EVENTS TO ESTIMATE N_0 FOR AIRBORNE TRANSMISSION OF COVID-19

Mara G Prentiss, Arthur Chu, [Karl K. Berggren](#) (Professor of Electrical Engineering, Quantum Nanostructures & Nanofabrication Group)
medRxiv, 23 October 2020 <https://doi.org/10.1101/2020.10.21.20216895>

We study transmission of COVID-19 using five well-documented case studies: a Washington state church choir, a Korean call center, a Korean exercise class, and two different Chinese bus trips. In all cases the likely index patients were pre-symptomatic or mildly symptomatic, which is when infective patients are most likely to interact with large groups of people. An estimate of N_0 , the characteristic number of COVID-19 virions needed to induce infection in each case, is found using a simple physical model of airborne transmission. We find that the N_0 values are similar for five COVID-19 superspreading cases (~300-2,000 viral copies) and of the same order as influenza A. Consistent with the recent results of Goyal et al , these results suggest that viral loads relevant to infection from presymptomatic or mildly symptomatic individuals may fall into a narrow range, and that exceptionally high viral loads are not required to induce a superspreading event [1,2]. Rather, the accumulation of infective aerosols exhaled by a typical pre-symptomatic or mildly symptomatic patient in a confined, crowded space (amplified by poor ventilation, particularly activity like exercise or singing, or lack of masks) for exposure times as short as one hour are sufficient. We calculate that talking and breathing release ~460 N_0 and ~10 N_0 (quanta)/hour, respectively, providing a basis to estimate the risks of everyday activities. Finally, we provide a calculation which motivates the observation that fomites appear to account for a small percentage of total COVID-19 infection events.

WORK / TECHNOLOGY: THE IMPACT OF NEW TECHNOLOGY ON THE HEALTHCARE WORKFORCE

Ari Bronsoler (PhD student, Economics), [Joseph Doyle](#) (Sloan School), [John Van Reenen](#) (IDE)

[MIT Work of the Future](#), 26 October 2020, <https://workofthefuture.mit.edu/research-post/the-impact-of-new-technology-on-the-healthcare-workforce/> (download of research brief)

Dramatic improvements in information technology have the potential to transform health-care delivery, and a key question is how such changes will affect the healthcare workforce of the future. In this brief, we present the state of knowledge of the effects of health information technology on the workforce. We first lay out the rapidly changing health-care landscape due to the greater availability and use of information and communication technology (ICT) followed by a description of the evolution of employment, wages, and education across the wide variety of occupations in the healthcare sector since 1980. The healthcare sector has outperformed the rest of the economy and has proven resilient to the multiple downturns over the last four decades, although some groups have done much better than others. Next, we review the literature on the effects of ICT on productivity in terms of patient health outcomes and resource use, as well as the effects on healthcare expenditure. We find that there is evidence of a positive effect of ICT (e.g., especially electronic health records) on clinical productivity, but (i) it takes time for these positive effects to materialize; and (ii) there is much variation in the impact, with many organizations seeing no benefits. Looking at the drivers of adoption, we find that the role of workers is critical, especially physicians' attitudes and skills. Privacy laws, fragmentation, and weak competition are also causes of slow adoption. There is very little quantitative work that investigates directly the impact of new technology on workers' jobs, skills, and wages, but what there is suggests no substantial negative effects. Our own analysis finds no evidence of negative effects looking at aggregate data and hospital-level event studies. These findings are consistent with studies outside of healthcare, which stress the importance of complementary factors (such as management practices and skills) in determining the success of ICT investments. We conclude that management initiatives to increase the skills of workers will be required if the healthcare workforce and society more generally are to substantially benefit from the adoption of these powerful tools.

PUBLIC HEALTH / VACCINE / ETHICS: COVID-19: HOW TO PRIORITIZE WORSE-OFF POPULATIONS IN ALLOCATING SAFE AND EFFECTIVE VACCINES

Harald Schmidt, Parag Pathak (Economics), Tayfun Sönmez, and M Utku Ünver
BMJ 2020; 371 doi: <https://doi.org/10.1136/bmj.m3795> (Published 05 October 2020)

How should we decide which population groups receive covid-19 vaccines before others? Harald Schmidt, Parag Pathak, Tayfun Sönmez, and M Utku Ünver examine the existing frameworks and argue that prioritizing worse-off groups is urgent, justified, and feasible.

Conclusion: The recent WHO/SAGE and NASEM reports are significant in bringing in social justice from the periphery. In the next steps, clarifying exactly how disadvantaged groups should be prioritized, how reserves at the sub-national level should be

constructed, and what index is the most appropriate and feasible will help to further fulfill their critical promise in the US and elsewhere.

Reorienting allocation frameworks with social justice in mind can also reduce the risk of burnout among medical workers required to implement allocation strategies that may conflict, in their professional experience, with who should receive vaccines first. For many, the far higher rates of covid related deaths and hospital admissions only continue an all too familiar pattern of worse-off groups experiencing poorer health from adverse socioeconomic circumstances and insufficient access to healthcare.

Reverting to “color blind” allocation models—ones that ignore the pandemic’s vastly disparate impact, especially on worse-off minorities—would be to risk becoming complicit in structures that, once again, systematically disadvantage worse-off populations. The imperative is, therefore, to focus on a unique opportunity to become agents of change toward social justice. The NASEM framework provides a helpful starting point, both for planning the allocation of vaccines and for establishing disparate impact monitoring frameworks that may become necessary, given the flexibility provided to states.

DATA / ECONOMICS: NATURAL DISASTERS AND ELECTIVE MEDICAL SERVICES: HOW BIG IS THE BOUNCE-BACK?

Tatyana Deryugina, [Jonathan Gruber](#) (Economics), Adrienne Sabety
National Bureau of Economic Research (NBER) Working Paper 27505, July 2020,
DOI: <https://doi.org/10.3386/w27505>

COVID-19 has created a dual set of stresses on health care systems worldwide: a rise in expensive intensive care services and a dramatic decline in elective services. The U.S. government has responded with both grant and loan programs to help health care providers weather the storm. But the optimal size and nature of such programs are hard to evaluate without an understanding of the ability of providers to make up their lost elective service revenues over time. In this paper, we study the closest relevant parallel to the reduction in elective services seen under COVID-19: hurricanes. We match information on hurricanes to data on Medicare hospital elective visits and charges from 1997-2013, comparing counties impacted by hurricanes to nearby unaffected counties. We find that the average hurricane reduces elective services by about 7% in the month it makes landfall. For the most severe hurricanes, we estimate a reduction of more than 20%. Services return to baseline fairly rapidly, but for severe hurricanes it takes a year or more to make up lost revenues. Projections based on variation in hurricane severity suggest that it will take over 3 years for providers to make up the lost revenue from COVID-19.

MIT-RELATED STARTUPS

ENIGMATA

Pleasanton, CA, <http://www.engimata.net/>

Engimata is an early stage biopharma company located in the San Francisco Bay Area.

Engimata has developed a COVID-19 vaccine, using its platform nanolipid particle technology with recombinant viral surface proteins to mimic those found on the SARS-CoV-2 coronavirus particle. Engimata has promising results in animal studies and is looking forward to enter the next stage of development this fall.

IDELAN, INC.

San Jose, CA, <https://www.idelan.com/>

Idelan Inc.™ is an R&D company dedicated to providing technologies that improve the quality of life.

Ignaz: System for Increasing Hand Hygiene Compliance Rate and Mask Usage

We have developed a patent pending technology that can be used with existing washing sinks and hand sanitizer dispensers, including inexpensive plastic bottle dispensers, to create an incentive for people to clean their hands. Additionally, Ignaz can be used to increase mask usage indoors and outdoors (e.g., parks, streets). Our technology uses software and off-the-shelf hardware to improve hygiene by creating an unpredictable incentive to offset invincibility bias of individuals.

VOOMER

Brookline, MA, <https://www.tryvoomer.com/>

We are building a platform for people to learn how to excel in video interviews: For prospective college students, job applicants, and beyond. Applicants select their objectives and get an initial assessment. Based on that, Voomer builds a personalized prep program that helps to build up their confidence and speaking skills. AI video and audio analytics power the platform and provide immediate actionable feedback.

Video communication market penetration and use has exploded with COVID - and many people have finally realized how different it is to face-to-face communication. Our long term vision is to help people become confident communicators on video. This starts with the highly focused beachhead market of MBA applicants. They are a well-defined group that is highly motivated, relatively easy to locate and willing to spend money to get a solution that solves their problem.