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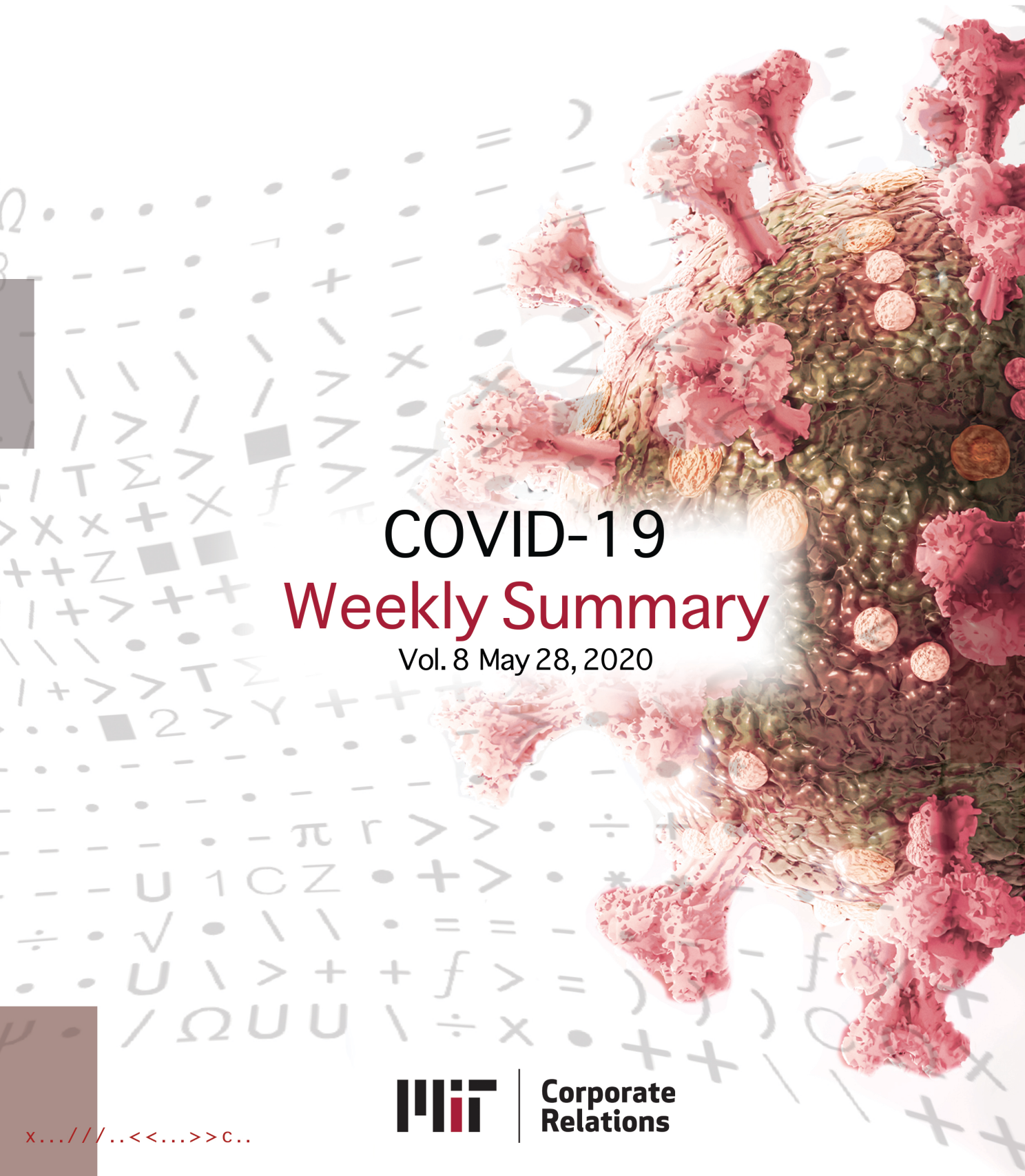

COVID-19 Weekly Summary

Vol. 8 May 28, 2020

MIT Corporate Relations

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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 unprecedented and disruptive time.

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UPCOMING EVENTS

MIT ILP WEBINARS

https://ilp.mit.edu/attend

28 May – Innovations in Management (2 of 4)
4 June – Digital Transformation (5 of 6)
9 June – Digital Transformation (6 of 6)
11 June – Innovations in Management (3 of 4)
18 June – Innovations in Management (4 of 4)
23 June – Voting in the Midst of COVID-19
25 June – An Analytics Approach to COVID-19

WEDNESDAY, 17 JUNE, 5:00-6:30 PM: LEMELSON-MIT PROGRAM – EUREKAFEST 2020 (LIVE WEBCAST)

Prof. Michael Cima,
Special guest: Andrei Iancu, Under Secretary of Commerce for Intellectual Property and Director, US Patent & Trademark Office
https://lemelson.mit.edu/events/eurekafest-2020

WEDNESDAY, 25 JUNE, 10:00-10:30 AM: DRIVING DATA: USING VEHICULAR SENSOR NETWORKS TO LEARN FROM OUR CITIES

MIT Senseable City Lab – Simone Mora, Senior Postdoctoral Associate, Senseable City Lab, Sebastiano Milardo, Postdoctoral Fellow, Senseable City Lab, Thomas Matarazzo, Postdoctoral Researcher, Senseable City Lab
http://senseable.mit.edu/webinars/Driving-Data
Register: https://mit.zoom.us/webinar/register/WN_2Vrbvur-QaSpbMCHhz9hOg

PROJECTS, INITIATIVES, RESEARCH

EPIDEMIC MODELING: IDSS: MIXTURES MATTER

MIT Institute for Data, Systems, and Society (IDSS), 24 April 2020
For further details, please contact Ali Jadbabaie, Arnab Sarker, and Devavrat Shah
https://idss.mit.edu/vignette/mixtures-matter/

As recently discussed in the New England Journal of Medicine, most models used to predict key quantities related to COVID19 take one of two general approaches. They are either mechanistic and assume an underlying model such as a Susceptible-Infected-Recovered framework, or use a data-driven, non-mechanistic method to make predictions based on existing trends in the data.

While there is a significant discussion as to when each type of approach is to be used, many of the models currently being used, regardless of their general approach, tend to share one key assumption. They either implicitly or explicitly assume that the data will have only one apex.

From a global perspective, the idea that the number of confirmed cases in a population has only one peak does not seem to account for the fact that the virus has spread from community to community. For example, the spread of COVID19 began in Wuhan, China, and the Hubei province then locally saw exponential growth in the number of confirmed cases. Later, the virus spread from community to community across the globe, starting outbreaks afterwards in Italy and the United States. These communities then saw their own local exponential growth in the number of confirmed cases.

This underlying reasoning based on community structure asks us to consider a mechanistic model based on a Stochastic Block Model, a process to generate a random graph which explicitly accounts for community structure. We can form a graph that consists of two very densely connected communities which have few connections in between members of those communities. Then, we can consider how an SIR process would spread. Such an experiment results in the following plot…. https://idss.mit.edu/vignette/mixtures-matter/

More IDSS COVID-19 Collaboration (Isolat) research at: https://idss.mit.edu/research/idss-covid-19-collaboration-isolat/

PATHOGENESIS / VIRUSES: PARTNERSHIP WITH CHAN ZUCKERBERG INITIATIVE TO PROFILE PEDIATRIC COVID-19

Alex K. Shalek, Pfizer-Laubach Career Development Associate Professor, Core Member of the Institute for Medical Engineering and Science (IMES), Associate Professor of Chemistry, Extramural Member of The Koch Institute for Integrative Cancer Research
http://shaleklab.com/partnership-with-chan-zuckerberg-initiative-to-profile-pediatric-covid-19-announced/
https://chanzuckerberg.com/newsroom/new-single-cell-technologies-help-scientists-understand-covid-19-disease-progression/
Lab: http://shaleklab.com/
Lab pubs: http://shaleklab.com/publications/

Research in the Shalek Lab is directed towards the creation and implementation of new technologies to understand how cells collectively perform systems-level functions in healthy and diseased states. We employ a comprehensive, five-step approach, developing innovative methodologies and applying them across multiple systems to empower more mechanistic inquiry and a deeper understanding of the rules that govern ensemble cellular behaviors.

With Boston Children's Hospital PI (and former post-doc) Jose Ordovas-Montanes, we will expand our COVID-19-related research to include understanding disease pathogenesis in a pediatric cohort – the data and findings of which will be readily accessible to the scientific community:

Project Leads: Alex K. Shalek and Jose Ordovas-Montanes
Researchers will study how the airways of pediatric patients respond to SARS-CoV-2 and common respiratory viruses to better understand COVID-19 disease in children. This project involves integral collaboration with clinicians at Boston Children's Hospital, and will profile 20 SARS-CoV-2 patients, 20 influenza patients, and 20 asymptomatic pediatric patients using computational tools to identify cells infected by these viruses.

Determining what causes protective and detrimental cellular responses in infected patients may have an immediate impact on pediatric and adult health.

Lab Papers:
SARS-CoV-2 receptor ACE2 is an interferon-stimulated gene in human airway epithelial cells and is detected in specific cell subsets across tissues

Ziegler et al, 2020, Cell, April 2020, DOI: 10.1016/j.cell.2020.04.035
http://shaleklab.com/publication/sars-cov-2-receptor-ace2-is-an-interferon-stimulated-gene-in-human-airway-epithelial-cells-and-is-detected-in-specific-cell-subsets-across-tissues/
http://shaleklab.com/wp-content/uploads/2020/04/CELL_CELL-D-20-00767.pdf

There is pressing urgency to understand the pathogenesis of the severe acute respiratory syndrome coronavirus clade 2 (SARS-CoV-2) which causes the disease COVID-19. SARS-CoV- 2 spike (S)-protein binds ACE2, and in concert with host proteases, principally TMPRSS2, promotes cellular entry. The cell subsets targeted by SARS-CoV-2 in host tissues, and the factors that regulate ACE2 expression, remain unknown. Here, we leverage human, non-human primate, and mouse single-cell RNA-sequencing (scRNA-seq) datasets across health and disease to uncover putative targets of SARS-CoV-2 amongst tissue-resident cell subsets. We identify ACE2 and TMPRSS2 co-expressing cells within lung type II pneumocytes, ileal absorptive enterocytes, and nasal goblet secretory cells. Strikingly, we discover that ACE2 is a human interferon- stimulated gene (ISG) in vitro using airway epithelial cells, and extend our findings to in vivo viral infections. Our data suggest that SARS-CoV-2 could exploit species-specific interferon-driven upregulation of ACE2, a tissue-protective mediator during lung injury, to enhance infection.

SARS-CoV-2 entry factors are highly expressed in nasal epithelial cells together with innate immune genes

Sungnak et al., Nature Medicine, 2020 April, http://shaleklab.com/publication/sars-cov-2-entry-factors-are-highly-expressed-in-nasal-epithelial-cells-together-with-innate-immune-genes/

We investigated SARS-CoV-2 potential tropism by surveying expression of viral entry-associated genes in single-cell RNA-sequencing data from multiple tissues from healthy human donors. We co-detected these transcripts in specific respiratory, corneal and intestinal epithelial cells, potentially explaining the high efficiency of SARS-CoV-2 transmission. These genes are co-expressed in nasal epithelial cells with genes involved in innate immunity, highlighting the cells' potential role in initial viral infection, spread and clearance. The study offers a useful resource for further lines of inquiry with valuable clinical samples from COVID-19 patients and we provide our data in a comprehensive, open and user-friendly fashion at www.covid19cellatlas.org

RAGON INSTITUTE OF MGH, MIT AND HARVARD COVID-19 PROJECTS

https://www.ragoninstitute.org/covid-19-research-projects/

Doug Kwon: The Kwon lab is studying SARS-CoV-2 burden and infectivity in the GI tract.

COVID-19 is thought to primarily impact the respiratory system, however, emerging evidence suggests that infection in the gastrointestinal (GI) tract may significantly impact COVID-19 transmission and severity. These findings will help determine if GI infection is associated with worse disease and whether the virus could be spread through fecal-oral route, as has been reported for other coronaviruses. Additionally, **in collaboration with the Yilmaz Lab at the Massachusetts Institute of Technology**, the lab is applying 3D organoid cultures of gut and lung cells to model SARS-CoV-2 infection in primary human tissues, and has developed a high-throughput screening that tests therapeutic compounds for efficacy against disease in primary lung and gut organs. **This work will inform our efforts to prevent SARS-CoV-2 transmission, determine those who are at risk of becoming seriously ill from COVID-19, and identify better ways to treat those who are infected.**

Laboratory of Stem Cell Metabolism and Cancer / YILMAZ Lab

Omer Yilmaz MD, PhD, Eisen and Chang Career Development Professor, Associate Professor of Biology https://ki.mit.edu/people/faculty/yilmaz
https://yilmaz-lab.mit.edu/
https://pubmed.ncbi.nlm.nih.gov/?term=Yilmaz+%C3%96H%5BAuthor%5D&sort=date&-size=50

The goal of the Yilmaz laboratory is to understand how adult stem cells and their microenvironment adapt to diverse diets in the context of tissue regeneration, aging, and cancer initiation. Towards this end, they are studying the effects of dietary interventions on intestinal stem cell (ISC) function in the mammalian intestine. Since ISCs, like all adult stem cells, possess the ability to self-renew and the capacity for differentiating into tissue-specific cell types, they likely play an important role in remodeling the intestine in response to diet-induced physiologies.

STUDENT PROJECTS / INITIATIVES ETC. / COVID-19

Essay: "The Coronavirus Chronicles: Emergence of a Global Pandemic"

2020 Benjamin Siegel Writing Prize Awarded to Jesse Gordon, MIT Chemistry

MIT's Science Technology and Society Program is pleased to announce that it has awarded the 2020 Benjamin Siegel Writing Prize to Jesse Gordon, for his essay "The Coronavirus Chronicles: Emergence of a Global Pandemic." Gordon is a fourth-year doctoral student in Professor Gabriela Schlau-Cohen's group in the Department of Chemistry.
https://sts-program.mit.edu/news/2020-benjamin-siegel-writing-prize-awarded-to-jesse-gordon-mit-chemistry/

Each year MIT's Program in Science, Technology, and Society offers the Benjamin Siegel Writing Prize to the MIT student submitting the best written work (under 50 pages) on issues in science, technology, and society. The Prize was established in 1990 by family and friends to honor the memory of Benjamin Siegel, S.B. 1938, Ph.D. The $2500 Prize is open to undergraduate and graduate students at MIT from any department or school. This year's selection committee is composed of David Mindell and Rosalind Williams.

Here's how the selection committee described the winning paper:

"Among the entries, Gordon's essay is unique for its two voices. The text opens in the first-person as account of the graduate student recalling when, barely two months ago, he first realized, "the gravity of the situation" of the novel coronavirus outbreak, through an email sent through his group's messaging system. Then the text shifts to a third-person description of the medical symptoms and mortality rates of the new disease we now know as COVID-19. The rest of the essay continues to alternate between the voice of scientific inquiry and that of personal experience… https://sts-program.mit.edu/news/2020-benjamin-siegel-writing-prize-awarded-to-jesse-gordon-mit-chemistry/

Essay: The Coronavirus Chronicles: Emergence of a Global Pandemic
by Jesse Gordon, 24 April 2020: https://chemistry.mit.edu/chemistry-news/the-coronavirus-chronicles-emergence-of-a-global-pandemic/

I did not realize the gravity of the situation until I was told explicitly. One of my lab mates shared an email from the Dean of Harvard Medical School on our research group's messaging system. In his email justifying the need to close research labs in his department, the dean said that COVID-19 is the single most threatening pandemic to arise in the last century and went on to compare it to the influenza pandemic of 1918, which killed tens of millions. I thought of other epidemics that had occurred during my lifetime. I was eight years old when SARS first appeared. I had heard about it but didn't know much else. I was in high school during the outbreak of H1N1, or swine flu. I recalled waiting in line at the mall to receive a vaccine and suffering from a very bad flu that winter. People panicked about the se earlier outbreaks, but COVID- 19 seemed like such a distant threat, something happening on the other side of the world that did not concern me, until I read that email. His words made me realize this pandemic might be one of the defining historical moments of our lifetimes.

MIT student applies her doctoral research to the Covid-19 emergency
Junli Hao's efforts aid procurement of face masks and respirators for first responders.

Elizabeth A. Thomson I Department of Chemical Engineering / MIT News, May 19, 2020
http://news.mit.edu/2020/mit-student-applies-her-doctoral-research-covid-19-emergency-0519
http://news.mit.edu/2020/testing-kn95-respirators-rutledge-health-0430
Rutledge Lab: https://rutledgegroup.mit.edu/

Junli Hao was close to earning her MIT doctorate in chemical engineering this year when Covid-19 hit the United States — and forced universities including MIT to quickly de-densify. Hao suddenly found herself applying everything she'd learned to a major problem associated with the pandemic: the short supply of face masks and N95 respirators for medical personnel and other first responders.

For the past two months Hao, working closely with her advisor, Professor Gregory Rutledge, has used specialized equipment in the Rutledge lab to test the filtration properties and breathability of close to 100 types of masks that claim to be as effective as the N95 but do

not have official certification from the U.S. National Institute for Occupational Safety and Health (NIOSH). These include different types of KN95 respirators, which are regulated by the Chinese government, and even a stockpile of N95 respirators that had expired.

To date, about one-third of the KN95s tested by Hao appear to meet or come close to the N95 standard. The results, which are listed on the Massachusetts Department of Public Health's website, allow hospitals and other organizations to make better decisions on which masks and respirators to use, and under what conditions.

"The goal is to make sure that the masks and respirators being distributed are actually protecting our frontline responders. Ineffective masks could put them in danger," says Hao.

MIT D-Lab and local community partners to deliver virtual trainings on making masks, hand sanitizer, vertical gardens, and portable chicken coops
http://news.mit.edu/2020/mit-d-lab-helping-artisanal-miners-colombia-face-covid-19-crisis-0518
https://d-lab.mit.edu/education/classes/d-lab-inclusive-economies

Informal, small-scale gold miners extract 20 to 30 percent of all gold worldwide, and in Colombia, they produce 60 percent of all gold extracted nationally. As a rule, small-scale miners in remote communities face myriad challenges: Intermediaries demand low prices, there are few alternative ways to earn an income, and serious health problems related to mercury exposure plague miners.

Now, with the onset of Covid-19, these problems have compounded: The market for gold has ground to a halt, business closures have caused a breakdown in the food supply, and these small mining communities have few defenses against the novel coronavirus, which has arrived in Colombia with more than 12,000 cases recorded to date.

"What will happen to us, the miners and our families, if this 'corona' continues?" asks Maria del Carmen Herrera Tamayo, a small-scale gold miner and community organizer in the Antioquia region of Colombia. "The price of food goes up and income goes down. God forbid the time comes when [we don't have money] even for rice. The situation is difficult."

Herrera Tamayo was one of 70 Colombian gold miners taking part in an ongoing MIT D-Lab Inclusive Economies program and was interviewed to assess the impact of Covid-19 on this already fragile community.

Since July 2019, D-Lab has collaborated with artisanal and small-scale gold miners working in four Colombian mining communities, along with longtime D-Lab community partner C-Innova, Universidad Nacional de Colombia, and Uniminuto (Corporación Universitaria Minuto de Dios). The program, which was designed to spark economic diversification in the region, leverages D-Lab's Creative Capacity Building methodology to train small-scale gold

miners in a collaborative design process. Through these workshops, participants identify everyday challenges — at work and at home — and develop the skills to design technologies and businesses to address them.…

… we were able to hear from the miners directly about their needs," says **Ta Corrales Sanchez '16, a D-Lab alumna** who has designed and implemented D-Lab programs in Oaxaca, Mexico, and is **now working with D-Lab's Inclusive Economies program in Colombia.** "We are leveraging technology like cellphones, WhatsApp, and Facebook to establish conversations with very remote areas of the province of Antioquia."…

… Libby McDonald, who **leads D-Lab's Inclusive Economies program and teaches two classes, D-Lab: Gender and Development and D-Lab: Inclusive Economies**, comments, "We were very lucky in that we had a great team and trained facilitators on the ground in Colombia to quickly conduct a diagnostic to understand the needs of the miners during the Covid crisis and create the virtual design workshops to effectively meet those needs."

See also: https://d-lab.mit.edu/news-blog/blog/d-lab-innovation-practice-and-its-response-covid-19-pandemic
https://d-lab.mit.edu/news-blog/blog/mit-d-lab-launches-covid-19-bridge-fund-help-d-lab-scale-ups-social-entrepreneurs

PAPERS, ARTICLES, PRESENTATIONS, TALKS

POLICY / TRACKING: THE COST OF UNCOORDINATED RESPONSES TO COVID-19

Correspondence to: Sinan Aral (sinan@mit.edu) or Dean Eckles (eckles@mit.edu)
IDE, 21 May 2020
http://ide.mit.edu/news-blog/news/cost-uncoordinated-responses-covid-19
Full paper: http://ide.mit.edu/sites/default/files/publications/Interdependence_COVID_520.pdf

Social distancing is the core policy response to COVID-19. But as federal, state, and local governments begin opening businesses and relaxing shelter-in-place orders worldwide there is a lack of quantitative evidence on how policies in one region affect mobility and social distancing in other regions. In particular, no one has measured the consequences of uncoordinated regional policies adopted in the presence of such spillovers.

We know that pandemics are interdependent phenomena. Viruses, and people's adherence to the government policies designed to contain them, spill over from region to region. It is less well known, however, how behavioral responses to the pandemic and to government mitigation policies spread as a result of social influence.

The Social Analytics Lab at the MIT Initiative on the Digital Economy (IDE) just released a comprehensive study of the cost of uncoordinated responses to COVID-19. We combined daily, county-level data on shelter-in-place and business closure policies with movement

data from more than 27 million mobile devices, social network connections among over 220 million Facebook users, daily temperature and precipitation data from 62,000 weather stations, and county-level census data on population demographics to estimate the geographic and social network spillovers created by regional policies across the United States. We then used our empirical estimates to calibrate a model of what we call the "loss from anarchy" created by states failing to coordinate responses to these spillovers.

We found that peoples' behaviors are influenced not just by those in their local communities; social connectivity is often as important as geographic proximity. Social networking through mobile phones, video conferencing, and social media can substantially alter perceptions of the effectiveness of local policies. Therefore, it is likely that individuals' mobility and adherence to social distancing are impacted by the policies of neighboring and distant regions where their social network connections reside, not only by local mandates. Put differently, a local government's social distancing policy may significantly impact the health outcomes of other communities, near and far.

POLICY / ECONOMICS: EUROPE HAS KEPT DOWN PANDEMIC UNEMPLOYMENT--AND THE US HASN'T. HERE'S WHY.

24 April 2020, Washington Post
Anke Hassel, **Kathleen Thelen** (Ford Professor of Political Science) http://cis.mit.edu/publications/analysis-opinion/2020/europe-has-kept-down-pandemic-unemployment-and-us-hasn%E2%80%99t-here%E2%80%99s

The US approach has problems that go deeper than a lack of funding, says **Kathleen Thelen** and her coauthor. This opinion piece was published online on April 24, 2020, in the Washington Post Monkey Cage.

For the first time, the US government is subsidizing companies to hold on to their workers. However, the Paycheck Protection Program (PPP) that Congress passed to fight unemployment in the coronavirus economic crisis is having trouble delivering benefits. Its first round of funds was quickly exhausted.

Congress's new bill will add more funds, but the problem goes deeper. To understand what is going on, it's helpful to understand how European governments approach the same problem: through "short time work" (STW) policies. The PPP program in the United States is plausibly more generous to those it helps than its European equivalents. However, it's having a harder time fighting unemployment. That's both because of its design and because of the US government's weaknesses. Here's what you need to know.

The PPP is supposed to address the crisis faced by American workers

The PPP is supposed to keep people working by loaning funds to small- and medium-sized businesses. Those businesses are then supposed to use the loans to keep paying workers and other basic operating costs. According to the bill, the United States will forgive the loan if

businesses use it for payroll costs, mortgage interest, rent, and utilities payments—so long as the borrowing firm keeps the same number of workers.

The program's rollout has been rough. Small businesses complain they are having difficulty applying for and actually receiving the funds. Some banks that were supposed to distribute the funds imposed additional eligibility rules and prioritized their richer and better established clients.

The program quickly exhausted its initial $349 billion budget. And despite the program, 22 million American workers applied for unemployment benefits in the last month—the biggest spike in unemployment numbers since the Great Depression.

Europe has a different approach.

Europe is adopting a different approach. What are called "short-time work policies" directly compensate workers when their hours are reduced. That lets firms avoid layoffs and their associated costs by instead reducing employees' hours.

These policies aren't new: Germany has had them for decades, using them in economic downturns to compensate workers whose hours are reduced by paying between 60 and 87 percent of net earnings lost—and more if they are covered by collective bargaining agreements. This helped German companies keep employees during the 2008-09 financial crisis and recover quickly afterward. Since they had not laid off workers but simply put them on hold, they were able to resume production easily when market conditions improved. Now other European countries such as the United Kingdom and Sweden that never had short-time work policies are turning to them.

DATA ANALYTICS / ECONOMICS: COVID-19 SPECIAL REPORT: RECENT DROPS IN MARKET LIQUIDITY MAY FORESHADOW MAJOR DROPS IN US COMMERICAL REAL ESTATE MARKETS

Dorinth van Dijk, Anne Kinsella Thompson, David Geltner
MIT Center for Real Estate: Price Dynamics Platform, 18 May 2020
https://mitcre.mit.edu/news/price-dynamics-platform-quantifies-impact-of-pandemic-on-commercial-property-market
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3604606

The MIT Center for Real Estate: Price Dynamics Platform just released a special report quantifying the impact the pandemic has had so far on the investment property market in the US. Based on the Platform's Investors Supply/Demand Indexes, the study quantifies liquidity impacts measured by the Supply-Demand Gap in terms of asset pricing implications.

So far, New York is the hardest hit among the eight metros examined, with a predicted average price drop between 19 and 30%, reflecting a drop in liquidity already ¾ of the total liquidity drop that occurred in the entire Global Financial Crisis of 2008-09. Among property sectors nationwide, retail is hit hardest with 14–19% predicted price drop and liquidity down already almost 60% as much as it dropped in the entire GFC.

ECONOMICS / STATISTICS: MIT EXPERT: COVID-19 FORCING TRADEOFFS BETWEEN PHYSICAL AND ECONOMIC SURVIVAL

Peter Cohan, Forbes, 15 May 2020, https://www.forbes.com/sites/petercohan/2020/05/15/mit-expert-covid-19-forcing-tradeoffs-between-physical-and-economic-survival/#426e6fef4efe

Richard Larson, Professor (Post Tenure), Data, Systems, and Society

The health and economic toll of COVID-19 has been tremendous — but will that toll get worse or better?

As of May 12, 83,000 had died and 1.3 million had been infected with COVID-19, according to The Lancet. As of May 15, 36.5 million Americans had filed unemployment claims, according to CNBC and April retail sales had plunged a record 16.4%, according to NBC News.

Our national debate has oversimplified the choices we face — between minimizing COVID-19 illnesses and death and restoring economic growth by reopening businesses. An MIT expert argues that as a society, we must agree on the specific categories of pain we are trying to minimize.

Meanwhile, many states have begun to allow more businesses to reopen subject to considerable limitations — despite the absence of solid data to measure a statistic called R0 (pronounced R-Naught).

R0 measures the number of previously uninfected people who are sickened by a contagious one. As **Richard Larson**, an MIT expert whose research was funded by the CDC, explained in a March 21 email, "R0 is the Basic Reproductive Number of the disease. It's defined as the mean number of new infections that will be created by a newly infected person, at the start of the disease when there is no immunity. An R0 of 1.0 means that every infectious person sickens one other on average."

In March, he said that COVID-19 was expanding faster than that. "Now R0 is greater than one which implies exponential growth of numbers infected, the exponential growth from cycle to cycle. If R0=2, for instance, the number of infections doubles each cycle. Clearly we do not want that!," he said.

VENTILATORS / TREATMENT: A RAPIDLY DEPLOYABLE INDIVIDUALIZED SYSTEM FOR AUGMENTING VENTILATOR CAPACITY

Shriya Srinivasan, Khalil B Ramadi, Francesco Vicario, Declan Gwynne, Alison Hayward, David Lagier, Robert Langer, Joseph J Frassica, Rebecca M Baron, Giovanni Traverso, 2020 Science Translational Medicine, 18 May 2020: eabb9401, DOI: 10.1126/scitranslmed.abb9401
https://stm.sciencemag.org/content/early/2020/05/18/scitranslmed.abb9401.abstract

https://doi.org/10.1126/scitranslmed.abb9401

Related MIT News story: http://news.mit.edu/2020/safer-method-sharing-ventilators-0518
Project: https://i-save.mit.edu/ and: https://i-save.mit.edu/team

Strategies to split ventilators to support multiple patients requiring ventilatory support have been proposed and used in emergency cases in which shortages of ventilators cannot otherwise be remedied by production or procurement strategies. However, the current approaches to ventilator sharing lack the ability to individualize ventilation to each patient, measure pulmonary mechanics, and accommodate rebalancing of the airflow when one patient improves or deteriorates, posing safety concerns to patients. Potential cross-contamination, lack of alarms, insufficient monitoring, and inability to adapt to sudden changes in patient status have prevented widespread acceptance of ventilator sharing. We have developed an individualized system for augmenting ventilator efficacy (iSAVE) as a rapidly deployable platform that uses a single ventilator to simultaneously and more safely support two subjects. The iSAVE enables subject-specific volume and pressure control and the rebalancing of ventilation in response to improvement or deterioration in an individual's respiratory status. The iSAVE incorporates mechanisms to measure pulmonary mechanics, mitigate cross-contamination and backflow, and accommodate sudden flow changes due to subject interdependencies within the respiratory circuit. We demonstrate these capacities through validation using closed- and open-circuit ventilators on linear test lungs. We show that the iSAVE can temporarily ventilate two pigs on one ventilator as efficaciously as each pig on its own ventilator. By leveraging off-the-shelf medical components, the iSAVE could rapidly expand the ventilation capacity of healthcare facilities during emergency situations such as pandemics.

MIT-RELATED STARTUPS

MIT Startup Exchange: https://startupexchange.mit.edu/

CORAL GENOMICS

San Francisco, CA, https://www.coralgenomics.com/
https://www.linkedin.com/company/coral-genomics/

Coral improves the clinical utility of genetic testing by integrating molecular, functional, and clinical factors. This will result in more efficient healthcare delivery.

Developer of a medical platform designed to optimize the drug prediction process. The company's platform uses a combination of diverse primary cells, functional (phenoypic) drug response, and genomic information to develop better models of personalized medicine.

SONOGENIX

Erie, PA, http://sonogenix.com/

Sonogenix focuses on the design, development, and manufacture of medical devices that utilize ultrasonic energy to enhance clinical outcomes.

Non-invasive COVID-19 treatment for kidneys, lungs and other organs.

UMBULIZER

Cambridge, MA, https://www.umbulizer.com/

Our mission is to make molecular diagnostic tests accurate, affordable and available to all.

Umbulizer has developed a reliable, low-cost breathing device that can help fulfill global needs for life-saving ventilators. UMV-001 is the product of years of collaboration among a diverse team of product designers, engineers, and international pulmonary and critical care experts.

Low-cost ventilator wins 2019 Sloan health care prize: Device was one of eight inventions pitched at this year's MIT Sloan Healthcare Innovations Prize competition
http://news.mit.edu/2019/umbulizer-sloan-health-care-innovation-prize-0225