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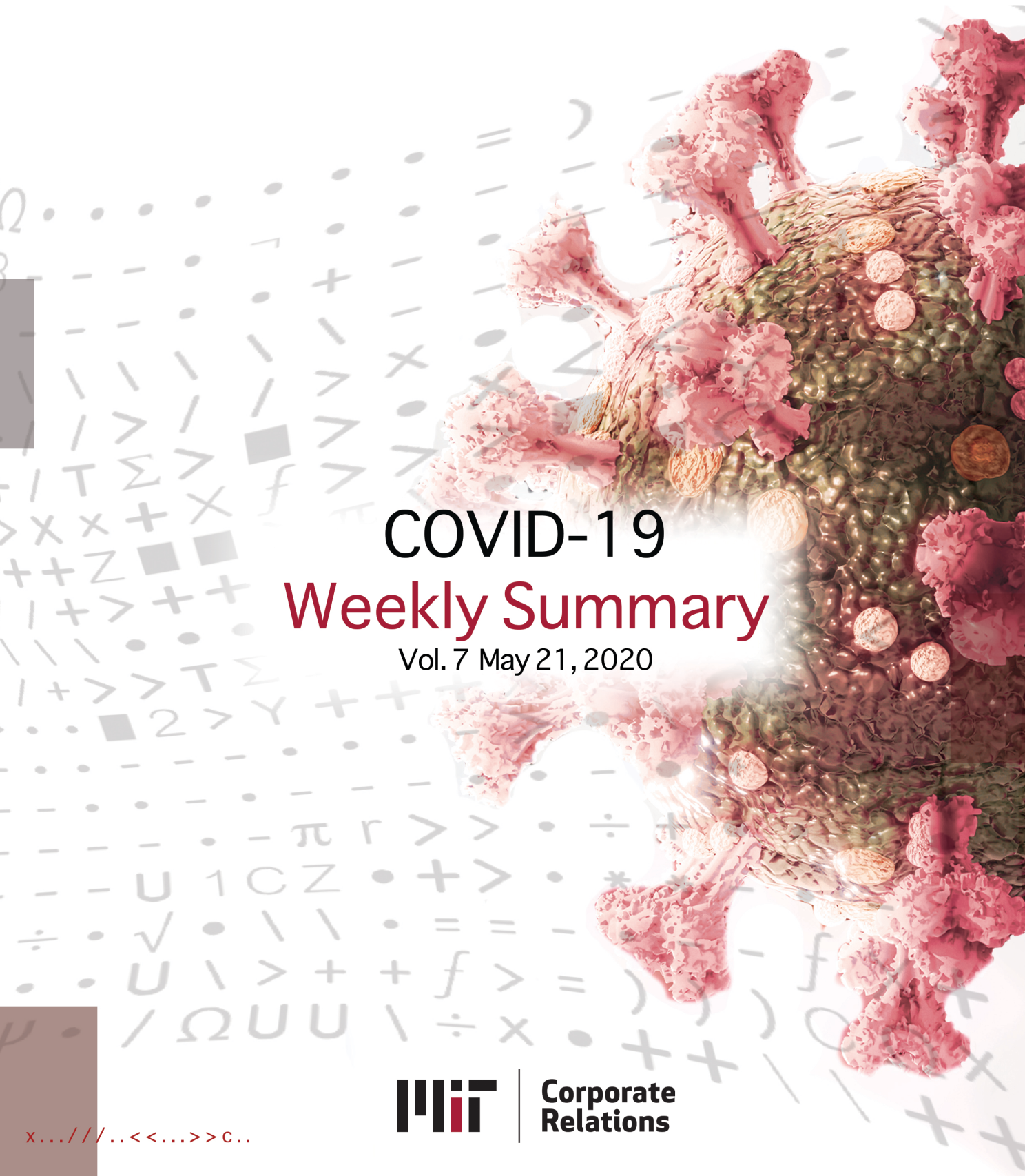

# COVID-19 Weekly Summary

Vol. 7 May 21, 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.

## UPCOMING EVENTS

### MIT ILP WEBINARS
https://ilp.mit.edu/attend

21 May – Grid-Scale Energy Storage
22 May – Innovations in Management (1 of 4)
26 May – Digital Transformation (4 of 6)
28 May – Innovations in Management (2 of 4)
2 June – Future of Transportation
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)

### WEDNESDAY, 27 MAY, 12:00-12:45 PM: MIT COVID-19 FACE SHIELD PROJECT

Prof. Martin Culpepper, Professor, Maker Czar
Mechanical Engineering Alliance Webinar
https://meche.mit.edu/meche-alliance-seminar-series#upcoming
Zoom Webinar Link: https://mit.zoom.us/j/95785548695

### WEDNESDAY, 10 JUNE, 11:00 AM: MAXIMIZING ORGANIZATIONAL OPPORTUNITY — ALIGNING WORKFORCE CAPABILITIES WITH STRATEGIC EXECUTION

Michael Schrage (Research Fellow, MIT Initiative on the Digital Economy)
Free, Sloan Management Review webinar
Registration coming soon: https://sloanreview.mit.edu/webinar-series-leading-through-radically-changing-times/

### THURSDAY, 18 JUNE, 12:00 PM DEADLINE FOR SOLUTION SUBMISSIONS: MIT SOLVE HEALTH SECURITY & PANDEMICS CHALLENGE

https://solve.mit.edu/challenges/health-security-pandemics
https://solve.mit.edu/challenges/health-security-pandemics/custom/prizes#challenge-subnav-offset
Judges: https://solve.mit.edu/challenges/health-security-pandemics/judges#challenge-subnav-offset
Submitted Solutions: https://solve.mit.edu/challenges/health-security-pandemics/solutions#challenge-subnav-offset

…need improved solutions for prevention, accurate detection, and rapid response. MIT Solve is seeking tech innovations that can slow and track the spread of an emerging outbreak, for example by improving individual hygiene, developing low-cost rapid diagnostics, analyzing data that informs decision making, and providing tools that support and protect health workers...

Other MIT SOLVE Challenges: https://solve.mit.edu/challenges

## PROJECTS, INITIATIVES, RESEARCH

### COVID-19 POLICY ALLIANCE: REPORTS

Profs Retsev Levi, Simon Johnson, Kate Kellogg, Vivek Farias
https://www.covidalliance.com/
Interactive Data Tools: https://www.covidalliance.com/infection-trajectory and https://www.covidalliance.com/senior-facility-risk

The COVID-19 Policy Alliance rapidly generates actionable data intelligence and operational recommendations that can help government entities and organizations make better policy decisions regarding the healthcare system and economy.

***Managing COVID-19 High-Risk Population Clusters***
Prof. Retsef Levi
https://b7ad0ea1-41fd-44bc-a1f0-1e2785174d9d.filesusr.com/ugd/3c0d50_be1df3fbd-b31459eb507b93602f38a8e.pdf

This report highlights data analytic tools created by the Alliance to enable states to identify the highest risk facilities and localities – those with clusters of individuals over 65 or with relevant health issues. Targeted action can reduce strain on local hospital systems.

***Report #1: Creating a Coordinated Federal Telehealth Response to COVID-19***
Profs. Simon Johnson & Retsef Levi
https://b7ad0ea1-41fd-44bc-a1f0-1e2785174d9d.filesusr.com/ugd/3c0d50_e3c75f1f-bae54806a28c394a83b84756.pdf?index=true

(9 pages) We need to ensure that hospitals are not overwhelmed by patients with minor, non-life-threatening symptoms who can be treated elsewhere, that medical professionals are not exposed more than is necessary, and that care is focused on high-risk patients.

***Report #2: Urgent Problems that can be solved with State Telehealth Platforms***
Profs. Simon Johnson & Retsef Levi
https://b7ad0ea1-41fd-44bc-a1f0-1e2785174d9d.filesusr.com/ugd/3c0d50_f8a741a71e-0840798c23e2f63e8d089b.pdf

This (8 page) document describes an emergency operational strategy that leverages telehealth technology and extensive analytics that could allow the state to manage the coming COVID-19 outbreak, with minimal fatalities and while preserving the sustainable operation of state health systems. The plan includes imperatives that, if not followed, create a very high risk of following the path of countries like Italy.

***IDSS: A PRIVACY-PRESERVING OPT-OUT MECHANISM FOR RETURNING TO CAMPUS***
MIT Institute for Data, Systems, and Society (IDSS), 24 April 2020

For further details, please contact Social & Engineering Systems Doctoral Students: Andreas Haupt and Manon Revel
https://idss.mit.edu/vignette/a-privacy-preserving-opt-out-mechanism-for-returning-to-campus/

In a phased reopening of MIT, some members of our community (graduate student researchers, faculty, and staff) may not yet feel comfortable returning to campus. Yet, they might not raise these concerns for fear of repercussions from their supervisors. To create an atmosphere in which concerned employees can opt-out anonymously and work remotely, we propose a mechanism to recruit other workers to volunteer to be randomly selected to stay home. Volunteers would be reimbursed and, by acting for the common good, they provide a mechanism to preserve the privacy of those opting-out owing to health concerns. The mechanism presents a trade-off between privacy and efficiency by enabling people who have the greatest need to work on campus to do so. The following proposal is in response to a question posed by MIT's Vice Chancellor Ian Waitz.

Before deploying the proposed mechanism, subunits of MIT (e.g., labs or dining halls) and target occupancies should be identified. Choosing target occupancies is a complex decision problem which we do not tackle with our proposal. Given a target occupancy, we propose to use the following mechanism to select who should be on campus in each subunit.

First, workers express their concerns, if existent, using a private means of communication, e.g., through a personalized survey. Using similar means of communication, other workers announce a reimbursement amount that would incentivize them to work remotely. MIT then chooses a reimbursement threshold t. (We discuss the choice of the threshold in the next paragraph.) Workers who "bid" an amount below t constitute the pool of potential volunteers. From the potential volunteers, a small group of volunteers, e.g., 5% of the number of those with concerns, is randomly chosen (e.g. if 100 people express concerns, MIT randomly selects 5 people from the pool of volunteers). An MIT entity (not directly related to supervisors) informs concerned workers, volunteers and their supervisors that they were chosen to work remotely. Payments to volunteers are deposited directly into the volunteer's bank accounts, without access by supervisors….

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

## MACHINE LEARNING / THERAPEUTICS: DRUG-REPURPOSING FOR COVID-19 WITH 3D-AWARE MACHINE LEARNING

Rafael Gomez-Bombarelli, Toyota Assistant Professor in Materials Processing
The COVID-19 High Performance Computing Consortium (Bringing together the Federal government, industry, and academic leaders to provide access to the world's most powerful high-performance computing resources in support of COVID-19 research)

Project: https://covid19-hpc-consortium.org/projects/5ea0c5f856238c007c05b6af
Lab: http://gomezbombarelli.mit.edu/

Novel active therapeutics against coronaviruses like the one responsible for Covid-19 (SARS-CoV2) are in urgent need. Drug repurposing is much faster and efficient than de novo discovery since molecules are already tested to be safe and bioavailable.
Drug repurposing efforts can themselves be accelerated with machine learning, by rapidly finding which known drug is most likely to be effective based on available training data.

Here, we ask whether the repurposing of drugs for Covid-19 treatment can be accelerated with a combination of physical simulation and machine learning (ML). Specifically, we will explore the advantages of using ML models over accurate 3D geometries compared to traditional approaches based on the molecular graph. We will utilize affordable electronic structure simulations to calculate molecular conformations and train 3D-based message-passing neural networks from existing molecular screens against the related SARS-CoV1 and SARS-CoV2 data as it becomes available.

## MACHINE LEARNING / THERAPEUTICS: DESIGNING VIRUS-SPECIFIC SACE2 MIMICS FOR COMPETITIVE INHIBITION OF SARS-COV-2

Kevin Esvelt, Assistant Professor of Media Arts and Sciences, NEC Career Development Professor of Computer and Communications
The COVID-19 High Performance Computing Consortium
Project: https://covid19-hpc-consortium.org/projects/5e90e0ca836090007f1ddb39
Group: https://www.media.mit.edu/groups/sculpting-evolution/overview/

SARS-CoV-2 enters cells using the ACE2 receptor, which can be liberated into a soluble form (sACE2) that also binds the viral spike protein. There is an ongoing clinical trial of recombinant human sACE2 as an evolutionarily stable and non-immunogenic competitive inhibitor. However, sACE2 exhibits other biological roles including integrin signaling regulation, which likely limits the amount that can be safely delivered and its overall therapeutic effectiveness. We propose to use HPC Consortium resources to computationally design multiple sACE2 mutants exhibiting picomolar spike protein binding and reduced endogenous signaling activity using our recently developed UniRep protein representation and “low-N” in silico evolution platform (10.1101/2020.01.23.917682). Because the designed variants will be more effective at viral inhibition per molecule while enabling higher doses due to their decreased effects on native signaling pathways, we hypothesize that they will be capable of inhibiting viral entry much more effectively in patients. We will iterate the design process in a matter of weeks, rapidly test the variants in the laboratory and in animal models, then transition into pre-clinical and clinical trials as quickly as possible in order to save lives.

## STUDENT PROJECTS / COVID-19

***From DUSP: Aiding COVID-19 Response Across Africa***
https://dusp.mit.edu/news/aiding-covid-19-response-across-africa

Ethiopia COVID-19 Response Team
Africa Covid-19 Response Toolkit
5 key steps in mobilizing COVID-19 response efforts in Africa
COVID-19 data collection
Faculty Page: Gabriella Carolini

As the COVID-19 pandemic continues to impact the world, the MIT community is innovating new methods to leverage their skills and expertise to engage, respond, and aid in a multitude of capacities. For example, **DUSP MCP candidate Samra Lakew** and **DUSP alumna Fitse Gelaye (MCP '18)** are leading elements of the volunteer effort to enhance Ethiopia's capacity to respond to the COVID-19 crisis through the Ethiopia COVID-19 Response Team (ECRT).

The ECRT started with a single tweet calling upon the Ethiopian diaspora tech community. From that call to action, the ECRT has evolved into a multidisciplinary team of 1,700 volunteers working globally to collaborate in the effort to reduce morbidity and mortality, using a combination of digital tools and traditional responses.

Lakew, is part of ECRT's operations team that is responsible for setting the mission, creating partnerships, and facilitating projects within the informal organization. She is responsible for driving the Civic Engagement and Delivery workstreams -- overseeing public outreach and dissemination of knowledge through their blog and managing the distribution of care packages to vulnerable individuals.

***MISTI: Global perspectives on microscopic pathogens***

Junior Emily O'Rourke traveled to South Africa to investigate epidemics and returned with a broader outlook on her fundamental disease research.
https://biology.mit.edu/undergraduate/why-biology/undergraduate-testimonials/profile-emily-orourke/

Now a junior in Course 7 (Biology), O'Rourke is continuing to add stamps to her passport while exploring the global implications of disease research.

O'Rourke chose MIT because it offered a particularly wide array of study abroad programs, in addition to having top-tier research opportunities. One such study abroad program, MIT International Science and Technology Initiatives (MISTI)… The summer after her first year, O'Rourke participated in MISTI's MIT-Italy Program in order to gain some research experience in the realm of urban planning. For six weeks, she investigated the urban effects of sea level rise while living in Venice.

When she returned to campus for her sophomore year, O'Rourke was intending to double major in physics and biology. But she ultimately opted to drop physics and pursue the life sciences once she started working in Becky Lamason's lab in the Department of Biology.

"I started to see how biology worked on a practical level," she says. "I get to experience a hands-on connection by running DNA on a gel and doing other experiments. During our weekly lab meetings, I witness scientific stories as they unfold."

The Lamason lab investigates how parasites hijack host cells processes in order to spread infection. O'Rourke is working with graduate student Cassandra Vondrak to probe the proteins that allow the tick-borne Rickettsia parkeri to migrate from one cell to the next. Their protein of interest, surface cell antigen 4 (Sca4), is secreted by the bacterium and binds to the host's cell membrane, reducing the tension across the membrane and allowing Rickettsia to

punch through to the neighboring cell. O'Rourke and Vondrak aim to determine how Rickettsia releases Sca4, in the hopes of piecing together a general mechanism by which pathogens propagate.

While O'Rourke was studying infectious disease on a cellular level, she heard about an opportunity to explore epidemics on a global scale. Each January, the Harvard-MIT Program in Health Sciences and Technology sponsors **a two-week class in South Africa called Evolution of an Epidemic**. The class, taught by Professor of the Practice Bruce Walker, covers the medical, scientific, and political responses to new diseases, focusing on the HIV/AIDS epidemic. Walker, who is also the director of the Ragon Institute of MGH, MIT and Harvard, is a world leader in the study of immune control and evasion in HIV infection. Since then, he's developed strong connections and research partnerships in South Africa where the disease is most prevalent.

O'Rourke enrolled in **Evolution of an Epidemic**, and MISTI helped her to plan her trip. On January 16, she landed in Johannesburg, the first of three destinations. The cohort of students from MIT, Harvard, and the African Leadership Academy attended lectures, spoke with patients, and met medical professionals....

**CovEducation**
https://www.coved.org/
http://news.mit.edu/2020/coveducation-students-school-closures-0417

School closures brought on by the Covid-19 outbreak have affected students across the globe. But while some districts have moved quickly to train teachers and buy software to facilitate online learning, others lack the resources to make a smooth transition to the virtual world.

Different home environments also exacerbate inequalities, as some households lack computers for each member of the family, rely on children to care for their younger siblings, or have parents deemed essential workers.

Those were the problems on the minds of a **group of students from MIT and Harvard University** when they started CovEducation, a mentoring platform that connects volunteer college students with children from low-income communities for academic support.

The organization, also known as CovEd, has scaled rapidly since its inception in mid-March, with more than 1,300 mentors and 850 K-12 students currently signed up.

The early tutoring sessions have also included help with career planning, the college admissions process, and any other academic issues the student may be struggling with. The sessions are meant to be as natural and responsive as CovEd's fluid internal operations.

"One thing we're trying to preserve [as we scale], which is the essence of our organization, is that this is a very tailored program for the students," MIT undergraduate Daniela Velez says. "We match them in an organic way, trying to form very natural connections by finding mentors that are perfectly suited for them, and who can serve not only as a tutor, but also as a role model.

## PAPERS, ARTICLES, PRESENTATIONS, TALKS

### PUBLIC HEALTH / TRACKING: HOW DIGITAL CONTACT TRACING SLOWED COVID-19 IN EAST ASIA

by Yasheng Huang, Meicen Sun and Yuze Sui
Harvard Business Review, April 15, 2020
http://cis.mit.edu/publications/analysis-opinion/2020/how-digital-contact-tracing-slowed-covid-19-east-asia
https://hbr.org/2020/04/how-digital-contact-tracing-slowed-covid-19-in-east-asia?ab=hero-subleft-1

As Covid-19 steamrolls across international boundaries, public health officials are paying close attention to countries that are flattening the curve, slowing the spread of infection. Can other countries emulate their success? Top of mind has been whether authoritarian regimes have an edge over democracies, because they can mandate top-down measures like lockdowns and digital tracking of infected people's movements and contacts. Indeed, China's foreign minister Wang Yi proclaimed "Only in China and only under the leadership of President Xi can there be such effective measures to put this sudden and fast-spreading epidemic under control."

But the latest information from Our World in Data, which shows the doubling rate of cases by country, indicates that the type of regime is less important than it might seem. Both the top and bottom performers in Covid-19 containment span the spectrum from autocratic to democratic. It's true that China is effectively flattening the curve, but so is South Korea, a vibrant democracy. Other democracies — the U.S., Spain, Italy, and France, are faring less well.

### PUBLIC HEALTH / MODELING-SIMULATION: WEATHER CONDITIONS AND COVID-19 TRANSMISSION: ESTIMATES AND PROJECTIONS

Ran Xu, **Hazhir Rahmandad**, Marichi Gupta, Catherine Digennaro, Navid Ghaffarzadegan, Mohammad Jalali
SSRN, Posted: 11 May 2020, Last revised: 12 May 2020
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3593879

**Background:** Understanding and projecting the spread of COVID-19 requires reliable estimates of how weather components are associated with the transmission of the virus. Prior research on this topic has been inconclusive. Identifying key challenges to reliable estimation of weather impact on transmission we study this question using one of the larg est assembled databases of COVID-19 infections and weather.

**Methods:** We assemble a dataset that includes virus transmission and weather data across 3,739 locations from December 12, 2019 to April 22, 2020. Using simulation, we identify key challenges to reliable estimation of weather impacts on transmission, design a statistical method to overcome these challenges, and validate it in a blinded simulation study.

Using this method and controlling for location-specific response trends we estimate how different weather variables are associated with the reproduction number for COVID-19. We then use the estimates to project the relative weather-related risk of COVID-19 transmission across the world and in large cities.

**Results:** We show that the delay between exposure and detection of infection complicates the estimation of weather impact on COVID-19 transmission, potentially explaining significant variability in results to-date. Correcting for that distributed delay and offering conservative estimates, we find a negative relationship between temperatures above 25 degrees Celsius and estimated reproduction number ($R_t$), with each degree Celsius associated with a 3.1% (95% CI, 1.5% to 4.8%) reduction in $R_t$. Higher levels of relative humidity strengthen the negative effect of temperature above 25 degrees. Moreover, one millibar of additional pressure increases $R_t$ by approximately 0.8% (95% CI, 0.6% to 1%) at the median pressure (1016 millibars) in our sample. We also find significant positive effects for wind speed, precipitation, and diurnal temperature on $R_t$. Sensitivity analysis and simulations show that results are robust to multiple assumptions. Despite conservative estimates, weather effects are associated with a 43% change in $R_t$ between the 5th and 95th percentile of weather conditions in our sample.

**Conclusions:** These results provide evidence for the relationship between several weather variables and the spread of COVID-19. However, the (conservatively) estimated relationships are not strong enough to seasonally control the epidemic in most locations.

## SUPPLY CHAINS / LABOR: DOMESTIC LABOR ISSUES POSE HIDDEN SUPPLY CHAIN RISKS

Alexis Bateman, Research Scientist, CTL and Director, MIT Sustainable Supply Chains
7 May 2020, https://medium.com/mitsupplychain/domestic-labor-issues-pose-hidden-supply-chain-risks-4ee94ad61788

Companies have long known that visibility into the workplace practices of far-flung offshore suppliers is an essential component of supply chain risk management. Many enterprises lack that visibility, even though it is becoming increasingly important across global supply chains. The COVID-19 crisis is now making it clear that workplace conditions closer to home may need to come under similar scrutiny.

In the US, the vulnerability of employees in meatpacking plants to infection from the coronavirus is one issue that is shining a light on domestic workplace practices. The vital role these individuals — and countless others toiling in factories, plants, and farms — play in domestic supply chains has become painfully obvious.

The COVID-19 crisis has exposed many weak links in US supply chains, one of which is the importance of workers who do vital jobs but are low in the pecking order and are relatively anonymous.

Whether these individuals make a living in a meatpacking plant in Indiana or a textile plant in Bangladesh, companies need to address issues such as fair pay, health benefits, job security, and workplace safety or risk disruptions to their supply chains now and in the future.

## POLITICS / SECURITY STUDIES: DOES THE GLOBAL PANDEMIC OPEN NEW SOUTH CHINA SEA OPPORTUNITIES FOR BEIJING? NOT REALLY.

M. Taylor Fravel, Arthur and Ruth Sloan Professor of Political Science, Director, MIT Security Studies Program
Washington Post Monkey Cage blog, 7 May 2020
http://ssp.mit.edu/news/2020/does-the-global-pandemic-open-new-south-china-sea-opportunities-for-beijing
https://taylorfravel.com/2020/05/opportunism-in-the-south-china-sea/

A number of recent analyses have emphasized that China is seizing pandemic-created opportunities to improve its position in the South China Sea as other countries are distracted or otherwise unable to respond.

A key implication of such claims is that absent the pandemic, China would have acted differently and perhaps with more restraint.

In a new piece for the Washington Post's Monkey Cage, I argue that China's actions in the South China Sea so far in 2020 reflect a continuity of its approach to assert historic rights and to challenge the exclusive rights that Malaysia and Vietnam should enjoy in their Exclusive Economic Zones.

## MIT PRESS: UNDERSTANDING PANDEMICS, EPIDEMICS, & THEIR EFFECTS

https://covid-19.mitpress.mit.edu/

As the global community confronts the Covid-19 pandemic, access to knowledge and research is more urgent than ever. In response to the increased need for digital content and distance learning, the **MIT Press is making a selection of titles on pandemics, epidemiology, and related topics freely available for the foreseeable future.**

### *Also: Articles for Understanding Pandemics and Epidemiology*

https://mitpress.mit.edu/blog/articles-understanding-pandemics-and-epidemiology

At the MIT Press, our thoughts are with those whose lives have been profoundly affected by COVID-19. We have gone through our archives to select articles from our collection that speak to issues related to pandemics, epidemiology, and other relevant topics. We are thankful to our publishing partners in helping us make this vital information available and are hopeful that they contribute to a greater understanding of our current situation.

## MIT-RELATED STARTUPS

### HUMANYZE

Boston, MA https://www.humanyze.com/
https://twitter.com/humanyze

Founded in 2011 out of the MIT Media Lab, the company brings over a decade of advanced research in organizational network analysis and behavioral science to Fortune 1,000 companies to help them uncover how work actually gets done. With a global presence spanning the US, Europe and Asia, Humanyze is on a mission to improve the future of work.

***The Impacts of Our Current Reality on the Future of Work***
By Ben Waber, Ph.D. in Organizational Science, President and Co-Founder of Humanyze
https://www.humanyze.com/the-impacts-of-our-current-reality-on-the-future-of-work/

There is no question that this pandemic is forcing companies to rethink the way they work. From processes to policies, companies are having to rapidly adjust and mitigate the impacts that this new normal is having on their employees and the organization at large. As we all join to do our part in helping to reduce the spread of COVID-19, there is one question we are all asking: how is work going to change when this is all over?

Whether you are working from home or in the front lines providing an essential service, we are all having to adjust our day-to-day collaborations with colleagues and clients. Out of necessity, most workers are shifting their schedules to adjust to working from home patterns, even those who have been remote workers all along, as juggling children or loved ones sharing our “workspace” is impacting our ability to stay on top of work. Because of this, companies are forced to be flexible and many are adopting new collaboration technologies to help.

### CONQUERX

Boston, MA, and Cambridge, UK https://www.conquerxlab.com/

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

**COV-SenS a portable test for COVID-19**

During the past 4 years, ConquerX has been focused on prototyping and development of a poly-analyte diagnostic platform for cancer. However, due to the latest developments in the world, and the COVID-19 outbreak we have decided to shift our first intended of use to virology, namely COVID-19 and the flu.

ConquerX’s goal is to develop an electrochemical biosensor assay that can be used as a Point-Of-Care diagnostic test for COVID-19. Electrochemical biosensors are biosensors that transform biochemical information, such as protein recognition into an analytically useful signal: current or voltage.

The most common and scientifically validated example of electrochemical biosensor is the glucometer used by diabetic patients.

Our purpose is to use the mechanism that COVID-19 uses to invade the cell and mimic it on strip sensors to recognize the presence of the virus in saliva samples.

## KINSA

San Francisco, CA, https://www.kinsahealth.co/
https://www.kinsahealth.co/products/

We're a public health company dedicated to providing the knowledge, guidance, and tools to keep communities healthy.

Kinsa's mission is to stop the spread of contagious illness through early detection and early response. We do three things:

1. Help individuals access appropriate care early, right when they fall ill

2. Help communities respond to curb the spread of illness in schools and beyond

3. Track and predict the spread of infectious illness across the U.S. in real-time