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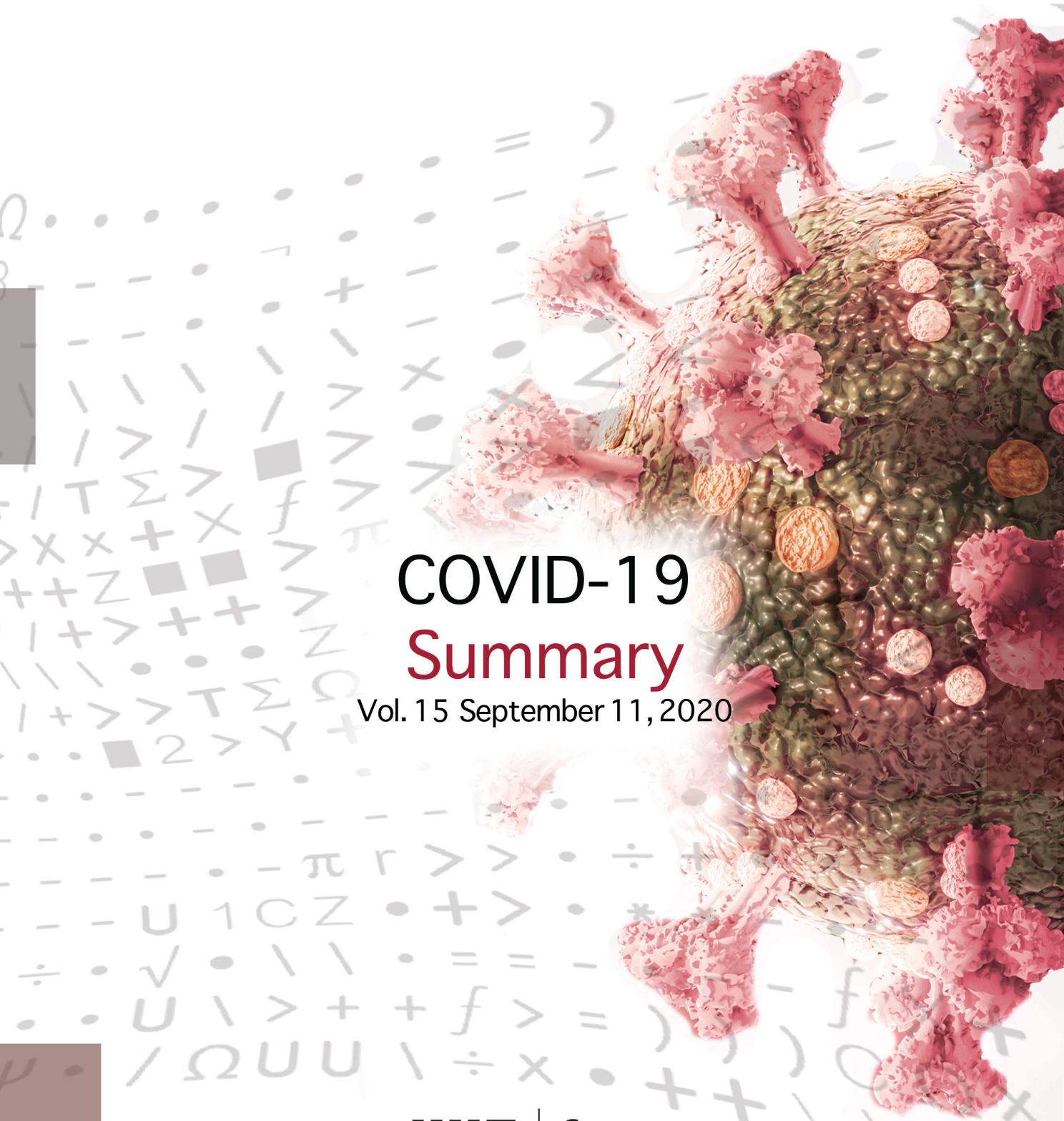

COVID-19 Summary

Vol. 15 September 11, 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

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

WEDNSDAY, 23 SEPTEMBER, 11:00 AM – 12:30 PM: APPROACHES IN CELL THERAPY AND REGENERATIVE MEDICINE

MIT Corporate Relations / ILP
Agenda: https://ilp.mit.edu/attend/approaches-cell-therapy-and-regenerative-medicine
https://us02web.zoom.us/webinar/register/WN_PYcW_gWzRyWzamQkF6s7cg

21, 22, & 29 SEPTEMBER: MIT SENSE.NANO SYMPOSIUM: THE BODY AT ALL SCALES

Day 1 / Sept 21, 1:00-5:00 pm – Sensing at the Level of Sub-cell, Cell, and Organs
Day 2 / Sept 22, 1:00-5:00 pm – Sensing at the Level of Body Systems and Populations
Day 3 / Sept 29, 1:00-4:00 pm – Startup Exchange and Future Impacts
Agenda: https://sense.mit.edu/2020-symposium-agenda
https://ilp.mit.edu/attend/2020-mit-sensenano-symposium-body-all-scales
Register: https://mit.zoom.us/webinar/register/WN_ohdUponeTimMKEwKVdmd3A

23 SEPTEMBER, 6:00 PM: THE HYPE MACHINE: HOW SOCIAL MEDIA DISRUPTS OUR ELECTIONS, OUR ECONOMY, AND OUR HEALTH—AND HOW WE MUST ADAPT

MIT Sloan Center for Information Systems Research (CISR)
Join Peter Weill (Chairman & Senior Research Scientist, CISR) for a book talk with author Sinan Aral (David Austin Professor of Management & Director of the MIT Initiative on the Digital Economy (IDE))
https://cisr.mit.edu/event/conversations-cisr-prof-sinan-aral-author-hype-machine
Register: https://mit.zoom.us/webinar/register/3515984774682/WN_WjlhIOPXRXiwR_rVm_p32g

PROJECTS, INITIATIVES, RESEARCH

MODELING / AIRBORNE TRANSMISSION: COVID-19 INDOOR SAFETY GUIDELINE

Prof. Martin Bazant, E. G. Roos (1944) Professor of Chemical Engineering, Digital Learning Officer, Professor of Mathematics http://web.mit.edu/bazant/www/index.html, http://bazantgroup.mit.edu/
http://web.mit.edu/bazant/www/COVID-19/

A growing chorus of scientists is sounding the alarm that COVID-19 is mainly spreading in homes or other enclosed spaces whenever people spend extended periods breathing tiny aerosol droplets suspended in air infected by the virus.

Public health advice has been slow to catch up with the rapidly advancing science, and official guidelines still only set a minimum social distance (6 feet in the U.S.) or maximum occupancy (25 persons in Massachusetts) for indoor spaces. Although the need for building engineering to control indoor air quality (IAQ) has been emphasized, no quantitative guideline has been proposed, specific to COVID-19.

To protect against airborne transmission, it is common sense that the exposure time, room size, ventilation and human activity must also be considered:

- Standing 6 feet apart is safe for a few seconds, but maybe not for a few hours;
- 25 people are safer in a large gymnasium than in a crowded bar;
- 6-foot separation is safer in a ventilated hospital than inside a sealed tent;
- At any distance, remaining quiet and calm is safer than singing or exercising;
- Social distance can be safely reduced if facemasks are worn.

Using mathematical models from chemical engineering and epidemiology, I have derived a safety guideline for well-mixed indoor spaces, in collaboration with John Bush, which combines all the key variables above in a bound on “cumulative exposure time”. The guideline is intuitive and quantitative, calibrated against the latest data for COVID-19 indoor spreading and respiratory aerosol emissions, and easy to apply using a publicly available spreadsheet....

Beyond Six Feet: A guideline to limit indoor airborne transmission of COVID-19
Martin Z. Bazant & John W. M. Bush (Professor of Applied Mathematics), 2020, medRxiv, preprint, posted September 01, 2020
https://www.medrxiv.org/content/10.1101/2020.08.26.20182824v1
https://doi.org/10.1101/2020.08.26.20182824

The revival of the global economy is being predicated on the Six-Foot Rule, a guideline that offers little protection from pathogen-bearing droplets sufficiently small to be continuously mixed through an indoor space. The importance of indoor, airborne transmission of COVID-19 is now widely recognized; nevertheless, no quantitative measures have been proposed to protect against it. In this article, we build upon models of airborne disease transmission in order to derive a safety guideline that would impose a precise upper bound on the cumulative exposure time, the product of the number of occupants and their time in an enclosed space. We demonstrate the manner in which this bound depends on the ventilation rate and dimensions of the room; the breathing rate, respiratory activity and face-mask use of its occupants; and the infectiousness of the respiratory aerosols, a disease-specific parameter that we estimate from available data. Case studies are presented, implications for contact tracing considered, and appropriate caveats enumerated.

VOTING: MIT ELECTION DATA AND SCIENCE LAB (MEDSL)

Founding Director: Charles Stewart III, Kenan Sahin Distinguished Professor of Political Science
https://electionlab.mit.edu/
Projects: https://electionlab.mit.edu/research#projects

Our lab supports advances in election science by collecting, analyzing, and sharing core data and findings. We also aim to build relationships with election officials and others to help apply new scientific research to the practice of democracy in the United States.

Using data-driven scientific analysis, we strive to better understand how elections function in the U.S.

What Queuing Theory Says About Managing Polling Places Amid COVID-19

MIT Election Data and Science Lab (MEDSL) & the Stanford-MIT Project on a Healthy Election
26 August 2020
by **Colin McIntyre** (SM & MBA 2020), with input from **Charles Stewart III** (Kenan Sahin Distinguished Professor of Political Science & Founding Director, MEDSL) and Steven Graves https://electionlab.mit.edu/sites/default/files/2020-08/WhatQueueingMeans-PollingPlacesCOVID19.pdf

This white paper focuses on one important aspect of managing the redesign of polling place procedures to accommodate the realities of voting amid the pandemic: managing the volume of traffic through a polling place. It discusses how queuing theory can be harnessed to provide guidance about questions such as these:

» How many voting booths, check-in stations, and scanners do I need to handle anticipated turnout?
» How long are the lines I should anticipate during the day?
» If I have to limit the number of people in the room where voting occurs, how many people are likely to be waiting outside to vote?

See also: Elections Performance Index, https://elections.mit.edu/#/data/map

MIT LINCOLN LABORATORY:

Biomedical Monitoring / Sensors: Study examines role of mobile health technology in monitoring COVID-19 patients

Lincoln Laboratory researchers join international task force to evaluate wearable and emerging technology
24 August 2020, by Kylie Foy | Communications & Community Outreach Office
https://www.ll.mit.edu/news/study-examines-role-mobile-health-technology-monitoring-covid-19-patients
https://www.ll.mit.edu/r-d/homeland-protection/human-health-and-performance-systems

A 60-person task force, including Lincoln Laboratory researchers, published a study reviewing mobile health (mHealth) technologies and examining their use in monitoring and mitigating the effects of the COVID-19 pandemic. They found that mHealth technologies are viable options to monitor COVID-19 patients and predict symptom escalation for earlier intervention.

The study entitled “Can mHealth Technology Help Mitigate the Effects of the COVID 19 Pandemic?” is published in the newest issue of IEEE Open Journal of Engineering in Medicine and Biology. The task force was led by Harvard Medical School associate professor Paolo Bonato, director of the Motion Analysis Lab at Spaulding Rehabilitation Hospital in Boston, and included international experts and those from across the United States.

The study reviewed mHealth technologies in three categories — wearable sensors, digital contact tracing technology, and electronic patient-recorded outcomes (known as ePRO) screening systems. Task force subgroups then looked at how these technologies could be deployed in various settings and strategies in response to the pandemic.

Lincoln Laboratory biotechnology experts Jeffrey Palmer and Thomas Quatieri led a subgroup focused on wearable sensors for monitoring COVID-19 patients. Their goal was to identify sensors that are suitable to detect worsening symptoms in COVID-19 patients who are self-quarantining at home. Data show that a portion of these mildly symptomatic patients experience a sudden occurrence of severe symptoms at home and require hospitalization…

Can mHealth Technology Help Mitigate the Effects of the COVID-19 Pandemic?
C. Adans-Dester et al., 2020, IEEE Open Journal of Engineering in Medicine and Biology, 7 August 2020 https://ieeexplore.ieee.org/document/9162431
DOI: 10.1109/OJEMB.2020.3015141

Aim: The aim of the study herein reported was to review mobile health (mHealth) technologies and explore their use to monitor and mitigate the effects of the COVID-19 pandemic.

Methods: A Task Force was assembled by recruiting individuals with expertise in electronic Patient-Reported Outcomes (ePRO), wearable sensors, and digital contact tracing technologies. Its members collected and discussed available information and summarized it in a series of reports.

Results: The Task Force identified technologies that could be deployed in response to the COVID-19 pandemic and would likely be suitable for future pandemics. Criteria for their evaluation were agreed upon and applied to these systems.

Conclusions: mHealth technologies are viable options to monitor COVID-19 patients and be used to predict symptom escalation for earlier intervention. These technologies could also be utilized to monitor individuals who are presumed non-infected and enable prediction of exposure to SARS-CoV-2, thus facilitating the prioritization of diagnostic testing.

Public Health / Pathogen Detection: The Impact of Host-Based Early Warning on Disease Outbreaks

Mark A. Hernandez, Lauren E. Milechin, Shakti K. Davis, Richard A. DeLaura, Kajal T. Claypool, and Albert J. Swiston,
Lincoln Laboratory Journal, Vol 24, No.1, 2020
https://www.ll.mit.edu/sites/default/files/page/doc/2020-07/9_Early_Warning_Tech.pdf

Lincoln Laboratory researchers investigated how early warning of exposure to pathogens could shape health care responses to disease outbreaks. Basing their analysis on the capability of an innovative algorithm that enables the detection of pathogen exposure in individuals before symptoms of disease occur, the research team evaluated the effects of such early warning on various strategies for mitigating a widespread outbreak. While not specifically focused on COVID-19, this effort lays the foundation for understanding the impact of early warning technology in combination with other nonpharmaceutical interventions….

… In conclusion, we have shown the epidemiological value of host-based early warning systems in a variety of pathogen outbreaks. By adjusting the underlying assumptions, both of the outbreak and the system performance metrics of a notional early detection system, we show in which scenarios early detection is most impactful. The results of this work emphasize the value of early detection in modulating public health responses, though future efforts will also include the value to individual patients. Current efforts at Lincoln Laboratory are focusing on the ability to monitor pathogen exposure of annual influenza, the ability to measure pathogen transmissibility non-invasively, and the impact this detection capability will have on patient care, public health responses, and service member readiness.

Vocal biomarkers / screening: Signs of COVID-19 may be hidden in speech signals

Processing vocal recordings of infected but asymptomatic people reveals potential indicators of COVID-19.

June 29, 2020, by Kylie Foy | Communications & Community Outreach Office
https://www.ll.mit.edu/news/signs-covid-19-may-be-hidden-speech-signals
https://www.ll.mit.edu/r-d/homeland-protection/human-health-and-performance-systems

It's often easy to tell when colleagues are struggling with a cold — they sound sick. Maybe their voices are lower or have a nasally tone. Infections change the quality of our voices in various ways. But Lincoln Laboratory researchers are detecting these changes in COVID-19 patients even when these changes are too subtle for people to hear or even notice in themselves.

By processing speech recordings of people infected with COVID-19 but not yet showing symptoms, these researchers found evidence of vocal biomarkers, or measurable indicators, of the disease. These biomarkers stem from disruptions the infection causes in the movement of muscles across the respiratory, laryngeal, and articulatory systems. A technology letter describing this research is published in IEEE Open Journal of Engineering in Medicine and Biology.

While this research is still in its early stages, the initial findings lay a framework for studying these vocal changes in greater detail. This work may also hold promise for using mobile apps to screen people for the disease, particularly those who are asymptomatic.

Talking heads

“I had this ‘aha’ moment while I was watching the news,” says Thomas Quatieri, a senior staff member in the Laboratory’s Human Health and Performance Systems Group. Quatieri has been leading the group’s research in vocal biomarkers for the last decade; their focus has been on discovering vocal biomarkers of neurological disorders such as ALS and Parkinson’s disease. These diseases, and many others, change the brain’s ability to turn thoughts into words, and those changes can be detected by processing speech signals.

He and his team wondered whether vocal biomarkers might also exist for COVID-19. The symptoms led them to think so. When symptoms manifest, a person typically has difficulty breathing. Inflammation in the respiratory system affects the intensity with which air is exhaled when a person talks. This air interacts with hundreds of other potentially inflamed muscles on its journey to speech production. These interactions impact the loudness, pitch, steadiness, and resonance of the voice — measurable qualities that form the basis of their biomarkers….

A Framework for Biomarkers of COVID-19 Based on Coordination of Speech-Production Subsystems

Thomas F. Quatieri, Tanya Talkar, Jeffrey S. Palmer, in IEEE Open Journal of Engineering in Medicine and Biology, vol. 1, pp. 203-206, 2020, doi: 10.1109/OJEMB.2020.2998051
https://ieeexplore.ieee.org/document/9103574

Impact Statement: This article has supplementary downloadable material available at http://ieeexplore.ieee.org, provided by the authors. The proposed sensing lends itself to nonintrusive widespread use through mobile devices. Thus, the approach provides a potential capability for scalable, longitudinal studies that seek to capture human behavior dynamics in naturalistic environments for early warning and tracking of COVID-19.

Goal: We propose a speech modeling and signal-processing framework to detect and track COVID-19 through asymptomatic and symptomatic stages.

Methods: The approach is based on complexity of neuromotor coordination across speech subsystems involved in respiration, phonation and articulation, motivated by the distinct nature of COVID-19 involving lower (i.e., bronchial, diaphragm, lower tracheal versus
upper (i.e., laryngeal, pharyngeal, oral and nasal respiratory tract inflammation, as well as by the growing evidence of the virus’ neurological manifestations.

Preliminary results: An exploratory study with audio interviews of five subjects provides Cohen’s d effect sizes between pre-COVID-19 (pre-exposure and post-COVID-19 (after positive diagnosis but presumed asymptomatic using: coordination of respiration (as measured through acoustic waveform amplitude and laryngeal motion (fundamental frequency and cepstral peak prominence, and coordination of laryngeal and articulatory (formant center frequencies motion.

Conclusions: While there is a strong subject-dependence, the group-level morphology of effect sizes indicates a reduced complexity of subsystem coordination. Validation is needed with larger more controlled datasets and to address confounding influences such as different recording conditions, unbalanced data quantities, and changes in underlying vocal status from pre-to-post time recordings.

PAPERS, ARTICLES, PRESENTATIONS, TALKS

SUPPLY CHAINS: FINANCIAL CRISIS IS LOOMING FOR SMALLER SUPPLIERS

By Federico Caniato, Antonella Moretto, & **James B. Rice** (MIT CTL Deputy Director & Director, Supply Chain Exchange Program)
6 August 2020, Harvard Business Review
https://ctl.mit.edu/news/financial-crisis-looming-smaller-suppliers
https://hbr.org/2020/08/a-financial-crisis-is-looming-for-smaller-suppliers?ab=hero-main-text

MIT CTL Deputy Director Jim Rice wrote an article in Harvard Business Review along with Federico Caniato and Antonella Moretto of the School of Management of Politecnico di Milano.

High-profile bankruptcies, refinancing deals, and drastic cost-cutting involving the likes of Brooks Brothers, JCPenney, Hertz, Neiman Marcus, Ford, and GM are testament to the financial distress wrought by the Covid-19 pandemic. But a less visible crisis deep within supply chains is destabilizing small and medium-sized enterprises (SMEs) and could add to the woes of the global economy.

SMEs tend to be the first to feel the effects of financial crises. But their current plight is exacerbated by punitive payment terms that large companies began introducing in the aftermath of the 2008 financial meltdown. These practices, in combination with the pandemic crisis, have starved countless SME suppliers of working capital and threaten to trigger a tidal wave of failures.

There are ways to avoid this outcome. Governments should provide financial support geared to the needs of SMEs, and large companies can assist by identifying and supporting suppliers at risk. SMEs can help themselves through a more rigorous approach to managing their working capital. And innovative supply-chain-finance solutions, including a new generation of digital solutions, can play a key role in providing sources of credit for SMEs. These solutions must be applied as soon as possible. If SMEs fail en masse, the ripple effects will hit larger companies and could further compromise a global financial system already stressed by the pandemic.

ECONOMICS: EFFECTS OF A UNIVERSAL BASIC INCOME DURING THE PANDEMIC

by **Abhijit Banerjee** (Ford International Professor of Economics), Michael Faye, Alan Krueger, Paul Niehaus, **Tavneet Suri** (Louis E. Seley Professor of Applied Economics)
2 Sept 2020, Department of Economics, Working Paper
https://www.poverty-action.org/sites/default/files/publications/Banerjee%20et%20al.pdf

We examine some effects of Universal Basic Income (UBI) during the COVID-19 pandemic using a large-scale experiment in rural Kenya. Transfers significantly improved well-being on common measures such as hunger, sickness and depression in spite of the pandemic, but with modest effect sizes. They may have had public health benefits, as they reduced hospital visits and decreased social (but not commercial) interactions that influence contagion rates. During the pandemic (and contemporaneous agricultural lean season) recipients lost the income gains from starting new non-agricultural enterprises that they had initially obtained, but also suffered smaller increases in hunger.

This pattern is consistent with the idea that UBI induced recipients to take on more income risk in part by mitigating the most harmful consequences of adverse shocks.

MEDICAL RESEARCH / ECONOMICS: WILL A COVID-19 VACCINE CHANGE THE FUTURE OF MEDICAL RESEARCH? (PODCAST)

Andrew Lo, Charles E. and Susan T. Harris Professor of Finance, MIT Sloan;
Director, MIT Laboratory for Financial Engineering [and Tal Zaks, chief medical officer of Moderna, and Peggy Hamburg, physician and public-health expert and former F.D.A. commissioner]
26 August 2020 https://freakonomics.com/podcast/vaccine/ Audio & transcript

MIT Sloan and IDSS professor Andrew Lo discusses how Covid-19 may inspire a new way to fund medical R&D on the Freakonomics podcast.

RISK / MACHINE LEARNING: PREDICTING COVID-19 INFECTION RISK AND RELATED RISK DRIVERS IN NURSING HOMES: A MACHINE LEARNING APPROACH

Sun, Christopher L.F., Eugenio Zuccarelli, El Ghali A. Zerhouni, Jason Lee, James Muller, Karen M. Scott, Alida M. Lujan, and **Retsef Levi** (J. Spencer Standish (1945 Professor of Management, Co-Director of Leaders for Global Operations Program
(2020 Journal of the American Medical Directors Association, available online 27 August 2020, in press/pre-proof, https://doi.org/10.1016/j.jamda.2020.08.030

Objective: Inform COVID-19 infection prevention measures by identifying and assessing risk and possible vectors of infection in nursing homes (NHs using a machine-learning approach.

Design: This retrospective cohort study utilized a gradient boosting algorithm to evaluate risk of COVID-19 infection (i.e., presence of at least one confirmed COVID-19 resident in NHs.

Setting and participants: The model was trained on outcomes from 1,146 NHs in Massachusetts, Georgia, and New Jersey, reporting COVID-19 case data on April 20th, 2020. Risk indices generated from the model using data from May 4th were prospectively validated against outcomes reported on May 11th from 1,021 NHs in California.

Methods: Model features, pertaining to facility and community characteristics, were obtained from a self-constructed dataset based on multiple public and private sources. The model was assessed via out-of-sample area under the receiver operating characteristic curve (AUC, sensitivity, and specificity in the training (via 10-fold cross-validation and validation datasets.

Results: The model's mean AUC, sensitivity, and specificity over 10-fold cross-validation were 0.729 (95% CI: 0.690-0.767, 0.670 (95% CI: 0.477-0.862, and 0.611 (95% CI: 0.412-0.809, respectively. Prospective out-of-sample validation yielded similar performance measures (AUC: 0.721; sensitivity: 0.622; specificity: 0.713. The strongest predictors of COVID-19 infection were identified as the NH's county's infection rate

and the number of separate units in the NH; other predictors included the county's population density, historical Centers of Medicare and Medicaid Services cited health deficiencies, and the NH's resident density (in persons per 1,000 square feet. Additionally, the NH's historical percentage of non-Hispanic White residents was identified as a protective factor.

Conclusions and Implications: A machine-learning model can help quantify and predict NH infection risk. The identified risk factors support the early identification and management of presymptomatic and asymptomatic individuals (e.g., staff) entering the NH from the surrounding community and the development of financially sustainable staff testing initiatives in preventing COVID-19 infection.

DATA / MODELING: MODELING THE IMPACT OF TESTING, CONTACT TRACING AND HOUSEHOLD QUARANTINE ON SECOND WAVES OF COVID-19

Alberto Aleta, David Martín-Corral, Ana Pastore y Piontti, Marco Ajelli, Maria Litvinova, Matteo Chinazzi, Natalie E. Dean, M. Elizabeth Halloran, Ira M. Longini Jr, Stefano Merler, **Alex Pentland**, Alessandro Vespignani, **Esteban Moro** & Yamir Moreno
(2020 Nat Hum Behav, Published: 05 August 2020
https://doi.org/10.1038/s41562-020-0931-9
https://www.nature.com/articles/s41562-020-0931-9.epdf

Prof Sandy Pentland: Toshiba Professor of Media, Arts, and Sciences and founding faculty director, MIT Connection Science Research Initiative

Prof Esteban Moro: visiting professor, MIT Media Lab, Connection Science, IDSS; associate professor at the Universidad Carlos III de Madrid (Spain & a member of the Joint Institute UC3M-Santander on Financial Big Data

While severe social-distancing measures have proven effective in slowing the coronavirus disease 2019 (COVID-19 pandemic, second-wave scenarios are likely to emerge as restrictions are lifted. Here we integrate anonymized, geolocalized mobility data with census and demographic data to build a detailed agent-based model of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2 transmission in the Boston metropolitan area. We find that a period of strict social distancing followed by a robust level of testing, contact-tracing and household quarantine could keep the disease within the capacity of the healthcare system while enabling the reopening of economic activities. Our results show that a response system based on enhanced testing and contact tracing can have a major role in relaxing social-distancing interventions in the absence of herd immunity against SARS-CoV-2.

MIT-RELATED STARTUPS

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

DAYTODAY

Boston, MA, https://www.daytoday.health/

Founded and led by MIT alums and experienced professionals, daytoday is dedicated to creating an unprecedented patient care experience before and after medical procedures. Our mobile app and platform provides turn-by-turn, personalized care content and interactive tools, and live chat with personal care coaches who take care of all our patients needs. We are a global company with operations in the US, India, & the UK.

Covid-19 Response: The DayToDay Health™ COVID-19 Care Management Program is designed for patients who do not yet require hospitalization. It offers comprehensive, individualized, and holistic support that addresses a patient's clinical, physical, and emotional needs. The DayToDay platform is designed for ease of use by caregivers and ease of implementation by providers to help onboard teams quickly and scale efficiently.

LARK

Mountain View, CA, https://www.lark.com/
https://twitter.com/ourlark?lang=en

Compassionate virtual care for chronic disease… diabetes care, diabetes prevention, hypertension care, behavioral health

Covid-19 Response: We're passionate about providing those with chronic conditions access to compassionate virtual care 24/7. It is imperative during this pandemic that we keep those at higher risk of COVID-19 – namely diabetics, hypertensives, and those suffering from obesity – at home and out of high-risk locations like doctor offices, ERs and pharmacies. Our COVID-19 resources have been specifically tailored to help members with chronic conditions, and those who are not members, get and stay healthy during this time…

OMNISCI

San Francisco, CA, https://www.omnisci.com/

OmniSci's mission is to make analytics instant, powerful, and effortless for everyone.

Covid-19 Response: Data and analytics have played a central role in the first wave of the global response to COVID-19. From the earliest days of the pandemic, OmiSci had up-to-date reports of case counts, fatalities and recoveries gathered by industrious volunteers everywhere. In this AI Demo Showcase from OmniSci, see how they and our partners at AWS, Safegraph, Veraset, and X-Mode are using anonymized, data-driven methods to contribute to relief efforts at a national scale for the next phase of the COVID-19 response efforts…