

A Better World in the Making



A Healthy
Humankind

A Healthy Humankind

Building a better global system of health care—with the goal of delivering longer, healthier, more fulfilled human lives—has proven to be one of the most pervasive challenges of our time.

As the third decade of the 21st century approaches, it is increasingly evident that the fields of economic theory, data analytics, and management science are every bit as crucial to create the health system of the future as is biomedicine. No wonder, then, that in environments built upon cross-disciplinary collaboration such as MIT Sloan, those mind-and-hand-melding partnerships are unlocking new approaches to long-standing quandaries.

Today, the faculty, researchers, and students of MIT Sloan are dedicating profound resources, energy, and ingenuity to hacking some of the most complex issues presented by the quest for a healthy humankind. The work conducted here each day is expanding the frontiers of how we can heal, keep people healthy, and deliver better, more affordable therapies faster to those who truly need them. It is solidifying a future where health care data and analytics drive discovery and improve delivery, operational and organizational improvements enable service advances, and economic incentives support high-quality and affordable health care.

We're pleased to share some examples of this groundbreaking work that has been made possible in part by the MIT Campaign for a Better World. Because the campaign is dedicated to supporting work to improve the world, it means that every gift to the campaign has a profound impact. Each gift is not only a gift to MIT Sloan, but also a gift to the world.

We hope these stories continue to inspire the support and dedication of our local and global community, as we strive together for better health for all of humankind. Learn more at mitsloan.mit.edu/campaign.



CAMPAIGN FOR A BETTER WORLD

Using Data and Analytics for Better Delivery

While it's generally understood that the "healing arts" have a component based upon intuition, the simple fact is this: Better care begins and ends with data. Whether used to diagnose and treat a single melanoma or evaluate a delivery system, today's quality and quantity of data can play a determinative role in achieving better outcomes. Armed with advanced AI, machine learning technologies, and sophisticated models, researchers at MIT Sloan are developing profound ways of putting data to work to optimize human health.



DIMITRIS BERTSIMAS

Unlocking an Analytics-Fueled Approach to Chemotherapy Combinations

Dimitris Bertsimas (Boeing Leaders for Global Operations Professor of Management; Associate Dean, Business Analytics; and Professor, Operations Research) and his co-researchers are undertaking a complex charge: pioneering new ways to apply state-of-the-art analytics and machine learning to the task of designing safe and effective chemotherapy regimens. They are focusing their efforts on gastric cancer,

a cancer type for which there is currently no best-in-class chemotherapy treatment regimen. Having constructed a database of 414 clinical trials for advanced gastric cancer, Bertsimas and his colleagues have now trained statistical models with randomized and non-randomized clinical data to more accurately predict survival and toxicity outcomes from combinatory chemotherapy treatments—and to evaluate those predictions.

Equipped with these first-of-their-kind methodologies that can help predict outcomes (including identifying 10–20 percent of the trials with high toxicity or efficacy issues as well as high-promise clinical trials *before* they are run), providers will increasingly have access to data-driven methods for selecting combination chemotherapy regimens—a step forward with safer, more precise, and more effective weapons in the battle against cancer.

Smart Sensors and Data Gathering to Improve Women’s Care

Many great medical advances carry with them a maddeningly low-tech irony: Pills work *only* if you take them—and remembering to take a pill is not as easy as it sounds. Similarly, potentially lifesaving cardiac health data is easily gathered using fairly simple technology, but such data is only available when and *if* it’s being measured and recorded. Enter two new MIT Sloan-originated startups, addressing these very issues in the traditionally underserved area of women’s health.

First Aavia, a health tech company that designed a medication compliance solution to learn and improve the birth control pill taking routine. Startup CEO and co-founder Aagya Mathur, MBA ’18, explains that Aavia has drawn on wide-ranging behavioral data and user research to create a “take your meds” device and method like no other—from reminders to record-keeping, Aavia’s core model is 100 percent automated. Since spring of 2017, co-founders Mathur, Chief Technology Officer Alexis Wong, and Chief Product Officer Aya Suzuki, SB ’18, have been iterating on the Aavia solution based on continuous user research on medication takers’ priorities, regimens, pressing needs, pain points, and desires. Notably, as Mathur elaborates, “When it comes to provoking anxiety and stress, birth control pills repeatedly topped the list.” And with good reason: It’s estimated that inconsistent use of oral contraceptives contributes to more than one million unintended pregnancies each year in the United States alone, not to mention the variable impacts



on general physical and mental health. Combining a “smart” case with patent-pending sensors to detect pill count and positioning with a connected health and wellness mobile app—users simply keep their usual pills in the case, and Aavia does the rest by sending reminders from the app until the pill is taken and then automatically recording the action. Aavia is packaging complex technology into a simple and effective solution for adherence, optimal health, and peace of mind.

Next: the “Bloomer” bra, originated by Alicia Chong Rodriguez, SM ’18, a comfortable undergarment with a potentially lifesaving benefit: accurately recording medical information which could save its wearers from heart disease, the leading cause of death in women worldwide. Together with classmate Aceil Halaby, SM ’17, and a third partner, Monica Abarca, the team behind the Bloomer bra and Bloomer Tech is about to begin clinical testing with plans to go to market later this year. Chong Rodriguez, a Legatum Fellow, recalls the technical innovations entailed in both engineering advanced functional fabrics into the garment to capture medical-grade data and the data analytics using proprietary algorithms for targeted medicine. The wearable result

allows for continuous monitoring and potential early detection of female-specific, precursor-abnormalities to arrhythmias, myocardial infarctions, and stroke. Such information is power: “When you own *your* health,” Chong Rodriguez explains, “you and your provider can understand better what to do and what not to do at a fraction of the cost.”

Echoing the sentiment, Aavia’s CEO Mathur points out that—for any health care tool—the user is the ultimate and most important judge of efficacy. “If you don’t listen to the end user, it’s not going to be something that’s actually going to help them. In which case, why are you even doing it?”



Using Data for Better Outcomes

“The more we harness data at scale to figure out what works, the more our toolbox expands. One size most definitely does not fit all in this field.”

miss the point. If Doyle is counting something, it’s bytes. And he is doing so with a mind toward seeing where health care can be made more productive, innovative, and meaningful for all stakeholders, from providers to patients.

Doyle explains, “With increasingly technology-fueled tools and advanced analytics techniques that can be used to mine massive amounts of health care data, what I’m studying is what works and what doesn’t when it comes to improving health outcomes.” He adds, “While health care does account for 18 percent of the United States’ GDP, and it is often said that upward of 30 percent of health care spending—roughly \$1 trillion—is wasted, improving the whole system is more than an economic imperative. It’s a moral and social imperative, too.”

TWO STREAMS, BOTH ALIKE IN DATA DIGNITY AND RIGOR

For nearly a decade, Doyle’s work has progressed along two self-described “streams.” The first consists of studies identifying, quantifying, and analyzing the present inputs and outputs that make health care most “productive” in terms of patient outcomes. The second focuses on Doyle’s work with health care organizations to evaluate their innovative ideas at scale, with an ultimate mind to establishing the evidence-based best practices of the future.

In the realm of productivity, Doyle’s work has been prolific. Using data sources as diverse as Medicare

Joseph Doyle (Erwin H. Schell Professor of Management and Applied Economics) might be said to deal in data—large, complex, industrial sets of it, gleaned from the correspondingly large and complex world of health care. Contrary to an easy assumption that an economist might be analyzing data to (as Doyle says with a laugh) “count beans,” such an assumption would largely

claims data and ambulance referral patterns, Doyle has recently completed several randomized control trials to compare the outcomes of similar patients who receive different “inputs” in the forms of procedures, providers, and assigned hospitals, and has several more under way. From those studies completed, an encouraging theme has emerged: a positive correlation between hospitals and procedures rated to be high quality and better patient outcomes.

Doyle notes, “Hospitals that score well on patient satisfaction, follow good processes of care, and record lower hospital mortality rates over the prior three years *do* seem to keep patients alive and out of the hospital longer.”

But for Doyle, there’s more to do, and deeper to go in the data when it comes to determining what works and what doesn’t to drive better health at scale—especially given a current explosion of interest from health care organizations in addressing the social determinants of health, varied and often interwoven health factors happening outside the doctor’s office, from hunger to income level; transportation to personal behavior. In fact, Doyle and his colleagues are currently evaluating multiple innovative programs that address these factors. One such multi-city evaluation is that of Geisinger Health’s novel “Fresh Food Farmacy,” a program that “prescribes” healthy food and education to low-income diabetics. Another is an evaluation of the effectiveness of using layered demographic and health data to identify “hotspots” of high-risk patients (a term conceived by MacArthur “Genius” Award winner Dr. Jeffrey Brenner) to then determine whether proactive clinical and behavioral interventions stick.

“It’s notoriously hard to change behaviors,” Doyle admits. “But the more we harness data at scale to figure out what works, the more our toolbox expands. One size most definitely does not fit all in this field. We need to continuously test the best and brightest ideas we find, using rigorous analytical techniques. And that’s where MIT Sloan has a critical role to play.”

THE WORLD IS COMING TO MIT SLOAN

Doyle will be the first to tell you that he has found himself in an environment—and among a community—

that matches his own intensity of purpose when it comes to advancing health outcomes.

“As the place to conduct this kind of work, MIT Sloan has a number of advantages: our history of analytical acumen combined with a systems-level approach; our training (and tendency) to think *outside* of a clinical episode or box; and our broader orientation toward understanding the needs and opportunities for patients, providers, and a wider network of stakeholders,” shares Doyle. He adds, “I feel genuinely lucky to be among over 30 MIT Sloan faculty working in health care, applying the lenses of economics, finance, operations, and workforce development to see a better, healthier future.”

In his leadership role at the MIT Sloan Initiative for Health Systems Innovation (HSI) guiding and representing the Initiative’s applied research interests, Doyle has witnessed firsthand how MIT Sloan’s approach supports systemic improvements. A mere one case in point is an ongoing set of projects conducted in partnership with the Staten Island Performing Provider System (SI PPS) in which Doyle and five of his faculty colleagues from the fields of operations research and organizational studies are working with clinicians designing workforce interventions, predictive tools, and operational approaches to support providers in tackling

the opioid epidemic. Over the course of the first year of the data-driven approaches employed by the SI PPS, Staten Island went from having the highest overdose numbers in the New York metro area to the lowest.

Even with the growing diversity of HSI’s applied research projects in health care and mounting evidence as to what works, MIT Sloan’s role will always be—as Doyle puts it—to “bring rigor to the rhetoric.” Scaling the work of HSI is now on Doyle’s mind, and this is where he believes that alumni are *the* leaders and stewards who will bring this work to the world.

He shares that the Geisinger’s Fresh Food Farmacy partnership came about through an on-campus meeting with Geisinger’s then CIO Dr. Alistair Erskine, EMBA ’18. “I asked Alistair what innovative programs they had going on, and the rest was working out the details. Frankly, some of the best research I see coming out of business schools is exactly this kind: where we tap into the amazing resource of our alumni network as partners, supporters, and collaborators. Our own alumni advisory board continuously helps provide strategic direction, and connects us with the expertise of industry leaders.”

He continues, “With the help of alumni and other donors to build even a five-city infrastructure for HSI’s work, the scaling of the impact would be exponential.”

Doyle’s hope, then, is as straightforward as it is ambitious: “If we can build a nationwide research network for health care transformation, we can test out the best and brightest ideas—first for the social determinants of health, and then with health care analytics. *That’s* how we can build and share the tools to build a healthier system.”

Because, so long as the need remains this urgent, Doyle adds, “with the financial support of alumni and with MIT Sloan’s intellectual resources behind us, we can take on the *most* important problems in the *most* important industry—and solve them.”





Locking Down Health Care Organization Cybersecurity

Stuart Madnick (John Norris Maguire [1960] Professor of Information Technologies; Professor, Engineering Systems, School of Engineering; Director, Cybersecurity at MIT Sloan) wants you to start taking cybersecurity seriously. Because no matter what business you're in, it's time to start talking about your vulnerabilities to hacking, and time to start seeing them for the profound threat they constitute.

Evident from his work studying security in the health care industry in particular (which in 2016 alone was the target of 88 percent of malevolent hacking attacks), Madnick insists that even the best-intentioned organizations are prone to underestimating threat levels. In a world where social engineering (such as a seemingly innocuous email from a co-worker that hides malware) is often the sharp end of a hacker's spear, Madnick concludes "[cyber]security *isn't* just a matter for top executives or IT people. It requires the involvement of the whole organization."

So what's the solution? Madnick believes that effective cyberattack countermeasures all begin with: (1) the acknowledgment that the threat is real and imminent, and (2) open, ongoing, and frank discussion about where vulnerabilities may exist. Only then can health care organizations start to plug gaps in security, and attempt proactive measures to protect themselves and their crucial systems.

Looking to the future, as the health care industry moves into automation and IoT (Internet of Things), it is only a matter of time until connectivity becomes a security risk. In sum: To keep health care organizations, patients, and employees safe, the first step is truly acknowledging the scale of the threat. With that reality kept in mind, nearly anyone—no matter their level of technical expertise—can become an asset in helping their organization to be more wary, and more secure. Madnick concludes: "We need to be more creative in our workforce. You and your organization need to be vocal about security."

Expanding Health Care Access with Artificial Intelligence

UNDIAGNOSED CASES

50%

HEART FAILURE

80%

CHRONIC KIDNEY DISEASE

50%

CHRONIC OBSTRUCTIVE PULMONARY DISEASE (COPD)

40%

DEPRESSION

“Ninety percent of the nation’s \$3.3 trillion in annual health care expenditures are for people with chronic and mental health conditions.”

—Centers for Disease Control and Prevention

In many cases, chronic conditions can be managed if diagnosed and treated. However, despite existing efforts, approximately 50 percent of heart failure, 80 percent of chronic kidney disease, 50 percent of COPD, and 40 percent of depression patients remain undiagnosed today. With the growing shortage of primary care doctors, it’s hard to keep up with the 10,000 new seniors aging into Medicare every day.

Remedy, co-founded by Michael Ng, MBA ’16, provides a health care platform that enables low-cost, non-physician care coordinators to efficiently screen patients for early signs of costly and often missed chronic diseases. The platform leverages the latest in human-interpretable deep learning technologies to piece together available historical claims, labs, pharmacy, and electronic medical record data on a patient. When necessary, the AI platform guides the care coordinator through a personalized phone conversation with the patient to collect the missing facts required to form a comprehensive picture of the patient’s chronic disease burden.

“Our early warning system helps to proactively direct at-risk patients to come in for confirmatory diagnosis and treatment with their primary care doctor,” Ng explains.

Earlier this year, Remedy signed a new Medicare Advantage Plan client in Florida.

100K

AMERICANS ON THE WAITING LIST FOR A KIDNEY DONATION

DIMITRIS BERTSIMAS/NIKOS TRICHAKIS

Analyzing and Improving the Kidney Transplant Process

Improving kidney transplant success rates is a matter of life or death to the nearly 100,000 Americans on the waiting list for donations. The longer candidates have to wait, the lower the odds of successful recovery—as it stands, patients often wait more than five years to receive their transplants. And since transplant patients are recipients of physician decisions historically made quickly and with little data, the consequences for even one incorrect call can be dire indeed. To that end, Nikos Trichakis (Zenon Zannetos [1955] Career Development Professor; Associate Professor, Operations Management) and Dimitris Bertsimas (Boeing Leaders for Global Operations Professor of Management; Associate Dean, Business Analytics; and Professor, Operations Research) have developed a machine learning-enabled application that acts as a powerful decision support tool for physicians evaluating whether or not to accept an organ. Using a “random forest” sampling methodology, Trichakis’s and Bertsimas’s application offers a systematic way to mine patterns from 10 years of historical data on kidney transplants. Already showing predictive outcomes closely matched to historical data, theirs is a tool that will only improve as its dataset grows.





Analytically Engineering a Healthier Humankind

As the father of the influential Adaptive Markets Hypothesis, among many other innovations, Andrew W. Lo (Charles E. and Susan T. Harris Professor; Professor, Finance; Director, Laboratory for Financial Engineering) is widely acknowledged as one of the leading lights in the fields of economics and finance.

Yet, over the past decade, Lo has chosen to apply his economic and financial expertise to a place other than the global financial markets: a healthier humankind—specifically, exploring innovative ways to support research and drug development in cancer, Alzheimer’s disease, and many other afflictions. How can leaders start to use knowledge from the financial world to find efficiencies and economies in biomedical innovation, drug development, and clinical trial design? The answers lie not just in the megafund structures Lo and his collaborators have developed, but also stretch into public–private partnerships and clinical trial analytics.

MODELING TO BEAT THE ODDS ON PEDIATRIC CANCER

Currently, Lo is developing and testing the feasibility of new financial structures that encourage greater private-sector investment and drive lifesaving innovation. A recent

article published in *JAMA Oncology*, for example, explores new business models to fund drug development for treating pediatric cancers, and suggests that collaborative investment structures developed among the private sector, government, and philanthropic organizations hold the greatest promise for new drug discovery.

“Traditional methods of funding are just not working,” says Lo, “and pediatric oncology is a perfect example.” This is one of the least well-funded areas of cancer research, and Lo points out the irony that reluctance to conduct drug trials on younger patients yields a perverse “unintended consequence”: Cancer drugs are much less available for children than adults.

To solve this challenge, Lo and his collaborators have run multiple financial simulations combining a model of philanthropic support, government guarantees, and asset portfolios that show expected returns ranging from -5.6 percent to 22.5 percent for pediatric cancer treatment investment. “In the public-private partnership simulation, the private sector does the heavy lifting, but the so-called ‘Valley of Death’—the earliest stages of R&D where the financial risk is greatest—is taken on by government and charitable groups,” says Lo. “Philanthropic support helps pay for the R&D in the early stages, and the government guarantees reduce the downside risk of investment at a reasonably low cost to taxpayers. This is the kind of collaborative approach that’s needed to make pediatric cancer drug development attractive to investors and the private sector.”

PROJECT ALPHA: AN “A+” FOR MORE POWERFUL CLINICAL TRIAL PREDICTIONS

While tackling new models for financing pediatric cancer therapeutics—as well as other diseases such as ovarian cancer and rare genetic disorders—Lo is also focusing on analytics and predictive models to make the risk/reward profiles for biomedicine investments more transparent and precise through a new initiative called Project ALPHA (Analytics for Life-sciences Professionals and Healthcare Advocates). Lo remarks that he was as surprised as anyone to learn how little had been done in modeling the success rate for clinical trials. “In the investment world, financial analysts spend enormous amounts of time, effort, and data resources estimating the success rates of their investments, so why not apply some of the same tools to estimating the success rates of biomedical investments?”

This is the focus of Project ALPHA—to provide the entire biomedical ecosystem with timely and more accurate estimates of the risks and rewards of clinical trials, with the ultimate goal of bringing more and better therapies to patients faster and cheaper.

“When you recognize something of obvious value, something that has the potential to improve society, that *isn’t* currently being done, be the one to do it. Stop waiting.”

The first set of analytics offered by Project ALPHA is clinical trial success rates, first published in the academic journal *BioStatistics* (entitled “Estimation of Clinical Trial Success Rates and Related Parameters”) at the beginning of 2018. Based on algorithms developed by MIT researchers at Lo’s MIT Laboratory for Financial Engineering (LFE) in collaboration with Informa Pharma Intelligence, these metrics offer the most comprehensive view on clinical success rates ever published.

To encourage further research and improvements by academics, regulators, and industry professionals, the LFE will regularly update these metrics—as well as post new analytics—and make them freely available to the public at projectalpha.mit.edu.

ONLY AT MIT SLOAN

In describing the advantages of working at MIT Sloan, Lo speaks of the “great good fortune” of working in the unique culture that thrives at the school. “Having worked in other university settings, I can say this from experience: MIT is special—we share what you might call an ‘engineering mindset.’ We focus not on departments or academic disciplines, but on really challenging problems that need to be solved.”

At MIT and MIT Sloan, according to Lo, traditional institutional boundaries are very porous. “MIT people don’t care what the discipline is; they just want to work on cool problems. You won’t find that at any other university. *Mens et manus* is in our DNA.” Which leads Lo to his parting advice for MIT Sloan alumni: Don’t wait for permission.

“When you recognize something of obvious value, something that has the potential to improve society, that *isn’t* currently being done, be the one to do it. Stop waiting. As members of the human race, we all have the right—and the responsibility—to contribute, in any and all ways we can.”



Ryan Davis and Anne Kim, SB '16, MNG '19

Secure AI Labs: Using Machine Learning to Accelerate Medical Discovery

The one-in-ten Americans living with a rare disease face a daunting challenge: gathering and using information on their condition that exists across a vast network of lab data, health records, and genomic libraries. Historically, physicians have had no way of accessing or combining these critical datasets, but with the help of technology, explains the CEO of Secure AI Labs (SAIL) Ryan Davis, Visiting Fellow '18, we can protect both privacy *and* security to enable unprecedented data access for clinicians and research. “Where some people saw a big problem,” Davis recalls, “we saw the kind of big problem that MIT students love to solve. The kind with bigger solutions.”

SAIL seeks to accelerate the process of medical discovery, drug development, and patient care by using secure computation to enable hospitals, universities, and biotech companies to comb and analyze cross-indexed data with absolute security, model ownership, and data privacy preserved. Through partnerships with MIT Sloan, CSAIL Alliances, ILP STEX25, and the Martin Trust Center for MIT Entrepreneurship, Secure AI Labs is now deploying their technology to life science companies and researchers. Davis imagines a new day for treating orphan diseases where we can freely and safely access data to make the life-changing discoveries we need. Davis adds, “We are hoping to forever change the way we approach the search for new cures and new solutions for the rarest diseases.”



“Data-driven operations management is increasingly valuable in health care to ensure scarce resources are used effectively. What partnering with MIT Sloan has demonstrated is that the school’s leaders are not just expert data analysts, but also able change management stewards—a necessary combination in creating lasting improvements.”

Peter L. Slavin, MD, MIT Sloan Initiative for Health Systems Innovation Board Member; President, Massachusetts General Hospital

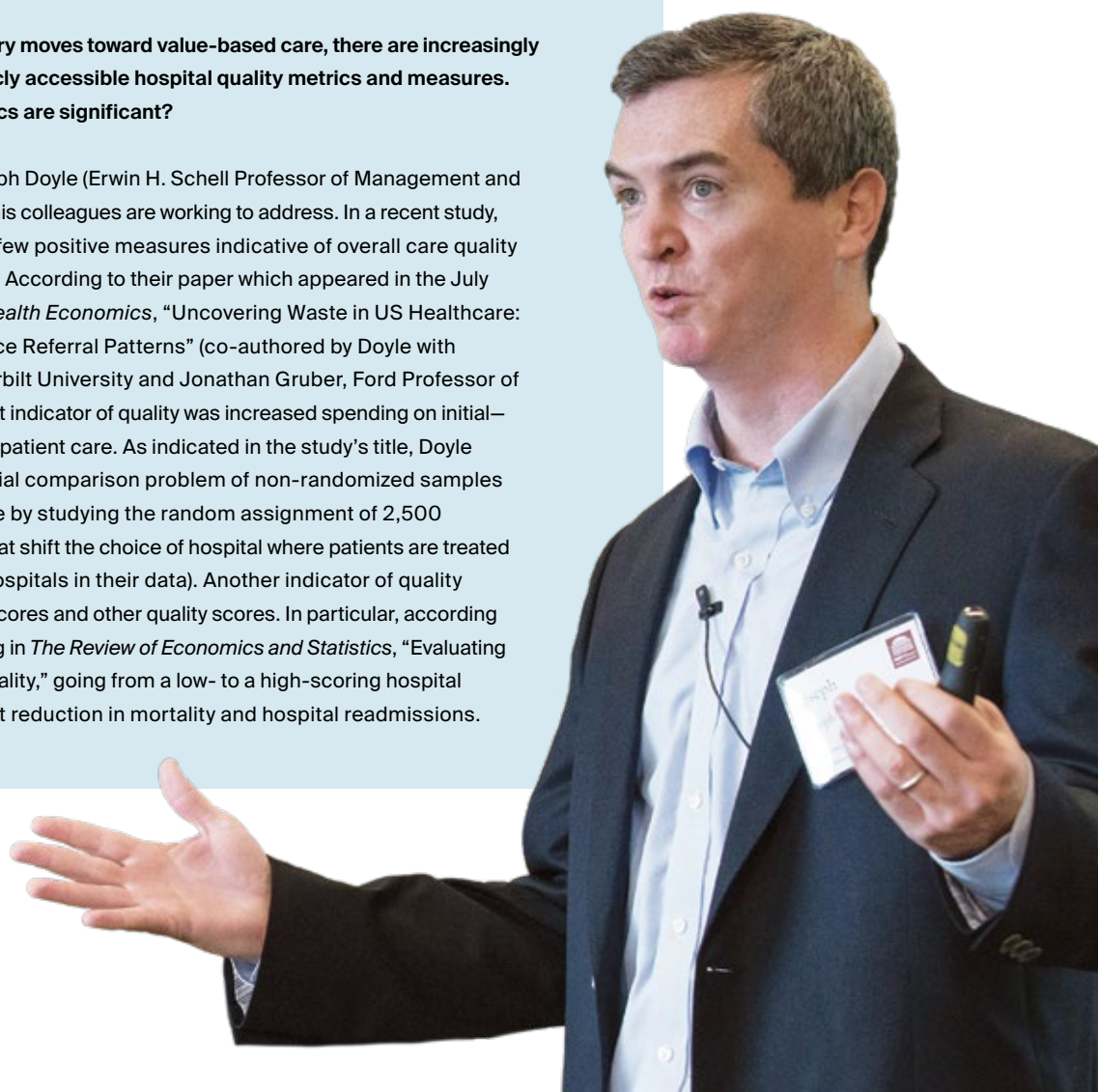
JOSEPH DOYLE

Increased Hospital Spending on Initial and Emergency Care Shown to Yield Better Long-Term Outcomes

As the health care industry moves toward value-based care, there are increasingly diverse sources of publicly accessible hospital quality metrics and measures. But which of these metrics are significant?

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This is the question Joseph Doyle (Erwin H. Schell Professor of Management and Applied Economics) and his colleagues are working to address. In a recent study, Doyle has determined a few positive measures indicative of overall care quality and lower mortality rates. According to their paper which appeared in the July issue of the *Journal of Health Economics*, “Uncovering Waste in US Healthcare: Evidence from Ambulance Referral Patterns” (co-authored by Doyle with John A. Graves of Vanderbilt University and Jonathan Gruber, Ford Professor of Economics, MIT), a salient indicator of quality was increased spending on initial—rather than longer-term—patient care. As indicated in the study’s title, Doyle et al. dodged the perennial comparison problem of non-randomized samples skewed by patient choice by studying the random assignment of 2,500 ambulance companies that shift the choice of hospital where patients are treated (across roughly 3,000 hospitals in their data). Another indicator of quality was patient satisfaction scores and other quality scores. In particular, according to their paper forthcoming in *The Review of Economics and Statistics*, “Evaluating Measures of Hospital Quality,” going from a low- to a high-scoring hospital results in a 10–15 percent reduction in mortality and hospital readmissions.



Improving Operations & Organizations

Innovating for a healthier humanity may begin with bold imagination, but it succeeds—or fails—in the realms of operations and implementation. Whether it's challenging long-held assumptions regarding health care operations or finding new, research-based methods to reinvent the organizations that deliver that care, MIT Sloan faculty, researchers, students, and alumni are turning their energies to changing institutions, networks, and practices for the greater good.

Community Servings: The Model That Tripled Patient Helpings

Community Servings has been a familiar fixture of the Boston nonprofit roster for decades, providing customized, home-delivered meals to the chronically ill. But what if, with a little help, they could dramatically scale up the number of people they serve? That's the charge they brought to a group of students from the MIT Sloan Healthcare Lab (one of MIT Sloan's 16 Action Learning labs), who committed their minds and hands to helping Community Servings increase their efficiency and production of the meals their clients rely on—all without compromising quality. As Melissa Jane

Webster, MBA '09, (Lecturer in Global Economics and Management; Mentor to the H-Lab team) explains, the experience provided exactly the kind of real-world, imagination-through-implementation challenge that MIT Sloan sees at the heart of its mission. "We like to connect to the MIT motto of *mens et manus* through projects just like this."

The H-Lab team immediately set about identifying areas where efficiencies could be found to deliver better throughput. While analyzing the Community Servings menu designed to cover more than 140 unique diet needs, the team discovered that some menus served only a handful of clients, recipes weren't calibrated to produce an exact number of meals consistently, and ingredients were often unnecessarily restrictive. The H-Lab team proposed reducing the number of unique menu items, and created a recipe database that could help chefs select what food to cook from standardized recipes designed to reduce waste. As a result, Community Servings has already reduced their diet combinations from 140 to 87, thus preparing the organization operationally to serve three times more patient-clients in need.



A Networked Product and Service Model for Diagnostic and Primary Care

MDaaS (Medical Devices as a Service) Global's co-founders Oluwasoga Oni, SM '16, (2015–16 Legatum Fellow) and Genevieve Barnard Oni, MBA '19, (2017–18 and 2018–19 Legatum Fellow) aim high with their new venture in planning nothing less than to provide health care for Africa's next billion patients through low-cost, tech-enabled diagnostic centers. Oni has firsthand knowledge of the particular operational and practical challenges in Africa: His father, a primary care physician, delivered him at his hospital in southwest Nigeria. While still a student, Oni found himself devising potential solutions for Nigerian health care



centers in need of basic medical devices, wrestling with the conflation of high temperatures, an unreliable grid, and ignored maintenance instructions leading to devices that were either unused or quickly inoperable. As Oni elaborates, “The [local] challenges are the high cost of the equipment, little to no financing available for it, and the lack of skilled biomedical technicians to fix the equipment.” Between the massive and *unused* U.S. inventory of such equipment and the profound need for devices and maintenance expertise, MDaaS Global has modeled a solution. The Onis have chosen to focus primarily on setting up and operating modern diagnostic centers in low- and middle-income communities. The centers offer a wide range of services, including imaging, cardiac, and lab services, with many tests costing less than US\$5. MDaaS Global serves as the centralized diagnostic department for surrounding hospitals and clinics in the community, currently partnering with over 60 referring health facilities at their flagship center in Ibadan, Nigeria.



Left: Joe McCord, SM '15, Genevieve Barnard Oni, MBA '19, Oluwasoga (Soga) Oni, SM '16, and Opeyemi Ologu

ANNE QUAADGRAS

Moving Past PTSD with PTSI

What are the best practices for managing post-traumatic stress disorder (PTSD) efforts across the continuum of care—and how can effective innovations be scaled, access to critical services be broadened, and mental health support be destigmatized? Anne Quaadgras (Director of the Initiative for Health Systems Innovation; Senior Lecturer, Operations Management) and her fellow researchers aimed to find out by venturing into a complex system: that of the U.S. military. In a study conducted from February 2012 through January 2016 entitled, “Military Psychological Health Enterprise: Post-Traumatic Stress Innovations (PTSI),” Quaadgras and a multidisciplinary team of faculty and students from across MIT analyzed the structural, political, and cultural features of the garrison-based care system in the Army and Marine Corps, the two service branches identified as being the highest need. Harnessing a combination of qualitative data analysis,

fieldwork, and simulation modeling, Quaadgras et al. explored the ways the behavioral health of active-duty service members was addressed, and identified critical systemic disconnects in the realms of programming, information infrastructure, cross-service learning, and mindsets. The team then delivered findings and recommendations to help leaders improve continuity of care; advocate for coordinating information systems infrastructure; conduct ongoing performance measurement and adaptations focused on care transitions; and create a robust learning culture across the organization to support a future of better care at lower costs for those committing their lives to service. The best evidence of the study's efficacy was the acceptance and adoption of the team's recommendations by local and service leaders in the Army, Marine Corps, and the Department of Defense at large.

Micro-Improvements for Macro-Level Institutional Change

As the old saw would have it, the devil's in the details. But when it comes to instituting profound change in institutions of any size, the work of Kate Kellogg (David J. McGrath jr [1959] Professor of Management and Innovation; Professor, Work and Organization Studies) indicates that profound good—and possibility—is there, too.

Kellogg's prolific research pushes where, evidence suggests, *actual* institutional change really happens: in the realms of professional relationships, spaces, and behaviors. She's covered such issues in depth in her book, *Challenging Operations: Medical Reform and Resistance in Surgery*, and has examined models for developing and spreading quality improvement innovations; other Kellogg studies have scrutinized “radical flank effects” during organizational power shifts, as well as how “brokerage professions” can help to implement reforms. By investigating the underlying human mechanics in health care organizations, Kellogg's work reveals the big picture of how and why change happens in some organizations, while failing at seemingly identical organizations elsewhere.

IMPROVING OPERATIONS, ONE CARE TEAM AT A TIME

While perhaps no industry faces more challenges than health care, no area is more critical for testing and introducing interventions than primary care. Primary care providers (PCPs) are, in Kellogg's description, the “quarterbacks” of the industry, accounting for 560 million (55.5%) of all U.S. doctor visits and holding purview power. Presently, transitioning to “team-based” primary care

operations is considered a high priority within the industry, both for quality improvement ends and cost-control rationales. That said, it's a transition fraught with obstacles. Since reforms require doctors to cede some areas of practice to “paraprofessionals” like medical assistants, they are often being met with individual and institutional resistance.

“Embrace the change agents you work with, and be one of them.”

That's why engaging a health care institution in the reform process is, in Kellogg's assessment, “easier said than done.”

But her work, by its nature, is nothing if not powerfully specific. Kellogg therefore has pointers and strategies for providers and industry leaders, based most recently on a two-year ethnographic study of the primary care department operations in two U.S. hospitals, which was published in *Administrative Science Quarterly* as “Subordinate Activation Tactics: Semi-professionals and Micro-level Institutional Change in Professional Organizations” (2018). In the paper, she focuses on similar institutions working with similar grants to implement the so-called “Patient-Centered Medical Home” reform, a widely praised (but still not broadly implemented) reform designed to move health care entities to team-based, patient-focused care that emphasizes prevention over intervention. Her data on one institution's success—and another's relative failure—gathered on the ground is where things get *really* fascinating.

THE PERSON-TO-PERSON DYNAMICS OF REFORM

“Significant differences around successful reform implementation come at the level of interpersonal dynamics and subordinate activation tactics,” Kellogg explains. For instance, she has found that medical assistants occupy uniquely powerful structural position vis-à-vis doctors. Central to workflows and engaging with multiple physicians and peers, assistants are involved in many of the most important operational aspects of a practice (e.g., keeping doctors on time, providing relevant patient information, and much more). In short, Kellogg determined that the institutions that enjoyed success in implementing reforms were the ones that gave medical assistants tools to use *all* aspects of their powerful structural position to influence change. She provides this concrete example: “Medical assistants are central in the doctors' peer network. So, if a medical assistant introduces a new process with even one doctor in their group, they can tell that doctor's colleagues, ‘Well, I'm already doing this with Dr. So-and-So,’ which makes his or her peers far less resistant to change.” Kellogg cited several other specific aspects of medical assistants' “structural power,” such as occupying a central position in the doctors' daily workflow. They could both remind doctors to

implement new practices, such as delivering particular vaccinations, and give doctors opportunities to review and approve suggested changes before they are implemented.

As she concluded in the correlated “Operating Room: Relational Spaces and Microinstitutional Change in Surgery” study, “frontline reformers,” whether doctors or support staff, *must* be engaged by the institution for successful reform to take place. But, Kellogg cautions, change agents and those resistant to change should not be brought together prematurely. Once change agents have agreed upon concrete strategies in “safe relational spaces” with their like-minded fellows, it will ease the process of introducing small changes to those who would instinctively fight them.

AN INSIGHT INTO THE MECHANICS OF CARE—AND CHANGE

Kellogg relates her own experiences among doctors and health care providers as formative to her research interests. “My father had childhood polio, grew up with a brace, and ended his life in a wheelchair...so I was always surrounded by excellent caregivers, and they always were deeply important to me and my family.” Kellogg, in fact, began her undergraduate studies on a pre-med track, but ultimately concluded her personality and interests were better suited to teaching, research, and writing. “I realized what a huge difference improving operations

could make in the world at large...and I guess it’s no surprise I’ve found myself focused on health care, at MIT Sloan, which is a place so focused on tackling real-world problems.”

Indeed, health care shares a salient feature with so many other challenges of the 21st century: the fact that, in Kellogg’s words, “everyone knows *what* to do—it’s the *how* that’s difficult.” She continues, “No health care leaders disagree with the premise of team-based care, cost-effectiveness, greater access, and so forth. So, the barrier to change becomes: *How* do you make that change in day-to-day work, when people are such creatures of habit and routine? That’s the difficulty.” It seems no accident that uncovering and giving evidence as to the *how* is where Kellogg plays best.

As for MIT Sloan alumni working in the health care industry, Kellogg has characteristically specific advice: “Embrace the change agents you work with, and be one of them. Consider the real importance of the ‘paraprofessionals’ in your organization to make change happen—not just for administrative support, but also for using their structural power to help change the practices of the professionals with whom they work. Don’t underestimate them.”

As Kellogg’s work demonstrates, the quotidian interactions between individuals shouldn’t be underestimated, as they present a point of leverage from which the biggest institutional changes can emerge.



ANJALI SASTRY

Reducing Wait Times with Quick and Practical Front-Line Interventions

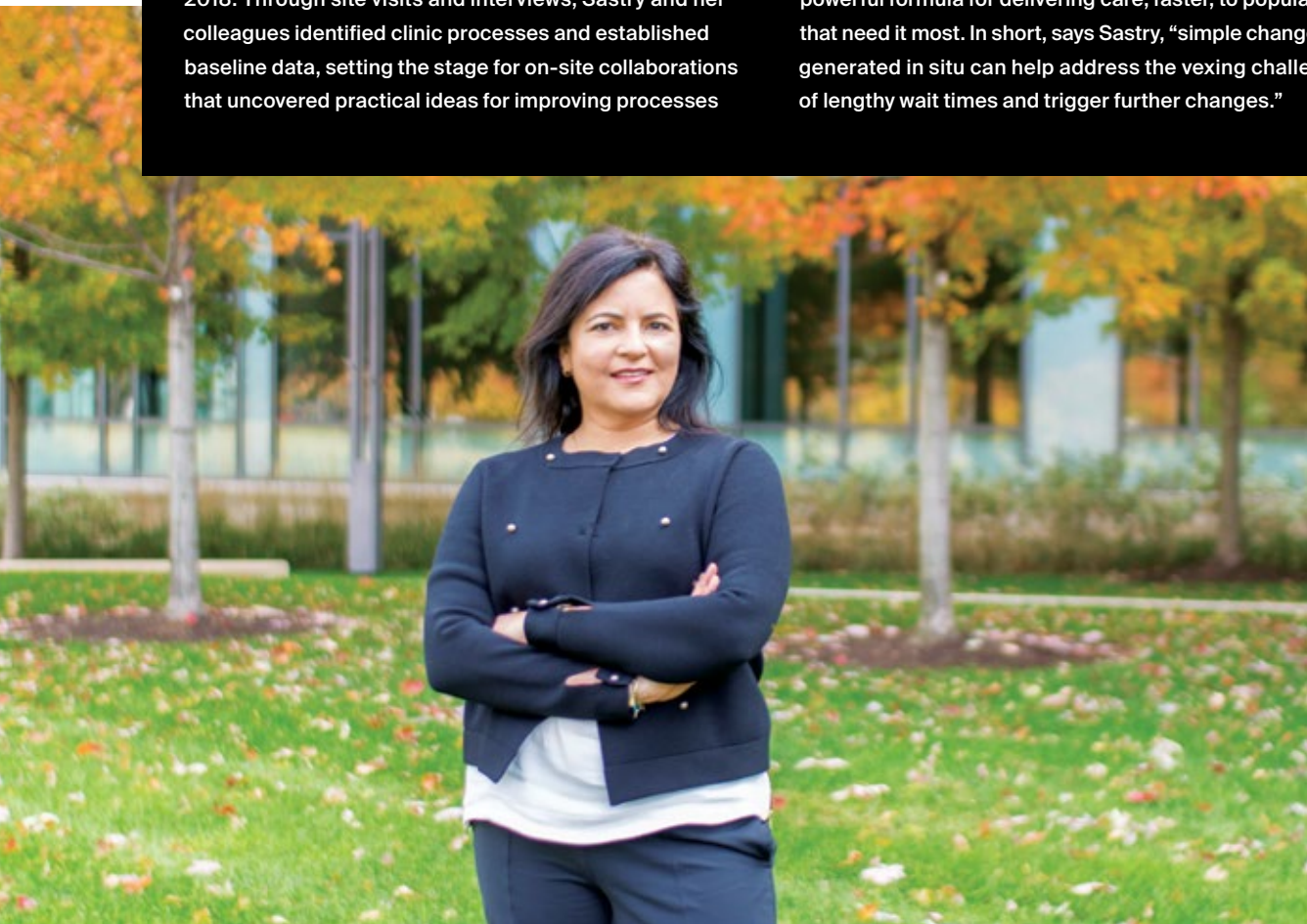
Can seemingly minor interventions make a big difference for patients in busy public clinics? Anjali Sastry (Senior Lecturer in System Dynamics)—together with fellow researchers and graduate business students—set out for Cape Town, South Africa, to find out. Their partners in the 2014 study were two public urban primary care centers in the historically disadvantaged neighborhoods of the Cape Flats that served high volumes of low-income patients with varied health care needs, including such chronic conditions as epilepsy and diabetes.

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In each case, the aim was to tackle a stubborn problem: persistent lengthy wait times that diminished the experience of patients and staff alike. Patients with limited resources had few alternatives to busy public clinics, and long in-person wait times that extended many hours—in some cases over a day—reduced the likelihood of follow-up visits, threatening health outcomes. One project tackled wait times at an in-house pharmacy in a clinic that served some 18,000 patients a month, while the second looked to reduce waiting across the board in a clinic seeing up to 13,000 monthly patient visits.

An initial round of data collection began in November 2018. Through site visits and interviews, Sastry and her colleagues identified clinic processes and established baseline data, setting the stage for on-site collaborations that uncovered practical ideas for improving processes

and addressing bottlenecks. The MIT Sloan team gathered quantitative and qualitative data throughout the project, including insights drawn from participant observation. For the third and final phase, researchers and clinic staff measured the effects of these procedural improvements. The team's ultimate findings? Using *t* tests to compare beginning and end wait times across both clinics, dramatic improvements were recorded. In the first clinic, months after the intervention, mean pharmacy waiting time was reduced from 129 minutes (median 86 min.) to 102 minutes; in the second, mean wait times fell from 275 minutes (median 256 min.) to 196 minutes.

While Sastry and her research team noted that barriers to success included staff turnover, fatigue from adapting to new requirements, and resource constraints, the collaborative study's overall results suggest that three factors enabled significant impact in busy public clinics. First, functional changes were facilitated by the engagement of clinic leadership in joint problem-solving with staff, researchers, and students. Second, clinical teams' past experiences with MIT Sloan Action Learning projects enabled them to make the most of this short-term engagement. Third, joint development of targeted (and locally appropriate) solutions informed and inspired the team's subsequent efforts. The study suggests that correctly designed short-term projects offer a potentially powerful formula for delivering care, faster, to populations that need it most. In short, says Sastry, "simple changes generated in situ can help address the vexing challenge of lengthy wait times and trigger further changes."



Removing Barriers to Affordable and High-Quality Care



Amar Gupta, SM '80, (Principal Research Associate at MIT Sloan [1985–91]; First Senior Research Scientist at MIT Sloan [1991–2004]; currently leading telemedicine research at the MIT School of Engineering) has been instrumental in advancing a variety of world-changing technologies in health care and beyond, including microcomputer-based and content-based image search

techniques, neural-network algorithms for reading mammograms, and the character-recognition technology that's now widely used for nationwide electronic check processing. Yet, none of Gupta's previous work had prepared him for the reality—and frustration—of facing a family medical emergency on the other side of the country. On a trip to Los Angeles, Gupta's wife broke both her wrists in a fall. At the emergency room of a local hospital, the Guptas were informed that she could not be treated as she was not a member of the hospital's health care system. They were given the following jaw-dropping advice: fly back to Boston and seek treatment there. Needless to say, Gupta, who had developed MIT's popular 6.884/HST.S58 (Telemedicine and Telehealth for Enhancing Global Health) course in an honorary mode, redoubled his efforts to address the operational and organizational dysfunctions that plague the U.S. health care system.

Gupta is perhaps among the best-qualified researchers for this sort of task, having spent a great deal of his career wrestling through the phase that follows innovation: implementation. And here, he has shown his ability to get results. According to former colleague Phillip Clay (Former MIT Chancellor; Professor Emeritus, MIT Department of Urban Studies and Planning), "Amar is among the small fraction of researchers who propose innovative ideas and who can also address the institutional and policy challenges related to broad use of those ideas."

Case in point: the burgeoning field of telemedicine, which still finds itself mired in regulatory and legal hurdles relevant to practice over state lines. Here, Gupta has put himself on the forefront. When, in 2017, the U.S. Veterans Administration announced that it would provide veterans with telemedicine services regardless of where patients and providers are located, Gupta's expertise was cited in support. A 2011 paper he coauthored, with Deth Sao, in *Health Matrix: Journal of Law-Medicine*, first challenged the constitutionality of regulations and state laws inhibiting the practice of telemedicine. After all, as Gupta notes, regulation of interstate commerce is the constitutional domain of the federal—not state—government.

Gupta continues to pursue the practical aspects of operations in his recent proposal on adopting a "consortium approach" (previously used to drive the rapid adoption of machine-based reading of bank checks) for health care system interoperability. He stresses the need to link information from electronic health record (EHR) systems, pharmacy systems, lab systems, and devices. "We really need to have some rational way of thinking about and implementing medical services across organizations, state boundaries, national boundaries, and other manmade barriers," Gupta asserts.

As he stressed to his students in 6.884/HST.S58 during the spring of 2016, 2017, and 2018 and to the 22 students whose research he supervised during the spring of 2019, it is they who will need to continue the push for innovations that account for both the theoretical and practical needs of tomorrow's health care industry. Gupta remains as hopeful as he is determined: "I can see a day when political and commercial barriers are surmounted and care happens on a global basis...where health care for all is better, quicker, and less expensive."

BUILDING BETTER

"One of the greatest opportunities for MIT Sloan's leaders is taking something that is not a functional system—the U.S. health care system—and using our systems thinking acumen to devise a solution."

Ron Williams, SF '84, MIT Sloan Initiative for Health Systems Innovation Board Chair; former chairman and CEO, Aetna

Creating a Long-Term Future for Long-Term Care



By 2030, unless current policies and practices change, you—and those you care about—had better not be unlucky enough to require long-term care. According to the estimates of Paul Osterman (Nanyang Technological University Professor; Professor of Human Resources and Management; Co-Director, MIT Sloan Institute for Work and Employment Research), that’s the year that an already severe national shortage of caregivers will hit a record number. The population 65+ will grow by 50 percent whereas if nothing changes, the number of paid care workers will increase by only 6 percent. To make matters worse, the ratio of potential unpaid family care workers to those in need will also fall. “These are conservative estimates,” Osterman notes, not mincing his words. “It’s an absolute train wreck waiting to happen.”

The looming caregiver crisis results from a conflation of circumstances. Demography means that aging baby boomers will find themselves in need of care workers, just as the United States will experience growing shortages of labor in the elder care and long-term care markets due to the low wages and low prestige afforded to these positions. Where a labor shortage would traditionally put upward pressure on wages and bring more workers into the field, Osterman explains a large part of long-term care is financed by public programs (Medicaid and Medicare) that limit reimbursements and hence compensation.

But our future prospects need not be grim, according to Osterman. In fact, he holds that this incipient crisis presents an opportunity to redesign a failing system, add to the skills of workers, and enhance worker dignity and pay, all while saving public and private players money. Indeed, Osterman’s leading-edge research in improving low-wage jobs suggests a roadmap that will help us all avoid an unacceptable fate.

WHO WILL CARE FOR US? AND HOW WILL THEY DO SO?

Osterman’s concern with low-wage workers—and how to improve work in many low-wage industries—has been a longstanding area of his study and interest. During two years of intensive research into the long-term care industry, Osterman gathered enough data (and arrived at enough conclusions) to publish his most recent book, the widely praised *Who Will Care For Us? Long-Term Care and the Long-Term Workforce*. In the text, he outlines both problems and possible solutions, along with supporting evidence.

As Osterman points out, long-term care workers currently earn “poverty wages.” But, as his book details, the marginalization of long-term care workers is largely the result of conditions we can change for the better. By expanding the scope of training and thus the scope of care that these workers provide, savings could be realized and channeled back into livable pay.

Osterman provides examples such as the well-documented New York University post-op study where better-trained health aides led to better patient self-care outcomes, Mt. Sinai's decision to include health aides as part of the formal care team, and the increasingly popular "Green House Project" model of residential elder care. Hence, there is ample potential to tap into greater worker productivity. But therein lies a critical challenge. Even if workers were given a broader scope of training and practice leading to greater productivity and value, it doesn't follow that workers themselves would benefit. "You still have to worry that insurance companies or other payers will say thank you very much, and keep the money," Osterman comments wryly.

Changing these economics, he suggests, will require solutions including organized labor and collective bargaining, as well as sustained political pressure on lawmakers at the state and federal levels. Osterman notes that many organizations and state governments are already taking steps based on the urgency around long-term care. He cites generational political activism from the "Grey Panthers" in Oregon in changing that state's health system; proposals to create publicly funded long-term care benefits advanced in California, Illinois, Iowa, Maine, Michigan, New York, and Washington; and the efforts of labor unions and advocacy groups such as the National Domestic Workers Alliance. Beyond politics, Osterman points out, change requires that the payers (from Medicaid

to private insurance) listen. He shares, "Power follows money. And if it's true, as I argue, that the system can save money by expanding the scope and training of these aides, then people who have that money should sit up and take notice."

NEW RESEARCH AND MOUNTING EVIDENCE FOR CHANGE

In search of further demonstration models, Osterman has just begun a new research project under the auspices of the MIT Sloan Initiative for Health Systems Innovation (HSI), which examines data from a new program by New York City's health care ecosystem. Osterman and his colleagues will examine the efficacy of placing community health workers into emergency room settings to work with Medicaid patients, which he expects will provide evidence regarding what value additional training and expanded care can add to an overburdened, understaffed system.

Returning to the urgency of change, Osterman reminds us that this is one of those rare issues that doesn't play favorites. "This issue impacts *everyone*. Every American will eventually either need long-term care or be closely connected to someone who does. And without systemic changes, they won't be able to get it at a price that's affordable or a quality that's acceptable. This is in any person's interests."

MAKING THE DIFFERENCE

Osterman observes that many in the wider MIT Sloan community have expressed their shared concern. "A number of MIT Sloan alumni have gotten in touch with me, sometimes because they're involved in the [long-term care] industry, or they're involved in policy. But I would urge *every* alumnus and alumna to put pressure on state and federal policymakers. We're a community that cares about making a difference, and this is a tangible way to do so."

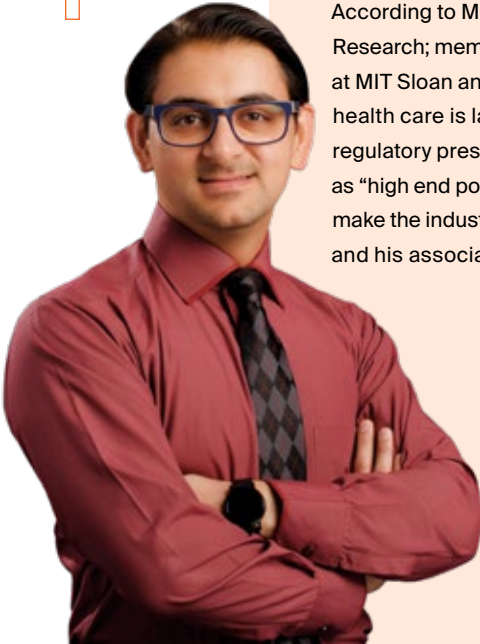
Finally, as to Osterman's own choice to pursue his study at MIT Sloan, he is quite clear. "I have found that MIT Sloan combines two crucial characteristics: one is a very serious commitment to research at the highest professional level. The other is focusing on *how* to make organizations perform better, by translating research into real-world practice. My interests are the same."

He concludes, "This is a unique combination. That's why we're all here, and how we'll see a better future."

"This issue impacts *everyone*. Every American will eventually either need long-term care or be closely connected to someone who does."

MOHAMMAD JALALI

Fortifying Hospitals Against Cyberattacks



According to Mohammad Jalali (member of the Harvard Medical School faculty; affiliate of MIT Sloan Research; member of the MIT Sloan Initiative for Health Systems Innovation; affiliate of Cybersecurity at MIT Sloan and the MIT Initiative on the Digital Economy), when it comes to issues of cybersecurity, health care is lagging far behind in protecting its primary stakeholders: patients. In particular, regulatory pressures, complex internal politics, technology saturation, and what Jalali has identified as “high end point complexity” (i.e., technologically diverse points of entry data input and control) make the industry and its patient information vulnerable to attacks and breaches. To that end, Jalali and his associates have conducted a study aimed at developing a systematic perspective

on shoring up cybersecurity in America’s health institutions. Through extensive interviews and qualitative data analyses, Jalali et al. have concluded that while “security resources”—the investments made in security, whether technological or human—are important, the low-level investments typically found in health care settings can be compensated for by setting higher internal standards. According to the study’s conclusions, hospitals and information security officers should focus on reducing end point complexity, improving internal stakeholder alignment, and setting target levels of cybersecurity beyond current regulation and policy requirements to protect their information and assets.

Optimizing Non-Face Time Work to Prevent PCP Burnout and Improve Care

In the field of health care, physician burnout looms as a major malady: a public health crisis that could, in little more than a decade, lead to a shortage of more than 120,000 physicians. This dire situation holds potential consequences ranging from profoundly reduced care capacity (from a diminished workforce) to lower quality of care. But Michael Hu (PhD student, Operations Research Center) and his colleagues may have illuminated a majorly misunderstood root cause of physician burnout: non-face time

work (NFTW), a term subsuming the various note-taking, record-keeping, and other administrative work conducted during time not spent face-to-face with patients. More promising still, Hu and his colleagues have designed predictive models that can help health care leaders—from primary care physicians (PCPs) to administrators—understand the nature of these physician work burdens,

and redesign workflows and compensation structures to enhance physician engagement and improve patient care.

After first analyzing a robust dataset, including approximately 200,000 individuals across 18 Massachusetts General Hospital-affiliated practices using machine learning, Hu and his colleagues arrived at some illuminating findings and critical insights. While they found that “face time work” is relatively consistent across doctors, NFTW varies quite dramatically. And to date, risk models have done poorly in predicting NFTW (and total work). Hu found, for instance, that 60 percent of such specific NFTW as note-taking happens during off-hours (between 6 p.m. and 7 a.m., and/or on weekends), a significant increase and snowballing burden over the estimates from a 2016 study, which reported that physicians spend as much as 49 percent of their day on similar desk work, as well as 1–2 hours per day of their own personal time. Hu and his colleagues have since pioneered predictive models that improve early correlation of patient risk with NFTW (and total work). Their next steps include designing, deploying, and analyzing the efficacy of operational strategies designed to reduce NFTW burdens, improve workflows, and fairly compensate physicians for the full span of their work. The team is also discussing potential collaborations and the expansion of the analyses with several other major health systems across the country.

120K

A PUBLIC HEALTH CARE
CRISIS COULD LEAD TO A
SHORTAGE OF MORE THAN
120,000 PHYSICIANS



“Hacking” the Opioid Crisis with an Unusual Idea



Chatterjee

While the six-year-old Enterprise Management (EM) Track at MIT Sloan is a relatively new addition to the MBA experience, its invention corresponds to an increasingly pervasive human capital need of global multinationals: that is, for cross-functional leaders able to tackle complex problems of business and societal relevance. To that end, the EM Track has been heralded for engaging students from day one in real-world problem-solving. Were you to venture into the yearly Enterprise Management Lab Hackathon, you’d witness second-semester students applying operations, marketing, and strategy habits of mind and hand to tackle challenges from aging in place to the sustainability of the global food supply chain, sponsored by organizations from Apple to IBM to SAP. As Sharmila Chatterjee (Senior Lecturer in Marketing; Academic Head for the MBA Track in Enterprise Management) explains, “The Hackathons have been designed

to provide incredible learning opportunities in fairly short periods of time for students, and also to create great value for sponsor companies in terms of generating new ideas for tackling emergent issues, matched to the pace of today’s business environment.”

The recent challenge posed to students in MIT Sloan’s 2018 Enterprise Management Lab Hackathon was as broad in scope as it was urgent: create novel solutions to address America’s opioid crisis. With only four days to learn from industry and policy leaders, ideate rapidly, and then prototype approaches, the winning team made use of their time by designing a model around an existing analog: the “Planned Parenthood for substance abuse.” Borrowing from the nonprofit’s resource and service model offered to diverse stakeholders, the team’s approach detailed a “one-stop shop” for information and support for opioid abusers, family members

and friends, government entities, nonprofits, hospitals, and rehab clinics. As team member Yesseña Brown, MBA ’19, posed rhetorically: “How can we address as many factors [of the crisis] as possible under one umbrella?” Elaborated teammate Kyle Chapman, MBA ’19, “We knew a lot of people would try to solve the problem by going upstream. And while a smart pillbox might address part of the crisis, the issue is that it’s only attacking one point of a really systemic problem.”

Chatterjee notes that seeking a holistic approach to a problem like the opioid crisis constitutes the mindset she and her colleagues seek to instill in every student. She also shared that the winning team’s model was requested by sponsor company SAP to present to health vertical stakeholders in Germany—a phenomenon not uncommon among the Hackathon’s industry partners. Says Chatterjee, “Given the quality of work that came out (and typically comes out) of these Hackathons, it’s a win-win for all. We have the honor of supporting the principled, innovative leaders who are able to go out and make contributions in organizations worldwide.”

Incentivizing Health & Care

For far too long, many fundamental incentives in the health care industry have been at odds with both public policy goals and economic reality. But today, MIT Sloan's innovators and visionaries—with the help of rigorous research, data analytics, and financial know-how—are finding ways to change that. Whether seeking effective interventions to encourage access to better nutrition, devising funding incentives for orphan disease drug development, or exploring novel ways to deliver medications, it's clear that their technological and institutional disruptions will help make effective and affordable care the rule.

GEORGIA PERAKIS

Impact of Access and Value on Fresh Food Consumption: Policy Implications

What are the real factors that impact diet in conjunction with access—or the lack of access—to fresh and healthy food? According to recent work by Retsef Levi (J. Spencer Standish [1945] Professor of Management; Professor, Operations Management; Co-Director, Leaders for Global Operations Program), Elisabeth Paulson (PhD student from the Operations Research Center), and Georgia Perakis (William F. Pounds Professor of Management; EMBA Faculty Director; Professor, Operations Management and Operations Research and Statistics; Co-Director, Operations Research Center), answers may be more complicated than widely thought. While it is understood that in many low-income communities, fresh and healthy food is often out of reach, Levi, Paulson, and Perakis wanted to assess the impact of both access to grocery stores and value of nutrition on consumer consumption, with a goal of “improving operational aspects” of food policy for low-income households. “These kinds of food policy issues haven’t received much attention from the operations management community,” explains Perakis, “but it’s a significant opportunity for impact—especially as we learn more about the interplay among supply chain, financial, and consumer behavior.” Focusing on their own analyses of the USDA’s Food Acquisition and Purchase Survey dataset, the researchers found evidence for several novel conclusions. Among them, that (1) grocery “value” and “access” interventions are substitutable (i.e., that receiving both interventions has a similar impact to receiving either one), revealing that policymakers should make localized, data-driven decisions about which intervention to pursue to avoid redundancies. The team also concluded, “contrary to recent literature,” that (2) interventions related to access (such as building new grocery stores) are worth pursuing, so long as unique and relevant features of the neighborhood are studied ahead of time. Provocatively, the study also presents evidence that the “standard distance threshold” of one mile used to define access and “food deserts” may be “inappropriate[ly small],” and thus “misrepresenting the true impact of access.”





PillPack: The Billion-Dollar Approach Changing Big Pharma

PillPack, an online pharmacy startup based in Manchester, New Hampshire, and co-founded in 2013 by MIT Sloan alumnus Elliot Cohen, MBA '13, delivers personalized packets of medication to customers at home—and was acquired by retail giant Amazon for “just under \$1 billion,” according to *TechCrunch*. It’s a sign that the online giant has active plans to disrupt the current pharmacy industry. Co-founder TJ Parker, a pharmacist, met Cohen while the MIT Sloan student was working on the MIT \$100K Entrepreneurship Competition; the pair collaborated on their idea at the Martin Trust Center for MIT Entrepreneurship, going on to win the 2012 MIT Hacking Medicine hackathon. For Martin Trust Center managing director Bill Aulet, this fledgling company’s success represents precisely the kind of “digital disruption” success story that drives the Center’s vision of supporting and growing tomorrow’s entrepreneurs and world-changers. (Cohen was, in fact, the first “Entrepreneur-in-Residence” that Aulet hired at the Martin Trust Center.) Aulet recalls, “There were a lot of naysayers. They said, ‘It’s putting pills in a package. What’s so magical about that?’ But it’s about the user experience. [At the Martin Trust Center], we teach people that innovation is about creating value—whether through new technology, new processes, or a new user experience. The latter is what happened here, and it’s exciting for all of us.”

BUILDING BETTER

“I can’t think of a community that better embodies what it is to be both principled and innovative than MIT Sloan. The scale and importance of the work being done to improve global human health make me believe that no challenge is too big for our leaders to solve.”



**Judy Lewent, SM '72,
Executive Board Member;
Former EVP & CFO, Merck**

Unlocking the Incentives to Drive Healthier Behavior

How do you uncover effective levers that can incentivize people to, in a phrase, do the right thing? For self-professed “Econ geek” Erez Yoeli (Research Associate; Co-Director of the ACT: Applied Cooperation Team), that very question became both relevant and career defining early in his journey. Particularly, it arose during Yoeli’s PhD study when he undertook what appeared would be a side project from a public utility. The utility’s ask: increasing participation in an energy efficiency/blackout prevention program. “I had assumed [the assignment] would entail quantitative fieldwork,” Yoeli recalls. “When I learned it was about changing consumer behavior, I remember wondering: ‘Isn’t that what marketers do?’”

The task, it turned out, was deceptively challenging, and did indeed entail fieldwork and analysis—especially as the utility had sent out letters urging their customers to join the program with anemic results. Yoeli shares, “Based on promising results from lab studies on increasing the observability of good deeds, I proposed that they alter the mechanism: Instead of letters, use an actual sign-up sheet in residential buildings—placed somewhere where everyone can see it.” The measurable outcome was a surge in sign-ups. “We gave people a way to get public credit for doing the right thing—in this case, using less power at peak blackout risk times.” He adds, with a smile, “after taking on that challenge, I was hooked.”

Yoeli has since expanded his research and his area of impact to global public health—from tuberculosis treatment and prevention in sub-Saharan Africa to co-founding ACT (Applied Cooperation Team), a research group that

was recently acquired by MIT Sloan. Taking behavioral economics insights from the lab to the real world, Yoeli has dedicated himself to “working on field experiments and thinking about how to motivate good behavior.”

Despite what Yoeli would profess, he’s in pursuit of no less a goal than developing a toolbox of techniques to help humankind do the right thing: more often, more predictably, and at a greater scale than ever before attempted.

FROM ECONOMICS TO PUBLIC HEALTH, AND BEYOND

After obtaining his PhD degree in economics, Yoeli quickly found work with the Federal Trade Commission addressing information economics problems where markets just weren’t working well in the service of consumers. From there, and through research posts at Harvard and Yale, Yoeli consistently pursued theory and data-backed strategies to motivate large populations to good.

Co-founding ACT in 2015 with David Rand (Associate Professor of Management Science and Brain and Cognitive Sciences, an affiliate of the MIT Institute for Data, Systems, and Society, and the director of the Human Cooperation Laboratory and the Applied Cooperation Team), the team’s first project was conducted with the Harvard T.H. Chan



School of Public Health and a local property management company to introduce a “smoke-free” policy to public housing. Here, as with Yoeli’s early body of work, individual “good” actions (like abiding by the smoking ban) and their context within a larger community (e.g., benefits to children, social rewards) came to the fore.

“We developed a scalable, three-part checklist that’s become the basis of so many of the interventions we work on today: (1) increase observability—so individuals can get the community credit they crave and deserve for their good behavior; (2) eliminate excuses—remove the “easy outs” for not participating; and finally, (3) set and communicate expectations, so that the individual knows the weight of the community is behind the ask.”

A REAL-WORLD MODEL WITH REAL-WORLD IMPACT

At what kind of scale has Yoeli’s model found success, so far? What about tackling the world’s most lethal infectious disease: tuberculosis (TB)? “Here’s a disease where we’ve had a cure for literally 70 years, and yet so many are still dying and suffering—and medication compliance problems have made drug-resistant TB a truly devastating threat.” In his current work with Keheala, a mobile health company dedicated to addressing the non-medical drivers of disease that exist outside of clinical settings, Yoeli and his colleagues have found dramatic success in building cost-efficient interventions to help TB patients in Kenya take their medicine—consistently, and effectively. Using a non-smart phone, text-based approach, the Keheala system sends repeated reminders to patients urging them to take their medications while framing the need for doing so as a benefit to the community as well as the individual. Yoeli explains, “We used the checklist as a basis for our work. We increase observability and eliminate excuses by requiring daily verification. To set expectations, we leverage the language of community, with slogans like ‘Together, we’re kicking TB out of Kenya.’”

Having recently completed a pilot study, during which the proportion of patients in their study dropped from 13 to 4.3 percent, Yoeli and his team are now in the midst of a much larger three-year study to replicate and build

on their results, with a population upward of 15,000: comprising nearly 20 percent of all of Kenya’s tuberculosis patients. Yoeli has high hopes that, having achieved success in a region with such medical infrastructure challenges, their approach might work nearly anywhere in the developing world—for HIV, other infectious diseases, and more.

Yoeli professes that his time in the field has “opened my eyes to the fact that the public health world really seems to have forgotten about the ‘public’ part of the equation.” Citing the example of vaccinations, he elaborates: “I had been exposed to work on vaccines at the time I worked on this project, and there has always been this emphasis on the importance of the action for the *individual*, but a bit of a fear of emphasizing how important an action is for the *community*—the ultimate beneficiaries. As Yoeli quips, his ongoing mission and litmus for his endeavors going forward is “to put the ‘public’ back into ‘public health.’”

ACT-ING FOR GOOD

As to the future of ACT, Yoeli cites the group’s founding DNA as indicative of their future trajectory: a model built on applying diverse vantages and models from economics, psychology, sociology, anthropology, and marketing directly to issues of real-world impact. ACT’s team currently works with government agencies, nonprofits, and for-profits on a range of challenges, including charitable donations, volunteering, energy conservation, compliance with smoking bans, and antibiotic compliance, with the common goal of sparking mass altruism.

And though Yoeli is a fairly new arrival to MIT Sloan, he is quick to identify the unique strengths he’s already seen on display. “The folks here are motivated by advancing technologies; advancing ideas that improve the human experience in some way. MIT is built for that. I love that—and that orientation has been critical to advancing the work of ACT.”

He adds, “I have been truly struck by this community’s widespread commitment to making a better world. It’s something that I’ve never experienced before, at any other institution.”

Committed as he is to uniting *mens et manus* for the greater good of humankind, it would seem that at MIT Sloan, Yoeli has found his place.

Photo by Bearwalk Cinema





How Contagious Are Health and Fitness Behaviors?

Researchers have suspected for some time that exercise—among other health-impacting habits—displays “contagious” qualities within social groups: Runners and other athletes will often show tandem behaviors and mutual influence in exercise routine, intensity, or workout choice, among other factors. But a challenge remained with this theory: How could researchers separate behavioral contagion from “homophily,” the tendency to gravitate socially toward others who are similar? For Sinan Aral (David Austin Professor of Management; Professor, Information Technology and Marketing) and his team at MIT Sloan, the solution to correcting for homophily came from the ability to mine a trove of truly big data related to runners, their habits, and activity levels, at scale. Leveraging a global social network (the identity of which, for contractual reasons, cannot be named) devoted to sharing empirical data on personal exercise routines, Aral and colleagues were able to cross-index five years’ worth of data (covering 225 million miles run) from approximately 1.1 million runners worldwide with side-by-side tallies for how much various runners and their virtual running buddies had worked out in any given period. Points of salience emerged: Friends,

even when separated geographically, demonstrated similar training routines over time. To verify these correlations, researchers overlaid detailed weather information (five years’ worth of it from global weather stations) to demonstrate that runners’ performance behavior was contagious among their peers, independent of inclement weather. Significantly, when one ran farther or faster on a given day, those in their group often compensated immediately afterward to “keep up” virtually. Gender was a factor in distinct behaviors seen in the data as well, with women showing a tendency to alter their running routines in response to their women peers while remaining largely unaffected by male peer performance, whereas men showed a response to both male and female peers, although their tendency was to work out longer and/or more intensely when their male virtual running buddies had done so. Aral explains their overall conclusions regarding this contagious habit: “In general, if you run more, it is likely that you can cause your friends to run more,” creating an effect which he describes as going “beyond correlation to causation.” Aral and his colleagues hope next to study groups other than self-identified runners, to see if a contagion-like effect might be observable among less active members of the population—those who, arguably, might be most in need of a nudge toward health-promoting behaviors.

Steering the Health Systems Initiative

The MIT Sloan Initiative for Health Systems Innovation (HSI) finds itself playing a pivotal role—at a pivotal moment—as the world confronts the new realities, requirements, and possibilities of *the* most important levers for societal well-being: the health care industry itself. As HSI continues its pioneering work into bringing systems-level thinking to the business of human health, the future of the initiative continues to focus on cross-disciplinary innovation and exploration, drawing on practitioners, government, industry leaders, and members of the MIT community alike.

Anne Quaadgras (Senior Lecturer, Operations Management; Director, HSI) explains: “The existing health care system is disconnected and reactive. It won’t be fixed by individuals, but rather multiple teams of people representing different disciplines. As a leader in thought and action, MIT Sloan is well positioned to bring people together to think about health care as a system and discuss new ways to approach this problem, particularly using data and analytics.”

Colleague Joseph Doyle (Erwin H. Schell Professor of Management and Applied Economics; Faculty Director, HSI) points out that although many ideas may present merit, ultimately it is analytic (and academic) rigor that will create real, lasting solutions for a healthier humanity. “The idea that we might want to prescribe fresh, healthy foods instead of insulin for food-insecure diabetics makes intuitive sense, but it requires more rigorous evidence of health improvements before wider adoption is possible. This is an example of where the initiative can add value to the ongoing health care transformation, in applying health care analytics to generate rigorous evidence for what works and what doesn’t in health care delivery.”

“The answers to a problem may not be clear yet,” Quaadgras adds, “but our goal [for HSI] is to think differently about the possibilities for creating a better system. Here at MIT Sloan, I believe that is one of the things we do best.”

TAVNEET SURI

Connecting Mobile Technology to Health Outcomes

For many un-banked or under-banked citizens in Kenya, mobile technology has meant more than communication: It has meant mobile money, and upwardly mobile incomes. An innovative family of applications, “mobile money” enables mobile phone owners to deposit, transfer, and withdraw funds from digital wallets on their (non-smart) phones without having bank accounts. Pioneering work conducted by Tavneet Suri (Louis E. Seley Professor of Applied Economics; Associate Professor, Applied Economics) and colleagues on mobile money’s effects has already shown its economic impact, having contributed directly to reducing Kenyan poverty rates by a full two percentage points (196,000 households moved out of extreme poverty). Suri and her colleagues also showed that mobile money protects households in Kenya from income and health risks. More recently, Suri, along with a team of collaborators, has undertaken a 12-year study on the socioeconomic and health impacts of implementing a universal basic income in Kenya. “I expect we will have a stream of results,” Suri explains. “If it is really going to change the villages in the long term as we expect, we will be watching closely, from the sidelines.”



Addressing the Opioid Crisis and Corporate Responsibility for a Healthier Humankind

Beyond maximizing shareholder value, what is the true purpose of the corporation? It's a question of increasing relevance for today's principled, innovative leaders at all levels. For Bethany Patten, EMBA '13, (Lecturer; Senior Associate Director of the Sustainability Initiative), it is, and always has been, by MIT Sloan's definition, a question inextricably linked to sustainability and to America's leading public health crisis—the opioid epidemic.

“When profit was placed ahead of medical data and human impact in treating pain,” says Patten, “that’s when pharmaceutical companies crossed the line into business practice that was not only unethical, but also epically unsustainable.”

With an eye toward continuous improvement, Patten sought to reimagine the MIT Sloan Sustainability Certificate signature 15.878 Capstone Seminar in Sustainability. Understanding that sustainability had long centered on environmental topics, she looked for cases that could explore the social dimensions and uncovered the pharmaceutical companies at the center of the opioid controversy.

Using what she learned, Patten transformed the spring 2019 offering from a routine academic requirement to a worldview-changing, integrated learning experience that gets to the root of corporate responsibility.

“Multiple circumstances led to this idea,” Patten says. “Many students pursuing a Sustainability Certificate are interested in diving deeper into the corporate and social dimensions of sustainability. And, as an involved citizen here in Boston, the human pervasiveness of the opioid crisis is impossible to ignore, with a crisis of conscience at its core.”

A FIRSTHAND, FIRST-OF-ITS-KIND STUDY IN CORPORATE RESPONSIBILITY

Though MIT Sloan has long been a leader in the theory and practice of sustainable business (posting the first Sustainability Certificate program of its kind among top-tier management schools seven years ago), Patten drew additional inspiration from the school's boundary-breaking work in labor economics, system dynamics, and experiential learning.

Rather than a survey of topics learned, Patten redesigned the capstone to be an integrative learning experience that sends students out into the Greater Boston community to engage in understanding unintended consequences and explore interventions. Instead of focusing solely on the corporate strategic perspective in a case analysis of pharmaceutical companies' choices, the course brings leading policymakers, public health experts, criminal justice leaders, and caregivers into the classroom to give students context on the real-life repercussions of corporate decisions.

“This model for active and multidimensional learning has unmatched power,” says Patten. “To quote our faculty director John Sterman, ‘Research shows that showing people research doesn’t work.’” When students explore a problem in the field, they are living the experience rather than observing it from afar. That creates both an emotional response and a connection to the community that doesn’t exist in a classroom.”

So far, the model is working. As one 2019 MBA candidate wrote in a class assessment, “I thought it was so useful...because it allowed us an opportunity to see the real people behind this problem. I think one of *the* most important things that can help us be ethical leaders who can make a positive impact and make the right decisions in those critical moments is to ‘get close’ to the problems we are trying to solve.”

ACADEMIC RIGOR, GRASSROOTS POLITICAL EXPERIENCE

Leading the charge in introducing the effects of corporate behavior on society to MIT Sloan comes naturally to Patten, as her involvement with city politics and the local community is

longstanding. In addition, her natural affinity for connecting academic rigor to corporate decision-making through her long involvement with recruiting organizations for the sustainability Action Learning Lab allows her to share that imaginative leap with her students. “For instance, how can our students, along with local businesses, come together to design experiments that reduce the over 400,000 discarded syringes that litter our streets every year?” Students learned that with this kind of challenge comes potential solutions, leading directly to opportunities, such as job creation, public-private collaboration, and other creative forms of community problem-solving.

“While this may not be the first program of its kind at MIT Sloan, it really represents *mens et manus* in its purest form: getting in there, as students and mentors, with a hands-on approach...the kind that can get lost in a modern educational experience that’s increasingly digital. We must *not* lose the hands-

on aspect of mind and hand. And that’s what makes funding for this kind of program more critical than ever.”

**AN UNPRECEDENTED NEED,
AND A CALL TO ACTION**

“The symptomatic opioid crisis is a wicked problem impacting over 2 million Americans,” Patten says, “but one that our problem-led leaders are perfectly qualified and increasingly motivated to understand and start to address.” Sustainability Certificate alumni are part of a growing community of leaders motivated to take action on a myriad of social, sustainability-related issues. Many are putting their enthusiasm, energy, and expertise back into the critical work of the Sustainability Initiative at MIT Sloan. Patten invites all alumni to get involved.

“Come back, share your experiences with us, and help us continue the virtuous cycle that will empower today’s and tomorrow’s leaders to act in the interests of a better world.”

The Sustainability Initiative’s mission is to deliver the best education, apply academic rigor to real-world problems, and empower leaders everywhere to take action. The redesigned capstone course checks all three boxes, and gives students a strong foundation for making change.

“I think MIT Sloan students and alumni are all proud of our affiliation with this place,” says Patten. “It confers a credibility that opens doors...and it carries with it a powerful responsibility to act for the greater good. Together, that’s what we’re doing and should be doing. And each of us can ask: Where are my company’s priorities? What are the potentially unintended consequences of our business practices? Are our beliefs in line with our actions? And finally: How can I share those insights with tomorrow’s principled, innovative leaders?”

These are the questions that will get us to a sustainable future, Patten believes. “And the systemic approach we take at MIT Sloan to answering them lends the power to go beyond aspiration into real-world practice. That’s where the support of our *own* community can make all the difference.”



“The human pervasiveness of the opioid crisis is impossible to ignore, with a crisis of conscience at its core.”



JÓNAS ODDUR JÓNASSON

Determining Barriers, Proposing Solutions to the Diagnosis and Treatment of Infants with HIV

According to the latest UNAIDS data, 150,000 children are infected with HIV in sub-Saharan Africa annually. A third of those infected and left without treatment die before their first birthdays. As administering lifesaving treatment depends on timely testing and diagnosis, therein lies the root of the challenge—HIV tests have historically depended on a complex and inefficient supply chain, with time lags extending for months.

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This issue of global and human import is the one Jónas Oddur Jónasson (MIT Sloan Class of 1943 Career Development Professor; Assistant Professor, Operations Management) has long focused on solving. As part of the MIT Sloan Initiative for Health Systems Innovation (HSI), Jónasson and his colleagues have recently investigated—through a landmark study in Mozambique—ways to speed up not only lab procedures, but also the supply chain itself.

Testing has traditionally been distributed through a network of clinics and labs throughout the country, leading to misused resources and unacceptable delays. “In general, shorter turnaround times can be achieved by improving the clinic-to-lab supply chain, through increasing the number of vehicles equipped to transport samples, hiring enough drivers, training enough medical personnel, buying the right type of diagnostic equipment, and improving communication systems. But, as Jónasson explains, their study indicates that “improving the day-to-day operations of clinic-to-lab supply chains is simply not enough. Sometimes the opportunities lie in the structure of the supply chain itself.” Jónasson and his colleagues modeled the operational, medical, and behavioral aspects of the system and concluded that consolidating all diagnostics into a single lab destination could decrease average turnaround times by an estimated 22 percent. This would increase the number of infected babies initiating treatment by 7 percent, potentially saving the lives of up to 50–60 children per year in Mozambique.

In the end, a surprisingly simple principle is at work: using the lessons of operations management to improve population health, at scale. As Jónasson concludes, that’s what truly matters. “By shaving precious days, weeks, and even months off diagnostic turnaround times, infants infected with HIV are able to get treatment quicker.”

150K

CHILDREN ARE INFECTED WITH HIV IN SUB-SAHARAN AFRICA ANNUALLY



Okoa: Driving Emergency Service Access

In a place like Tanzania, where less than half of mothers have a skilled health professional at their sides when they give birth, bringing children safely into the world is challenge enough. Factor in road conditions and the absence of traditional ambulance service to rural villages, and—when complications arise—you have a serious issue. That’s why Eva Boal, SB ’18, has been leading a serious solution. Boal’s Okoa Project is undertaking to spread the use of “motorcycle ambulances” with detachable stretchers (and room for additional passengers), all created from locally sourced material. Begun by her co-founder Emily Young, SB ’18, in an engineering and international development-focused D-Lab class in 2016, this project went on to win \$10,000 at the MIT IDEAS Global Challenge in May 2017. Boal joined the team afterward and credits early advising from MIT Sloan’s Development Ventures classmates on the project, as well as participation in delta v, and

support from the Sandbox Innovation Fund and the Legatum Center. With prototypes now deployed, Boal, as director of business development, is making much-needed rural emergency service real, providing transportation services to more than 5,000 residents in rural Tanzania. Best of all, since the Okoa ambulances fit (and can be transferred between) any motorcycle makes and models, they are possible to adopt at scale. “This type of ambulance is a huge incentive for motorcycle drivers,” Boal concludes.

5K TANZANIAN RESIDENTS PROVIDED WITH TRANSPORTATION SERVICES BY OKOA



Emily Young and Okoa Co-Founder Sade Nabahe, SB '17

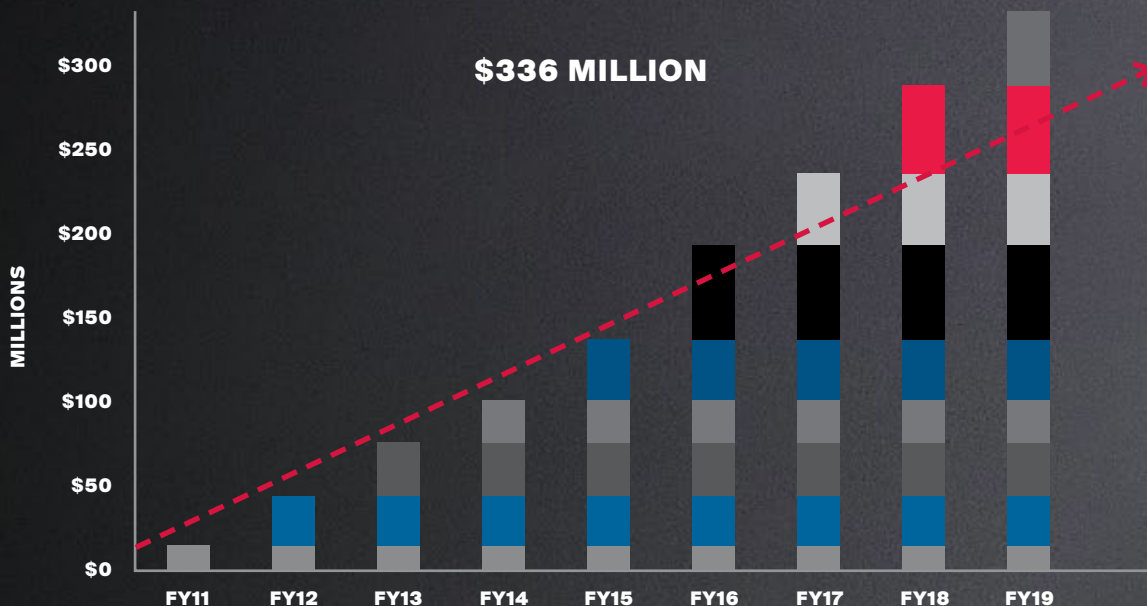
A better world is our business.

The MIT Campaign for a Better World has been launched because worldwide we find ourselves at a critical inflection point. Technological, environmental, economic, and demographic trends are converging to present new—and complex—challenges. In the MIT community, complexity is our call to action. By harnessing the collective ingenuity of the school and Institute, we can take on the greatest issues of our time, if given the resources to do so.

The MIT Campaign for a Better World is structured around these crucial global topics:

- Discovery Science
- Health of the Planet
- Human Health
- Innovation and Entrepreneurship
- Teaching, Learning, and Living
- The MIT Core

MIT Sloan Campaign Progress (as of 6/30/19)





The funding to support the students and faculty featured in this newsletter comes in part from alumni and friends just like you. We are making progress toward meeting our goals to support our students, our faculty, and our alumni as they tackle the world's toughest challenges.

As you consider your impact on a better world, consider supporting MIT Sloan, a place with the right ideas and people to address our most pressing societal problems. Join us by making a gift to the MIT Campaign for a Better World.

Together with the Institute, MIT Sloan is responsible for raising a portion of the total campaign funds across all groups within MIT. This means we need the help of people like you: alumni, colleagues, collaborators, and well-wishers who support MIT Sloan's mission. While our aims and goals align with those of the Institute, our responsibility is to fund efforts to bring our particular strengths to the campaign—namely, applying management theory and practice to tackling the world's toughest challenges.

While our fundraising is making strong progress, we are still in need of continued support: gifts directly to the campaign, to the Annual Fund (which also supports the campaign), and to other important initiatives at MIT Sloan.

Be a part of the
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MIT Sloan Office of External Relations
77 Massachusetts Avenue, E60-200
Cambridge, MA 02139

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