How to Build Academic-Public Health Partnerships: The Stanford - Santa Clara County Experience with COVID-19 Response[1]

Chapter for Tamar Bauer ed., *Build Me the Evidence* (Brookings 2022)

Sara H. Cody[2]
Santa Clara County Public Health Department

Daniel E. Ho[3]
Stanford University

In March 2020, in conjunction with five other Bay Area counties, one of us issued the first shelter-in-place order in the country. As the county health officer of Santa Clara County, CA, home to roughly 1.9M residents, San Jose, and Silicon Valley, I (Cody) had the benefit of longstanding trust and collaboration with other Bay Area health officers. Collaboration, iteration, and rapid information sharing was critical at a time when public health infrastructure was strained to the max. What is less known is that through the crisis, the Public Health Department (PHD) and Emergency Operations Center (EOC) also developed partnerships with several groups at Stanford, including Stanford's RegLab (directed by Ho) that shaped key aspects of COVID-19 response.

In this chapter, we describe some of the elements of the RegLab partnership and articulate what we have learned about academic-public health partnerships. We emphasize that the problems we faced were profound. Many lessons will be drawn from a once-in-a-generation crisis, spanning far beyond the scope of this chapter. Yet our collaboration has persuaded us that one important set of lessons is about getting academic-government collaborations right. How can health departments and researchers partner most effectively to tackle the most vexing problems, when the current ecosystem often impedes such collaborations?

Origins

At the beginning of the pandemic, there was already a longstanding history of collaboration and consultation between the County and Stanford. PHD, for instance, had consulted extensively with faculty engaged in infectious disease modeling to understand the spread of COVID-19

[1] We thank extraordinary teams at Santa Clara County, Stanford RegLab, and the Stanford Future Bay Initiative for driving these collaborations. There are too many to name, but key leadership was provided by Sarah Rudman, Pamela Stoddard, Analilia Garcia, Anandi Sujeer, Alexis D'Agostino, Mariana Jimenez-Alvarez, Maritza Rodriguez, Greta Hansen, and James Williams on the County side, Derek Ouyang, Lisa Lu, Ben Chugg, and Ben Anderson on the Stanford side, and Jacqueline Franco from Mujeres Empresarias Tomando Acción (META). We thank Tamar Bauer, Mark Krass, and Derek Ouyang for helpful comments and conversations about this piece.
[2] County Health Officer, Santa Clara County Public Health Department.
[3] William Benjamin Scott and Luna M. Scott Professor of Law; Professor of Political Science; Senior Fellow, Stanford Institute for Economic Policy Research; Associate Director, Stanford Institute for Human-Centered Artificial Intelligence; Director, Regulation, Evaluation, and Governance Lab (RegLab).

(James et al. 2021). Our specific collaboration began when a PHD epidemiologist attended a virtual talk about the use of mobility information to understand disease spread, based on joint work with the City of San Jose (Ouyang et al. 2020). The RegLab began a series of conversations with PHD staff and EOC leadership on the potential use and limitations of mobility information for situational awareness. The Stanford RegLab team built out a mobility dashboard that enabled the County to ascertain (a) which areas exhibited lower (apparent) social distancing compliance, (b) business activities, and (c) intercountry travel patterns. Such information helped to inform, for instance, public health order revisions in advance of fall holidays. Similar situational awareness came from wastewater sampling, also developed by a Stanford group (Graham et al. 2020).

Evolution

Beyond that initial connection, however, the Stanford RegLab (and its sister lab, the Future Bay Initiative) engaged in a series of exploratory conversations, mindful of the extreme demands on time, with a range of EOC/PHD stakeholders. We identified an immediate need around data science for health equity (see, e.g., Krass, Henderson, and Ho 2020). While Latinx individuals are roughly 25% of county residents, they represented over 50% of COVID-19 cases, due to long-standing structural sources of inequality. As a result, we examined how a partnership could augment pandemic response to address health inequities. This resulted in three areas of investment:

(1) Contact tracing. The Stanford RegLab team built out a language matching algorithm to enable over 900 contact tracers to be matched to predicted language of incoming cases, using census data. Previously, because laboratory reports have only spotty information about language and ethnicity, cases were effectively assigned blindly, requiring many contact tracers to dial in for third party translation. In a randomized trial, this intervention reduced time to interview cases by nearly 14 hours per case and increased the likelihood of interview completion (Lu et al. 2021).

(2) Testing. After a series of in-depth focus groups with community members, the County and Stanford RegLab partnered with community health workers (promotores de salud) to launch a novel door-to-door COVID-19 testing program that utilized both local knowledge and machine learning. The trial increased the proportion of tests administered to Latinx individuals from 49% at the closest neighborhood site to *88%*; and it yielded an 11% positivity rate, dramatically expanding testing resources in the most vulnerable communities (Chugg et al. 2021).

(3) Supporting Services. Quarantine and self-isolation can be profoundly challenging for more marginalized communities. To address this, the County built a specialty team of contact tracers offering “high-touch” support services. This team matched diagnosed cases with social support services, such as rental assistance, grocery delivery, cleaning supplies, and hotel accommodations. Stanford RegLab helped to design the rollout with

an impact demonstration in mind, showing that high touch services improved the take-up rates of such services by up to 16%.

In recent months, the collaboration has pivoted toward vaccine distribution (e.g., mobile vaccine siting and outreach efforts) and variant tracking based on a similar data-driven approach.

In normal times, each of these interventions might have taken months, if not years, to deploy. The pandemic, however, required rapid iteration within days. Such agility demonstrates what government could be and yet is so often not: innovative, evidence-driven, and fast-moving.

Lessons

What lessons can we learn from this case study of rapid innovation? For public health and the public sector, we think there are three:

(1) Build trust, relationships, and capacity. Critical to the pandemic response were relationships of trust, both within the county and across the county-academic divide. We were aided here by many informal ties between the groups, but without such preexisting relationships, it will be key to foster open exchanges around ideas and opportunities. Increases in public health funding can improve this kind of capacity for historically understaffed departments.

(2) Find champions and empower them. Departments should identify the individuals within the organization who have the vision and desire to do things differently. Who are "operational nerds" who spot process improvements and can identify places where external partners can help? Who are the evidence champions? Critical to the RegLab partnership were these champions inside the EOC (e.g., Greta Hansen, Pamela Stoddard, Anandi Sujeer, Analilia Garcia, and Alexis D'Agostino) who could help quickly identify "win-wins": i.e., projects that would not get done but for an academic partner.

(3) Assign barrier-busters. Academic-public sector collaborations can fail in many different steps. For contact tracing, there was initial resistance to changing a process that had been painstakingly built (in Assistant Health Officer Dr. Sarah Rudman's words: "we were building the plane as it was taking off"). This might have made routing cases to specialty language teams impossible. But Dr. Rudman valiantly stepped in and busted these barriers. (Indeed, we credit her with the term as self-anointed "barrier buster.") For testing, one barrier was how to deliver private health information to promotores in a way that protected privacy of individuals. Within days, we figured out with the exceptional help of compliance and legal counsel how to provide County-issued devices that were subject to public health security restrictions. Assigning specific individuals the role to bust these barriers is critical.

This then leads us to the lessons for the academy. Academics can play pivotal roles for the future of public health. But barriers need to be busted in universities as well: contract review, for

instance, can blindly fixate on risks, and it took escalating the matter up to the Stanford provost to get sign-off on our initial data use agreement. The future of public health will depend on a significant transformation of how academic researchers organize themselves:

(1) Escaping silos and building teams. University units are organized by specialization. Academics are hence sometimes perceived as "hammers in search of nails" or as engaged in "extractive research" (take the dataset, publish, and run). Instead, curiosity about the world should include curiosity about things we know nothing about. COVID-19 response does not stay neatly confined in an infectious disease department, as evidenced by profound social disparities. Epidemiologists, data scientists, engineers, social scientists, and lawyers all have critical roles to play, but need to do so together in defiance of conventional academic units. What this invariably will mean is building collaborative teams without regard to academic methodology, conventions, and hierarchy.

(2) Center the real problem. Curiosity should entail learning first about the most important problems. There was much hype at the beginning of the pandemic about what artificial intelligence (AI) can do to fight COVID-19 (Krass et al. 2021). But when major health departments were still receiving droves of lab reports by *fax machine*, off-the-shelf AI may be entirely inapposite. Of course, AI did prove critical in specific respects, but it first took an understanding of the human and institutional challenges to know what algorithms, if any, might help. This kind of "human-centered" approach will be critical to adapt state-of-the-art tools for actual problem-solving. Researchers and academic journals will need to recognize the unique value of institutionally-grounded and problem-oriented research collaborations.

(3) Solve first, publish later. Conventional academic models posit influence through publication. (Step One: Publish. Step Two: Question Mark. Step Three: Influence!) Our model was distinctly different. In pandemic times, publication cycles largely cannot respond to the moment, and so we addressed problems first, and developed publications later where there was time to catch our breath. For instance, one of the early things we noticed was that widely used mobility data exhibited demographic bias. We were mindful of this bias when presenting data for operational insights, but wrote up the general implications for algorithmic bias audits later (Coston et al. 2021). Universities need to recognize these collaborations in promotions and tenure decisions.

(4) Follow through in practice. Our theory of impact was to directly help embed data-driven interventions into COVID-19 response. Often, that meant solving a range of practical problems on the way, as operational systems often are not built to facilitate research. For instance, the County had developed an elaborate system for case intake on top of the state system for contact tracing. We realized after extensive deliberation that it would be much better to automate the process entirely, enabling iterative assignment and any refinements of the process. Our team hence built out the automated process that saved time and enabled interventions that were otherwise operationally infeasible. For many

academics, this would be seen as a distraction. For us, it was part of mutual problem solving and building trust in the partnership.

Last, we turn to some broader policy implications. For the first time in decades, public health has seen the increase in public investment that it deserves. Controlling COVID-19, preventing the next pandemic, and reducing the social disparities of health will be critical for ensuring health equity going forward. Several reforms could ensure that academic-public health collaborations can thrive.

(1) Invest in information infrastructure. During this collaboration, our teams built a data infrastructure on tests, cases, mobility, housing units, and demographics largely from scratch. One of Stanford's on-premises servers for health research, luckily not used for this work, went down for over months during the pandemic. The basic public health data and information system used for surveillance and situational awareness in California, CalREDIE, went down several times during the course of the pandemic, leaving the PHD essentially blind. This is not the future. Policymakers need to invest in public health data infrastructure (DeSalvo et al. 2021; Maani and Galea 2020) and initiatives like the National Secure Data Service and the National Research Cloud to ensure that secure data and compute infrastructure is in place to engage in this kind of work.

(2) Intergovernmental Mobility for States and Localities. Federal agencies can easily assign academics to function as agency employees under a somewhat obscure statute, the Intergovernmental Personnel Act (IPA). The IPA has been used to great success to streamline access under government security standards to sensitive data and information. Yet states and localities by and large lack such a vehicle. We addressed this in part by having Stanford students and researchers work as part-time employees or volunteers, so that they could quickly understand County systems, subject to full security protocols. But such authority needs to be established more generally: we need an IPA for local government.

(3) Open Systems. Proprietary systems can be major blockers for innovation. If the contact tracing system had not been controllable by code (i.e., by application programming interface), many of the improvements to contact tracing would have required intensive manual workarounds at a time with no FTEs to spare. Such technical systems need to be opened up to facilitate the ability to work and extend such systems effectively.

(4) Funding Models. Much of this work would not have been possible without core funding. All of the Stanford work was done on a pro bono basis without a prespecified grant deliverable, which enabled rapid iteration and adaptation. Conventional grant cycles simply do not work in this timeframe, and both government and philanthropic communities need to recognize that project-specific funding may crowd out some of the most innovative work. Instead, funders should sponsor partnerships with built-in space to explore, iterate, and pivot where necessary. One of Stanford's newest initiatives, the Stanford Impact Labs, where one of us (Ho) is on the Advisory Board, for instance, is an

important step in this direction, as are initiatives like FDA's Centers of Excellence in Regulatory Science and Innovation that partner with universities.

Conclusion

We each bring different perspectives to the table. From the perspective of the County Health Officer, I (Cody) have seen the challenges of getting academic partnerships to work, and want to promote this kind of collaboration that moves from lab to field. From the perspective of an academic that has partnered with many government agencies, I (Ho) have seen many initiatives fail because one barrier or another was not busted.

We make the recommendations above in the spirit of genuine excitement about what is possible when academics focus on problems and when government is agile. Ensuring that such innovation happens is critical to government programs and mitigating what Michael Lewis vividly coined the "Fifth Risk" (Lewis 2018). With such collaborations, we have an opportunity to shape, transform, and revitalize public health and government.

References

Chugg, Ben, Lisa Lu, Derek Ouyang, Benjamin Anderson, Raymond Ha, Alexis D'Agostino, Anandi Sujeer, Sarah L. Rudman, Analilia Garcia, and Daniel E. Ho. 2021. "Evaluation of Allocation Schemes of COVID-19 Testing Resources in a Community-Based Door-to-Door Testing Program." *JAMA Health Forum* 2 (8).

Coston, Amanda, Neel Guha, Derek Ouyang, Lisa Lu, Alexandra Chouldechova, and Daniel E. Ho. 2021. "Leveraging Administrative Data for Bias Audits: Assessing Disparate Coverage with Mobility Data for COVID-19 Policy." In *Proceedings of the 2021 ACM Conference on Fairness, Accountability, and Transparency*, 173–84.

DeSalvo, Karen, Bob Hughes, Mary Bassett, Georges Benjamin, Michael Fraser, Sandro Galea, J. Nadine Gracia, and Jeffrey Howard. 2021. "Public Health COVID-19 Impact Assessment: Lessons Learned and Compelling Needs." *NAM Perspectives*.

Graham, Katherine E., Stephanie K. Loeb, Marlene K. Wolfe, David Catoe, Nasa Sinnott-Armstrong, Sooyeol Kim, Kevan M. Yamahara, et al. 2020. "SARS-CoV-2 RNA in Wastewater Settled Solids Is Associated with COVID-19 Cases in a Large Urban Sewershed." *Environmental Science & Technology* 55 (December): 488–98.

James, Lyndon P., Joshua A. Salomon, Caroline O. Buckee, and Nicolas A. Menzies. 2021. "The Use and Misuse of Mathematical Modeling for Infectious Disease Policymaking: Lessons for the COVID-19 Pandemic." *Medical Decision Making* 41 (4): 379–85.

Krass, Mark, Peter Henderson, and Daniel E. Ho. 2020. "Prioritizing Public Health Resources for COVID-19 Investigations: How Administrative Data Can Protect Vulnerable Populations." *Health Affairs* (blog). April 22, 2020. https://www.healthaffairs.org/do/10.1377/hblog20200420.729086/full/.

Krass, Mark, Peter Henderson, Michelle M. Mello, David M. Studdert, and Daniel E. Ho. 2021. "How US Law Will Evaluate Artificial Intelligence for Covid-19." *Bmj* 372.

Lewis, Michael. 2018. *The Fifth Risk: Undoing Democracy*. Penguin UK.

Lu, Lisa, Benjamin Anderson, Raymond Ha, Alexis D'Agostino, Sarah L. Rudman, Derek Ouyang, and Daniel E. Ho. 2021. "A Language Matching Model to Improve Equity and Efficiency of COVID-19 Contact Tracing." *PNAS* 118.

Maani, Nason, and Sandro Galea. 2020. “COVID-19 and Underinvestment in the Public Health Infrastructure of the United States.” *The Milbank Quarterly* 98 (2): 250.
Ouyang, Derek, Cansu Culha, Neel Kasmalkar, Maeve Givens, Simone Speizer, Cameron Tenner, and Julia Wagenfehr. 2020. “Stanford Future Bay Initiative Covid-19 Projects: Social Distancing Compliance.” http://bay.stanford.edu/covid19.