STANFORD REGLAB-SANTA CLARA COUNTY

ACADEMIC-PUBLIC HEALTH COLLABORATION FOR RAPID EVIDENCE BUILDING

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In March 2020, in conjunction with five other Bay Area counties, one of us issued the first shelter-in-place order in the country in response to the emerging COVID-19 pandemic. As the county health officer of Santa Clara County, California, home to roughly 1.9 million residents, San Jose, and Silicon Valley, I (Cody) had the benefit of long-standing trust and collaboration with other Bay Area health officers. Collaboration, iteration, and rapid information sharing were 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[1] (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.[2] 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 long-standing 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 (James and others 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 and others 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 and others 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, for example, Krass, Henderson, and Ho 2020). While Latinx individuals are roughly 25 percent of county residents, they represented over 50 percent 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 fourteen hours per case and increased the likelihood of interview completion (Lu and others 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 percent at the closest neighborhood site to *88 percent*; and it yielded an 11 percent positivity rate, dramatically expanding testing resources in the most vulnerable communities (Chugg and others 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 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 percent.

In later periods, the collaboration has pivoted toward vaccine distribution (for example, 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 so often is 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, within the county, with community stakeholders, 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 the "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 (for example, Greta Hansen, Pamela Stoddard, Sarah Rudman, Anandi Sujeer, Analilia Garcia, and Alexis D'Agostino) who could help quickly identify "win-wins" (that is, projects that would not get done but for an academic partner) and key stakeholders to be involved.
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 busted these barriers. For testing, one barrier was how to deliver private health information to *promotores* in a way that protected the 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. *Escape 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 and others 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, community, and institutional challenges to know what algorithms, if any, might help. For instance, extensive engagement around design and weekly check-ins with community health workers helped develop a shared sense of the motivation, constraints, and goals of the approach. 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 community-embedded, 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, when 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 and others 2021). Universities need to recognize these collaborations in promotions and tenure decisions. Publishing later does, ultimately, involve publication, the currency for academics, but merely on a different timeline.
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 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 six 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 and others 2021; Maani and Galea 2020) and initiatives like the National Secure Data Service[3] and the National Research Cloud[4] to ensure that secure data and computing 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[5] (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 lack such a vehicle for bringing academics in. We addressed this in part by having Stanford students and researchers work as part-time employees or volunteers so they could quickly understand county systems, subject to full security protocols. But such authority needs to be established more generally; we need model state IPA and wide adoption to enable academic-local government partnerships.

3. *Open Systems.* Proprietary systems can be major blockers for innovation. If the contact tracing system had not been controllable by code (that is, 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 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,[6] 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[7] 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 who 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.

NOTES

1. See Stanford website, https://reglab.stanford.edu/.
2. See PHF website, www.phf.org/programs/AHDLC/Pages/Academic_Health_Departments.aspx.
3. Nick Hart and Nancy Potok, "Modernizing U. S. Data Infrastructure: Design Considerations for Implementing a National Secure Data Service to Improve Statistics and Evidence Building," Data Foundation, July 2020, www.datafoundation.org/modernizing-us-data-infrastructure-2020.
4. See National Research Cloud page at Stanford University website, https://hai.stanford.edu/policy/national-research-cloud.
5. See Policy, Data, Oversite page at OPM.gov website, www.opm.gov/policy-data-oversight/hiring-information/intergovernment-personnel-act/.
6. See Partnership Helps Oakland Students Thrive after Juvenile Detention page at Stanford website, www.opm.gov/policy-data-oversight/hiring-information/intergovernment-personnel-act/.
7. See Centers of Excellence in Regulatory Science and Innovation (CERSIs) at USFDA website, www.fda.gov/science-research/advancing-regulatory-science/centers-excellence-regulatory-science-and-innovation-cersis.

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