COVID-19 MODELING TO POLICY IN WASHINGTON STATE: LESSONS LEARNED

UNIVERSITY OF WASHINGTON STRATEGIC ANALYSIS, RESEARCH & TRAINING (START) CENTER

REPORT TO THE BILL & MELINDA GATES FOUNDATION

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Executive Summary

Washington State has done a commendable job in managing the COVID-19 crisis. It was the state where the first case was discovered and the Washington State Department of Health (DOH) along with the Governor's office set up a research-policy partnership very early on in the crisis to help guide its policy decision based on science and data. This research-policy partnership consisted of experts from the Institute for Disease Modeling (IDM), Microsoft AI for Good, Fred Hutchinson Cancer Research Center (Fred Hutch), University of Washington, and the Institute of Health Metrics and Evaluation (IHME).

The goal of this project was to document how evidence from modeling and analytics was used to inform policy in Washington State and identify lessons learned from this experience during the period from February 2020 and June 2021. Specifically, the project aimed to:

- Identify best practices and enabling environmental factors for a strong research-policy partnership;
- Gather lessons learned on how to efficiently (re)deploy technical capacity (e.g., databases, modeling tools, etc.);
- Understand what systems infrastructure is needed for a modeling-to-policy process to successfully support policy decisions and a rapid and effective response.

The research-policy partnership which occurred in Washington State was examined to better understand what made this modeling-to-policy process successful and the challenges that were encountered. By understanding this partnership and the modeling-to-policy process, the START Team was able to identify several best practices which can inform research-policy partnerships and set up systems that can be responsive and useful for informing policy decisions during public health emergencies in the future.

Key Findings

Several aspects of the response worked well. First, stakeholders with diverse expertise in modeling and understanding policymaking—both from public and private sectors—worked closely with the Washington State leadership through a weekly cadence of meetings. This close collaboration led to the utilization of relevant models that answered key policy questions, and subsequently, informed important decisions. Additionally, the organizational culture of IDM was geared towards using modeling to assist with decision and policy making. This resulted in an environment where they freely shared their expertise along with the models they developed, which were focused on understanding the transmission of COVID-19, with Washington State and others. Second, despite a lack of DOH technical modeling capacity initially, it was able to rapidly leverage expertise from external modeling

partners. In addition to technical expertise, modelers' capabilities in communicating complex ideas to other researchers, policymakers, and Washington State leadership—and the latter's curiosity and willingness to learn from modelers—contributed to better decision-making during the response. Third, despite the expected data-sharing issues, there were enormous efforts to ensure prompt sharing of clean, usable data.

However, the START Team identified several gaps in the modeling-to-policy process. First, there were numerous issues around health data infrastructure that should be addressed prior to the next crisis. For instance, the DOH's data infrastructure is inadequate as it was not built to handle large volumes and complex types of data. Second, there was insufficient expertise for exploratory data analysis, technical modeling, and translational capacity at the DOH. Moreover, the COVID-19 response consortium was not able to leverage decentralized expertise, partly due to the existing restrictive data-sharing agreements and a lack of onboarding procedures to bring outside organizations and personnel in to help with the response. Third, there were delays in data-sharing among organizations due to the existing restrictive data-sharing agreement protocols. Lastly, stakeholders described an early misalignment of priorities among some organizations which may have resulted in their eventual absence or reduced participation within the research-policy partnership. Further, some potentially useful models may not have been translated to policy due to competing interests by other stakeholders in the multistakeholder collaborative policymaking process.

Recommendations

For research-policy partnerships to have a better response to future public health emergencies, the START team has several recommendations based on the strengths and gaps identified in Washington's utilization of the modeling-to-policy process.

We recommend that academic and research institutions do the following:

- Embed principles and capacities for modeling and knowledge translation within the training curricula across programs and departments to integrate different competencies and enhance modeling capacity building.
- Implement secondment with policymaking bodies to establish working relationships, learn each other's workstyles, create a sense of shared goal, and build trust with policymakers.
- Redesign recruitment, retention, and promotion criteria that value and recognize a broader set of experiences, competencies, and achievements to incentivize researchers to engage with policymakers through knowledge translation activities

We also recommend the following to the public health authorities:

- Develop adequate data management infrastructure, that include improved large data handling and processing capacity.
- Establish integrated maps of data, pre-defined metadata, and existing modeling expertise across different organizations to facilitate efficient leveraging of information and expertise needed in a timely manner.
- Prepare templates of comprehensive, clear, and flexible data-sharing agreements conducting thorough legal consultations ahead of time—to allow for the sharing of rapid exchange of information during the response.
- Dedicate budget towards training or hiring data modelers to bypass potential issues that may delay onboarding of external modeling experts.
- Allow modelers to participate actively in the decision-making meetings with the policymakers and the political leadership to facilitate creation of models that address policy questions effectively.

Lastly, we recommend the following to the funders:

- Develop funding mechanisms dedicated towards improving technical modeling and translation capacity and building sustainable data management infrastructure in academic, research, and public health institutions.
- Provide incentives to researchers, such as preferential funding towards research proposals that include engagement with policymakers and knowledge translation activities.
- Accommodate delayed effects of grants impacts to encourage researchers to submit proposals that include engagement with policymakers

Introduction

Research-Policy Partnerships

Despite substantial generation of evidence, much of it goes unutilized by policymakers due to misalignment in relevance of the produced information.¹ One way to address this issue is through forming research-policy partnerships. Research-policy partnerships are long-term, mutually beneficial collaborations that promote the generation and utilization of rigorous research to inform policy decisions.^{1,2} Other than correcting the misalignment, these partnerships improve access to relevant evidence in a timely fashion when making policy decisions, create ways for systematic use of evidence, and build credibility in the policymaking process.³ This project sought to understand and document the dynamics of a research-policy partnership in the modeling-to-policy process during the 2020-2021 COVID-19 response in Washington State and learn how to efficiently redeploy various aspects of the partnerships in the future.

Washington State was able to leverage technical capacity in modeling to support policy and decision making early on during the COVID-19 pandemic. While there was a major effort by the Washington State Department of Health, this was largely due to the multistakeholder partnerships that were developed early during the pandemic. Through these partnerships, technical capacity was built and deployed. This capacity was then able to be used by Washington State's leadership, including the Governor and his office, in making decisions and policy focused on addressing the spread of COVID-19. This process of providing modeling expertise to be used by policy makers to make rapid and effective decisions, the modeling-to-policy process, relied heavily on a modeling consortium that was brought together by leadership at the Washington State Department of Health.

There were several key events which preceded the formation of the modeling consortium. During March of 2020, the Institute for Disease Modeling (IDM) published a working paper⁴ with model-based estimates of the COVID-19 burden in King and Snohomish counties through April 7, 2020. The working paper also provided estimates for active and cumulative COVID-19 infections based on business as usual, and then for 25%, 50%, and 75% reductions in contact. Interviewees stated that this work and report were in part due to an organizational relationship between King County Public Health and IDM which was focused on understanding how the Stay Home Stay Healthy order affected COVID-19 cases in King County. However, after this report was published, DOH reached out to IDM, and eventually other organizations who could provide technical expertise to assist with the modeling consortium. There were several organizations outside of DOH and IDM. Although incomplete, the list of organizations who took part in the modeling consortium included Washington State Department of

Health, Institute for Disease Modeling, Fred Hutchinson Cancer Research Center, University of Washington, and Microsoft AI for Good Research Lab.

Modeling-to-Policy Process

The modeling consortium was a key component to the modeling-to-policy process. Integral to this process was communication. The modeling consortium had weekly meetings where they reviewed the data and the models that would be presented to the governor. There were also weekly meetings with the governor and his office where some members from the modeling consortium were present. This frequency of meetings, both for the modeling consortium and the meetings with the governor's office, was referenced by many interviewees as an important part of the success for the modeling-to-policy process. The meetings with the governor, which were schedule for one hour but could last for 90 minutes, were particularly influential. The questions the governor posed helped the modeling consortium to better understand what policy decisions were being considered, which helped guide the consortium in providing him with the data so that he could be more informed in making those decisions.

Data-sharing agreements enabled DOH to share their data which resulted in COVID-19 models which were updated on a weekly basis. The updated models would be published to the public within situation reports or SitReps on a weekly basis.⁵ The SitReps, which were often referenced by the governor during state addresses and on twitter when addressing the pandemic response, contained information regarding COVID-19 transmission across Washington State. The SitReps included authors from several of the organizations who were a part of the modeling consortium.

The success of the modeling-to-policy process was helped by several other key factors. Although membership within the modeling consortium was voluntary, individuals from organizations outside of DOH had support from their employers and supervisors. This was important since it allowed modeling consortium members to prioritize their COVID-19 work without funding being an issue. This would however necessitate an ability to put prior research obligations either on hold or reduce the amount of work that was focused on them.

The consortium members had a variety of expertise that was beneficial in making the modeling-topolicy process a success. There were modelers who were adept at quickly creating models, exploratory data analysis, and collaboratively coding. There were also researchers who were able to focus their capacity on explaining models, and the implications of the assumptions they relied on up, to policy makers. Regardless of whether a consortium member had their own model or not, there was a focus on the importance of communication. Communication between policy makers during the weekly meetings with the governor, as well as providing clear and accessible updates to the public through the weekly SitReps. And lastly, and most importantly, there was a shared goal. From the governor's office, to DOH leadership, to the modeling consortium, there was a need to better understand what was currently taking place in terms of COVID-19 transmission, and a desire to use that information to support rapid and effective decisions to respond to the pandemic.

Methodology

An interview protocol was developed to be given to participants prior to their interview. The protocol included information about the START Center, the objective of the interview, how their confidentiality would be protected, the length of the interview, and topics that would be addressed. To ensure interviewees would feel comfortable, the protocol stated that interviews would not be recorded, and detailed notes would be taken. The protocol also stated that names would not appear on the detailed notes and that the findings would be aggregated to further protect anonymity. Two research guides were developed for individuals who were either more acquainted with modeling or the policy/decision making aspect of the Washington COVID-19 response. The modeling interview guide consisted of questions on technical modeling capacity, analysis, and data translation. Both interview guides were designed for individual, in-depth, semi structured interviews. The Washington State Department of Health reviewed the interview protocol and the policy interview guide.

Potential interviewees were identified by the Department of Health, a gray literature review, and during interviews. A total of 12 individual, in-depth, semi structured interviews were conducted between July and September of 2021. Three policy interviews and one modeling interview were conducted with individuals from the Washington State Department of Health. The remaining 8 modeling interviews were conducted with individuals from The Institute for Disease Modeling (3), Fred Hutchinson Cancer Research Center and the University of Washington (3), Microsoft AI for Good Research Lab (1), and Institute for Health Metrics and Evaluation (1).

What Worked

The following sections are a compilation of successful elements of the modeling-policy partnership. Given the information analyzed from key informant interviews, the sections will focus on data management, relationships, and technical capacities.

Data

Managing the large volume and diversity of data being generated during the pandemic was a key issue from the beginning. The multiple information sources provided important information but only through a massive variety of variables and data quality. However, IDM participants noted the high quality of data being delivered for analysis from DOH. With some exceptions, datasets are frequently fairly clean – that is, ready for immediate analysis rather than requiring substantial manipulation and management. Delivery of clean data saves modelers a significant amount of time and energy and can enable faster outputs, which was paramount in the early phase of the pandemic response. Given the volume of data and its many different sources, this is a remarkable achievement.

Both IDM and DOH partners stressed how helpful it was to have clear roles in data management. For example, IDM partners were comfortable in their role in part because they were not being asked to make policy recommendations; instead, their focus was entirely on model building and interpretation related to current situations. A DOH-affiliated participant noted that their role included choosing relevant data sources, requesting specific types of models, and other tasks, all of which were also quite clear.

Lastly, one DOH participant noted that data-sharing agreements came together more quickly than they expected because all stakeholders understood that the situation was an emergency. Multiple stakeholders referred to having some leeway to go back and formalize certain details after the fact. The scope of this practice, as well as how the process avoided abuse, is not clear.

Relationships

Functional, respectful relationships between the various parties to the pandemic response played a critical role in Washington State. While some of the organizational partnerships were originally rooted in relationships between individuals with a history of working together, many elements of successful organizational relationships still stand out.

In particular, modeling stakeholders at IDM seem to have found success in their approach to partnering with DOH employees by understanding the importance of earning trust. Some key informants at IDM spoke of approaching the DOH work as if it were a job interview, with a desire to demonstrate the

value of their expertise and intentions to serve DOH's goals. Based on their accounts, IDM was ideally situated to pick up the types of modeling and complement the functions of DOH employees who did not have the same expertise. Although there does not appear to have been any formal effort to orchestrate this, being able to match needs, tasks and abilities at an early point in the collaboration was a key component in the success of the relationship. Finally, as one DOH employee stated, IDM's experience working with policymakers in diverse contexts across the globe was a significant asset in building a successful relationship with DOH: they were able to bring a nuanced understanding of the policy-making process and a professional working style to the consortium.

Other relationships were similarly based on specific needs of DOH. For example, funding from the Centers for Disease Control and Prevention (CDC) allowed the foundation of a new division within DOH for COVID duties. This funding allowed DOH employees to fully shift to roles in the pandemic response. Similarly, researchers at the Fred Hutchinson Cancer Research Center noted that seeing a specific need they could address given their expertise and resources was an important component in their relationship with DOH; in that case, an employee at the Center noted that an extra voice in model translation would be helpful and was able to step into that role quickly.

Skills and capacity

Three specific capacities came up repeatedly in our interviews: a specific culture of professionalism, communications, and leadership.

Both DOH and IDM employees remarked on the high value of partners who are capable of leaving professional ego out of pandemic response work and embrace instead a culture of professionalism that puts the shared mission first. Although such partners do not seem to be responding to a particular call or feature of the response work, they all appeared to be motivated by a desire to use whatever skills and abilities they have. One DOH employee used a striking metaphor to explain this laudable set of partners: they described people who, before a flood hits, are willing to simply show up and fill sandbags, laying them out where directed, until the person in charge can take stock of their particular skills and re-assign them. This DOH employee explained their metaphor by emphasizing the importance of not being tied to traditional roles or benefits, such as securing first-author status for a publication, but rather focusing effort on what needed to be done most urgently and garnering value from accomplishment of shared tasks. However, it is not clear that this attitude was externally incentivized in any way.

All partners involved in the pandemic response found themselves faced with novel communications challenges, both in terms of public- and partner-facing statements. Many DOH employees emphasized how critical it was that modelers and other researchers were able to explain technical concepts in multiple ways, both to leaders and, at times, to the public. They also praised their partners' willingness

to be open when they were not sure of something, and to explain the limitations of models without hesitation.

IDM's history of valuing the impact and quality of their work over the number of published papers resulting from their efforts was particularly praised by DOH employees, who noted that this emphasis means IDM employees have a great deal of experience in communicating technical concerns to audiences without necessarily having an expert background.

Also, many people on the research side of the pandemic response have praised various Washington State public officials for their comfort with imperfect information, for the eagerness with which they listened to complicated explanations, and for their curiosity in general.

Although it does not appear that pandemic response participants have worked frequently with science communications professionals, those who did reported that they were helpful when preparing for public-facing work. Other communications techniques evolved due to the emergency nature of the work. For example, the regular SitReps were written with an executive summary, so that important details were at the top of the document, and with hyperlinks to referenced materials for easy access.

Lastly, interviewees were unanimous in their vocal appreciation for many people in leadership positions within the response, particularly Governor Jay Inslee. DOH leadership in general was praised as flexible, open to novel concepts, invested in critical thinking, open to checking their understanding, and doing the best they could to comprehend highly technical components of the response without the benefit of training. One IDM employee also praised DOH leadership for their focus on working around procedural barriers to address emergencies, but interviewees did not touch on specific examples where this was the case.

Gaps

Data

One of the most frequently reported issues with the response involved the sharing and management of data. Because the pandemic generating a much higher volume of data than the systems in place were used to handling numerous problems resulted. Some of these problems were purely technical and brought in to question the resilience of existing systems; with one interviewee reporting that the data infrastructure seemed to be held together by the "force of will [of one particular DOH employee] alone." An interviewee from IDM noted that data were not initially being collected using a standard procedure. In response, some jurisdictions quickly started using a digital data management system like REDCap, while others used paper-based management systems that required additional transcription steps and raised data quality concerns. These data management issues contributed to delays in sharing important data. At times, data management issues also meant that important data files were corrupted. Delays in formalizing data-sharing agreements also contributed to frustrations about the pace of data acquisition, management, and analysis. For example, one interviewee from IHME mentioned that IHME's data-sharing agreement with the DOH got terminated at some point, which may have limited their contribution to the partnership.

The lack of a standard system for data collection inhibited timely and robust analyses. For example, an IDM employee noted that a single positive SARS-CoV-2 test might be associated with a number of dates. For example, the presumed date of exposure, date of onset of symptoms, or when the sample was collected. It was not always clear what the meaning of the date was in such cases.

Although the response brought together people with a powerful and complementary diversity of skills, many interviewees noted that having more data analysts with experience in collaborative programming (e.g., using GitHub, a repository for sharing code) or fluency in descriptive and exploratory methods would be beneficial.

Finally, interviewees noted that they were often worried about how the public would respond to a particular type of data. For example, one interviewee noted that if you had a model that showed that cases, hospitalizations, and deaths would begin climbing in six weeks, the public would not be likely to endorse preventative measures based on modeling data. Whether this opinion reflects reality or not, it was widely shared by interviewees on the policy side as well.

Relationships

While interviewees were largely positive about working relationships across organizations formed during the pandemic, they also noted important gaps or cultural conflicts that made some of these

relationships more difficult. At times, partners found a misalignment of goals. Those in or aspiring to academic posts were more motivated by a desire to publish papers in peer-reviewed journals, which, at times, inhibited effective work in the pandemic context. Both those partners and others exhibited an institutional desire to set protocols or declare ownership of a certain process: that tendency, characterized as, "this goes through me" or "we do this in house" by the interviewees, was largely seen as obstructive or even destructive.

Interviewees noted that relationships within organizations were initially stifled by more competitive atmospheres at the onset of the pandemic when individuals were seen as competing for a role in the response. One interviewee noted that they saw several coworkers with the potential to make important contributions to the response lose interest in doing so because of that environment. Although the atmosphere changed over time, the initial environment still resulted in some people not feeling comfortable in the work at first.

Finally, at times there was a need for clearer conversations about priorities in data analysis. According to an interviewee from IDM, the modelers at one point realized that they had been doing work that they thought was important, but that did not align with what DOH needed at the time. However, this seemed to be a rare occurrence.

Skills and capacity

Despite the successes detailed above, gaps in skills and capacity hampered the response. At the beginning of the pandemic in particular, interviewees noted that the length of time it took to bring someone new into a role was a critical limiting factor in their ability to expand their team. Because there have been few opportunities to add capacity by hiring additional staff members, most people working on the pandemic initially were simply relieved of their typical work, creating some tensions and difficulties in balancing their pandemic response workload with their other professional responsibilities.

Finally, interviewees also noted that as the pandemic response continues, burnout is a growing problem among both academics and those working in other capacities.

Limitations

This work has some limitations. Firstly, we could not obtain information on the best legal practices to foster effective research-policy partnerships. Further research on this aspect of the collaboration would be beneficial to understanding the legal infrastructure needed for a modeling-policy relationship to be successful. Furthermore, we learned about the effectiveness with which internal communication was effectuated. However, the team could not obtain information that would lead to understanding what should be done, from a communication perspective, beforehand to prepare for future public health emergencies.

Recommendations

Based on the observed findings from interviews, the START Team identified recommendations that could help to improve preparedness and response to pandemics and other crises, now and in the future. These systems infrastructure should be put in place ahead of time, before any public health emergency occurs.

Technical Capacity

ACADEMIC AND RESEARCH INSTITUTIONS

- Embed principles and capacities for modeling and knowledge translation within the training curricula across programs and departments so as to integrate different competencies and enhance capacity building.⁶
- Offer institutional incentives, such as extra academic credits or prioritized funding, to students or faculty that engage in modeling and evidence-to-policy translation research.

PUBLIC HEALTH AUTHORITIES

- Develop adequate data management infrastructure, that include improved large data handling and processing capacity.
- Establish integrated maps of data, pre-defined metadata, and existing modeling expertise across different organizations to facilitate efficient leveraging of information and expertise needed in a timely manner.
- Dedicate budget towards hiring data modelers to bypass potential issues that may delay onboarding of external modeling experts.
- Standardize metrics used to inform public health crisis response across counties, cities, and states.

• Establish surveillance systems capable of collecting real-time human mobility and movement patterns data to help understand disease propagation patterns.

FUNDERS

• Develop funding mechanisms dedicated towards improving technical modeling and translation capacity and building sustainable data management infrastructure in academic, research, and public health institutions.

Relationships

ACADEMIC AND RESEARCH INSTITUTIONS

- Implement secondment with policymaking bodies—giving researchers an opportunity to work in public health institutions—so as to establish working relationships, learn each other's workstyles, create a sense of shared goal, and build trust with policymakers.⁷
- Redesign recruitment, retention, and promotion criteria that value and recognize a broader set of experiences, competencies, and achievements to incentivize researchers to engage with policymakers through knowledge translation activities.⁶

PUBLIC HEALTH AUTHORITIES

- Implement exchange programs with research institutions, where policymakers temporarily spend time working in research institutions with modelers.⁷
- Prepare templates of comprehensive, clear, and flexible data-sharing agreements conducting thorough legal consultations ahead of time—to allow for the sharing of rapid exchange of information during the response.
- Allow modelers to participate actively in the decision-making meetings with the policymakers and the political leadership to ensure creation of models that address policy questions effectively.

FUNDERS

- Provide incentives to researchers, such as preferential funding towards research proposals that include engagement with policymakers and knowledge translation activities.
- Develop common, adaptable grant-making criteria that will be used to identify potential collaborative projects for funding.⁸
- Accommodate delayed effects of grants impacts when making funding decisions to encourage researchers to submit proposals that include engagement with policymakers.⁶

Conclusion

The existing culture at the Washington State Department of Health of seeking and leveraging experts led to identifying the need for modeling and approaching modelers during the state's 2020-21 COVID-19 response. Several factors seem to play a pivotal role in enhancing the observed modeling-policy translation process during the Washington State COVID-19 response. These include functional, respectful relationships between the various parties to the pandemic response, a specific culture of professionalism, communications, leadership, and prompt data-sharing procedures. The realization of the importance of specific expertise in modeling in informing policy decisions, the organizational culture, workstyle compatibility, and the desire to help combat the COVID-19 pandemic influenced the policymakers and modelers' willingness to collaborate and was critical to the successful partnership. Having systems infrastructure in place beforehand could lead to more effective modeling-policy partnerships in case of future public health emergencies.

Appendix

Appendix 1: Academic Interview Guide

My first questions are about the evidence to policy pipeline.

Can you describe how COVID-19 models and the subsequent analysis were used to impact policy?

What aspects of this process worked well? What areas could have been improved?

Think about a relationship with a trusted policymaker. How would you characterize that relationship?

Prompt: How did it develop? How often were you in touch about policy matters before the pandemic?

What shapes whether policymakers trust a body of research?

How do policy makers think about the methodological details of research, e.g., the difference between observational data and randomized controlled trials?

Prompt: How did these habits of mind shape the evidence to policy pipeline?

My questions are now about data collection and management practices.

I'll begin with some questions about priorities.

How were data analysis priorities formed? Prompt: decisions to analyze data using different metrics i.e. county, age, region, as well as metrics used) Prompt: Who were the people or organizations that assisted with this? Prompt: Did DoH ask IDM specifically? Prompt: Did these priorities change over time? What led to these changes?

What factored into what data were given to policymakers?

My next few questions are on data management and infrastructure.

Can you describe how data were shared between agencies?

Were there any issues that arose around these? Prompt: What were they? Prompt: How did they arise? Prompt: What was done to address them? Prompt: In the future, how could they be avoided?

How were data managed?

Prompt: Was there a process to address any issues? Prompt: Where there any issues that arose around the data (i.e. data access, accuracy, timeliness, etc.) Prompt: How were these issues addressed and by whom?

I have a couple of questions about modeling, analysis, and data translation.

Technical modeling capacity – How was the modeling team constructed? Prompt: How was it built and used? Prompt: What existed already? What was built? Prompt: What type of expertise was sought after? Prompt: Which agencies worked on modeling (was it just IDM?) Prompt: Were personnel shifted from other areas/agencies?

How much translation did modeling groups do themselves? Prompt: Translation to policy makers, to the public, media

What partners did they have who could serve this role? Prompt: What made this easy/difficult? What were the skills required?

My next set of questions are about relationships and partnerships among organizations.

Firstly, what organizations in policy have you been working with during the COVID-19 pandemic?

What is the partnership with [partner organization] for?

How was this partnership formed? [repeat for each for each partner organization]

Have your organizations worked together before the COVID-19 pandemic?

How did these partnerships work?

How familiar were the teams from each organization?

What level of trust existed among the partnering organizations?

Were there new partnerships between organizations formed during the COVID-19 pandemic? Which are they?

How has the relationship changed over time, before and during the pandemic?

Is there anything else you think I should know about what we've talked about today?

Thank you so much for your time.

Appendix 2: Policy Interview Guide

My first questions are about the evidence to policy pipeline.

Can you describe how COVID-19 models and the subsequent analysis were used to impact policy?

What aspects of this process worked well? What areas could have been improved?

Can you think of a specific piece of evidence that led to a change in policy and describe how that process worked?

Prompt: What was so compelling about the specific evidence? Prompt: Were there people who were involved in shepherding this particular piece of evidence into policy? If so, what did they do?

Can you think of a specific piece of evidence that did not lead to a change in policy and describe why you think it did not?

What are the other factors that seemed to contribute to a piece of evidence successfully translating to policy?

What shapes whether you in your capacity as a policymaker trust a body of research?

Think about a relationship with a trusted academic or researcher. How would you characterize that relationship?

Prompt: How did it develop?

Prompt: How often were you in touch about policy matters before the pandemic?

When you assess research for its policy potential, what are you looking for to determine its applicability to your situation?

When you assess research for its policy potential, what are some things you would consider red flags?

My next questions are about data analysis and management.

I'll begin with some questions about COVID-19 models and data analysis.

Can you describe the role of DOH in the creation of the COVID-19 models? What role did they have in terms of data analysis? Did these roles change over time?

My next few questions are on data management and infrastructure.

Can you describe how data were shared between agencies?

Were there any issues related to data management that arose? Prompt: What impact did these issues have on the evidence-to-policy process? Prompt: What were they? Prompt: How did they arise? Prompt: What was done to address them? Prompt: In the future, how could they be avoided?

How was data managed? (Data management infrastructure) Prompt: Was there a process to address any issues? Prompt: Where there any issues that arose around the data (i.e. data access, accuracy, timeliness, etc.) Prompt: How were these issues addressed and by whom?

My next set of questions are about relationships and partnerships among organizations.

Firstly, what organizations have you been working with during the COVID-19 pandemic?

What is the partnership with [partner organization] for?

How was this partnership formed? [repeat for each for each partner organization]

Have your organizations worked together before the COVID-19 pandemic?

How did these partnerships work?

How familiar were the teams from each organization?

What level of trust existed among the partnering organizations?

Were there new partnerships between organizations formed during the COVID-19 pandemic? Which are they?

How has the relationship changed over time, before and during the pandemic?

Is there anything else you think I should know about what we've talked about today?

Thank you so much for your time.

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