

Nigel Goldenfeld Interview, Part 2

SHIELD COVID-19 Modeling Team, University of Illinois Urbana-Champaign

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SPEAKERS

Paul Gilbert II, Nigel Goldenfeld, Jessie Knoles (Tech)

Paul Gilbert II 00:01

So, as you were saying...

Nigel Goldenfeld 00:04

Right, um. Do you want to ask a prompt? Or do you want, do you just want me to rabbit on?

Paul Gilbert II 00:12

Yes, I can ask this as a prompt. So you note in the first interview that amongst your other responsibilities, you also advised the governor of the state of Illinois during the pandemic. Was there a name for this task force that you were a part of? Or was this more of an ad hoc thing that just came to be?

Nigel Goldenfeld 00:42

Well, I think it probably did have a name but I don't remember what its official name was. It was...but I always called it the governor's COVID modeling group, something like that. And it was a formal structure. So the history of this is, after Sergei Maslov and I communicated to the governor that there was a window of opportunity to preserve the health care system in Illinois without [destroying it?] completely. If he shut down the state very quickly, then we discussed with him, the governor and, you know, we would send him a technical document explaining our calculations. And then as you know, the state did shutdown on March the 20th 2020. I think it was the first state to do so, although it may have been longer synchronous with the state of California. I don't remember which one came first. But they were both in they were independent events and they happened the same day. After that, the governor set up this task force. Now the way he set it up was he first of all, realized that there was a need for some sort of modeling, and some sort of analytics. So he had a sort of open house, and a lot of people were at that. And a lot of different groups, some consulting groups, and some university people and so on. Most of those I never heard of again. There ended up just being three groups. Well it was our group, of course, Northwestern, there was a company called Civis, which was a data analytics company, which had done work with the governor before in other contexts. And they were tasked with sort of data federation, working with the Illinois Department of Public Health and so on. And then at the time, I also urged them to include in the group, a modeling group from the University of Chicago, which had expertise in influenza viral dynamics. And so that was the three groups that were in this task force, as you called it. And um, and then later on another group from Argonne National Lab joined as well. So,

yeah, I don't remember what it's, I don't remember if we ever gave it, if it had a full name, to be honest. We were too busy while to worry about what our acronym should be.

Paul Gilbert II 03:33

Speaking of which, was this the first time that you were a part of this kind of a pathogen response team that reported to the governor, or were there previous instances such as Ebola, or SARS, where something like this was created?

Nigel Goldenfeld 03:54

This was the first, this was the first time and the--you may wonder why we were able to do this, I mean, both Sergei Maslov and I, well, let me just backtrack. We both worked at the Institute for Genomic Biology at the University of Illinois campus and I led a group there since the inception of the Institute called the biocomplexity group. And Sergei was recruited to the University some years ago, and he had the office next door to mine. He's also a physicist by background and had, for the last 20 years just like me, been working on microbial ecology, viral dynamics, populations dynamics, systems biology, and things like this. And so we both have expertise in the mathematics of ecosystems which is on, which forms the core of the way that epidemiologists make computational models still today. So that's how we were able to very quickly pivot. But neither of us, as far as I know--you'll have to check with Sergei, but--neither of us had any formal public health experience or participation in any viral outbreaks previous to that.

Paul Gilbert II 05:24

What were some of the biggest difficulties when it came to forecasting for the state population in contrast to the University of Illinois population, because you have mentioned having access to data from the University, and I wasn't sure if the State was able or willing to provide anywhere near as much information on eight million people versus a population of about 46,000.

Nigel Goldenfeld 05:57

Yeah. So good question, the...so the answer is the data analytics company, Civis, works with the three epidemiology groups and acted as a conduit to get the data from the Illinois Department of Public Health, to make it available to us in a form that we could access through computer scripts, and automated ways and then use those data as input into our calculations. So we did have access to the data, but the purpose of the groups was a bit different. So the modeling group was really a forecasting group. And we were there to answer questions like, probably the most useful thing that we did in my view, is answer the question like, "Will we have an outbreak likely to start during the winter? Will we need to have extra hospital facilities available in this area or that area, or will the outbreak be able to be contained with the facilities that we already have?" And we were able to answer that question using modeling. What we were doing for the University answered a different question. Initially, what we did for modeling was to try to predict whether or not the mitigations that we were planning to make on the University of Illinois campus would prevent transmission and out of control growth of the, of the pandemic. And then once we had set that up, we pivoted to doing data analysis, literally being able to do this in a hyperlocal way, in a very fast period of time, to be able to see where outbreaks are occurring, and immediately, you know, as it were, closing those outbreaks off, have those people either be, people that are effectively isolated, contact traced, and quarantined, and also, if there was a

building that was really undergoing a huge outbreak, to make the residents of that building be tested more frequently, so that we could, we could really make sure that we were catching people before they transmitted COVID to too many other people. So they were, they had different, near different, functions. Also, what we did for the state worked on a slower cadence. So we would meet once a week. Actually, no, that's not true. We would meet several...we would meet...we met with them twice a week, I think, eventually the cadence changed. And, and what we would do is at the end of each week, eventually we would, you know, how this, how this three groups working together, worked out, it took a bit of time for it to settle down. But eventually, the way it settled down was, we would prepare predictions based in a format that Civis would send us. So they would say, "Okay, we want you to send us a spreadsheet in CSV format which tells us about, you know, the, the growth and you know, how many cases they're going to be and so forth, for these different reasons." They were eleven Illinois Department of Public Health regions in the state of Illinois, and we would make predictions for them and we'd be predicting many things. We'd be predicting hospital occupancy, ICU occupancy, deaths, all of these sorts of things, and then we would send those, those spreadsheets in. All of this we figured out ways to do in automated fashion and then those predictions would then be presented in a big document every week to the governor's office. So that's what, that's how it eventually ended up. So we had all the data that we needed. And in fact, we had, we actually ended up having [Linus?] level data, meaning every person in the state of Illinois who was was a patient, who was infected by COVID, we would have access to all the information about that as it went. So, we didn't do this, but the two other groups who are much more epidemiologically-focused as opposed to computationally-focused, they did do things like look at the amount of incidents and different ethnic groups and things like this, which we weren't really set up to do.

Paul Gilbert II 11:03

How much of an impact do you think your work and the work of those two other teams that you mentioned, had on policies related to shutting down and reopening of the state?

Nigel Goldenfeld 11:22

So there's a wonderful article, which is a kind of history, from Chicago magazine. I don't know if you've seen this article, I can--if you haven't, I'll send it to you. But they did a kind of oral history of the events leading up to the shutdown. So you can see, that's exactly what happened. In fact, we--Sergei and me--were the only group that alerted the governor to these issues, because the analysis that we did was a different kind of analysis that any epidemiologist had done before. They, you know, we, we asked a very different question. We said, you know, how can you, you know, how can you how can you make predictions and know that they're going to be true? Of course, that's very, there's a technical question, which is very difficult to answer. So we asked a different question, which is, if I look, if I compare two different interventions, whether they're separated in time, as opposed to by assumptions, can I then see, what are the differences in these outcomes? And the idea was that the difference between those two scenarios, any errors that you have in your predictions will be sort of the same in both comparisons, but you'd be able to see the difference between the allowance have you. What would be the impact of early intervention versus just, you know, just doing something else? So we weren't really trying to say, like other epidemiologists were at the time, like your focus on [inaudible], well, this is what's going to happen. We were just saying, we don't know what's going to happen, but if you did this intervention here, this intervention here at this point in time, what will be the difference? And we saw

there was a huge difference in that. So you know, so I think, I think that difference that you the biggest...go back to being what effect we had...the biggest effect, we had, I think, was informing the governor of this window of opportunity which nobody else had thought of doing before. And he told us many times that he kept our report on his desk, the gra--we figured out very carefully, what is the right way to present these data so somebody who is not a theoretical physicist or whatever, trained in epidemiology, can really see the difference. And so we did come up with a way to do that. And, you know, it was the best we could do. And we did it and it was effective. And that's reported in this Chicago Magazine special about the history of this. And he told us this many times when we met with him personally. And then we were involved in, well as you probably know, I gave a talk at a press conference on Sunday, April the 20th, or something like that, when the lockdown was extended, and Sergei talked after me. So I talked about the general principle--I can't remember the exact content now--but it was all recorded, I guess it's on YouTube or something. But anyway, so we were involved in those in those things. And we would, we were asked by the governor's office to make predictions about different scenarios. Should we open up, should we wait a bit, you know, various things like that. And so we and the other modelers did those things.

Paul Gilbert II 15:05

Last time, we had briefly talked about how your and Sergei's notoriety, especially in the response to the state, elicit some strong reactions from people. In particular, I think you said Sergei at one point needed a police escort in order to do--

Nigel Goldenfeld 15:31

--that wasn't quite true. We had threats, and we ended up having an enhanced police...what do you call it...surveillance or whatever you call it? [Yeah.] Yeah, at our houses for a while...yeah.

Paul Gilbert II 15:49

I was going to ask you to elaborate more on what was that like for you and your colleagues? And what led up to having that increased surveillance of your house for your own safety? Because I couldn't imagine...[yeah]...under those conditions.

Nigel Goldenfeld 16:09

I'm trying to remember, I think that...I think it was after we were on...um, I'm not sure. I don't really remember precisely so. But I think, I think it was, it would have been either after we were on television, or you know, having press--talked at the governor's press conference--or yeah, I think that must have been, must have been then. I mean, there was this whole conspiracy theory thing going on, on the internet, which I didn't really follow from, started by, anti-vaccination people who then FOIAed a lot of our emails, and so on, and also from the Wall Street Journal, which FOIAed our emails and interviewed us, and then put the interview on the internet, and various things like this. So there was a lot of, you know, very hostile activity that came from this. I didn't, I personally didn't pay very much attention to it. I mean, we did, talk to the University about the threats, and I remember that Sergei was threatened more than me in the sense of, because he was identified as being Russian, as far as I remember. But he will tell you all about that...he probably remembers that better than me. And so we did talk with the, with the Provost at the time [inaudible], and then he wanted us to talk to the police about that. So I didn't really

pay much attention to it, I mean, what had happened, I mean, they were doing other things, they were trying to get us fired from the University and things like this.

Paul Gilbert II 17:58

I mean, like I said, I couldn't imagine working under those conditions where I'm just trying to do my job, and people are screaming for my head on the platter and coming after my family's livelihood.

Nigel Goldenfeld 18:16

Well, it's great, you just turn off Twitter, and then you don't, you don't notice as much...but you know, yeah, but I mean, it's a concern, because these days, you cannot take anything for granted. I mean, I'm glad that the University wanted us to have some form of protection or surveillance or whatever, because, you know, crazy people do crazy things. We've seen many examples of that in the news, particularly in the last few weeks and so on. So yeah, but I didn't, we didn't pay that much attention to it. The constant harassment by fire was, in a sense, more of a practical impediment because it took so much time...we had to talk a lot with lawyers and so on. The University was very good at, you know, helping us to be able to meet our legal requirements on the fly and things like that.

Paul Gilbert II 19:26

Did other agencies or entities ask for your assistance when it came to modeling? Think, things from a public health standpoint, such as the local department of health, or others agencies in the state of Illinois?

Nigel Goldenfeld 19:46

We worked very closely with Awais Vaid with the Champaign-Urbana Public Health Department--and Julie Pride--and and so all the results of our modeling was shared with them when they wanted to know about it. So they were really part of the University's team, it was a real, it was a real partnership. I mean, Awais must have been in hundreds of meetings that I was at with the University people and so on. So I mean, it was a very, very close partnership. So anything that they wanted to know, we would, to the best of our knowledge, provide that for them.

Paul Gilbert II 20:31

Do you still get consulted for modeling purposes when it comes to the pandemic, or did that end around the time that you left the University?

Nigel Goldenfeld 20:42

So when I left the University, I moved to, you know, California, San Diego, they had their own response here, they had chosen a somewhat different model. I knew one of the people who had been closely involved in setting up their system, particularly the wastewater sampling. And so what they did was, they essentially had COVID nasal test vending machines on campus and, and they had [inaudible] many places did about that. They tried to do the saliva test, but for various reasons, I don't really know for sure, they haven't been able to get that to work, or at least the way that they needed to. So they fairly early on decided not to do that. They put a lot of money into wastewater sampling, which is a very good idea, but it tells you whether a pandemic is starting to rise again, but it doesn't tell you where with any specificity. And we wanted to find out exactly, we wanted to get, know who had COVID, who was

transmitting it, and stop the chain of transmission. So you need to do that. So when I came here, I did talk a fair amount with the local COVID people. There was nothing really that I could do that they didn't already know how to do. So they were doing a fine job. They didn't have the same sort of challenges in terms of compliance that we did at the University of Illinois, the student population here at University of California, San Diego, is in general, very different. And so you can walk around the campus here, and you'll see many students with masks on and so on, even outside and even today, when generally people think that there's not much risk. It's a very different environment. So I wasn't needed to really do anything but when we've, when there have been COVID meetings that I was asked to participate in, I did...there was one organized the beginning of the semester, this quarter, for example. So yeah, so I'm in touch with the people, but...well, one of the faculty members here at the University of California, Kimberly Prather, is an expert in aerosols, was one of the people who really was behind some of the work on establishing aerosol as a means of transmission and publicizing that this is still something that the CDC hasn't fully taken on board. It's quite, quite disgraceful. Even today, I was just on a plane--I came to Illinois a couple of weeks ago--you know, the airport, there was an announcement from the CDC telling you how to be, stay safe in the airports. It was telling you to wash your hands and wash surfaces, things like this. The sort of things that people were doing at the beginning of the pandemic, when everybody was wiping down their groceries and stuff like that, which we know has completely no value whatsoever. There was nothing in the CDC messaging about wearing masks, and there still isn't today.

Paul Gilbert II 24:05

I mean, I think there is a bit of dramatic irony in this message over the intercom taking place in the airport considering a lot of people criticize the TSA as being security theater, where it doesn't make people safer, it just makes them feel safer. And you can make the arguments that washing your hands and asking people to wipe down surfaces is another example of security theater when it comes to Coronavirus.

Nigel Goldenfeld 24:42

It is, we call it hygiene theater. Yeah, it's exactly, it is exactly analogous. And it is a shocking to see even today as we talk, when you look at some of the information that the CDC puts out on its website or on Twitter, they are not talking about masking. They're talking about other things. They're being...if you look at epi-Twitter--there's still epidemiologists on Twitter--you'll see a whole lot of criticism of the CDC for this.

Paul Gilbert II 25:24

I was going to say, maybe another factor into this is that...oh, what happened? Did--

Tech 25:37

You're still on.

Paul Gilbert II 25:40

My computer, or Zoom, crashed.

Tech 25:43

You're here with us.

Nigel Goldenfeld 25:45

We can see you.

Paul Gilbert II 25:47

Oh, that's, that's really weird.

Nigel Goldenfeld 25:49

We see you and hear you.

Paul Gilbert II 25:52

But I can't see Zoom and it's...okay...um...

Nigel Goldenfeld 25:54

It's monitoring you. [Laughs.]

Paul Gilbert II 25:59

Okay, Zoom just reopened. Big Brother is trying to get me, I guess. I was going to say, I think another factor in terms of why they're still promoting the hand washing thing instead of masking is because, as we've talked about before--and I have another question asking about it--a lot of the pandemic response has been politicized. I think as of right now, it still isn't a controversial thing to ask people to wash their hands after going to the bathroom, to the same extent asking people to put a mask on is. It's a lot easier to condemn someone for not wanting to wash your hands as part of their rights, quote, unquote, than wearing a mask, because everyone just goes, "Okay, we all know what goes on in the bathroom, and you're telling me you don't want to wash your hands afterwards? What's wrong with you?" But like I said, on the politization front, do you think that your work has been impacted by people going to these two big tents--one of trust the science and the other one screaming about civil liberties related to mitigating the pandemic?

Nigel Goldenfeld 27:40

So I'm not sure what you're asking.

Paul Gilbert II 27:44

So what I'm asking is, we talked last time about compliance rates as part of you modeling things. I'm asking, did your job of trying to model and forecast become easier or harder, or not be impacted much, as things became much more politicized, and then you had people who are much more strictly compliance in one camp, and then other people who were are doing everything they could to flout the rules?

Nigel Goldenfeld 28:23

Yeah the um, okay, let me answer that question in two ways. So one, one way I will answer this is the following: we choose a different type of modeling for the state of Illinois than we did for the university campus. And the reason we chose to do individual level modeling for the university campus, and

population level modeling for the state, was because we knew that there was a huge diversity of behaviors on the university campus, even before the compliance issue came. So we knew that it was important that there were going to be people who just, you know, are in the lab, you know, working, for example, and then there's people who are out partying every night and so on, so we had to model that and so we that's why we chose to do that. So, so we did have that built in right from the beginning, the compliance thing then came out later on, we could actually, we actually were able to measure it and document it. We measured this two ways, if you remember, one from making our simulations agree with what we actually observed. And the other was from looking at the data that we had taken on how frequently people went to get the saliva test. And so both of those gave a number that we could put into our forecasting. So that was how we were, you know, how we were able to deal with these two big extremes. So that's the first thing. The second thing is, at the beginning of the pandemic, I think it was easier to model because nobody really knew what was going on. So the politicization hadn't really taken effect then. And then the third thing I want to say, which is [what I always say?], which goes back to your opening question, which is an anecdote I want to record. The anecdote was this: I was once on a plane after the pandemic, I think I was coming back last summer from San Diego after I was negotiating with the university here before I retired from Illinois and moved here. And I found myself sitting next to a physician from Chicago, who worked at one of the hospitals in Chicago. And we started talking about the pandemic, of course, and, and, and before we've got too far, he, he said, You know, I was very astonished, how we never had the same situation that they had in New York City, we never had, we were never full, we never had our ICUs overflowing, we were never treating people in the car park, all that kind of stuff. And, and I explained to him, yes, you know, I told him what what we had done. And for that reason, he--and he was very, he was very grateful and amazed. Also, that the story of that really hadn't, hadn't really filtered through to the general public. I mean, it was certainly known, I mean, the *Chicago Tribune* was writing articles about the modeling group every couple of weeks. So they would check in with us, and ask us for predictions and to comment on stories. And so I think I must, was quoted a lot of times on the *Chicago Trib*--so people kind of knew about this, we hadn't really quite internalized the whole sequence of events, and the impact it had. And it wasn't just that we came up with a modeling way of communicating that to policymakers that was persuasive and correct, in fact, but they were able, they were able to listen, and were prepared to listen and made the correct call. I think it was very lucky that we had the administration that we had in the state. If we'd had the previous governor, I shudder to think what would have happened. Um so.

Paul Gilbert II 32:35

...and not the current governor of Florida.

Nigel Goldenfeld 32:38

Or the current governor of Florida, exactly, exactly. And I think, also, the other thing I want to mention, since we're talking about that, that incident...you know, the way we communicated to the governor, who neither of us knew originally, of course, was, you know, we went through Tim Killeen, President Killeen, who, actually his background was in physics, so I knew him, I suppose because I was a senior member of the faculty, as well, and the provost knew him so, and then he knew the deputy governor for education. And so it was really literally very easy for our information to be transmitted to the governor and also to be validated as being worth paying attention to. So the University of Illinois played a very

important role in that. If we'd been in another university, it wouldn't have happened like that. If I'd been at the University of California, I don't think I would have had that same level of access.

Paul Gilbert II 33:11

Speaking--

Nigel Goldenfeld 33:34

--did I answer your question?

Paul Gilbert II 33:57

Yes. Okay, so we have a couple of winding down questions. The first one I want to ask, we talked about this briefly towards the end of our initial interview on what your thoughts were about the University's--these guidelines and policies related to abating this pandemic. I also want to hear about your thoughts on the state of Illinois as a whole reopening and the guidelines that you helped craft as part of your forecasting.

Nigel Goldenfeld 34:38

Right, so I don't have all the details in front of me, but I can tell you that we were asked to model different scenarios for reopening and yeah, let me see, let me think here, can I, is there anything I can...can I be a bit more specific about that? Yes, there are, for example, the state was not a homogeneous entity, as I said, it has eleven sub-regions. And so at various times, we were modeling, you know, opening up one region, but not opening up another and things like this. So there were instances like that, which were scenarios that we ran. There were also things like what would be Illinois Department of Public Health eventually came up with, with a sort of decision tree, the kind of flowchart that says, if hospital admissions get to be above this amount for a certain number of days, and blah, blah, then that region goes into yellow alert, or green alert, or red alert, or whatever it might be. They have different terms for those things. And we were sometimes asked as a modeling group to provide input into what would be rational ways to create those decision trees. And sometimes our input was used. And sometimes it was not. I remember having quite a lot of vigorous discussion in the modeling group where we were all complaining about how one of the criteria that the state was using just made no sense whatsoever. And we were, you know, we were often as modelers or epidemiologists, frustrated about, you know, what kinds of surveillance the state was undertaking and what kinds of, how they, symmetries are made, whether the sort of analytics that was going on internally in the Illinois Department of Public Health reflected what we saw from the outsider working essentially from the same data, but using different mathematical tools. So there were people in the Illinois Department of Public Health who had a much less technically sophisticated perspective on forecasting and so on, based on various, what we would regard as rather simplistic modeling. And sometimes what they were doing was not really in agreement with what the consensus was from the modeling group. So there were issues like that. And I was, speaking personally, I was never terribly happy about the way that our input was always received and used by the Illinois Department of Public Health. Sometimes they just would hear what we had to say, but then they would sort of do their own thing. Yeah, I mean, that's inevitable, you know, we were only a small part of the input that they get, but there were definitely frustrations there, from us and the other modeling groups. Incidentally, you didn't ask me why there were three modeling groups, or four eventually...

Paul Gilbert II 38:20

I was going to ask that as my next question, actually.

Nigel Goldenfeld 38:24

Oh well there you are, great minds think alike. The reason is: we were all academics and two of the three groups were, had professional careers in epidemiology. Not our group, of course, the, you know, so the usual way in which a scientific advance is made, is you do some work, and then you write it up, and then you send it to a journal, then it gets peer reviewed, it takes six months to peer review it, and then it gets published maybe a year, or a year and a half after you eventually did the work. And, and there wasn't time to do that during a rapidly evolving pandemic. So just as the vaccines were developed in record time--in a year--so the way that epidemiologist and computational epidemiologists work together also move very, very fast. So what we would do is we would, we would be taking the same data and be doing the same modeling. And then the idea was that we would try to come to a consensus about what the forecasts were like. And we all used very different methods. And at first I thought, well, wouldn't it be a good idea if we all just, all sat down and you know, I explained how modeling worked and the other group, the Northwestern group explained how they're modeling worked, and Chicago would explain how their's worked...because these were all quite technically complicated models, some more sophisticated than others, with lots of built-in assumptions and uncertainty, some of which were known, some of which were not known. And the group decided they didn't want to do that, although I would have been, I did actually push for that. But the other teams really didn't want that. So what happened was that, you know, the groups were essentially, I mean, we had a vague, we have some understanding of what we each did, and we, and, you know, the Chicago group and our group, we just put all our work online as public domain, as much as we could. But there were definitely differences in in predictions. Sometimes the predictions, I would say--I know I'm going on the record here, but I think the data show this very clearly--I would say that the other groups had much wider error bars than we did. They use different methodologies. I think our methodology was very principled and we have a peer review paper published in a prestigious physics, interdisciplinary, journal about that eventually. And so, you know, sometimes there were these differences and we had to sometimes discuss why did one group, you know, see that the pandemic was going down, while another group said it was going up, and so on. And sometimes there were real reasons for that, and they were very, it was very, insightful to learn about those things, and important. So it was a very interesting process, it was sort of doing peer review in real time as you were doing the work, not peer review months after you had already done it and ribbon it up in a sanitized form. It was the best that one could do. I don't know of any other state that had a team had this kind of structure. There were certainly other epidemiologists around the US who were in touch with public health authorities, I believe, some were, you know, less welcoming, to be able to advise them than others. I don't know of any other group, any other state where there were like multiple teams all collaborating, but, you know, working in a focused way towards the same goal of helping in the public. I think that was something that Governor Pritzker set up. And to his credit, it worked well at the time that they actually needed it.

Paul Gilbert II 42:46

So you're saying that, in short, one of the advantages that the state of Illinois had was this triangulation going on between multiple teams where, based off of the various models that the teams made, as well

as the closest thing to peer review that you could get under those circumstances, Illinois was better equipped to predict what was going to happen than many other states were?

Nigel Goldenfeld 43:19

Well, I don't want to be comparative. Because I don't know what the other states were doing. I would say that it was as well-equipped as it could be given its resources. In other words, I don't know of any group in the state that had the expertise to do these sorts of calculations that wasn't involved. You know, as I said, I recommended that the group at University of Chicago be involved and they were helpful. The group at Argonne National Lab, which was doing modeling more focused on the city of Chicago than on the state, they also became involved. So I think the state did a very good job of creating this sort of forum where different groups would come together for a shared purpose, and I think it benefited the state.

Paul Gilbert II 44:13

Was any of your forecasting data used to determine which populations needed access to the vaccine sooner versus later, as far as you're aware?

Nigel Goldenfeld 44:26

Well, I don't know if it was, because, the, we certainly made those points. We were asked about privatization and so on, you know, and so we made recommendations about living in care homes, prisons, and communities where there's not enough access to health care and so on. So, we as a group definitely discussed that. Those weren't things that came out of our modeling, they just came from our being very, very connected to the epidemiological discussions that were going on. So whether or not that, you know, influenced the IDPH or the state policy, I don't actually know. But we certainly as a group discussed these things a lot. And, I suppose we could probably go back and look at the, you know, what we would do is, every week, as I said, we would send the state a report, which I would typically write like this, I'd write as a PowerPoint presentation with an executive summary. And, you know, sometimes that would be like, you know, forty pages or something like that, showing lots of data from the different Illinois regions. But also, we would have an executive summary and we would talk about the implications for vaccination strategy, and things like this. So, but the other groups who were much bigger than us, were not so computationally focused but had much more experience in epidemiology and sort of thinking of different ways to stratify the population and study the incidence and so on so forth. They did that much more than we did.

Paul Gilbert II 46:32

Do you know if you're at liberty to share some of those PowerPoints with us for preservation in the greater COVID-19 Documentation Project? Or is that something protected under executive privilege with the governor's office?

Nigel Goldenfeld 46:50

I don't know. I have no problem in sharing those things. The thing that we're not allowed to share are the individual data. So I would say that we should probably pick this up separately. I'm not, you know...I don't know, I wouldn't know how to answer that. But if you're asking a legal question, or a data preservation question, the last person you want to ask is some theoretical physicist. [Laughs.]

Paul Gilbert II 47:41

Asking, um--

Nigel Goldenfeld 47:43

--yeah, I think it's a good--

Paul Gilbert II 47:43

--if there's nothing as far as you're aware of that stopping you from giving that information to us?

Nigel Goldenfeld 47:51

I don't know because we had to sign, there were a lot of forms that we had to sign for the Illinois Department of Public Health, and I don't know what they permit and what they don't permit. I'd have to look at those. But certainly if we we're allowed to, would be happy to make those things available to you. I think they should be archived is my personal view, but there was--I don't know what the word for it is, not NDA or--some legal things that we had to do with the Office of the President?

Paul Gilbert II 48:33

...NDAs, maybe? Are you thinking about NDAs...nondisclosure agreements?

Nigel Goldenfeld 48:39

Now, it wasn't an NDA. I know what NDAs are. Anyway, there's some, there was legal work that had to be done in order to allow us to have access to these data in the first place. And under specific rules about disclosure and who they can be circulated to, and so on, so forth. And, like, the president of the university wanted to, for example, to see some of the data that we were sending to the governor, and we had to check to see whether which data would be allowed to send to them so. So definitely, I think this is a good thing to explore offline. But all those things are kept and can be transmitted for the archive.

Paul Gilbert II 49:31

All right. And one last question before I let you go. Do you think we're ever going to get back to normal? And by normal, I mean, pre-pandemic, ways of modality and living? And if the answer is no, do you consider that to be a bad thing?

Nigel Goldenfeld 49:59

Well, I think the answer is obviously no. Because the shock of this global pandemic, have permeated through society in many ways which are completely unexpected. It's not just a question of how one deals individually with, you know, what's required in terms of safety. As you know, it is certainly transformed the way people view work. You know, and I'm working at home now, before the pandemic, if you call me up on a, on a Wednesday afternoon, I'd be in my office at the university. Well [laughs], you know, that'll be true half the time, but not nearly as much. And obviously there's plenty of people who essentially will not work for a job unless they can work at home and things like this. Other people who have, of course, don't have a choice because of the nature of the work that they do. So I think there's all sorts of changes that are made, that have been made. And you can talk about the changes

that are made in the US, I mean, the US is in a situation where you have a circuit of vaccines, I mean, there's a booster shot, which is really helpful, can be really helpful, but has had a hugely low and disappointing uptake rate, even amongst people who are most susceptible to COVID. We still have, you know, 300-400 people dying every day of COVID. People just normalizing that. That means pretty much in a week, you're having one event which is as large as, or close to being as large as, 9/11 was. That's happening every single week. And we're in a quiet phase of the pandemic right now. So, so obviously, the initial phase of the pandemic, we thought, wow, who would have guessed that society would do all of this to protect the most vulnerable people in the population? That was, you know, first half of 2020, or first nine months of the pandemic? Well, here we are in 2022. And it's sort of like, oh, well, okay, so 400 people died today. Well, so, so what? You know, so there's been lots of changes. And then you go and look at other countries where they would love to have the vaccines that are going to waste here. So I think the answer to the question of will we ever go back to as it was before...can't see how, and the changes that have happened are extremely heterogeneous throughout the world. In, say, Japan, where one of my family members lives, because of what happened in the early 2000s, with SARS, people are much more used to wearing masks wherever you go out, and so on. It's just just a standard thing. So the impact of that lasted until COVID, at least 20 years. So when COVID happened, people knew exactly how to behave. And so in countries like Japan, Taiwan, some other countries, you know, their incidence rates of COVID, the death rates and so on, far, far lower than in the US. So those changes in their society as a result of what happened in the first SARS were very long lived. So I don't see why it would be any different in this particular case, except the changes in the US might be very, might be very different. Those changes might be the, you know, the complete bifurcation of society into into two different viewpoints about infectious disease. So I think those things are probably long rooted. I don't think the pandemic is going to go away. The suddenly--one of the things that I was trying to explain to people very early on was that there's no scientific reason why the virus should get more and more benign, as people said, and many people said, well, viruses get more and more benign as they get older because they kill you know, any virus that kills [a?] population is not going to spread. And that argument is fallacious in the case of SARS-CoV-2, because SARS-CoV-2 spread before you start feeling symptoms. And so, you know, if SARS kills you, well, you've already passed on the disease to other people, so it doesn't affect it spread. And so what we've seen is that that is true, it has--different variants have different levels of virulence. We're now in a situation where monoclonal antibodies are no longer working for the variants of SARS-CoV-2 that are circulating as we speak right now. So, you know, whether or not there'll be a wave in winter, I don't know. But the other thing is, we don't know, we don't really know how to tell, because we've stopped sampling. We stopped surveillance. If the hospitals fill up, we'd be able to know about that. But on the other hand, one of the most dangerous ways that you can get sick from COVID is through long COVID. And that's my own personal things I'm worried about. I don't want to have long COVID. I have a friend who suffers from long COVID, who, after months and months and months is still not able to walk very far and has brain fog and things like this. So those things aren't recorded any of the statistics of [inaudible], hospital occupancy, and ICU and death and so on. We see in the US, there's, people know that there's a reduction in the workforce. In the UK last week, the Bank of England talked about the threats to the English economy. And they specifically mentioned two things. One was the post Brexit economic stuff, but the other was, was that--I've forgotten what the numbers were--but I think they were like half a million people were out of the workforce because of ailments associated to COVID. So those sorts of changes, which don't get much of the headlines are dramatically affecting society. Not just in supply chains, such as you hear about

what's happening with factories, say in in China when they have lockdowns there, but also things like, you know, here's a simple story, I go to my bank and I want to open a safe deposit box as I move to California. Well, you can't...there aren't people, enough people, to work in the bank, to be able to do all these things. So your bank is saying we can't get people to work here. You know, this is a well-paying bank, one of the biggest banks in the US. So there are major changes that perhaps don't get the headlines so much, but are certainly changing the way society has functioned.

Paul Gilbert II 57:39

There's a saying that I've heard ever since I was on the high school staff of my school newspaper--if it bleeds, it leads. In other words, if something particularly shocking or eye catching happens, that will be the top story. And things that are just as, if not more, important don't get the same attention from the news because they're concerned that it's not going to, by extension, get the attention of viewers unless you have a--[to Nigel] help me out with the physics--critical mass, a critical mass of either numbers or people that make this otherwise mundane thing worthy of writing about. Your example of the bank doesn't have enough people in order to fully staff tellers is a very important thing to make mention of because that's a critical part of our financial industry that is not functioning because of this. But unless Bank of America publishes a report saying that they have, I don't know, 100,000 vacancies across all of their branches in the wake of COVID, the *New York Times* is not going to bat an eye.

Nigel Goldenfeld 59:07

Right, right. That's right. And in fact, the bank was, is the Bank of America. And [inaudible], and well, they probably do say this in their financial, their quarterly reports, to their investors, and so on. I'm sure, I don't think any of this is secret but as you say, there's journalistic selectivity even amongst the best outlets, so...and best intentions.

Paul Gilbert II 59:27

I think this is as good of a time as any to lament the fall of traditional media sources as sources and conveyors of information.

Nigel Goldenfeld 59:56

Well, I think the biggest problem is the--not just the national outlets--but the decline in local reporting due to, amongst other things, private equity companies taking over such outlets and dismantling them. And, but this is an example where it's actually really important because COVID does happen locally and you really need to have good reporting on the ground. So yeah. So before we end--I was looking at the questions that you had written down was wind down. Did you want to go through those wind-down questions you've listed in this document that you'd sent me?

Paul Gilbert II 1:00:48

[Thinking to himself] I thought I did cover that...I asked you about the University's and the state's responses, and I also asked you about will we return to normal...I guess the only thing that I've asked and I felt like it was kind of redundant, because you had made it very clear, especially in the first interview that "no, we didn't screw up. People did not understand whether that was willfully ignorance or, just, we had a communication breakdown, what exactly our modelings were trying to say, and we

have made great strides to improve that." I don't think--and maybe I'm putting words in your mouth--that you would change much about what you and your team did during the pandemic?

Nigel Goldenfeld 1:01:45

No, that's right. But you did ask me if I could have done anything different, what would it have been? I have an answer to that.

Paul Gilbert II 1:01:56

Okay, what would you have done differently? I am a fairy godmother and wave a magical wand, grant you the ability to do whatever you want, what is it?

Nigel Goldenfeld 1:02:07

I would have played my piano more during the pandemic. Because I was working sixteen, sometimes eighteen, hours a day on trying to do pandemic work and then struggle to sort of keep my research group going and teach my courses and so on. And so the thing that I didn't do, which I regret is not playing the piano. And so, you know, I lost a lot of ability to play Chopin and things like that, which were, which will take me a long time to recover. So the point about that is, when in places like this, work-life balance is one of the things that inevitably suffers, perhaps, and well...so you have to make it, so there's a lot of sacrifices that are made, like, the sacrifices that I made are minor, very minor compared to the ones that you know, people who are on the frontlines--nurses and doctors, people working in hospitals and so on--had to make, and many others I mean, there's no comparison. But in terms of what I would have done differently, I would have liked to play piano a bit more...I got I got sick as a result of working too hard, and then not paying proper attention to my own health. So that's something I would have, I would change if I had to do it again.

Paul Gilbert II 1:03:40

Was the comment on--this is not something that we have to include in the records, it's just something I thought about that was funny--when you said that you wanted to play more Chopin namely, was that you making a joke about Piano Sonata No. 2, or in general parlance, The Funeral March?

Nigel Goldenfeld 1:04:07

No, no. Actually, that sonata has a, is a great sonata, and it has an ending which is impossible to play, at least for someone at my level. No, no, I just...my hobby was playing Chopin.

Paul Gilbert II 1:04:25

Because I'm just saying, that would have been a great example of British dry wits of, "I'm just going to sneak in that funeral march joke and see if anyone caught it."

Nigel Goldenfeld 1:04:35

No, no, I wouldn't do that because that would be in real bad taste, you know, nearly one and a half million, well, for certainly, one of the half million Americans died from this, many of which could have been prevented. So that wasn't the reason. This is just purely...my own personal, mental, and physical well-being suffered as did many, many people's, far more than mine, I would say. But I would try to do it

a bit better, I would try to drink more and eat more and not end up in hospital like I did last year, and things like that.

Paul Gilbert II 1:05:19

Alright, thanks again for agreeing to continue our initial conversation. Man, we have so much more information on just how involved you, Sergei [Maslov], and all the other people at the University were in terms of, not just keeping the student population safe, but also trying to forecast the...I can only imagine nearly unforecastable...of this pandemic and how the action of millions impact untold millions more.

Nigel Goldenfeld 1:06:02

Yeah.

Paul Gilbert II 1:06:05

Is there anything else that you want to add before we stop recording?

Nigel Goldenfeld 1:06:11

No, thank you very much for your really well thought out questions that stimulated a lot of recall. I hope it's useful and if you have any others I'm always ready to provide my input to your project. I think it's very important to preserve this sort of thing.

Paul Gilbert II 1:06:35

I hope you have a great Thanksgiving.

Nigel Goldenfeld 1:06:37

Yeah, I hope both of you do, too...celebrate with family or at least take a break. And I will repeat my usual cynical jokes I [make of?] Thanksgiving as a non-American [inaudible]. So anyway, so yeah. So enjoy the break and all the best.

Tech 1:07:05

Thank you.

Nigel Goldenfeld 1:07:06

Thank you. Bye bye.