

**THE NEW NORMAL:
PREPARING FOR AND ADAPTING TO
THE NEXT PHASE OF COVID-19**

HEARING
BEFORE THE
SUBCOMMITTEE ON INVESTIGATIONS
AND OVERSIGHT
OF THE
COMMITTEE ON SCIENCE, SPACE,
AND TECHNOLOGY
OF THE
HOUSE OF REPRESENTATIVES
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**THE NEW NORMAL:
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THE NEXT PHASE OF COVID-19**

THURSDAY, MARCH 31, 2022

HOUSE OF REPRESENTATIVES,
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT,
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY,
Washington, D.C.

The Subcommittee met, pursuant to notice, at 10:01 a.m., in room 2318 of the Rayburn House Office Building and via Zoom, Hon. Bill Foster [Chairman of the Subcommittee] presiding.

**U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
SUBCOMMITTEE ON INVESTIGATIONS AND OVERSIGHT**

HEARING CHARTER

*The New Normal: Preparing for and Adapting to the Next Phase of
COVID-19*

Thursday, March 31, 2021
10:00 a.m. EDT – 12:00 p.m. EDT
Zoom

PURPOSE

The purpose of this hearing is to discuss how research, data, and coordination efforts must evolve as COVID-19 surges ebb and flow. The hearing will examine existing gaps in data and public health preparedness as we enter the third year of the pandemic in the United States. Members and witnesses will discuss how the federal government can scale up data collection and communication to detect surges and variants as early as possible, and how federal guidance can best reflect the evolving threat of COVID-19 while minimizing social disruption.

WITNESSES

- **Dr. Ezekiel Emanuel**, Vice Provost for Global Initiatives, Co-Director of the Healthcare Transformation Institute, and Levy University Professor at the Perelman School of Medicine and The Wharton School of the University of Pennsylvania
- **Ms. Karen Ayala**, Executive Director of DuPage County Board of Health
- **Dr. Lucy McBride**, Practicing Primary Care Physician in Washington, DC
- **Dr. Mariana Matus**, Co-Founder, Biobot Analytics

OVERARCHING QUESTIONS

- What research and data gaps have emerged as we enter the third year of the pandemic, and how can federal resources best be leveraged to close these gaps?
- What are the most useful metrics to judge whether a particular municipality, state, or nation should implement increased protective measures?
- How can data collection and communication be improved to get information to public health decision makers across the country?

“Endemic” COVID-19?

In recent months, conversation around the transition to the next phase of the pandemic has invoked the concept of COVID-19 as “endemic.”¹ Endemicity has been posed as a potentially permanent offramp from current pandemic COVID. The Centers for Disease Control (CDC) classifies endemic levels of disease as the constant or usual presence of an infectious agent in a particular area.² The recent omicron surge and current rising COVID levels in Europe and Asia have made it clear that we are not at a point where disease levels are constant and predictable. COVID infection and mortality rates are also tied to external factors such as vaccination rate, protective measures such as masking, and hospital capacity, which vary from community to community and will have differing impacts on unpredictable future variants. It may be years before COVID-19 meets the CDC definition of endemic.

Even diseases that have been circulating for decades are perhaps inappropriate to classify as endemic. While tuberculosis, HIV/AIDS, and malaria are at low levels or nonexistent in wealthy countries, they remain at pandemic levels around the world.³ The COVID-19 pandemic has emphasized the importance of a global perspective in fighting infectious disease.

While “endemic COVID” has been used as a shorthand in discussions of the new normal of living with COVID-19, the term is imprecise and unlikely to apply to a virus that continues to mutate unpredictably. This hearing will therefore focus on the steps that must be taken to prepare for and adapt to the likely scenario that COVID-19 levels will continue to ebb and flow across the country and the globe.

Vaccines

In the past two years, a growing understanding of the virus has allowed public health entities to determine what metrics give us the best understanding of a particular individual’s risk of contracting, suffering from, and dying from COVID-19. Early on, it was clear that age and underlying health conditions contributed to the risk of severe illness and death. Eighty-one percent of those who have died from the virus were aged 65 and older; and underlying lung, heart, and autoimmune conditions, among others, increase the likelihood of developing severe illness.⁴

Vaccines were rolled out to the general population of the United States in the first half of 2021. All three vaccines granted Emergency Use Authorization by the Food and Drug Administration by spring 2021 were at least 85 percent effective at preventing serious illness within a month of receiving the recommended doses.⁵ Getting vaccinated is an incredibly important step to reducing risk at the individual level – during the omicron surge, unvaccinated individuals were

¹ <https://www.wired.com/story/covid-will-become-endemic-the-world-must-decide-what-that-means/>

² <https://www.cdc.gov/csels/dsepd/ss1978/lesson1/section11.html>

³ <https://www.statnews.com/2021/07/06/why-arent-diseases-like-hiv-and-malaria-which-still-kill-millions-of-people-a-year-called-pandemics/#:~:text=HIV%20and%20AIDS%2C%20tuberculosis%2C%20and%20malaria%20shouldn't%20be,been%20beaten%20in%20rich%20countries>

⁴ <https://www.mayoclinic.org/diseases-conditions/coronavirus/in-depth/coronavirus-who-is-at-risk/art-20483301>

⁵ <https://www.fda.gov/emergency-preparedness-and-response/coronavirus-disease-2019-covid-19/covid-19-vaccines>

23 times more likely to be hospitalized than those who had received booster shots, and 5.3 times more likely than those who had been vaccinated but not boosted.⁶ However, data on infectiousness, hospitalization, and death during the omicron surge showed that vaccine efficacy declined compared to previous surges, including the delta wave.⁷ Furthermore, we have fallen short on both national and international vaccination goals, due to a combination of widespread misinformation and, in low- and middle-income countries, production and distribution issues.⁸ An under-vaccinated population puts both vaccinated and unvaccinated individuals at higher risk as the ground remains fertile for new variants to proliferate.

Confronting the problem of an under-vaccinated population in the United States will require an understanding of vaccine hesitancy in populations that are persuadable and investing in public health communication to meet individuals where they are.⁹ Despite ongoing questions about the ideal dosing, booster sequencing, and how efficacy differs across different populations and against new variants, it is incontrovertible that vaccines improve an individual's likelihood of avoiding severe or fatal COVID.

Testing

The landscape of COVID-19 testing has changed dramatically in the past two years. Americans now have access to tests through a combination of test centers, pharmacies, hospitals, and antigen tests available over the counter and from the U.S. government.¹⁰ Due to falling case numbers and individuals' increasing preference for at-home antigen tests, many local and state governments are shuttering mass testing sites.¹¹ While PCR tests have been considered the gold standard for much of the pandemic, antigen tests offer some advantages – test results are available immediately, and offer a better indication of contagiousness, while PCR test results take hours, if not days, and can remain positive past the point of contagiousness.¹²

Despite the convenience of antigen tests, accuracy remains a problem to the point that the CDC recommends taking multiple tests within a relatively short timeframe for more reliable results.¹³ In addition, antigen test results are decoupled from virus surveillance networks. This prevents public health authorities from getting a full understanding of the prevalence of COVID-19 in the community, potentially delaying a timely and comprehensive response. It also creates a barrier for individuals who test positive and need to seek treatment. Investing in a robust reporting

⁶ <https://www.fiercehealthcare.com/providers/unvaccinated-23-times-more-likely-boosted-be-hospitalized-during-omicron-wave>

⁷ https://www.washingtonpost.com/health/interactive/2022/vaccine-omicron-effectiveness/?itid=hp_pandemic&itid=lk_inline_manual_3

⁸ <https://www.covidroadmap.org/roadmap>

⁹ <https://www.nature.com/articles/s41591-022-01713-6>

¹⁰ <https://www.whitehouse.gov/briefing-room/statements-releases/2022/01/14/fact-sheet-the-biden-administration-to-begin-distributing-at-home-rapid-covid-19-tests-to-americans-for-free/>

¹¹ <https://www.nytimes.com/live/2022/03/20/world/covid-19-mandates-cases-vaccine#some-states-in-the-us-are-closing-virus-testing-sites-despite-fears-of-a-new-surge> , <https://www.axios.com/local/austin/2022/03/21/austin-covid-testing-sites-shutter> , <https://www.axios.com/local/twin-cities/2022/03/21/minnesota-tim-walz-to-close-testing-vaccine-sites>

¹² <https://www.washingtonpost.com/opinions/2022/01/26/use-rapid-antigen-tests-instead-of-pcr/>

¹³ <https://www.cdc.gov/coronavirus/2019-ncov/testing/self-testing.html>

system for positive antigen tests can bolster public health response, improve individual outcomes, and expand the reach of clinical trials of new treatments.¹⁴

Epidemiologists have suggested that a more robust testing infrastructure should incorporate a test-to-treat model, connecting those who test positive to health professionals who can assess any relevant underlying conditions, prescribe appropriate therapeutics, offer enrollment in relevant clinical trials, and provide advice on protecting patients and their families.¹⁵ A scaled-up test-to-treat paradigm, in concert with scaled up genomic sequencing to shorten the lag between sample collection and variant identification, could also inform treatment options, as treatments successful against delta have been shown to be less effective against omicron.¹⁶

Gaps in data collection of positive test results also has the potential to underestimate the number of people who have some level of COVID-19 immunity. Infection with COVID-19 confers a level of immunity against re-infection.¹⁷ Antibody levels are even more durable amongst those who received two doses of mRNA vaccines either before¹⁸ or after infection.¹⁹ Infection-induced immunity appears to wane more quickly than vaccine-induced immunity,²⁰ but a full understanding of the level of COVID resistance in a community requires a better accounting of the virus's permeation among vaccinated and unvaccinated people alike. More robust reporting structures for positive PCR and antigen tests will improve our ability to make informed decisions on protective measures, facilitate broader genomic sequencing of samples, and allow better forecasts of future surges.

CDC Community Levels Dashboard

On February 25th the CDC deployed the Community Levels Dashboard. Previous community recommendations were based on the number of new cases and the percent of positive tests, which the CDC felt did not sufficiently capture the risk levels for omicron community spread.²¹ The number of cases was maintained as a metric, and two new metrics, hospital admissions and percent of hospital beds in use by COVID patients, were added to shift the focus towards where omicron was most burdening the healthcare system.²²

Though the metrics did not always reflect it, mortality rates have been tied to hospital capacity since the beginning of the pandemic.²³ Rural areas in particular are vulnerable to severe surges, because rural hospitals have been closing at an accelerating rate over the past decade and rural

¹⁴ <https://www.covidroadmap.org/roadmap>

¹⁵ Ibid.

¹⁶ <https://www.statnews.com/2022/03/25/fda-limits-therapy-ineffective-against-ba2-variant-omicron/>

¹⁷ <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/covid-natural-immunity-what-you-need-to-know>

¹⁸ <https://www.hopkinsmedicine.org/news/newsroom/news-releases/in-covid-19-vaccinated-people-those-with-prior-infection-likely-to-have-more-antibodies>

¹⁹ <https://www.nejm.org/doi/full/10.1056/NEJMc2201607>

²⁰ <https://www.hopkinsmedicine.org/health/conditions-and-diseases/coronavirus/covid-natural-immunity-what-you-need-to-know>

²¹ <https://www.cnn.com/2022/02/23/health/cdc-covid-metrics/index.html>

²² https://www.cdc.gov/coronavirus/2019-ncov/science/community-levels.html#anchor_82254

²³ <https://news.yale.edu/2021/02/01/lack-icu-beds-tied-thousands-excess-covid-19-deaths>

areas have mortality rates almost double those of metropolitan areas.²⁴ Incorporating hospital capacity and resources into the CDC Community Levels Dashboard allows for a more nuanced prediction of the impact of a COVID surge on both urban and rural populations.

To power the Dashboard, case rate data is collected by hospitals, healthcare providers, and laboratories, which then communicate it to a public health authority for aggregation and transmission to the CDC. The other two metrics are drawn from the Department of Health and Human Services Unified Hospital Data Surveillance System.²⁵ The process of transmitting data from the frontlines to the CDC is far from simple. Though the CDC corroborates the data where possible, both the CDC and public health officials acknowledge that the data can be incomplete.²⁶ Data reporting can be especially strained when the demands of a spike in cases detracts from hospital staff's ability to enter timely health data into their system.

Once data are put into the Dashboard, there are clear thresholds for each metric which combine to produce a green, yellow, or red rating for a county depending on the level of risk. Each level then corresponds to individual and community level recommendations. Green counties are simply encouraged to have residents stay up to date with vaccines, while red counties are encouraged to deploy indoor masking, and significant testing²⁷. Tangible recommendations based on local risk level are key to navigating a new normal, where precautions will need to scale up and ease back based on the best available information, rather than come to an end altogether.

Wastewater Surveillance

By the time positive tests, hospital strain, and mortality begin to rise in a particular area, COVID has been spreading at elevated levels in that community for days or even weeks.²⁸ Wastewater surveillance offers an opportunity to detect COVID-19 spikes days before the impact is seen at testing centers and hospitals.

In November 2021, the omicron variant was detected in wastewater across the nation 11 days before it was detected in a test sample.²⁹ Wastewater surveillance works by sampling wastewater from sewers and treatment plants to detect virus RNA secreted by those infected with the virus. Many states and municipalities stood up wastewater surveillance programs in the past two years, and as of February 4, 2022, the CDC has published wastewater data from 672 participating sites.³⁰

In addition to serving as a leading indicator of COVID surges, wastewater surveillance can provide researchers with a wealth of data on emerging and potential variants. Researchers have

²⁴ <https://www.politico.com/news/2022/03/19/covid-closed-rural-hospitals-tennessee-deaths-anti-vax-conspiracies-00018204>

²⁵ <https://covid.cdc.gov/covid-data-tracker/#county-view> Footnotes

²⁶ <https://www.cdc.gov/coronavirus/2019-ncov/covid-data/faq-surveillance.html>

²⁷ <https://www.cdc.gov/coronavirus/2019-ncov/your-health/covid-by-county.html>

²⁸ <https://www.hawaiidata.org/news/2020/8/4/importance-of-leading-lagging-indicators-monitoring-hawaii-covid19>

²⁹ <https://www.scientificamerican.com/article/wastewater-monitoring-offers-powerful-tool-for-tracking-covid-and-other-diseases/>

³⁰ <https://covid.cdc.gov/covid-data-tracker/#wastewater-surveillance>

identified variants in wastewater that have never been detected in human samples, which can provide insight into how the virus might mutate into another variant and inform how particular sequences might contribute to the virus's ability to evade the human immune system response.³¹

The Department of Health and Human Services and the CDC lead a National Sewage Surveillance Interagency Leadership Committee that consists of representatives from nine federal agencies and to collect and analyze COVID wastewater data and communicate with state and local partners.³² Continued investment to expand the scope of surveillance efforts can help in the fight against COVID-19 as it ebbs and flows, and the infrastructure put in place can provide a wealth of public health information beyond the current pandemic.

The Next COVID Wave

There are early indicators that another wave of COVID may be on its way in the US. This wave would be driven by the BA.2 variant of omicron, which is about 30 percent more infectious than BA.1.1 omicron variant which caused the previous domestic spike³³. BA.2 is already present in the United States and has steadily grown to 35 percent of U.S. COVID cases as of the week ending on March 19th.³⁴ Europe, which has repeatedly been a leading indicator for U.S. cases, has seen BA.2 dominate other variants, including BA.1.1, and cases are slowing in their descent or rising in France, the United Kingdom, and Italy.³⁵ Additionally, wastewater data in the United States, a leading indicator as discussed above, has begun to show spikes in certain regions of the country, though with cases low overall in the United States it is difficult to separate signal from noise.³⁶

These alarming indicators come as large numbers of U.S. citizens abandon the individual behaviors previously employed to contain the pandemic. Mask mandates and proof of vaccine requirements have been lifted across the United States,³⁷ and the availability of tests, treatments, and vaccines is expected to decline.³⁸ Both factors may exacerbate the severity of the next COVID wave.

Despite the concerning indicators, another spike in cases is not necessarily imminent. White House Chief Medical Adviser Dr. Anthony Fauci has said that while there may be an uptick in cases, a full surge is unlikely.³⁹ Countries such as Austria, Germany, and Greece are already seeing a decline in case counts following the spike due to BA.2.⁴⁰ Moreover, early studies

³¹ <https://www.nytimes.com/2022/02/03/health/coronavirus-wastewater-new-york.html>

³² <https://www.cdc.gov/healthywater/surveillance/wastewater-surveillance/federal-coordination-partnering-wastewater-surveillance.html>

³³ <https://www.medrxiv.org/content/10.1101/2022.01.28.22270044v1>

³⁴ <https://covid.cdc.gov/covid-data-tracker/#variant-proportions>

³⁵ <https://ourworldindata.org/explorers/coronavirus-data-explorer?facet=none&Metric=Confirmed+cases&Interval=7-day+rolling+average&Relative+to+Population=true&Color+by+test+positivity=false&country=ITA-GBR-FRA>

³⁶ <https://covid.cdc.gov/covid-data-tracker/#wastewater-surveillance>

³⁷ <https://www.nytimes.com/explain/2022/03/01/us/mask-mandates-us>

³⁸ <https://www.nytimes.com/2022/03/25/opinion/covid-funding-congress-biden.html>

³⁹ <https://www.cnbc.com/2022/03/23/covid-omicron-bapoint2-subvariant-will-soon-dominate-in-us-but-fauci-doesnt-expect-another-surge.html>

⁴⁰ <https://ourworldindata.org/explorers/coronavirus-data-explorer?facet=none&Metric=Confirmed+cases&Interval=7-day+rolling+average&Relative+to+Population=true&Color+by+test+positivity=false&country=DEU-GRC-AUT>

suggest that a BA1.1 omicron infection does provide protection from BA.2, so the recent wave of cases may protect against a BA.2-fueled wave.⁴¹ Finally, the warming weather and current decrease in time spent inside in close quarters may also play a part in decreasing the impact of BA.2 in the United States.⁴² However, even if another spike in COVID cases is not imminent, it is still likely over a longer time frame.

⁴¹ <https://www.nature.com/articles/d41586-022-00558-w>

⁴² <https://www.theatlantic.com/health/archive/2022/03/omicron-subvariant-new-covid-wave/627094/>

Chairman FOSTER. Well, the hearing will now come to order. And without objection, the Chair is authorized to declare recess at any time.

Before I deliver my opening remarks, I wanted to note today that the Committee is meeting both in person and virtually. And I want to announce a couple of reminders to the Members about the conduct of this hearing. First, Members and staff who are attending in person may choose to be masked, but it is not a requirement. However, any individuals with symptoms, a positive test, or exposure to someone with COVID-19 should wear a mask while present.

Members who are attending virtually should keep their video feed on as long as they are present in the hearing. Members who are—are responsible for their own microphones, and so please keep your microphones muted unless you are speaking. Finally, if Members have documents they wish to submit for the record, please email them to the Committee Clerk, whose email address was circulated prior to the meeting.

Well, good morning, and welcome to our Members and to our panelists. Thank you for joining us for this hearing on preparing for the next phase of COVID-19. Over the past two years, this Subcommittee has held a number of hearings on the pandemic, often with an eye to how lessons learned can pave an easier path through health crises to come. But the current fight against COVID-19 looks far different than it did in March 2020, and we must consistently evaluate how existing tools meet our needs as case counts ebb and flow.

Fortunately, national COVID cases have been going down since the January omicron peak. And after a difficult winter, where the death rate has surpassed the rate during the delta surge, spring has arrived. Around the country, mask mandates have relaxed, schools have opened, and now I'm chairing this Subcommittee hearing in person for the first time in two years. But we learned from previous lulls that we cannot expect this period to last forever.

Now is the time to invest in research and infrastructure that can detect the next pandemic variant as early as possible, determine what communities will be at high risk of surges, and implement protective measures and communication strategies to minimize incidence of severe and fatal infection.

Our witnesses here today exemplify a broad umbrella of COVID preparedness and response. Today, we'll discuss the great strides that have been made in vaccines and therapeutics to prevent and treat COVID-19 and what more research must be done to ensure a robust response to future variants. We'll talk about public receptiveness to behavioral mitigation measures and how these tools can be scaled up or eased back based on the best available information. We'll unpack what goes into that information, what metrics must be—we must get better at collecting, and how we can most effectively analyze these metrics to determine the relative risk in our communities. And we'll discuss how that information is best communicated at the individual level, to ensure that people are empowered with the facts and tools that they need to protect themselves and their families.

Entering a new phase of the pandemic does not mean we've declared victory over the virus, nor does it mean that we are resigning ourselves to a never-ending state of crisis. The landscape has changed immensely in the past two years, and that is a testament to the incredible research that's been done on how the virus and how we behave.

Unfortunately, as public health guidance shifts to incorporate new information, it's all too often interpreted as being flaky or unreliable. Changing recommendations regarding mask-wearing are looked at with skepticism, and research on vaccine efficacy in the face of new variants causes everything from cynicism to panic.

I am often struck by how navigating through this crisis resembles the job of an ancient sea captain. A captain should not be criticized for changing course as the wind shifts, but any captain who deliberately ignores signals of an approaching storm has no place at the helm. Today's fair weather may indicate the end of the storm, or we may be simply passing through the eye of the cyclone. And a captain will receive advice from everyone from the grizzled old salts who have survived many stormy passages, to young seamen terrified of stories of sea monsters and falling off the edge of the Earth. And that was even before social media. And the captain must also answer both to his investor's desire to get the cargo to market on time, and to the mothers and children of every person onboard.

But in the end, what has made sea travel far safer today has been science: the tools of navigation, weather forecasting, ship construction, understanding and treating the chronic vitamin C deficiencies of his crew, and maintaining a proper written record of lessons learned.

And we've learned so much about this virus that reached our shores two years ago, but if this knowledge is not thoughtfully communicated to the public, misinformation will fill in the gaps. It's unlikely that we've seen the last surge of COVID-19. And the good news is that we are more prepared than ever to confront what comes. We must seize the opportunity to build upon what we've learned. It's imperative that we continue to invest in data tracking and communication capabilities at every level, and to ensure public health decisionmakers have the best information to make recommendations. Misinformation must be confronted thoughtfully and aggressively.

Outstanding questions on issues such as long COVID, infection-based immunity, and therapeutic cocktails should be aggressively pursued by scaling up clinical studies. And while we may not be out of the woods yet, we have the opportunity to meet future COVID surges with clearer eyes and stronger tools.

So I look forward to the hearing today from our witnesses, and learning about how we can bolster preparedness efforts in the next phase of the COVID-19 pandemic.

[The prepared statement of Chairman Foster follows:]

Good morning, and welcome to our members and our panelists. Thank you for joining us for this hearing on preparing for the next phase of COVID-19. Over the past two years, this Subcommittee has held a number of hearings on the pandemic, often with an eye to how lessons learned now can pave an easier path through health crises to come. But the current fight against COVID-19 looks far different

than it did in March 2020, and we must constantly evaluate how existing tools can meet our needs as case counts ebb and flow.

Fortunately, national COVID cases have been going down since the January omicron peak. After a difficult winter, where the death rate has surpassed the rate during the delta surge, spring has arrived.

Around the country, mask mandates have relaxed, schools have opened, and now I'm chairing this subcommittee hearing in person for the first time in two years. But we learned from previous lulls that we cannot expect this period to last forever. Now is the time to invest in research and infrastructure that can detect the next problematic variant as early as possible, determine what communities will be at high risk of surges, and implement protective measures and communication strategies to minimize incidence of severe and fatal infection.

Our witnesses here today exemplify the broad umbrella of COVID preparedness and response. Today we'll discuss the great strides that have been made in vaccines and therapeutics to prevent and treat COVID-19, and what more research must be done to ensure a robust response to future variants.

We'll talk about public receptiveness to behavioral mitigation measures, and how these tools can be scaled up and eased back based on the best available information.

We'll unpack what goes into that information—what metrics we must get better at collecting, and how we can most effectively analyze these metrics to determine relative risk level in our communities. And we'll discuss how that information is best communicated at the individual level, to ensure that people are empowered with the facts and tools they need to protect themselves and their families.

Entering a new phase of the pandemic does not mean we've declared victory over the virus, nor does it mean we are resigning ourselves to a never-ending state of crisis.

The landscape has changed immensely in the past two years, and that is a testament to the incredible research that has been done into how the virus—and we—behave. Unfortunately, as public health guidance shifts to incorporate new information, it's all too often interpreted as being flaky and unreliable.

Changing recommendations regarding mask-wearing are looked at with skepticism, and research on vaccine efficacy in the face of new variants causes everything from cynicism to panic.

I am often struck by how navigating through this crisis resembles the job of an ancient sea captain. A Captain should not be criticized for changing course as the wind shifts, but one who deliberately ignores signals of an approaching storm deserves no place at the helm. Today's fair weather may indicate the end of the storm, or we may simply be passing through the eye of the cyclone.

A captain will receive the advice of everyone from the grizzled old salts who have survived many stormy passages, to young seamen terrified of stories of sea monsters and falling off the edge of the flat earth.

And the captain must answer both to his investor's desire to get their cargo to market on time, and to the mothers and children of every person aboard.

But in the end, what has made sea travel much safer today has been science: the tools of navigation, weather forecasting, ship construction, understanding and treating the chronic Vitamin-C deficiencies of his crew and maintaining a proper written record of lessons learned.

We've learned so much about this virus that reached our shores just two years ago, but if this knowledge is not thoughtfully communicated to the public, misinformation will fill in the gaps.

It is unlikely that we've seen the last surge of COVID-19. The good news is that we are more prepared than ever to confront what comes. We must seize the opportunity to build upon what we've learned. It is imperative that we continue to invest in data tracking and communication capabilities at every level, to ensure public health decision makers have the best available information to make recommendations. Misinformation must be confronted thoughtfully and aggressively.

Outstanding questions on issues such as long COVID, infection-based immunity, and therapeutics cocktails should be aggressively pursued by scaling up clinical studies.

We may not be out of the woods yet, but we have an opportunity to meet a future COVID surge with clearer eyes and stronger tools.

I look forward to hearing from our witnesses today about how we can bolster preparedness efforts in the next phase of the COVID-19 pandemic.

I now yield to Ranking Member Obernolte for his remarks.

Chairman FOSTER. And I now yield to Ranking Member Obernolte for his remarks.

Mr. OBERNOLTE. Well, thank you very much, Captain Foster.

Chairman FOSTER. Aye, aye.

Mr. OBERNOLTE. And thank you to the Chair for convening what as usual is a very timely and I'm sure will be a very informative hearing.

You know, it's—we're here in the Science, Space, and Technology Committee, and I think it's, you know, a very timely discussion to have to think about the application of science to fighting the spread of COVID and to reflect on the lessons that we've learned over the past couple of years because, as the Chair said, this is not something that's over and done with. It's something that we're going to be dealing with for many years. And it also is something that we have to learn from because this—you know, we would hope that this would be the last pandemic the world experiences, but history shows that it's probably not going to be. And we certainly would be doing society a disservice if we did not apply the lessons that we've learned here.

So I'll tell you a couple of things that I'm looking forward to talking about in this hearing. First of all, I think that we need to be more holistic about considering what our goals are when we institute public health measures in response to a pandemic because it seems pretty clear looking at what has happened with COVID that focusing on merely containment is probably not the right thing to do. Containment proved to be impossible with many of the variants of COVID. The countries that were the most draconian in trying to contain rather than trying to manage the spread of the virus are some of the ones that did the worst in terms of healthcare outcomes. So I look forward to having that discussion.

And I also think it's time that we acknowledge the fact that when we are contemplating what to do to mitigate the spread, that we contemplate all of the societal costs that are borne, not just the health costs, and that's something that we kind of learned to our more misfortune through the recent pandemic is that we've got a lot of societal costs that public health officials were not considering when they made some of these decisions, for example, things like learning loss in children, for example things like behavioral health issues, things like substance abuse issues that occur when people are not allowed to socialize with each other, and certainly the economic costs that are imposed on society by actions like lockdowns.

Not to say that any of those are more important than stopping the spread of a variant, but we would be foolish not to consider the fact that the actions that we take as a government do have societal consequences. And I think that we've determined kind of through this process that making these decisions is more complex, that we have to kind of weigh all of these different factors. And although it is difficult to balance something like an economic cost against lives lost, we have to somehow parse that metric.

And to something that the Chairman just mentioned, communication I think is something that we've learned is much more important than we ever thought it was. The words that we use when we communicate with the public about the science of an epidemic are critically important and the fact that we need to maintain the public's trust. In many cases I think that we were—we had kind of a scientific arrogance in our communication with our public over the last couple of years, and that's something that we need to avoid

in the future because only through being transparent and honest with the public can we get them to trust us when we tell them that a certain action is the best thing for society.

We certainly can't hide things like uncertainty and tell people that this is the right thing and then tomorrow tell them that the science has shifted and something else is now the right thing to do. That's going to shatter their trust. We need to be upfront and honest with them when uncertainty exists.

And then lastly—and I'm—I don't think any of our witnesses today would have the sand to tell us this, but, you know, we as public leaders, I think we need to learn by example, and that's something that we've learned to our misfortune over the last couple of years. The words that we use are very important, and the actions that we take are very important. And I think that events in my home State of California and States around the country have proven that when public officials are caught not following their own guidance, that is incredibly destructive to public trust. So that's something I think we need to keep in mind as we not only go through this hearing but as we contemplate the way to handle epidemics in the future.

So, Mr. Chairman, I'm looking forward to the hearing with you and looking forward to see what our witnesses have to say. I yield back.

[The prepared statement of Mr. Obernolte follows:]

Good morning. Thank you, Chairman Foster, for convening this hearing. And thanks to our witnesses for appearing before us today.

We are here today to discuss "the New Normal" and how we can best prepare for and adapt to the next phase of COVID-19 and beyond. I'm glad that we're here today looking forward at what's to come, and I believe to be successful we need to examine what worked and what didn't over the past two years of this pandemic. I think we can all agree that the government's response hasn't been perfect. So we need to consider what lessons we've learned so that we can avoid making similar mistakes in the future.

First and foremost, to establish a "new normal" we need to set specific goals for combating COVID-19 to guide the implementation of reasonable policies. We can't expect zero transmission, so we need commonsense policies that not only protect the most vulnerable, but also allow our schools, workplaces, and business to return to normal operating status as quickly as possible. Containing the virus must be a priority, but so is avoiding additional long-term consequences, like those being reported in children from mask mandates.

Second, we need public health officials to clearly communicate these goals and policies so that Americans know what to expect as we move forward. I can't emphasize this enough.

Americans were told to "trust the science" but the science wasn't being fully and clearly communicated. That led to a lot of mistrust and vaccine hesitancy. So we must clearly communicate up front what we do and don't yet know about the virus itself. And we need to give people the facts on the various mitigation measures that are being proposed. Public health leaders and the CDC (Centers for Disease Control and Prevention) must also avoid missteps of the past two years. They should not withhold data from the public due to fear that such data could be misinterpreted. This only serves to erode trust and create a perception that the government is hiding something. Public health decisions aren't based on medical factors alone—they must take into account other factors including social, economic, or other risks. That should be communicated. Only through clear and concise communication about what is known, what is unknown, and what is changing can we hope to restore Americans' trust in the public health apparatus.

Additionally, we need to look at past COVID relief funding to inform future appropriations. There is no doubt that more funding is needed for testing, vaccines, therapeutics, and the infrastructure necessary to allocate each where it is needed. Moving forward, however, we absolutely must be more responsible with hard-earned taxpayer dollars, especially given the high rate of inflation. This means investing in

areas where we can get the most bang for our buck. For example, rather than blanket handouts to states for things like luxury high-rise hotels and minor league baseball stadiums, future COVID relief funding should be measured and targeted to ensure that those at high risk and our most vulnerable populations get the vaccines, treatments, and testing that they need. Indiscriminately throwing money at the problem is not a solution—it just creates further problems.

We also need to take a good hard look at various health issues that have taken a backseat to COVID-19 during the pandemic. We should examine the adverse health consequences—physical, social, and mental—that have either cropped up during or been exacerbated by our response to COVID over the past two years. We are just beginning to see the tip of the iceberg in terms of looming mental health challenges, developmental issues in young children, and other adverse consequences of COVID-19 beyond the disease itself. These challenges cannot remain unaddressed.

Finally, we in Congress should lead by example. I'm disappointed but not at all surprised that earlier this week the Speaker extended the "covered period," allowing remote committee proceedings and vote-by-proxy to continue in the House until at least May 2022. This was done under auspices of a public health "emergency," making the "new normal" look more and more like the old normal. What's the justification for this when our kids are back in school?

How can we in good faith ask Americans throughout the country, in both the private sector and Federal workforce, to get back to work when the House refuses to do the same? How can we ask the American public to adhere to public health guidance and mitigation measures, and to follow CDC recommendations, when the Speaker isn't doing that? Throughout the pandemic, we've seen far too many examples of "rules for thee but not for me." As we move forward to the "new normal," public leaders must lead by example and adhere to the same rules that they expect the American people to follow. This, too, would go a long way in restoring Americans' trust in their public health officials and elected leaders.

In closing, we can't move into the new normal without reestablishing trust with the American people. We do that by establishing specific goals for public health, by clearly communicating and empowering Americans to make informed decisions about their own health; by spending judiciously, and by returning to normal here in Congress. We represent the American public here in the House, and we should trust our constituents to do what is needed to overcome this pandemic. If we do this, just maybe we can begin to reestablish Americans' trust in our public health apparatus. If we don't, I'm afraid the new normal may be nothing more than the old normal. And that is unacceptable.

Thank you, Chairman Foster, for convening this hearing. And thanks again to our witnesses for appearing before us today. I look forward to our discussion.

I yield back the balance of my time.

Chairman FOSTER. Thank you. And if there are Members who wish to submit additional opening statements, your statements will be added to the record at this point.

[The prepared statement of Chairwoman Johnson follows:]

Thank you Chairman Foster for holding this hearing, and thank you to all of our esteemed witnesses for appearing before the Subcommittee today. The fight against COVID-19 today looks much different than it did in March 2020. That progress is thanks to the tireless healthcare workers, researchers, public health officials, and citizens everywhere working to protect their families and communities. We must continue to build on our successes and learn from the hardships of the last two years. Today's witnesses bring a wealth of experience from many facets of pandemic response. I am looking forward to their testimonies on how we can best prepare ourselves for the next phase of COVID-19.

As we've discussed before on this Committee, this is a global battle. It will not be solved anywhere until progress is made everywhere. So long as low- and middle-income countries remain under-vaccinated, the virus will continue to circulate and mutate. Surveillance of emerging variants requires strong international research partnerships, so our world-class scientists can offer their expertise and get real-time information about variants emerging abroad.

On a national level, we must position our public health authorities to receive and share timely, good quality data. To get reliable projections of COVID surges, we need a wealth of data. We need to know the test positivity rates, which gets more difficult as take-home tests become more common than PCR tests. We need insight into how immunized a population is, whether their immunization comes from vaccines, natural infection, or a combination. We need to know whether hospital systems are overwhelmed by dwindling capacity or worker shortages. Public health

communication is a two-way street. Bolstering communication among individuals, healthcare facilities, and public health officials will be imperative to detect COVID surges early and equip our communities with the tools they need.

So much of the fight happens in the last mile. We've made such great strides in answering the grand scientific questions of how this virus spreads and kills. And how vaccines and therapeutics can save lives. We must also focus on translating knowledge to health outcomes. We need more research into how misinformation can derail effective public health communication, and how we can deliver accurate information to counteract these lies. We need to be thoughtful about reaching those who remain unvaccinated. We need to learn from past COVID surges when it comes to how we implement personal protective measures. Researching these issues can help us overcome future hurdles in public health messaging.

It is tragic that we are still battling this virus more than two years after it reached the U.S. But it is truly remarkable to reflect on the progress that has been made. We can now face the next phase of the pandemic building upon the knowledge and the infrastructure we've put in place since March 2020. I thank our witnesses for joining us today and I yield back.

Chairman FOSTER. And at this time I'd like to introduce our witnesses. Four old salts who have weathered many stormy passages. Our first witness is Dr. Ezekiel Emanuel. Dr. Emanuel is the Levy University Professor at the Perelman School of Medicine at the University of Pennsylvania. He's an oncologist, a world leader in health policy and bioethics, and has authored or edited over 350 publications and 15 books. Dr. Emanuel is currently Special Advisor to the Director General of the World Health Organization. He previously served as the founding Chair of the Department of Bioethics at the NIH (National Institutes of Health) and as a Special Advisor on Health Policy to OMB (Office of Management and Budget) and the National Economic Council.

And I will now yield to Mr. Casten to introduce his constituent and our next witness.

Mr. CASTEN. Thank you, Mr. Chairman. You are not only the master of your fate, you are the captain of your soul. It is—we're going to push this all hearing.

I'm so grateful and honored to introduce my good friend and Illinois Sixth District community health champion and expert Dr. Karen Ayala. Dr. Ayala serves as the Executive Director with the DuPage County Health Department. Prior to that role, she served as the Director of Community Health and Public Health Services since 2007. Throughout her career, Dr. Ayala has worked in community services and public health, bringing a strong commitment to social justice and a creative approach to system design.

I'm particularly proud that Dr. Ayala was responsible for the opening and management of a mass testing and vaccination facility in the district that allowed DuPage County to be one of the most successful examples in the country of why high vaccination rates could mean a quicker return to normal for businesses and students.

Just as a personal note, I am—I cannot tell you how grateful I am for all your great work, Dr. Ayala. The—you know, those moments through the crisis when we had uncertainty about the status of the disease, uncertainty about how supplies of testing and vaccines were going to be allocated from the feds to the States, from the States of the counties, learning the science as we went, and of course the growing politicization of that and all the slings and arrows that were thrown in directions of anybody, including you. You were just consistently such a rock and a beacon of strength and you

made us all look better and I know you made our constituents all feel like they were in good hands.

So thank you, Dr. Ayala, for your service to our State, to our country, and I look forward to hearing your testimony.

Chairman FOSTER. Thank you. And following Ms. Ayala, our next witness is Dr. Lucy McBride. Dr. McBride has worked on—as an internal medicine physician in Washington, D.C., for nearly two decades. She is also a prominent healthcare educator, mental health advocate, and author of a COVID-19 newsletter, as well as articles published in *The Washington Post*, *The Atlantic*, and *USA Today*. Dr. McBride’s work aims to increase the awareness of the inseparability of mental health and physical health.

Our final witness is Dr. Mariana Matus. Dr. Matus is a computational biologist by training and the CEO (Chief Executive Officer) and Co-Founder of Biobot Analytics. Biobot won multiple entrepreneurship competitions at MIT (Massachusetts Institute of Technology) for its wastewater epidemiology platform. The subject initially used its platform to track opioid usage patterns before pivoting to COVID-19 detection at the beginning of the pandemic. They were selected by HHS (Health and Human Services) to execute a national COVID-19 wastewater monitoring project and have expanded their platform to analyze wastewater treatment plants across the Nation for early warning signs of new COVID outbreaks and variants.

As our witnesses should know, each of you will have five minutes for your spoken testimony. Your written testimony will be included in its entirety in the record of the hearing. When you’ve all completed your spoken testimony, we will begin with questions. Each Member will have five question—five minutes to question the panel, and we will attempt, if time permits, to have two rounds of questions.

And we will start with Dr. Emanuel.

**TESTIMONY OF DR. EZEKIEL EMANUEL,
VICE PROVOST FOR GLOBAL INITIATIVES,
CO-DIRECTOR OF THE HEALTHCARE
TRANSFORMATION INSTITUTE,
AND LEVY UNIVERSITY PROFESSOR
AT THE PERELMAN SCHOOL OF MEDICINE
AND THE WHARTON SCHOOL
OF THE UNIVERSITY OF PENNSYLVANIA**

Dr. EMANUEL. Chairman Foster, Ranking Member Obernolte, thank you for having me. It’s a privilege to be before this Committee at this critical juncture for COVID response in our country.

As you know, this month marks 2 years since our first surge and our first lockdown in the country. We’ve experienced almost 1 million deaths, 80 million cases, tens of millions of students whose learning has been affected, and hundreds of millions of Americans who have suffered socially and economically because of this pandemic.

At this moment, we are at a critical juncture, as I mentioned. We need to confront the situation with some humility. We’re certainly going to have another surge. How bad it is, no one here in the room knows. We know that we’re going to confront some waning immu-

nity from the vaccines. We are going to confront some resistance from the virus to some of our interventions. How bad all of these things are, we don't know. The only way to stay ahead of SARS-CoV-2 virus and to get a handle and to go into the next normal smoothly is to scale up our physical, our virtual, and our human infrastructure to combat this.

As human beings, as a society, we are bad at prevention. Prevention does something in the future. It requires investing today for a return tomorrow, and we're not constitutionally by nature good at that. We always underinvest in prevention. There are loads of data about how individually we do that and how socially we do that. But we can't do that going forward.

Over the last few months, I've convened 25 of the country's leading experts on COVID to create a strategic roadmap for the country. I've submitted that roadmap as written testimony. I want to highlight six points from it.

First, we need a viral dashboard to follow to determine when we need to impose public health measures, when we can relieve them safely, how to go forward, and when we're going to be in the next normal. That dashboard has to include at least five critical items: vaccination rates, seroprevalence of the virus—of immunity in the community, wastewater testing—and you'll hear about that from others—the health system stretch, how close to the peak we are, and of course death rates in the community. All of those need to be looked at.

Truth be told, we're not there yet in measuring these five elements. We need a surveillance infrastructure that is bolstered up to measure four important things on a continuous basis: The wastewater in this country, we need standardization of that wastewater. We need it for more communities than we have it. We need to measure population immunity, which we don't do a good job of. We need to measure genetic variants. We don't do a good job of that. And we need to measure animal reservoirs, zoonotic surveillance, and we need to have a platform and have that data available in real-time. We don't have that today. That is the second item.

The third item is we need to invest in vaccines, right? Our scientific agencies need to rapidly prioritize different kinds of vaccines, mucosal vaccines, different pan-coronavirus vaccines. We need a heavy investment in that.

Fourth, we need to invest in therapeutics. Yes, we have Evusheld today, we have Paxlovid, but they're not enough. Our virus becomes resistant to these things and will more and more as they come out in the community. So we need a heavy investment in therapeutics, especially oral therapeutics that people can take readily.

Five, we need an investment in indoor air quality. It was good that OSTP (Office of Science and Technology Policy) yesterday had a major event—or Tuesday a major event on indoor air quality, a first recognition by the government of its importance. We need to standardize what good indoor air quality is and enforce it. We also need to use some of our rescue funds to get indoor air quality in schools and childcare centers up immediately using portable filters or improvements in the HVAC (heating, ventilation, and air conditioning) systems.

Finally, we need an urgent, very rapid research into long COVID. The NIH and the CDC have not prioritized this. They have studies, for example, the NIH RECOVER study, but it's got an aim of 40,000 people and it's only enrolled 1,000 people to date. We need half a million people studied to get going.

Let me just remind you, what I've said are investments in the future. They're investments in prevention. They are—should not be considered spending and wasteful spending. This is how we're going to prevent serious complications from the next surge or the next virus that comes along. Thank you very much.

[The prepared statement of Dr. Emanuel follows:]

Submitted on 24 March 2022

Oral Testimony of Dr. Ezekiel J. Emanuel, MD PhD

U.S. House of Representatives
Committee on Science, Space and Technology
Subcommittee on Investigations and Oversight

The New Normal: Preparing for and Adapting to the Next Phase of COVID-19
Thursday, March 31, 2022 | 10:00 AM ET

Chairman Foster, Ranking Member Obernolte, and members of the Subcommittee:

It is a privilege to be here with you today at this critical juncture in our nation's response to the COVID pandemic.

As you know, this month marks the two-year anniversary of SARS-CoV-2 officially being declared a global pandemic. Since that time, the U.S. has experienced nearly 1 million deaths, 80 million infections and hundreds of millions of lives dislocated economically and socially. As we look towards a "next normal", there is need for humility in acknowledging we don't know what the next few years will bring, and to be ready for a range of possibilities: new variants and surges, waning immunity to existing vaccines or previous infection, viral resistance to our current arsenal of therapeutics, and so on.

The only way to stay ahead of this virus is to prepare for different scenarios by scaling up physical, virtual and human public health infrastructure. Our system has many gaps that predate COVID. These need to be filled to address the current situation and preempt future biosecurity and pandemic threats. There are no shortcuts here. The government needs to do more, do better and move faster.

Since January, I have convened an independent, bipartisan group of 25+ public health experts in drafting a [Strategic Roadmap](#) with actionable steps for how the country can achieve – and, most importantly, sustain – this "next normal". I'd like to highlight 6 of our core recommendations.

1. [Respiratory Viral Diseases Dashboard for Policymakers](#)

When economists determine the health of the economy, they use multiple indicators: unemployment, inflation, GDP growth. Similarly, there is no single metric that dictates when we are in the "next normal", or when emergency measures should be either imposed or lifted. Policymakers should create a COVID data dashboard that tracks 5 critical metrics: vaccination rates, seroprevalence, wastewater virus levels, health system stress and death rates. Each of these metrics has a threshold at which public health interventions kick in. Chapter 1 of the [Strategic Roadmap](#) - submitted as my written testimony - contains an in-depth description of these metrics and thresholds, including mock-ups of this data dashboard.

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- **Vaccination rates** assess population immunity, especially among the elderly, and impact predictions for the expected burden of disease in a community.
- **Seroprevalence** shows immunity from previous infections, which is important for assessing how well the community can withstand viral infection.
- **Wastewater virus levels** determine the amount and type of circulating virus, serving as a passive but accurate early indicator of viral spread that often precedes confirmed cases.
- **Health system stress**, including staff shortages and excessive hospital occupancy, is critical to track since deaths tend to increase when hospitals cannot provide optimal care.
- **Death rates** should consider COVID within the mortality totals from all major respiratory viruses. For example, a tolerable “risk” level in the next normal might place the cumulative viral respiratory illness risk at about the level associated with a bad influenza and RSV season.

By establishing a dashboard of metrics with clear, straightforward thresholds, policymakers will be able to define “tolerable” vs. “emergency” risk levels in the context of different regions, states and localities and make decisions based on real-time data. This will help build trust with the public, who will better understand the rationale for decisions based on localized, standardized, evidence-based criteria.

Unfortunately, the U.S. does not presently have enough real-time data or appropriate national standards/definitions for each of these metrics. For example, wastewater surveillance is not yet standardized or timely enough to provide a comprehensive snapshot across the whole country, and hospital bed occupancy is not reliably reported by all hospitals. The data inputs for these metrics need rapid upgrading.

This may sound like a straightforward next step for the CDC to solve. However, the CDC lacks the legal ability to direct what and how data are reported to public health agencies, resulting in a fragmented, inefficient system with inconsistent reporting across all 50 states and territories that requires excessive data cleaning. This has undermined our COVID response. The CDC needs the legal authority to lead and coordinate data reporting across our complex public health ecosystem. I’d encourage you all to read a recent opinion piece published in [The Hill](#) by 5 former CDC Directors on this very issue.

2. Necessary Investments: Vaccines, Therapeutics, Surveillance, Indoor Air Quality, Long COVID

Let me highlight 5 other critical investments that urgently need to be made.

- **Vaccines:** There is already evidence of waning immunity to a three-dose mRNA vaccine regimen 6+ months after the booster. Our scientific agencies need to rapidly prioritize the development of next-generation vaccines, especially mucosal, pan-coronavirus and variant-specific designs. We also need to establish the optimal dosing schedule for the vaccines already in use. That we haven’t done so already is a failure of the NIH.
- **Therapeutics:** There is potential for the rapid emergence of viral resistance to existing monotherapies. We urgently need new, more effective therapeutics, especially multi-drug oral antivirals and monoclonal antibodies matched to circulating variants.

Submitted on 24 March 2022

- **Surveillance:** Our viral surveillance systems have left us weeks behind many peer nations. We need to invest in a substantial upgrade of data collection and analysis infrastructure for pathogen surveillance at the national, state and local levels to ensure our data is standardized and collected on a timely basis. We also need to enhance our monitoring capacities in 4 key areas: (1) environmental (wastewater), (2) immunologic, (3) genetic and (4) zoonotic, and ensure these monitoring systems are equitably available across geographies.
- **Indoor Air Quality:** Throughout much of the pandemic, the importance of improved ventilation and filtration was unrecognized or unacknowledged in CDC guidance. States and localities should be directed by Congress to use allocations from the American Rescue Plan to upgrade ventilation and air filtration in schools, childcare facilities and public buildings. The EPA and OSHA should work together to grade commercial buildings on indoor air quality.
- **Long COVID:** According to some estimates, as many as 1 in 3 individuals develop long COVID, yet little is known about this condition. We need to rapidly coordinate and expand research on long COVID to generate definitive answers to fundamental questions on frequency, risk factors, prognosis and clinical treatment guidelines. We should strategically leverage existing large-scale epidemiological cohorts such as ECHO and All of Us. We should ramp up the NIH's RECOVER trial to increase participation from its current level of 1,000 patients to its enrollment target of 40,000 patients. We should provide additional funding for the CDC's INSPIRE trial to expand it to additional clinical sites and ensure study participants are representative across age, sex, race and socioeconomic status. We also need to launch new clinical trials to investigate how best to treat this condition with immunomodulators and antivirals. The data from all these efforts should be immediately and widely accessible via open science, with our federal agencies setting the tone. These efforts will lead to more definitive answers to questions that affect millions.

Thank you very much for your time today. I look forward to answering your questions.

BRIEF BIO

Ezekiel J. Emanuel, MD, PhD, is the Vice Provost for Global Initiatives and the Diane v.S. Levy and Robert M. Levy University Professor at the University of Pennsylvania Perelman School of Medicine.

Dr. Emanuel is an oncologist and world leader in health policy and bioethics. He is a Special Advisor to the Director General of the World Health Organization, Senior Fellow at the Center for American Progress, and member of the Council on Foreign Relations. He was the founding chair of the Department of Bioethics at the National Institutes of Health and held that position until August of 2011. From 2009 to 2011, he served as a Special Advisor on Health Policy to the Director of the Office of Management and Budget and National Economic Council. In this role, he was instrumental in drafting the Affordable Care Act (ACA). Emanuel also served on the Biden-Harris Transition Covid Advisory Board.

Dr. Emanuel is the most widely cited bioethicist in history. He has over 350 publications and has authored or edited 15 books. His recent publications include the books *Which Country Has the World's Best Health Care* (2020), *Prescription for the Future* (2017), *Reinventing American Health Care: How the Affordable Care Act Will Improve our Terribly Complex, Blatantly Unjust, Outrageously Expensive, Grossly Inefficient, Error Prone System* (2014) and *Brothers Emanuel: A Memoir of an American Family* (2013). In 2008, he published *Healthcare, Guaranteed: A Simple, Secure Solution for America*, which included his own recommendations for health care reform.

Dr. Emanuel regularly contributes to the New York Times, the Washington Post, the Wall Street Journal, The Atlantic, and often appears on BBC, NPR, CNN, MSNBC and other media outlets.

He has received numerous awards including election to the Institute of Medicine (IOM) of the National Academy of Science, the American Academy of Arts and Sciences, the Association of American Physicians, and the Royal College of Medicine (UK). He has been named a Dan David Prize Laureate in Bioethics and is a recipient of the AMA-Burroughs Wellcome Leadership Award, the Public Service Award from the American Society of Clinical Oncology, Lifetime Achievement Award from the American Society of Bioethics and Humanities, the Robert Wood Johnson Foundation David E. Rogers Award, President's Medal for Social Justice Roosevelt University, and the John Mendelsohn Award from the MD Anderson Cancer Center. Dr. Emanuel has received honorary degrees from Icahn School of Medicine at Mount Sinai, Union Graduate College, the Medical College of Wisconsin, and Macalester College.

Dr. Emanuel is a graduate of Amherst College. He holds a M.Sc. from Oxford University in Biochemistry and received his M.D. from Harvard Medical School and his Ph.D. in political philosophy from Harvard University.

Chairman FOSTER. Thank you. And next is Ms. Ayala.

**TESTIMONY OF MS. KAREN AYALA,
EXECUTIVE DIRECTOR, DuPAGE COUNTY BOARD OF HEALTH**

Ms. AYALA. Good morning, and thank you for this opportunity to share testimony and for the warm welcome.

DuPage County Health Department is considered a large suburban local health department serving nearly 1 million residents in northeast Illinois. Incredibly, today marks the 800th day on the frontlines of our local public health COVID response. Since January of 2020, we have based our local response on the best available public health data. What are the best data to communicate to our residents? As a local public health official who routinely interacts with residents, community leaders, healthcare partners, the best data are those that are locally and consistently available as near to real-time as possible.

Early on at the health department we invested in developing interactive dashboards and easy-to-use platforms for sharing information that was available within our county. Still, we know being able to describe and analyze detailed in-depth information about who is becoming affected and potential outcomes and opportunities for treatment is critical to allow us to intervene more effectively and strategically.

Unfortunately, due to lingering data system and interoperability issues, we are yet to meaningfully respond to these reasonable expectations of our constituents. A new challenge around data infrastructure is related to the rapid rise in at-home tests in the absence of a robust reporting and surveillance system to capture these results and information about those testing positive. As a result, we once again risk creating ad hoc, uncoordinated, inefficient efforts that will ultimately limit our ability to analyze broader trends and waste precious resources in the absence of a coordinated effort.

We request investments in electronic data-sharing practices across healthcare and Federal leadership to promote the development of data-sharing standards. Those are critical to our ability to collect, analyze, and report back to our communities in standardized ways.

We have repeatedly learned that when communicating with the public, it is critical for public health agencies to be speaking in a coordinated fashion with one voice. While the CDC, the executive branch, and our other Federal agencies are responsible for formulating national guidelines across our response efforts, many of these announcements were made suddenly or unexpectedly. Local health officials were left in an avoidable position of scrambling to evaluate and develop local messaging that would assist our residents both to understand as well as to implement those guidelines. What is, after all, the value of even the most sound public health guidance if no one can explain what it means or how it applies to me? We must refocus our collective work to coordinate communication between local, State, and Federal agencies now in order to be better prepared for the next surge and the next public health emergency by rebuilding that structure.

Finally, I'd like to highlight the need for sustained investment in local public health departments and the public health infrastructure to enable us to address the ongoing public health challenges that already existed, as well as to be prepared to respond to future emergencies. We know there is a huge chasm between the per capita spending for public health services when compared with spending for traditional healthcare services.

Now is the time, however, I believe we can agree that our priorities for preventing severe disease, illness, and death can be and must be in closer alignment with the priority of simply treating those conditions through our funding decisions. Local public health departments need sustained, predictable disease-agnostic funding that can be used to support poor public health infrastructure activities upon which disease-specific funding can build when the situation and the need further arises. Investing in these core public health capabilities will strengthen and support all the work done by local health departments, and it will also assure more effective use of all healthcare resources.

Thank you so much to Chairman Foster, to Congressman Casten, and all of the other esteemed Committee Members for the opportunity to share my perspective and for your work to ensure that we are better prepared tomorrow to protect the health, safety, and security of our residents.

[The prepared statement of Ms. Ayala follows:]

Written Testimony Submitted to the House Committee on Science, Space and Technology
 Subcommittee on Investigations & Oversight Hearing,
 “The New Normal: Preparing for and Adapting to the Next Phase of COVID-19”
 On behalf of the DuPage County Health Department
 Prepared by Karen Ayala, MPH, Executive Director

Thank you for allowing me this opportunity to address the issues with the purpose of how research, data and coordination efforts must evolve as COVID-19 surges ebb and flow. My name is Karen Ayala, and I serve as the Executive Director of the DuPage County Health Department. DuPage County, IL, is the second largest county in Illinois home to nearly 1 million residents, and is located adjacent to Cook County, home of Chicago, in Northeast Illinois.

Throughout the past 28 months, the public health employees of the DuPage County Health Department have been in active response to the COVID-19 pandemic. DuPage County has been identified as one of the healthiest counties by the Robert Wood Johnson Foundation and the University of Wisconsin Population Health Institute’s annual County Health Rankings

The DuPage County Health Department, itself, was established in 1945, and is certified as a local public health department in the State of Illinois, as well as being accredited through the Public Health Accreditation Board (PHAB) and The Joint Commission. Through the support of DuPage County taxpayers, we receive just over \$18 million annually, and through the State of Illinois, we are awarded an annual grant of approximately \$700,000. We then leverage those funding streams to generate an additional \$42 million through grants, fees/permits and reimbursement for services, to operate a \$61 million annual budget, as of 2022.

One of the most unique elements of the DuPage County story is that although the Health Department is a separate legal entity, overseen by completely different individuals, from the DuPage County Board, we have developed and maintained an extremely synergistic and positive relationship between the two entities which has been further bolstered as the result of our COVID-19 pandemic response. In fact, the support of the DuPage County Health Department from the local, State and Federal level has been elected officials has been extremely helpful from the very first days of the pandemic to the present time.

Since the start of the pandemic, DCHD leveraged available data, provided analysis and transparency of the unfolding needs of the impact on residents. Our COVID-19 online dashboard, developed as a resource for our community in early 2020, has provided over 8 million views over the past 28 months, and links to other data elements have been used to educate, justify, and promote healthy behaviors across our communities. Through our response efforts, and together with our partners, DuPage County has one of the highest rates of COVID-19 vaccination of all U.S. counties with 77% of our entire population fully vaccinated. This puts DuPage County among the top 4% of over 3,000 counties. (CDC COVID Data Tracker)

Even with these noteworthy benefits, funding, political support and public health capacity/expertise, the response to the COVID-19 pandemic has been the challenge of a lifetime. I applaud Chairman Foster for hosting this hearing to explore how measures and resources can be brought to address the research, data and coordination efforts, both to address the remainder of the current pandemic, but also to prepare for the next pandemic. The lessons learned over the past 2 years have offered both specific,

short-term strategies that can be put in place immediately, as well as longer term projects/priorities that will require a longer-term commitment to address.

In addressing the first question,

1. What are the most useful metrics to judge whether your county should implement increased protective measures? How can data collection and communication be improved to ensure you are making decisions based on the best available information?

Above all, we've learned that no single metric or index accurately conveys the situation in any one phase of the pandemic. I offer the following comments to inform our thinking about the data we need to better understand the current situation, the impact of our work, and what we need to be prepared for in the future:

Useful Metrics:

- Many of the data elements currently provided by the Centers for Disease Control and Prevention (CDC), through the COVID Data Tracker, provide useful and helpful information, including data about new cases, hospitalizations and deaths.
- Additional demographic information of positive cases, e.g., age, race, ethnicity, underlying conditions, is also useful- efforts need to be increased, however, to assure the completeness of the data elements, specifically racial/ethnic data to assure accuracy and promote equity.
- Rate of new cases per 100,000 per week allows for a standardized approach to compare geographies, as would routine updates on the r-naught value.
- Any/all data that is reflected longitudinally is also extremely valuable.
- Currently not available, but it would be very helpful, is information on the utilization of COVID-19 treatments being prescribed and dispensed, as well as COVID-19-related outpatient and ER visits, to provide an earlier warning rather than relying upon hospitalization numbers.

Ideas for Improvement:

- Case rates have served as a cornerstone metric throughout this pandemic, but increasingly are becoming less relevant due to the decrease in convenient, low/no cost laboratory-based testing available at the same time as the proliferation and encouragement of the use of over the counter, at home tests. There is no public health awareness of the results of at-home testing, and therefore we are missing an increasing number of positive tests being identified every day.
- Wastewater metrics appear to provide a valuable resource in identifying trends and higher levels of viral shedding, but there are limited, if any, standardized thresholds or actionable levels identified to propel public health prevention measures.
- Hospital/healthcare capacity and utilization are another key metric; however, it is a difficult one to objectively understand/communicate with the public. It would be helpful to identify more objective ways to both assess and communicate critical staffing shortages, supply shortages and the impacts of those to better reflect the local healthcare capacity to address COVID-19 and the myriad other urgent health conditions that develop in communities every day.
- Communication around specific issues, such as the impact of COVID-19 on children, needs to be more effectively communicated. We have some information about the impact on children, but

not enough, and in lieu of clear messages about the impact on children, the public has increasingly decided the risk for children is low. Not only communicating the impact of the actual disease to kids, but an ability to quantify and communicate the deep and broad-reaching impact of loss of caregivers within our community is needed.

- Greater regulation and oversight of CLIA-certified COVID-19 testing sites are critically necessary to improving accuracy and quality of data collected. Widespread non-compliance with COVID-19 electronic laboratory reporting (ELR) requirements has contributed to:
 - Increased administrative burden for the local health department (LHD) as a significant amount of time is spent by LHD staff to obtain lab report copies and then manually enter these results into the secure online disease surveillance system.
 - Delayed case/contact/outbreak investigations, likely resulting in delayed containment efforts.
 - Potential risk of increased COVID-19 transmission in high-risk settings and the broader community.
 - Incomplete or delayed representation of the burden of COVID-19 disease in our communities; and
 - State and federal investigations into fraudulent practices and wasted COVID-19 response federal funding.
- Given increased transparency with provisional data, CDC needs to be prepared to proactively address misinterpretations of data and mis/disinformation with specific counters to falsehoods that are being spread.
- Clear, consistent COVID-19 diagnostic testing result interpretation guidance for clinicians and laboratories is sorely needed to accurately identify cases/contacts and provide timely public health and clinical recommendations for isolation/quarantine, treatment, etc. In the absence of this, there has been pervasive confusion and miscommunication of test result interpretation and recommendations between clinicians and patients.
- Finally, if local health departments are going to be providing recommendations for increasing/decreasing prevention measures and further directing local response, we must have direct access to any/all data that is available, as timely as possible. We have had to wait for data to flow through state agencies before being shared with local health departments or we had state agencies analyze data in meaningful ways to the state-wide response, and never provide the actual data to us. The delay of sharing data from the CDC in the early days of the pandemic response created a preventable delay in equipping local health departments with information to begin developing their responses.

II. When looking at the lessons learned around the communication of COVID-19 information, both to and from the public:

- It was apparent in this public health response that one size fits all around the issue of data and communication will not address the different needs of our communities. There must be, concurrently, as much real time data as possible, that allows for those interested to review and manipulate data themselves, while addressing the need for simple, easy to understand (non-jargon) to summarize key elements of that data.

- Based upon our experiences, we have identified the critical need of keeping local public health officials informed of changes in guidance and recommendations. Early on, local public health officials became some of the most trusted messengers —with this responsibility comes the need for local leaders to be armed with clear rationale and scientific understanding to explain changes to federal guidance. Examples were plentiful in our experience as we are the ones explaining changes to our local stakeholders about CDC isolation/quarantine guidance, vaccination priority groups, etc, but routinely needed to do so in the absence of rationale and rarely with the tools, evidence, or data to reinforce those decisions. While national policy direction is critical, we must act together to explain and back up these policies with the local stakeholders that look to local public health and medical organizations for guidance when implementing these policies.
- Communication flow from federal, to state, to local, to community residents needs to be more coordinated. Many times, there were instances when federal guidance and state guidelines were inconsistent which created frustration in the community and resulted in lack of confidence in the guidance the local public health officials were providing.
- Support national and state/local educational campaigns with direct, simple, and redundant messaging for medical providers, testing sites, and public for real-time recognition and counseling of suspect and known cases to self-isolate and contacts to self-quarantine.
- Need national and state/local educational campaign efforts and recommendations to build vaccine confidence and trust with equity, toward improving COVID-19 vaccination rates among all age groups, especially youth aged 5-11 years and 12-17 years. It would also be helpful to have a target/aspirational goal to achieve (perhaps 90% or higher, like the target identified for influenza vaccination among healthcare personnel [per Healthy People 2020 target] and MMR pediatric vaccination coverage level [per Healthy People 2030 target]).
- We would strongly recommend additional support for the Centers for Disease Control and Prevention to develop strong, simple, nuanced public health messages for development, timing and delivery of guidance. Most of the public will understand guidance will change as the result of the “scientific process,” but the timing and the delivery of those messages needs to be coordinated more strategically. Funding/support at all levels (federal, state and local) could then be leveraged, consistently and effectively.

III. What research and infrastructure investments can the federal government make to improve COVID-19 outcomes at the individual level?

Short-term Strategies:

- Evaluation of the use and impact of the at-home COVID-19 testing strategy.
- Investment into the evaluation of the impact of home testing on community level data about positivity and new cases. Refer to a response to Q1, with the inability of local public health to understand current disease activity due to the decreased laboratory-based testing efforts, and no transparency into at-home test results.
- Development of a national infrastructure to rapidly distribute and track personal protective equipment (PPE), tests, vaccines, therapeutics, etc. down to the community (and ideally even further) level. Pharmacies were great partners in tracking vaccination roll out, but not in the other areas of need. In DuPage County, and in counties throughout the country, many local health departments demonstrated significant capabilities to receive and distribute medical countermeasures — capabilities developed and supported since 9/11 through Congressional

support of the CDC's Public Health Emergency Preparedness or PHEP grants to local health departments.

- Focus needs to be provided to emphasize the recovery phase of the current pandemic. As we have entered into a phase where transmission is lower, many resources have been pulled or will soon be reduced (e.g., testing, funding for treatment, Medicaid expansion). Understanding that the level of support needs to transition with the actual level of need, pulling these resources too quickly will result in creating avoidable challenges later, e.g. early identification of increased spread, increases in hospitalizations, etc.
- Although there has been public recognition and discussion that highlights the impact on mental health on first responders, public health and healthcare workers and others, there have not been strategies identified as being effective in addressing those concerns. It would be extremely useful, from the local perspective, to have strategies identified to support our exhausted workforce as we work with our communities on the COVID-19 recovery and return to the other elements of our public health efforts.

Long-term Strategies:

- Establishing a minimum threshold for public health funding across the country would be helpful. According to an Issue Brief, published in May, 2021, the average per capita investment in public health across the United States sits at \$22.83. ([2021 PHFunding Fnl.pdf \(tfah.org\)](#)) Contrasted with the per capita spending for healthcare by United States citizens, reported to be \$12,050/annually, ([Health spending per capita in U.S. 1960-2020 | Statista](#)) and the concern comes into focus.
- Once established, assuring public health funding is maintained or increased over time is the top need. Continuing the policy and practice of surging dollars during an emergency and cutting them when not in that emergency is harmful, ineffective and leaves public health and our residents vulnerable to the next crisis. In fact, federal funding for emergency preparedness and response programs administered by the Centers for Disease Control and Prevention has been slashed by 50% over the past decade, according to Trust for America's Health (TFAH), the nonpartisan health policy research organization. That same TFAH study highlighted other concerning trends as well, such as a general decline in funding for the Strategic National Stockpile as well as the Hospital Preparedness Program. That program is the sole source of federal funding for emergency response by regional health care systems, and had its budget slashed from \$515 million in 2004 to \$275.5 million in 2020.
- Information systems containing valuable public health data have not been fully leveraged, due to the systems being outdated and not equipped with modern technology standards for accessibility. Investments to address this may entail creating funding and as importantly, a guided pathway (e.g. pre-designed consulting services) for system owners to build and document modern, open programming interfaces to their systems. This would allow providers and partners to easily create meaningful integration with their own existing systems.
- Finally, although not a revelation, the salaries for our governmental public health workforce often lag the traditional healthcare sector, we would recommend some strategic investments in the area of data scientists, ETL programmers, and other areas to assist in this area.

Once again, I would like to express my sincere appreciation to Congressman Foster and the esteemed members of the Science, Space and Technology Committee for this opportunity to share our input and

feedback. More importantly, however, we applaud this Subcommittee, for the willingness to invest time into identifying and evaluating these important issues.

On behalf of the entire team of the DuPage County Health Department, thank you.

Sincerely,

A handwritten signature in black ink, appearing to read 'Karen Ayala', with a stylized flourish at the end.

Karen J. Ayala, MPH
Executive Director



KAREN AYALA

Executive Director

Karen Ayala currently serves as the Executive Director with the DuPage County Health Department. Prior to that role, she served as the Director of Community Health and Public Health Services since 2007. Prior to her work in DuPage County, Karen served as the Community Services Division Director at Winnebago County Health Department where she began her formal public health career in 1998.

Karen has worked in direct service, mid-level supervision and senior level leadership positions throughout her public health experiences. In addition, the remainder of her work experience has been in community mental health/ substance abuse prevention, intervention and treatment systems.

Karen received a Bachelor of Arts degree in Social Work from Wartburg College and her Master's in Public Health from University of Illinois-Chicago in Health Administration. Karen's strong commitment to the social justice issues around public health, as well as her creative approach to system design have enabled programs she is responsible for administering to expand and become much more efficient in the service delivery.

Under Karen's leadership, the DuPage County Health Department was recently rated number 1 out of the 102 counties in Illinois by the Robert Wood Johnson Foundation County Health Rankings for both Health Outcomes and Health Factors.

Chairman FOSTER. Thank you. And after Ms. Ayala is Dr. McBride.

**TESTIMONY OF DR. LUCY McBRIDE,
PRACTICING PRIMARY CARE PHYSICIAN IN WASHINGTON, D.C.**

Dr. McBRIDE. Good morning, and thank you to Chairs Johnson and Foster and Ranking Members Lucas and Obernolte for inviting me today. My name is Lucy McBride. I'm a practicing primary care doctor here in Washington, D.C. I've been practicing for over 20 years. I see patients from teenagers to 90-year-olds, and I've dedicated my life and my career to helping people understand the inseparability of mental and physical health.

As we inevitably face more COVID waves and variants, I worry about the ongoing devastation from the virus itself and about the collateral damage from the mitigations. But perhaps most of all I worry about the ongoing confusion and anxiety from not knowing—for people not knowing who to trust in a global health crisis.

I'm not here today with any political agenda but rather to share with you what I've learned firsthand caring for patients almost every day during COVID, patients who are real people on the receiving end of often confusing guidance and the unfortunate politicization of science.

In patient care, trust is the glue. To help patients manage everything from mental and behavioral health to end-of-life care, I first have to establish a relationship and a rapport. But unfortunately, trust in medicine and public health hangs in the balance, as is our ability to help people get the information and services they need because we have not appropriately acknowledged uncertainty and we've lost sight of what I see is the four fundamental pandemic truths: No. 1, the effectiveness of the extraordinary vaccines; No. 2, the sophistication of the human immune system; three, the ability of patients and the public to understand nuance; and four, the complexity of human behavior.

I'll give you some examples of how trust has been threatened. The mixed messaging around school safety, booster shots, masks, and infection-acquired immunity has inadvertently sparked confusion, fear, and vaccine hesitancy. We've scared parents by suggesting that schools are inherently unsafe. We've terrified vaccinated folks about breakthroughs when the primary three-shot series continues to hold up beautifully against death and hospitalization for most people. We've alienated recovered patients by not validating their prior immunity until recently. And we've accelerated mask culture wars by not adequately explaining the difference between a mask mandate and the benefits to an individual of one-way masking when they need added protection. We should have more appropriately acknowledged the realities of the vaccines, of the immune system, and of human beings' ability to live in a constant state of emergency to better manage people's expectations and to build trust. People are more likely to take in information and follow guidance when the advice is nuanced, when it's not rooted in fear, and we don't moralize human behavior, also when we communicate uncertainty with humility and candor and provide reassurance when appropriate.

Just to be clear, I don't blame the CDC or any one person or political party for these challenges. Had our prior President, for example, messaged vaccine competence, we could have saved countless lives. But when we don't talk straight with the American public and when people lack a trusted guide, the vacuum of trust gets filled with the cacophony of political opportunism, lots of media opinions, and celebrities and internet influencers. And that's exactly what's happened. I see the effects every day in my patients.

So how do we build back trust? First, we must acknowledge our past mistakes and abandon mitigations whose harms outweigh the benefits like school closures, mask mandates, and asymptomatic testing in schools.

Second, we must be honest about ongoing uncertainties about COVID like about long COVID, while reassuring people about how well the vaccines and therapeutics drop the risk of serious outcomes.

Third, we need to ramp up public health measures that we know work from ventilating public buildings and scaling up outpatient treatments to legislating paid sick leave. We must surge resources like vaccines and rapid tests to our most vulnerable populations.

And last, we must arm people with the tools and guidance they need to manage the future variants and a myriad other health issues that are—that plagued us before the pandemic and that only got worse during COVID, specifically the epidemics of obesity, substance use disorders, and the worsening mental health crisis, particularly among young people.

To that end, we must allow every American unfettered access to a primary care hub with integrated behavioral and mental health services. We should heavily invest in school-based health centers, starting with marginalized communities to meet teens and kids where they are, exactly like the ones run by my pediatrician friend Dr. Ana Caskin here in D.C., clinics that are annexed to those high schools that serve our highest-risk teens.

Primary care providers specialize in building trust and rapport. We get the medical vulnerabilities of our unique patients. We get their biases and beliefs. We understand their unique resources and risk tolerance. Being human is risky. Eliminating risk is impossible. It is the job of public health and primary care to help people manage the everyday risk they inevitably face.

COVID is here to stay, and we are not done. We'll never be done protecting the most vulnerable. We must give people a place to go, someone to trust. By investing in primary care, we're investing in people, and that is the workplace of trust. Thank you very much.

[The prepared statement of Dr. McBride follows:]

**Committee on Science, Space, and Technology
Subcommittee on Investigations and Oversight**

Hybrid Hearing

**Thursday, March 31, 2022, at 10 a.m. (EST)
John D. Dingell Room
2123 Rayburn House Office Building**

“The New Normal: Preparing for and Adapting to the Next Phase of COVID-19.”

**Witness: Lucy McBride, MD
Title: Practicing primary care physician in Washington, DC**

Good Morning and thank you to Chairs Johnson and Foster and Ranking Members Lucas and Obernolte for inviting me to discuss how we can best prepare for and adapt to the next phase of COVID-19.

My name is Dr. Lucy McBride, and I am a primary care doctor in Washington, DC. I have been practicing medicine for 22 years. I take care of teenagers all the way up to octogenarians. I trained at Harvard Medical School and The Johns Hopkins Hospital. I hold a masters in Pharmacology from the University of Cambridge, UK.

I am not here today with any political agenda but rather to share with you what I have learned firsthand caring for patients every day during the pandemic—real people who are on the *receiving* end of often confusing public health guidance and the unfortunate politicization of science.

Today I want to talk about trust. As we move forward into the next phase of COVID-19 and inevitably face more waves and variants, I of course worry about the ongoing death and destruction from COVID. I worry about the social, emotional, and economic fallout of the virus and of the mitigations themselves.

But at its core, I worry most about peoples’ confusion and resulting anxiety about not knowing *who to trust* in a global health crisis. Specifically, I worry about the risk that the erosion of trust in medicine and in public health poses to our individual and collective health.

This pandemic is about a virus; it’s also about information, messaging, and the contagion of mistrust. To build back better we must start with trust.

In patient care, trust is hard-won and easily lost. To help my patients manage some of the most intimate parts of their lives—from sexual health and mental health to cancer treatments and end-of-life care—health care providers have to establish a relationship and a rapport first. We learn about patients' health as much as we try to understand who they are as people—their goals, their fears, their everyday experiences. We try to meet people where they are. We don't dictate or preach. Doctors are not moral authorities. We don't judge or shame. We don't sugarcoat information. We don't catastrophize.

We can help people eliminate risk when possible (for example, prescribing penicillin for strep throat is the easiest part of my day), but the lion's share of patient care involves helping people *manage* and *balance* the various risks that they inevitably face—from the risk of cancer to the risk of COVID. From the risk of the disease to the harms of the treatment itself.

I'll give you an example. My patient—let's call her Mary—is a divorced working mother with obesity, new-onset diabetes, a recent bout with COVID, and hesitancy about getting a COVID vaccine booster shot despite reading that she probably should get one given her risk for serious disease. She has also read about myocarditis and is worried because her dad died from a heart attack in his 50s. So, I recommend medication and lifestyle changes for her diabetes, and we discussed the benefits and limitations of each intervention. I also acknowledge the added stress of managing this chronic illness particularly given the realities of her busy life. In other words, I wouldn't ask her to exercise an hour a day or to *never* consume sugar—even if it would help her diabetes—because that just isn't realistically going to happen in her life. Rather, I help her replace some excess sugar in her diet with more nutritious foods and think of realistic ways to insert more movement in her daily life in order to lay the groundwork for a more sustainable way of improving her health—one where she has both information and agency.

Similarly, I explain the nuances of the immune system and how her immunity from her past Omicron infection helps protect her somewhat from BA.2. I give her the data on hybrid immunity as strongly protective against severe outcomes from reinfection. I explain the difference between a heart attack and the known rare vaccine side effect called myocarditis and reassure her about that low risk but also gave her the option of a booster—didn't force it—because she understands the potential risks and the potential harms. I also explain that *even better than a booster shot* would be for her to invest in managing the very underlying conditions that put her at higher risk for serious COVID outcomes. The concept of hybrid immunity was a welcome compromise.

She was glad for the information and glad that I trusted her and her immune system, and I felt confident she will come back to me when and if, for example, she isn't able to lose weight or her diabetes flares or she gets another infection. I won't shame or blame her; we'll simply try another plan that might work better for her life.

Trust is the *glue* in patient care. Being human carries occupational risk; our job in primary care is to help people navigate it.

Trust is born when doctors first acknowledge uncertainty—and then lean into things that *are* certain. Specifically, in order to help patients navigate the swirling information about COVID—and to help with decision-making about everything from booster shots to masks to how to safely attend a family wedding, I center my conversations with and advice to patients on the things that are known.

Here are the fundamentals—the well-understood tenets of this crisis—that we must re-center as we move forward:

- 1) the COVID vaccines,
- 2) the human immune system,
- 3) patients'—and the general public's—ability to understand nuance
- 4) people's unique medical vulnerabilities, lived experiences, risk tolerances, and the variability of their needs.

Let's start with re-upping trust in the **vaccines** and their ability to work well where it matters most. In the Omicron era, they do less of a good job at preventing infection and transmission to other people, but they continue to [dramatically reduce the risk for severe outcomes from COVID-19](#). Even though people can still get infected after vaccination, for most people the vaccines effectively take the claws and fangs away from the virus and turn it into a more manageable illness.

Next is the **human immune system**. It is vast and wide and much more sophisticated than the mere presence or absence of antibodies. In fact, it's our cellular immune system (the memory B cells and T cells) that does the heavy lifting and protects us from serious outcomes from COVID-19. Moreover, as is the case after an exposure to any respiratory viruses, an infection with novel coronavirus causes our body to mount an immune response that helps protect the infected person, albeit imperfectly, from the worst consequences from reinfection. In fact, [hybrid immunity](#) to COVID-19—that is, the combination of vaccine-induced and infection-acquired immunity—is, for many people, the strongest form of protection against this virus such that we can ["count" prior](#)

[infection with Omicron as a booster dose](#), since a breakthrough infection with Omicron after vaccination leads to [broad neutralizing antibodies and T cells against essentially all prior COVID variants](#). (Note that I do not recommend getting infected in order to get that immunity.)

We also need to remember that **patients and the general public are well-intended and smart**—much more than we sometimes give people credit for. For the most part, my patients want to do what's right. I now have eighteen thousand subscribers to my [weekly COVID-19 newsletter](#) from all over the country, and they, too, (at least the ones who email me) want to protect themselves and do what's best for their families and communities. They want to follow the rules. They also want to understand the *reasoning* behind the rules.

Most of my patients who are hesitant about the vaccine aren't anti-vax; they simply have historical or ongoing mistrust of medical institutions, limited access to trusted information, vulnerability to misinformation, a fear of needles, or other reasons to mistrust the vaccines that are worthy of understanding. Similarly, most of my patients who are ready to unmask aren't uncaring or callous toward others; they simply understand that by getting vaccinated they've taken the best step toward protecting themselves; they realize the limitations of masking and that the best way to protect others from respiratory viruses is to stay home when they're sick and to test themselves when they have symptoms.

Also like most Americans, my patients juggle multiple responsibilities—from working, caregiving and parenting to managing multiple medical problems themselves, all at once. In other words, my patients, like most people, understand trade-offs. They are used to navigating our perilous world—by tolerating some risk while mitigating the risks they can control. They simply need information and trusted guidance on how to calibrate risk and make everyday decisions.

And finally, we need to acknowledge the **variability of people's medical vulnerabilities; access to information and guidance and services; lived experiences; and risk tolerance**. There is no one-size-fits-all approach to patient care. Nor can any public health body, politician, or school board possibly speak to everyone's unique medical conditions. Which is why it's so important for nuanced messaging in the public space—and why it's critical for every American to have a primary care doctor to help people marry broad public health advice with their particular health issues, needs, and goals.

The problem is this: We seem to have lost sight of these fundamentals. And this is exactly where I and my patients have lost trust in our federal government's ability to protect us.

In the case of vaccines, people were spooked after the July 2021 Provincetown outbreak when politicians and public figures were begrudging the vaccines. But Provincetown was, in fact, a vaccine success story. It was a perfect storm, in fact a veritable stress test for the vaccines. And the vaccines performed well. But instead of messaging vaccine confidence and using this as an opportunity to explain how well the vaccines help up against death and hospitalization and to deliver more nuanced guidance about masking, the CDC instead reinstated mask mandates. It was a missed chance to help people understand the data on masking on a population level versus on an individual level. But instead, re-implementing mask mandates only exacerbated the mask culture wars by 1) suggesting that masks and vaccines are equally good at reducing the risk of COVID, 2) suggesting that everyone—vaccinated or unvaccinated, young or old—faces the same degree of risk from COVID when we knew that wasn't true, 3) suggesting that people are incapable of making their own decisions about how to best protect themselves and others from the virus, 4) making it harder to de-implement school mask mandates in spring 2022 such that now, despite falling case rates even *without* the school mandates in place, the mask wars rage on.

The lack of nuanced messaging on boosters has also sparked anxiety. Aware of the waning immunity by the vaccines, people unfortunately confuse the normal and expected drop in antibody levels with waning *total effectiveness* of the vaccines such that many are clamoring for 4th, 5th and 6th boosters shots even when they are already well-protected against serious outcomes from their primary series. In other words, we have again sowed doubt in the vaccines when they continue to be extraordinarily effective. We must do better about messaging: Let's not make perfect be the enemy of the great.

In terms of vaccine adverse events, people are well aware of the rare but real risk of vaccine-associated [myocarditis](#) but were spooked when experts weren't transparent about this. This furthered exacerbated vaccine hesitancy. People are also aware that after someone gets infected and recovers from COVID-19, they have some sort of immunity, but the CDC only this year recognized natural immunity as valid.

Parents are a particularly smart bunch. They knew intuitively that opening bars, restaurants and gyms before schools didn't make sense. They saw the data that [schools aren't intrinsically superspreaders](#) while many schools remained closed. They know that kids [face the lowest risk for severe outcomes](#) from COVID-19 yet have been

subjected to the strictest mitigations. Parents know—and parents won't soon forget about—the harms to kids from prolonged school closures, particularly parents of kids with disabilities, speech and language delay, autism, mental health issues, working parents trying to manage kids on Zoom school while working. We all saw this month's [GAO report](#), showing that an estimated 1.1 million students *never showed up at all during the 2020-21 year*, which no doubt contributes to the widening of educational and social disparities along racial lines and to the pre-existing mental health crisis among kids and teens.

Instead of inadvertently scaring parents, *reassuring them* would have gone a long way. Nuanced information about the relatively low risk kids (as a cohort) face from COVID-19, about the vaccines, about the seroprevalence data showing that most kids under 18 have some sort of immunity at this point, about the data from Spain that kids don't spread the virus as much as adults do, and about the reassuring data on long-COVID (specifically that [vaccination reduces the risk of long COVID back to baseline](#)) would have gone a long way to help them and their children. We should have reassured parents about the relative safety of school (when weighed against the harms of NOT being in school given that most transmission happens in the community). We should have reassured teachers about how well the vaccines protect them. But instead we scared parents and teachers.

People are also scared and aware that COVID isn't going away but also see that the [funding for COVID prevention and treatment is being cut](#) at the very moment we most need ongoing monies to advance vaccines, testing, and surveillance.

And last, many Americans are naturally frustrated that the responsibility of protecting oneself and one's community from COVID is being shifted onto the individual when 80 million Americans don't have access to a primary care provider (PCP). (Indeed, many of my newsletter readers don't have a PCP—which is a large part of why I've been writing it for two years.) Even if they do, they tend to have very little time with their provider and have a hard time getting through to them in a pinch. So they land in the ER because they don't have anywhere else to go when they're sick.

Of course the fear, confusion, and erosion of trust isn't the fault of any one institution, person, or administration. The concern also is not new. We have witnessed the deliberate dismantling of national confidence in our public health institutions from both sides of the aisle, and this will have another level of ramifications for future patient outcomes and our democracy as a whole.

For example, had our prior president messaged vaccine confidence and not spread conspiracy theories back in 2020 we would have saved many lives and a lot of suffering—including among doctors trying to help people get to the truth. We might not have seen patients end up in the ER after self-administering large doses of hydroxychloroquine. We might have seen fewer patients regret not getting the vaccine only after they found themselves on a ventilator, having transmitted COVID-19 to their loved ones.

That vacuum of trust has been and continues to be filled with a cacophony of voices calling out from across a variety of platforms, from celebrities, media personalities, and internet influencers. Without a source of truth, people look to the showy salesmen and get easily tangled in webs of harmful medical advice.

As a result, we've seen outsized fear of COVID-19 on one end of the political spectrum and outsized COVID skepticism on the other side.

Unsurprisingly, today, only [30.8% of Americans trust Anthony Fauci's advice](#) when it comes to COVID—a staggeringly disheartening statistic given his early stature as the trusted voice of pandemic guidance

As Ezra Klein has [artfully stated](#), "Policy lies downstream of society. Mandates are not self-executing; to work, policies need to be followed, guidance needs to be believed. Public health is rooted in the soil of trust. That soil has thinned in America."

So again, no one person or entity is to blame. But when the very public health guidance that's meant to steer us through a global crisis underestimates people's ability to understand nuance and is frankly out-of-touch with the reality of the human immune system and Americans' daily lives—people naturally lose trust.

Many loud critics of the federal COVID response say "We did too much." Or "We did too little." Rather than too much or too little, I think the problem is that we did too *much* of the wrong things and too *little* of the right things.

Here is my prescription for what to do to rebuild trust:

First, we need to recognize that there is nothing "normal" about our world right now—and that the "old normal" was pretty awful for too many people. We need to acknowledge ongoing disease and suffering from COVID-19 and admit our past mistakes.

Next, I think we must use this moment of relative COVID “quiet” to:

1. Surge resources to the highest risk patients and populations. For example, now that we know that the majority of persons under age 18 in the U.S. have [evidence of prior COVID infection](#), we should focus more resources on vaccinating and boosting non-immune older and high-risk people before worrying about vaccinating kids.
2. Replace resource-intensive asymptomatic testing, contact tracing, and quarantines with efficient and sustainable monitoring through wastewater surveillance.
3. Improve data collection—specifically COVID hospitalizations sorted by vaccination status, age, and race to better allocate resources and calibrate restrictions to the degree of actual population risk. For a more targeted approach to boosters, for example, we need more precise reporting from the CDC, which involves categorizing severe breakthrough infections by the specific comorbidities and vaccination status of those hospitalized. More refined data will allow for more efficient targeting of further booster shots, prioritizing those most likely to benefit from regular boosting by age and health status.
4. Work on broader infrastructural changes to help reduce transmission of SARS-CoV-2 and other respiratory viruses like upgrading the ventilation systems of public buildings and schools
5. Continue to improve widespread access to rapid testing.
6. Scale up [effective therapies](#) like the oral antiviral Paxlovid, the twice-yearly injectable monoclonal antibodies Evusheld for high risk patients, and new [monoclonal antibodies](#) for IV infusion for newly infected high-risk patients.
7. Invest in President Biden’s test-to-treat initiative to ensure that vulnerable adults have rapid access to effective therapies through community-based pharmacies and health centers.
8. Retire mask mandates (but not mask *recommendations*) for the long-term, given that [evidence is lacking](#) that the mandated use of masking ([including in schools](#)) had a significant impact on [slowing COVID transmission](#) or [hospitalizations](#) over the past two years—whether due to inconsistent use or variability in mask quality or both—and given that mask mandates are not harmless interventions.
9. Improve public health messaging. We have the opportunity to rebuild trust through better communication by recognizing that people are better able to take in information and follow guidance when the messaging is nuanced and not rooted in fear or shame; respecting the public’s diverse medical vulnerabilities, resources, lived experiences, and risk tolerance; sharing complex information (for example about the power of [hybrid immunity](#)); communicating uncertainty with humility and candor; providing hope when appropriate; avoiding judgments on

human behavior; and meeting people where they are (ie setting realistic goals given people's finite emotional and financial resources and limited time).

10. And, in my mind, most crucially: Scale up primary care to allow every American unfettered access to a trusted guide, a medical home with mental and behavioral health integration—in sickness and in health.

The pandemic exposed the ailing condition of crucial American infrastructure. We tossed over \$5 trillion at the problem through three necessary, but reactive, spending bills. If we hope to truly protect the health of our communities moving forward, we must fortify the frontline of the American healthcare system: primary care providers.

Indeed 80 millions Americans, particularly in rural and poverty-stricken urban areas, don't have a primary care provider, someone who can spend quality time answering their questions and allaying their concerns. Primary care providers are ideally positioned at the nexus between public health institutions and individual patients to build back and nurture the public's trust.

During regular check-ups, patients engage with their provider in safe, non-judgmental spaces where empathy and reason can reign. It is an opportunity to have a face-to-face nuanced conversation about a complex topic where the provider can marry broad public health advice with the unique patient in front of them.

Primary care providers are trained to build relationships and trust and to message complex information. We meet patients where they are—whether they're vaccine hesitant or come in asking for a fifth booster. Establishing rapport and understanding patients' lived experiences is the ground game of improved health. We can have the safest, most effective medical treatment in the world but without trust, no one would agree to take it.

Fighting *misinformation* has become part of the job for PCPs. Throughout the pandemic, we have been on the front lines of fighting misinformation. Every appointment is an opportunity to deliver real-time, fact-based information and guidance on COVID symptom management, isolation, quarantine, testing vaccine information.

63% of Americans still trust their primary medical providers, many of whom are members of their own communities. Their children attend the same schools, they root for the same football team, and attend the same places of worship.

With an endemic virus like SARS-CoV-2 that will be woven into the fabric of our lives—just like the other four coronaviruses and the flu—we need to work to limit the

severe consequences—through vaccination, boosting as needed, scaling up therapeutics, and giving people access to a medical “hub”—where they can care for their underlying health, get fact-based information, understand how broad public health advice applies to them, and feel fully seen and heard.

Investing in primary care is investing in our nation's health. Without more PCPs in the next pandemic, we can expect the merry-go-round of overwhelmed emergency rooms, increased wait times, staff burnout, and diminished quality of care.

Time with a trusted physician has been proven to improve vaccine uptake and patients' overall health. Establishing rapport with a PCP can save lives. [A February study in JAMA](#) showed that COVID vaccine uptake increases with the number of PCPs per capita. The common thread between countries who successfully navigated the pandemic was not GDP; it was trust. A [Lancet study](#) published last month concluded that higher levels of trust in public health measures were the most predictive factors of lower COVID infection rates. Where else better to translate government-issued health guidance than the primary care office?

Each patient has their own pandemic story. No one's pandemic story will be the same, nor will the same event affect people in the same way. But everyone needs and deserves trusted medical guidance in a health crisis.

There's no way the CDC, even at its best, could possibly speak to every person's unique medical situation, nor can elected officials or school boards; it's just not their job. It is, however, the very essence of what primary care does best: marrying broad public health advice with the patient in front of us, meeting people where they are, and carrying the baton of trusted public health advice into people's everyday lives.

Just like the federal government has finite resources, so, too, do human beings. People are exhausted and worn out. They are disillusioned and angry. They cannot live in a perpetual state of emergency.

As we move into the next phase of COVID-19, we must invest in the public health measures with the highest yield—from paid sick leave to ventilating indoor public spaces—while abandoning public policies that do more harm than good.

We must also give people a *place* to help people manage their everyday health—a personal health guide, someone to trust in a crisis. This starts by going back to the basics—to the self-evident truths about the virus, the immune system, and the fundamentals of relationship-building in medicine.

To build back better, we must build back trust first.

Lucy Martin McBride, MD

Employment

Internist and Partner at Foxhall Internists, PC <i>Washington, DC</i>	February 2006 – present
Faculty, Johns Hopkins Dept. of Emergency Medicine <i>Baltimore, MD</i>	October 2003 - November 2005

Education

Medical Residency	Johns Hopkins Hospital	July 2000 – July 2003
MD	Harvard Medical School	received May 2000
MPhil	University of Cambridge, UK	received May 1996
BA	Princeton University Phi Beta Kappa Senior Thesis Prize for best thesis in French studies	received May 1995

Publications

“Dealing with post-pandemic Stress: A doctor’s Guide” <i>MSNBC</i> https://www.msnbc.com/know-your-value/health-mindset/dealing-post-pandemic-stress-doctors-guide-n1292798	March 2022
“With Vaccines Available, Mask Mandates Are Not Necessary in School” <i>USA Today</i> https://news.yahoo.com/kids-vaccine-dont-masks-school-110102668.html	February 2022
“A COVID Serenity Prayer” <i>The Atlantic</i> https://www.theatlantic.com/ideas/archive/2021/10/covid-serenity-prayer/620343/	October 2021
“Fear of COVID-19 in Kids is Getting Ahead of the Data” <i>The Atlantic</i> https://www.theatlantic.com/ideas/archive/2021/08/children-delta-covid-19-risk-adults-overreact/619728/	August 2021
“My Patients Are Burned Out and So am I”	June 2021

The Atlantic

<https://www.theatlantic.com/ideas/archive/2021/06/burnout-medical-condition-pandemic/619321/>

“It’s Time for Children to Finally Get Back to Normal Life”

May 2021

The Washington Post

<https://www.washingtonpost.com/opinions/2021/05/26/its-time-children-finally-get-back-normal-life/>

“Can Primary Care Prevent the Next Pandemic?”

May 2021

MedPage Today

<https://www.medpagetoday.com/primarycare/generalprimarycare/92726>

“I Tell My Patients Not to Wear their Masks Outside”

May

2021

The Atlantic

<https://www.theatlantic.com/ideas/archive/2021/05/kids-masks-outdoors-cdc/618856/>

“The Secret Weapon for Ending the Pandemic”

May 2021

CNN Opinions

<https://www.cnn.com/2021/04/30/opinions/secret-weapon-ending-pandemic-mcbride/index.html>

“Wired and Tired after Months of COVID-19 Distress, It’s Time to Recover our Mental Health”

April 2021

USA Today

<https://amp.usatoday.com/amp/4807342001>

“I’ve Been Yearning for an End to the Pandemic. Now That It’s Here, I’m a Little Afraid”

March 2021

The Washington Post

<https://www.washingtonpost.com/opinions/2021/03/09/weve-adjusted-pandemic-life-now-we-face-anxiety-leaving-it-behind/>

“I’m a Doctor Seeing Patients with Coronaphobia. Here’s What You Need to Know”

March

The Huffington Post

2021

https://www.huffpost.com/entry/coronavirus-phobia-side-effects-anxiety_n_603d18eec5b6829715023334

Research in pharmacology, University of Cambridge, UK

1996

Publications in *American Journal of Physiology*:

1. Curtis CM, Martin LC, Higgins CF, et al. “Restoration by intratracheal gene transfer of bicarbonate secretion in cystic fibrosis mouse gallbladder.”
2. Martin, LC, Hickman ME, Curtis CM, et al. “Electrogenic bicarbonate secretion in mouse gallbladder.”

Honors and Awards

Washingtonian “Best Doctors” 2008-2021

Fulbright Fellowship Award 1995-1996
Cambridge, UK

Extracurricular activities

Author of COVID-19 Weekly Newsletter with over 17K subscribers March 2020 - present

Founder and President, Working Mothers Forum 2014 – present
Discussion forum and speaker series for 40 professional women in DC

Chairman FOSTER. Well, thank you. And next is Dr. Matus.

**TESTIMONY OF DR. MARIANA MATUS,
CEO AND CO-FOUNDER, BIOBOT ANALYTICS**

Dr. MATUS. Good morning, Chairman Foster and Ranking Member Obernolte. I am Mariana Matus. I'm the CEO and Co-Founder of Biobot Analytics, a wastewater epidemiology company based in Cambridge, Massachusetts. It is an honor to testify before you today about how wastewater epidemiology can help the United States and the world better manage the next phase of the COVID-19 pandemic.

Biobot was founded in 2017 with a mission to transform wastewater into actionable public health data. Just yesterday, we had the honor of being recognized as one of the most influential companies of 2022 by *Time* magazine for our novel approach to COVID-19 tracking. Everything we eat, the infectious pathogens in our bodies, and the medicines we use are all excreted in our urine and stool and end up in the wastewater. Biobot collects this data in order to understand population health trends.

In March 2020, our team was the first in the United States to successfully report the detection and quantification of SARS-CoV-2 in the wastewater. To date, we have tested samples from more than 700 communities across all 50 States, including U.S. territories and tribal nations, helping local officials track the spread of the virus, as well as variants of concern. In fact, our work includes analysis from wastewater from almost every congressional district represented by this Subcommittee.

Wastewater data is a leading indicator of new COVID-19 cases because infected individuals shed the virus in their waste several days before they develop symptoms. And this type of monitoring is holistic and it's equitable. It captures anyone who uses the bathroom, including people who are asymptomatic or lack access to healthcare. This means that wastewater data allows us to better understand the presence of COVID, regardless of socioeconomic status or racial composition.

Another advantage is that it preserves individual privacy as wastewater represents an aggregate sample of all human waste in a community. One sample drawn from a wastewater treatment plant is representative of tens of thousands of people, and testing wastewater is much cheaper than the alternative of testing each of those persons individually.

At this stage of the pandemic, we are witnessing fewer reported COVID-19 cases because at-home antigen tests are now widely available, and vaccination has boosted the population's immunity. As a result, clinical testing data has become less reliable, and public health officials are forced to rely on lagging indicators of the disease such as hospitalizations and deaths.

That is why we believe wastewater monitoring will play an even more important role in containing the spread of the virus as life returns to the new normal. Our work in Massachusetts has already demonstrated how powerful this data can be to inform decision-making. Our data is public. From Governor Baker receiving weekly briefings on wastewater data, to a Chief Medical Officer at Boston Children's Hospital, down to me as a new mom to a baby, we all

review these data to determine how to manage our little piece of the world.

To help facilitate the adoption of this new type of data, Biobot recommends Congress and the Administration take the following steps: First, assist States and localities who have started their own wastewater monitoring programs through consistent funding. Second, empower relevant Federal agencies to support wastewater monitoring efforts across the country, especially by standardizing testing and data collection methods. Third, align Federal support behind wastewater as a pathogen-agnostic technology that can monitor for many different public health threats beyond COVID-19, for example, the seasonal influenza. It can be as simple as a health map similar to a weather map or as complicated as an electronic health record. It's up to us to decide how to handle this new resource.

I look forward to answering your questions, and thank you again for this opportunity.

[The prepared statement of Dr. Matus follows:]



**Testimony before the House Committee on Science, Space, and Technology
Subcommittee on Investigations & Oversight**

***“The New Normal: Preparing for and Adapting
to the Next Phase of COVID-19”***

March 31, 2022

**Mariana Matus, PhD
Co-Founder and CEO
Biobot Analytics**

Testimony

Good morning Chairman Foster and Ranking Member Obernolte. I am Mariana Matus, the CEO and Co-Founder of Biobot Analytics, a wastewater epidemiology company based in Cambridge, MA. It is an honor to testify before you today about how wastewater epidemiology (WBE) can help the United States and the world better manage the next phase of the Covid-19 pandemic.

Growing up in Mexico City, I saw how many rivers and lakes were polluted because much of the city's wastewater was dumped back into the environment without being treated. I became motivated to find solutions to these types of public health and environmental issues, which is what led me to pursue my PhD at MIT in computational biology. At MIT I focused on how wastewater epidemiology can be used to study the collective microbiomes of cities, and this research formed the basis for what would eventually become Biobot.

Biobot was founded in 2017 with a mission to transform wastewater, or sewage, into actionable public health data. Everything we eat, the infectious pathogens in our bodies, and the medicines we use are excreted in our urine and stool and end up in wastewater. We collect and analyze city wastewater to understand population health trends, and this is the basic premise of wastewater epidemiology.

In March 2020, our team was the first in the United States to successfully report the detection and measurement of SARS-CoV-2 in wastewater. Excited by the promise of applying WBE to Covid, Biobot set up a pro-bono campaign to encourage municipalities across the United States to monitor the spread of SARS-CoV-2 in wastewater. For six months, we tested wastewater samples from more than 400 communities across the country, helping local officials track the spread of the virus and its variants in near real-time. Building on this experience, Biobot expanded coverage of wastewater monitoring across the country in 2021, resulting in a successful program that covered nearly 90 million Americans.

To date, we have tested wastewater samples from more than 700 communities across all 50 states, including U.S. territories and tribal nations. In collaboration with academic partners, we

have demonstrated that wastewater data is a leading indicator of new Covid cases because infected individuals shed the virus in their waste several days before exhibiting symptoms.

Moreover, wastewater monitoring is a holistic and equitable public health tool because it captures anyone who uses a bathroom, including people who are asymptomatic or lack access to healthcare. This means wastewater data allows us to better understand the presence of Covid regardless of socioeconomic status or racial composition. Another advantage is that it preserves individual privacy, as sewage represents an aggregate sample of all human waste in a community. One sample drawn from a wastewater treatment plant is representative of tens of thousands of people, and testing wastewater is much cheaper than what it would cost to test each person individually.

At this stage in the pandemic, we are witnessing fewer reported Covid cases because take-home antigen tests are now widely available and vaccination has boosted the population's immunity. As a result, clinical testing data has become less reliable, and public health officials are forced to rely on lagging indicators of viral spread, such as hospitalizations and deaths. This is why we believe wastewater monitoring will play an even more important role in containing the spread of the virus as life returns to normal. During the Omicron wave, for example, virus concentrations in Boston's wastewater peaked a full two weeks before clinical cases reached their apex.

Massachusetts was one of the earliest adopters of wastewater monitoring and Governor Baker is briefed weekly on wastewater data alongside other public health indicators tracked by the state's Covid-19 Command Center. Since then, we have also seen communities across the country use wastewater data to help determine when it is safe to relax mask requirements, reopen schools and businesses, and more efficiently allocate testing resources.

Currently, the majority of wastewater testing is run by treatment plants, who send the samples to a public or private lab for analysis, and then the data is shared with local and state public health agencies. The CDC now operates a program called the National Wastewater Surveillance System (NWSS) that invites state public health officials to share their wastewater data with CDC, who can analyze the data to glean regional trends and insights.

However, we continue to see several challenges to broader adoption of WBE:

1. A lack of consistent federal support and funding creates uncertainty among local officials when considering whether to dedicate time and resources to wastewater testing.
2. Different states and localities do not share the same methodologies and reporting requirements, which makes it very hard for CDC and other public health officials to compare wastewater data across state lines.
3. There is no long-term effort or coordinating function to develop wastewater epidemiology into a pathogen-agnostic platform. Rather, different federal agencies are using WBE for different purposes in isolation from each other.

To improve this situation, Congress and the federal government should:

1. Assist forward-thinking states and localities who have started their own wastewater monitoring programs through consistent funding.
2. Empower relevant federal agencies to support wastewater monitoring efforts across the country, especially by standardizing testing and data collection methods.
3. Align federal support behind WBE as a pathogen-agnostic technology that can monitor for many different public health threats beyond Covid-19. For instance, Biobot has already demonstrated that WBE can be used to monitor for seasonal influenza.

To conclude, As Covid-19 becomes endemic, wastewater monitoring can play a critical role in keeping our nation safe and healthy, while also ensuring we are prepared for the next pandemic or biological threat. To meet its full potential as a pathogen-agnostic platform, however, the U.S. government will need to play a more active role in developing the infrastructure to support wastewater testing. I look forward to answering your questions and thank you again for this opportunity.

Appendix:

“Accelerating wastewater-based epidemiology for pandemic preparedness and biosecurity in the United States”¹

Throughout the course of the Covid-19 pandemic, wastewater-based epidemiology (WBE) has been used effectively by state and local governments, federal agencies, universities, and private businesses to monitor the spread of the virus and its variants, inform public health responses, and help predict the level of new cases in a community several days in advance. WBE offers several advantages over traditional public health reporting mechanisms:

- WBE can track many pathogens, but is particularly well suited to detect and mitigate disease outbreaks that cannot be easily monitored by syndromic surveillance, such as diseases with nonspecific symptoms (e.g. respiratory viruses of pandemic potential), diseases with a pre-symptomatic shedding period (e.g. SARS-CoV-2) or diseases spread primarily by asymptomatic carriers (e.g. Hepatitis C).
- WBE is an equitable public health tool because it does not rely on an individual’s access to (or willingness to pursue) healthcare, and WBE data can provide public health officials with a more holistic and inclusive view of viral trends.
- WBE produces aggregated and anonymized data from community wastewater samples, avoiding difficult personal data and privacy issues. WBE is also cost-effective because one sample is representative of an entire community (e.g. a town or city).
- WBE has the potential to definitively and rapidly identify new emerging infectious diseases (EIDs), as well as pathogens intentionally or accidentally released into the population.

Here are a few examples of how government officials and business leaders have been incorporating wastewater data into their public health response:

- In Massachusetts, Governor Baker is briefed weekly on data from wastewater alongside other public health indicators tracked by the state’s Covid-19 Command Center. (Source: [NBC](#)) Several school districts in Massachusetts also rely on wastewater data to inform reopening plans (Source: [Cambridge Public Schools](#)).
- In December 2021, Boston Children’s Hospital canceled elective surgeries for Q1 2022 based on a surge in virus concentration in local wastewater. A decline in virus concentration in wastewater in the middle of January 2022 is prompting the hospital to consider rescheduling these activities for early spring. (Source: [New York Times](#))

¹ Recommendations Submitted to White House Office of Science and Technology Policy on January 27, 2022

- In New Castle County, Delaware, the County Executive's Office allocates clinical testing capacity based on virus concentration surges observed in the wastewater. (Source: [Delaware Online](#))
- The City of Cedar Rapids, Iowa, uses wastewater to support its local hospital system in planning and preparation as the pandemic continues to evolve. (Source: [City of Cedar Rapids](#))
- Miami-Dade County, Florida, has incorporated wastewater data into their "Moving to a New Normal Daily Dashboard," as part of their risk assessment approach. (Source: [Miami-Dade County](#))

Many state and local officials have already recognized the value that WBE provides in not only countering the spread of Covid-19 but also as a powerful tool to combat the opioid epidemic and fentanyl misuse. However, making WBE a foundational part of the nation's pandemic preparedness and biosecurity infrastructure requires existing efforts to be streamlined and centralized.

A patchwork WBE network has evolved out of necessity in response to the Covid-19 pandemic, but without greater support from the federal government, WBE is ill-equipped to scale or meet its potential as an early warning system for future EIDs and biothreats. Given this, we recommend that the Administration take the following steps to expand and improve implementation of WBE across the United States:

Recommendation 1: Elevate wastewater-based epidemiology as a standard monitoring strategy for Covid-19 and actively recommend the approach as part of pandemic response.

- *Risk:* A lack of consistent support for WBE at the federal level contributes to uncertainty among state and local governments when making decisions about whether to adopt WBE. For example, when the HHS-Biobot Covid-19 monitoring program ended last year, 98% of participants indicated via survey that they wanted to continue but did not have the budget or expertise to perform WBE services on their own.
- *Path forward:* The Administration should recommend the inclusion of WBE data for community-level Covid-19 response. Federal funding for WBE should be made available not only to federal agencies such as HHS, CDC, and EPA, but also to relevant state and local government entities to ensure funding reaches wastewater treatment plants.

Recommendation 2: Standardize testing and data collection methodologies and streamline requests sent to wastewater treatment plants.

- *Risk:* Wastewater treatment plants (WWTPs) provide the majority of samples for WBE services and are easily overwhelmed by multiple sampling requests from local, state, and

federal agencies, leading to logistical bottlenecks. Moreover, different localities use different testing and data collection methodologies, making it hard to compare wastewater data across state lines.

- *Path forward:* Convene an interagency working group among entities interested in WBE to align on testing and data collection methodologies, as well as establish clear channels for sampling requests to avoid overburdening WWTPs.

Recommendation 3: Align federal support of WBE as a broad public health monitoring tool beyond Covid-19.

- *Risk:* Without adequate federal funding and support, the full potential of WBE as a pathogen-agnostic early warning system may not be realized.
- *Path forward:* Raise awareness of the many potential applications of WBE in disease prevention, as well as its usefulness in areas like measuring drug consumption and antimicrobial resistance, to identify federal agencies that could benefit from this technology and provide support for its development and implementation.

MARIANA MATUS, PhD

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Computational biologist and entrepreneur working at the intersection of genomics and public health.

Education

Massachusetts Institute of Technology Cambridge, MA, USA PhD in Computational and Systems Biology, GPA: 4.8/5.0 June, 2018

Thesis title: "Analysis of fecal biomarkers to impact clinical care and public health."

Research areas: Human microbiome; Wastewater-based epidemiology.

Coursework includes: Computational and Systems Biology; Statistical Learning and Data Mining; Machine Learning; Regulation of Gene Expression

Wageningen University and Research Centre Wageningen, Netherlands MSc in Biotechnology January, 2012

Thesis title: "Mechanisms of promoter propagation in prokaryotes."

Universidad Nacional Autónoma de México Morelos, Mexico BSc in Genome Science May, 2009

Thesis title: "Survival assays of *Rhizobium etli* in sterile soil and its relation to the biosynthesis of the osmoprotectant trehalose."

Work Experience

Biobot Analytics Cambridge, MA, USA CEO and Cofounder June 2018 - Present

- Set the company direction and strategy
- Lead scientific and technology team
- Fundraising, including participation in Y Combinator, and other accelerator programs

Sample press coverage:

March 2022, CNBC; "Two years into the Coronavirus Pandemic, Fauci hopes the world will not forget lessons from a 'catastrophic experience.'" <https://www.cnbc.com/2022/03/14/fauci-warns-not-to-forget-pandemics-catastrophic-experience.html>

January 2022; The New York Times; "In sewage, clues to Omicron's surge" <https://www.nytimes.com/2022/01/19/health/covid-omicron-wastewater-sewage.html>

October 2021; Bloomberg; "MIT offshoot that detects virus in wastewater raises \$20 million" <https://www.bloomberg.com/news/articles/2021-10-22/mit-offshoot-that-detects-virus-in-wastewater-raises-20-million>

June 2018; STAT News; “Scientists can track the spread of opioids in sewers. But do cities want to know what lies below?” <https://www.statnews.com/2018/06/26/wastewater-epidemiology-biobot-opioids/>

Massachusetts Institute of Technology Cambridge, MA, USA Graduate Researcher in Prof. Eric Alm’s lab September 2012 - June 2018

Co-founded the MIT Underworlds Project in collaboration with MIT Senseable City Lab and the Kuwait Institute for Scientific Research. Participated in securing \$4M USD in grant funding from the Kuwait Foundation for Scientific Advancement. Biobot Analytics is a spin-off of the research.

Press release: <http://news.mit.edu/2015/real-time-urban-epidemiology-from-wastewater-1102>

Personal highlight: <http://news.mit.edu/2015/student-profile-mariana-matus-0915>

Collaborated with Prof. Dominick Mueller’s lab in the Max Delbrück Center for Molecular Medicine (Berlin, Germany) to publish a high impact scientific article that studied the link between high salt ingestion, the gut microbiome and high blood pressure.

Press release: <http://news.mit.edu/2017/gut-microbes-can-protect-against-high-blood-pressure-1115>

University of Cambridge Cambridge, UK Research Intern in Prof. Alison Smith’s lab September 2011 - December 2011 Studied biofuel production in microalgae and how to optimize the ratio of carbon to nitrogen. My work included literature review, mathematical modeling, and cultivating microalgae to test models. The European Union Erasmus Mundus Fellowship sponsored my internship.

Wageningen University and Research Centre Wageningen, Netherlands Graduate Researcher with Dr. Mark van Passel January 2011 - August 2011 Worked with Dr. Mark van Passel to study how regulatory elements (promoters) evolve in bacterial genomes, including a computational analysis and experimental work. My research work was published in a high-impact scientific journal.

Press release: <https://resource.wur.nl/en/show/Genetic-variety-through-mobile-switch.htm>

Teaching Experience

Massachusetts Institute of Technology Cambridge, MA, USA Instructor, MIT REDX: Rethinking Engineering Design and Execution January 2015

Massachusetts Institute of Technology Cambridge, MA, USA Teaching Assistant, Biology GIR January - June 2014

Massachusetts Institute of Technology Cambridge, MA, USA

Teaching Assistant, MIT Skoltech Initiative June - September 2013

Highlighted Awards

2021 Fast Company Most Innovative Companies, #3 in biotech and #16 overall
 2020 C&EN Trailblazing Women in Chemistry Award, nominated by Nobel prize awardee Prof. Jennifer Doudna

Extended List Awards

2022 GovTech 100
 2021 Newsweek's America's Greatest Disruptors: Enterprising Idealists
 2021 GovTech 100
 2020 Entrepreneur's Most Powerful Women
 2018 Lee Kuan Yew Global Business Plan Competition Finalist
 2018 MIT China Future City Lab Competition Winner
 2017 MIT Graduate Women of Excellence Award
 2017 MIT IDEAS Global Challenge Winner
 2017 MIT DesignX Winner
 2012 MIT Computational and Systems Biology Fellowship
 2011 European Union Erasmus Mundus Fellowship
 2010 Mexican National Science Council (CONACYT) Fellowship for Graduate Studies Abroad
 2008 Mexican National Science Council (CONACYT) Fellowship for Undergraduate Researchers

Professional Associations

American Chemical Society (ACS), 2018-present
Co-organizer of "Wastewater-based Epidemiology Symposium" at the ACS National Meeting in 2019
 Medical Development Group of Boston, 2015-present
 American Society of Microbiology (ASM), 2015-present
 The New York Academy of Sciences, 2015-present

Publications, Wastewater Epidemiology

Wei Lin Lee, Maxim Imakaev, Federica Armas, Kyle A. McElroy, Xiaoqiong Gu, Claire Duvallet, Franciscus Chandra, Hongjie Chen, Mats Leifels, Samuel Mendola, Róisín Floyd-O'Sullivan, Morgan M. Powell, Shane T. Wilson, Karl L. J. Berge, Claire Y. J. Lim, Fuqing Wu, Amy Xiao, Katya Moniz, Newsha Ghaeli, **Mariana Matus**, Janelle Thompson, Eric J. Alm. "Quantitative SARS-CoV-2 Alpha Variant B.1.1.7 Tracking in Wastewater by Allele-Specific RT-qPCR." *Environ. Sci. Technol. Lett.* (2021)

Nour Sharara, Noriko Endo, Claire Duvallet, Newsha Ghaeli, **Mariana Matus**, Jennings Heussner, Scott W. Olesen, Eric J. Alm, Peter R. Chai, Timothy B. Erickson. "Wastewater network infrastructure in public health: Applications and learnings from the COVID-19 pandemic." *PLOS Global Public Health.* (2021)

Timothy B. Erickson, Noriko Endo, Claire Duvallet, Newsha Ghaeli, Kaitlyn Hess, Eric J. Alm, **Mariana Matus**, Peter R. Chai. "Waste Not, Want Not" — Leveraging Sewer Systems and Wastewater-Based Epidemiology for Drug Use Trends and Pharmaceutical Monitoring." *Journal of Medical Toxicology*. (2021)

Claire Duvallet, Fuqing Wu, Kyle McElroy, Noriko Endo, Maxim Imakaev, Amy Xiao, Jianbo Zhang, Róisín Floyd-O'Sullivan, Morgan Powell, Samuel Mendola, Francis Cruz, Tamar Melman, Eric Alm, Timothy Erickson, Newsha Ghaeli, Peter Chai, **Mariana Matus**. "Nationwide trends in COVID-19 cases and SARS-CoV-2 wastewater concentrations in the United States." *In review*. (2021)

Katelyn S. Foppe, Elizabeth B. Kujawinski, Claire Duvallet, Noriko Endo, Timothy B Erickson, Peter R Chai, **Mariana Matus**. "Analysis of 39 drugs and metabolites, including 8 glucuronide conjugates, in an upstream wastewater network via HPLC-MS/MS." *Journal of Toxicology B*. (2021)

Fuqing Wu, Amy Xiao, Jianbo Zhang, Katya Moniz, Noriko Endo, Federica Armas, Mary Bushman, Peter R Chai, Claire Duvallet, Timothy B Erickson, Katelyn Foppe, Newsha Ghaeli, Xiaoqiong Gu, William P Hanage, Katherine H Huang, Wei Lin Lee, **Mariana Matus**, Kyle A McElroy, Steven F Rhode, Stefan Wuertz, Janelle Thompson, Eric J Alm. "Wastewater Surveillance of SARS-CoV-2 across 40 US states." *Water Research*. (2021)

Claire Duvallet, Bryan D Hayes, Timothy B Erickson, Peter R Chai, **Mariana Matus**. "Mapping Community Opioid Exposure Through Wastewater-Based Epidemiology as a Means to Engage Pharmacies in Harm Reduction Efforts." *Preventing Chronic Disease* (2020).

Noriko Endo, Newsha Ghaeli, Claire Duvallet, Katelyn Foppe, Timothy B Erickson, **Mariana Matus**, Peter R Chai. "Rapid assessment of opioid exposure and treatment in cities through robotic collection and chemical analysis of wastewater." *Journal of Medical Toxicology* (2020).

Fuqing Wu, Jianbo Zhang, Amy Xiao, Xiaoqiong Gu, Wei Lin Lee, Federica Armas, Kathryn Kauffman, William Hanage, **Mariana Matus**, Newsha Ghaeli, Noriko Endo, Claire Duvallet, Mathilde Poyet, Katya Moniz, Alex D. Washburne, Timothy B. Erickson, Peter R. Chai, Janelle Thompson, Eric J. Alm. "SARS-CoV-2 titers in wastewater are higher than expected from clinically confirmed cases." *Msystems* 5, no. 4 (2020).

Fuqing Wu, Amy Xiao, Jianbo Zhang, Katya Moniz, Noriko Endo, Federica Armas, Richard Bonneau, Megan A Brown, Mary Bushman, Peter R Chai, Claire Duvallet, Timothy B Erickson, Katelyn Foppe, Newsha Ghaeli, Xiaoqiong Gu, William P Hanage, Katherine H Huang, Wei Lin Lee, **Mariana Matus**, Kyle A McElroy, Jonathan Nagler, Steven F Rhode, Mauricio Santillana, Joshua A Tucker, Stefan Wuertz, Shijie Zhao, Janelle Thompson, Eric J Alm. "SARS-CoV-2 titers in wastewater foreshadow dynamics and clinical presentation of new COVID-19 cases." *medRxiv* (2020).

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Foppe, K. et al. Poster: Wastewater-based epidemiology to combat the opioid crisis. *The Association of Public Health Laboratories (APHL)* St Louis, MO (2019)

Mariana Matus & Nicole Raimundo. Presentation: "Assessing the scope of opioid use and overdose risk in residential communities through a novel wastewater epidemiology system: Learnings from the Town of Cary, NC." *Opioid data to action. Combating addiction through innovation. Indiana University School of Social Work, Indianapolis.* (2019)

Mariana Matus et al. Poster: "Biobot Analytics: A novel wastewater analysis technique to quantify opioid use in communities." *American College of Medical Toxicology 2019 Annual Scientific Meeting, San Francisco, CA.* (2019)

Publications, Other Work

Wilck, N., Matus, M.G., et al. (2017) Salt-responsive gut commensal modulates T_H17 axis and disease. *Nature*. <https://www.nature.com/articles/nature24628>

Press release: <http://news.mit.edu/2017/gut-microbes-can-protect-against-high-blood-pressure-1115>

Matus, M.G. et al. (2012) Promoter propagation in prokaryotes. *Nucleic Acids Research*. <https://academic.oup.com/nar/article/40/20/10032/2414736>

Press release: <https://resource.wur.nl/en/show/Genetic-variety-through-mobile-switch.htm>

Expert Revisions of Scientific Publications

(2019) American Chemistry Society Book: Wastewater Based Epidemiology: Estimating Community Drug Consumption

Title: "Detection of Stimulant Drugs in Conventional Wastewater Treatment Plants in Northeastern United States"

(2019) American Chemistry Society Book: Wastewater Based Epidemiology: Estimating Community Drug Consumption

Manuscript ID: bk201800748c

Title: "Wastewater-Based Epidemiology to Determine Temporal Trends in Illicit Stimulant Use in Seattle"

(2017) Journal: Environmental Science & Technology

Title: "Coupling Mechanism between Microbial Communities and Biological Metabolization of Organics in Urban Sewer System"

Chairman FOSTER. Well, thank you. And at this point we will begin our first round of questions. The Chair will now recognize himself for five minutes.

Dr. Emanuel, to oversimplify a bit, transitioning into the new normal for COVID-19 means assessing the risk level to a particular individual or community at a given time and adjusting the precautions accordingly. While the COVID-19 pandemic puts this calculation on a massive scale, this is an exercise that the public health community must conduct in real-time on myriad issues. So what are the lessons that we can draw from past public health crises and even just ongoing public health risk? And when considering the level of risk that might be considered acceptable by the general population, and how do we quantify at what point increased mitigation measures are actually worth the cost?

Dr. EMANUEL. I keep forgetting to unmute myself. Chairman Foster, that is an excellent question. And as I said, there's not one indicator we can follow. We need five indicators at least, and we need thresholds on those indicators. Again, they need to be vaccination rates, population immunity in the community, we need to have wastewater testing, we need to look at hospital and health system overload, and we need to look at the death rate.

But, as you point out and actually as Ms.—Dr. Matus—sorry if I mispronounce your name—has just pointed out we need to bring it down to the local level, and we can do that because each one of those metrics can be done on a population basis, and we need the information in each community and be able to give them a dashboard for the country but a dashboard for the community. And they need to see where the lines are where we need to take added protections and where we can ease off the protections. And I think adding in population immunity and wastewater testing will give us a very good handle—not a perfect handle but a good handle on what's coming down the pike in a week or 2 weeks so that people can prepare.

I think this is something that's going to be critical going forward for having that kind of dashboard, and I do appreciate the CDC's new dashboard. I don't think it encompasses everything we want. But remember, the dashboard is only as good as the data, and as you've heard from others on this panel, which I totally support, is we need an upgrade in those data, more real-time data, more standardization, and getting all communities to give it. And the Federal Government needs to give funding in exchange for people collecting the data in a reliable way and giving it to the Federal Government and localities to use.

Chairman FOSTER. Thank you. And I guess, Dr. McBride, how do we deal with recognizing that different costs are imposed on different segments of the population and different benefits? You know, we ran into this with one of the major reasons to get younger people—young, healthy people vaccinated was simply to protect the elderly in our society. And so you couldn't argue this only on an individual basis but for a population which may be different than your own group. So what is—what are the lessons learned and the best approaches to trying to deal with that?

Dr. MCBRIDE. Well, I think we have to realize, first of all, that in the panicked spring of March 2020 it made sense to treat chil-

dren and elderly people the same because we didn't know exactly who was most at risk for severe outcomes from COVID. But we're now in March 2022. We have abundant data to show exactly who is at highest risk for poor outcomes. It's older patients, it's patients with immune-compromised states, it's people with underlying health conditions, and it's people in marginalized communities who don't have the access to needed information and resources to protect themselves and their families and their communities.

So I think what we need to do is, as Dr. Emanuel was just saying, make sure we have evidence and data on hospitalizations that's stratified by age, by vaccination status, race so that we understand exactly who's at higher risk so that we can surge our limited resources to the most vulnerable populations and then appropriately calibrate the mitigation measures to the level of actually—actual risk in that population. For example, subjecting young, healthy college kids to mandates for boosters when they, for example, had COVID-19 and have had two or three shots already, does it make sense? It does make sense, though, to focus on surging the fourth shots to people who have, A, not had recent COVID, and B, who are at highest risk, and of course getting first shots, second shots in first and foremost.

But I think the larger question here is really how do we message to various populations? How do you tell my immunocompromised patient, you know, one piece of advice and a college student whose risk for depression and anxiety is more than their risk of COVID, and that is ultimately the job of the primary care doctor to help take broad public health advice and marry it to the person in front of us.

Chairman FOSTER. Thank you. And my time is expired, and I will now recognize the Ranking Member for five minutes.

Mr. OBERNOLTE. Well, thank you very much, Mr. Chairman.

You know, I'm fascinated by this discussion about the data necessary to make good decisions in the future and how those decisions are made. And so let me start with Dr. Emanuel. You in your testimony talked about the need for a viral dashboard with reliable data on things like vaccination rates, wastewater testing, community immunity, things like that. And I agree that all of those are things that we need better data on. But, you know, as scientists sometimes we pretend that if we had all the right data, we can make the perfect decisions, and I think everyone would acknowledge that in the case of decisions about COVID, the decisionmaking process is more complicated. And some of the things that we did not consider over the last couple of years are the societal costs that are concomitant to the decisions that we make about things like shutdowns and mandatory vaccination and things like that.

So I'm fascinated because your background in bioethics, I think this is something you've probably thought about. You know, how do you navigate that space, and don't you need data about when you're considering a shutdown what the economic costs are, what are the costs on behavioral health? You know, how do you parse all that?

Dr. EMANUEL. So, first of all, I think you're 100 percent right. We are making tradeoffs, and we're making tradeoffs on major things that don't look, as we say in the field, commensurable, mental

health versus, you know, getting kids back to school or mental health versus putting people into poverty because we've shut down businesses. I don't want to look self-interested, but I think understanding better and trying to create more models about how we do as human beings make those decisions is something that is worth thinking about and investing in.

But I would tell you, I do think there was a false narrative out there that, well, the public health people weren't considering these other factors like education or the economy. We saw from the public when rates went way up of COVID, they themselves, before any public health measures were introduced, stepped back from engaging in commercial activity, not being social, keeping their kids home from school. And so there was a very close correlation between fighting the infection and getting the economy going. It's very hard to get the economy fully going until we've got this fully under control, and the risks to us of COVID and other respiratory illnesses are at a low enough threshold that we think they're worth taking.

I don't think we're quite there in large measure in my opinion because we don't know anything really about long COVID, and we need to get understanding of long COVID. We know that if you're vaccinated with three doses—three shots, your chance of dying are about 1 in 30,000. That's a very low risk, and we go back to normal if there were no long COVID. The long COVID element to it, unknown, unknown who gets it, unknown what the risks actually are I think complicates this and complicates weighing all the things you said.

Let me finish with one point. I think going forward it's quite clear to all of us here that closing the schools was a mistake, that we could put in better indoor air quality, wearing masks, and have in-person learning, which would have been so important for the students. Schools should be the last thing we close, and they should stay open as long as possible. We shouldn't be opening restaurants before we open schools. That seems like we have our values quite wrong.

Mr. OBERNOLTE. Yeah, thank you. Yeah, I mean, I think you've illustrated some of the fundamental problems there. And, you know, the economic decision is actually, as you say, the most difficult. But, I mean, even in the space of public health when you talk about the effect on something like a future substance abuser, domestic violence, you know, I think it's really hard to—you know, to make decisions just based on stopping the spread of a contagion.

Let me ask one last question of Ms. Ayala. You know, in your testimony you were talking about the need for the availability of more of the at-home testing information. And I'm of the opinion that we actually made some bad decisions early in the pandemic about prioritizing PCR testing over antigen testing because PCR testing we know to be more reliable. But in reality antigen testing, we would've gotten a lot more data about that. I'm curious, do you think that that was a bad decision? And then if you could also address the privacy issues involved with gathering the data, I'd appreciate it.

Ms. AYALA. Thanks so much for those questions. Yes, I think that acknowledging that PCR testing has unique components and

is considered to be the gold standard for testing—for viral testing is a no-brainer. However, if the goal is to get as many people tested as possible and results turned around as quickly as possible, then antigen testing is something that we probably should have explored and built systems to support much earlier.

The idea of privacy issues surrounding testing is something that public health has centuries of addressing in much—with much more sensitive kinds of disease and virus activity, so I think that even if we did a—an opt-in type of opportunity for individuals who were getting antigen tested and using their at-home tests, we still would be further ahead than we are right now.

Mr. OBERNOLTE. Right. Well, thank you. I see my time is over. Thank you for the indulgence, Mr. Chair. I yield back.

Chairman FOSTER. Thank you, and we will now recognize Representative Dr. Bera for five minutes of questions.

Mr. BERA. Great, thank you, Mr. Chairman. And again, I really appreciate the panel and the witnesses, super important information.

I'll plug a piece of legislation that we've just reintroduced, the *Tracking Pathogens Act*, which would, you know, plus-up the budget for both gene sequencing but also for what you've talked about in terms of wastewater surveillance, you know, throughout the country. So, you know, it's a good bill. Folks should sign on to it.

Dr. Emanuel, let me ask you a question, and this is—maybe a one-off, but something that we talked about a little bit previously, one of my biggest concerns is we obviously have seen vaccine hesitancy, you know, spring up around the COVID vaccines and so forth. And, you know, in my home State of California, you know, we previously did have, you know, an anti-vax movement, but it was really largely a small percentage of the population. I have a big fear as, you know, we come out of COVID or we go into this next phase what that spillover effect may be. We know COVID, you know, does minimal harm to our children, but if the anti-vax movement now spills over into routine childhood vaccines like measles and so forth, I really, you know, worry very much about what may happen. And that, again, are you seeing any of that trend in terms of routine vaccination rates?

Dr. EMANUEL. You're 100 percent right, Dr. Bera, which is we have seen in the country a substantial drop in childhood vaccinations. Some of that is being able to get to the doctor, feeling safe going to the pediatrician's office, some of that is a spillover effect of the anti-vax movement. And I do think this is something that we have to confront dramatically. We need to make it clear that this is both a personal and—a responsibility and a community responsibility, and that these vaccines are very safe. They're very safe whether they're COVID vaccines or DPT (diphtheria, pertussis, and tetanus) or MMR (measles, mumps, and rubella) compared to almost anything else we do like driving a car, going swimming. And we have to change the mental attitude in this country that vaccines are something we have to do and we're obliged to ourselves, our family, and our community to do. We care about all of that, and people have to see these vaccines as helping make a healthy community.

Mr. BERA. Dr. McBride, you're on the frontlines still practicing, and I'd be curious what you're seeing in your practice with your patients and then, you know, again, what we should be thinking about from the congressional perspective to change this narrative in the most effective way.

Dr. McBRIDE. Thank you, Dr. Bera. I really appreciate the question because I have a lot of patients—most of my patients are vaccinated and firm believers in vaccines, as I am. I have a handful, though, who are vaccine-hesitant. And the way I've been able to convince my patients to get vaccinated or even consider getting vaccinated is by using that trust and rapport that I've built over time, by listening to their understanding. I mean, let's face it, people in the United States have historical and ongoing real reasons for distrusting the medical institution, and that needs to be heard. People need to be seen, and they need to be understood and not shamed or blamed for not getting vaccinated.

The second thing I would say is that there's a recent study in *JAMA* (*Journal of the American Medical Association*) from last month showing that vaccination rates increased with the number of PCPs (primary care physicians) per capita. So, again, I'm a little biased, I'm a primary care doctor, but that is what we do. You know, I can't—I can have the best vaccine in the world like we do now, but if I don't have the trust of my patients and I can't convey nuanced information and meet people where they are, respecting their lived experience and their biases and beliefs, then I really can't make headway or deliver the services that person needs. And so, again, I think we need primary care to help meet people where they are.

Mr. BERA. Well, I'm a primary care internist, so—I'm not practicing right now, so I hear that. I guess in the short time that have left—and maybe I'll throw it back to you, Dr. Emanuel—with regards to long COVID, it is something that, you know, we're concerned about, we're thinking about allocating the resources and trying to better understand it. Where would you want Congress to focus right now in terms of better understanding long COVID?

Dr. EMANUEL. So first thing is we need to make sure that the NIH and the CDC understand this is an emergency and not usual academic research. And I can say that as an academic. This has to be turbocharged.

Second, we knew to expand their trials. The estimate by the GAO (Government Accountability Office) is at least 8 million people have long COVID, 10 percent of the people who've gotten COVID, maybe as high as 23 or 24 million. There are many millions of people we can enroll. We need to enroll them in studies to find out what the actual rate is, what the risk factors, what increases the chance of long COVID, what decreases it? Do vaccines protect? Does Evusheld protect? Do other treatments protect?

The last thing we need to do is we need to start immediately doing clinical trials. We don't understand the biology. That doesn't prevent us from trying things like, you know, steroids or statins or SSRI (selective serotonin reuptake inhibitors) inhibitors, things that have been shown or suggested to lower the risk of COVID, maybe they lower the risk of long COVID. Immune modulators, those three things, what's the risk of COVID, what affects your

risk of COVID, improves or reduces your risk of long COVID, and finally, starting clinical trials for therapeutics that might curtail long COVID, all very important and need to be done immediately. Before the end of 2022 we should begin to have answers.

Mr. BERA. Great. I see my time is expired, so I will yield.

Chairman FOSTER. Thank you. And I will now recognize Representative Bice for five minutes of questions.

Mrs. BICE. Thank you so much. Dr. McBride, did you want to comment on that really quickly?

Dr. McBRIDE. I just want to comment on the fact that what I see in my patients and what I see in the public square is necessary and real concern about long COVID. I have patients with long COVID. I have a nurse who got COVID back in 2020 and is still suffering from the fallout, loss of taste and smell, brain fog. It's real. It is absolutely real.

At the same time, I think in the public, based on what I'm observing and what I understand based on the studies that have been done that are not well-controlled—they're not well-controlled studies, is that there seems to be an outsized fear of long COVID that, again, this is not to dismiss people's fears, this is not to dismiss people's lived experiences, this is not to dismiss people who are living with long COVID. My point is about the messaging and the difficult threading of the needle that we need to do as clinicians and that we need to do as public health leaders, reassuring people where reassurance is warranted because we see, based on the data so far, that vaccines do reduce the risk of long COVID. We need more research. We also can reassure people and not scare people unnecessarily when they've been vaccinated.

Mrs. BICE. So on that note, first of all, I want to thank Dr. Emanuel for mentioning not, you know, sending kids home from school. I think that's incredibly important. And we have seen the detriments of that across the country. Every socioeconomic demographic is being affected by kids being home, so I appreciate your comments on that.

Dr. McBride, I want to ask you this question. I had a conversation with a pediatrician recently who was asked—obviously is very interested in these conversations, and she asked the question, do you think a fourth booster is going to be required or recommended by the CDC? And I said, you know, I doubt it. But her concern was the virus that we're seeing today, these sort of mutations that we're seeing today are vastly different than what we saw 2 years ago. And her concern is that the vaccines have not been modified at all to be able to affect that. What are your thoughts on that?

Dr. McBRIDE. So lots of thoughts. One is that I think we need to do a better job of managing people's expectations of what the vaccines can do. The vaccines are no doubt the clearest way forward through the pandemic and through the next waves and set of variants. But we also need to make clear to the general public that vaccines are not magic force fields and that they don't protect us against infection like they did pre-delta. So we shouldn't be surprised, for example, if someone has a breakthrough infection despite three or even four shots. But the fact that they're not in the hospital, they're not severely ill is a vaccine success.

And that messaging is the nuance that has unfortunately I think been lost so that people like in my practice have been terrified by getting a breakthrough infection saying, oh my gosh, my vaccine doesn't work when actually if you're at home with the flu, not that it's the flu, it's a different virus altogether, that is your vaccine working.

So to answer your question, I don't have a crystal ball, and I would be lying if I knew what was happening in the future, but I do think we will see new variants and we will see more waves. And I think ultimately what we'll end up seeing is new formulations of the vaccine to target the variant at hand not unlike what we do with the flu.

Mrs. BICE. Right. And that's, I think, what her point was. The flu is an annual mutation or variant, and we're having to re-create those vaccines every year. We should be looking at that for COVID as well because we are seeing these mutations as we move through time and they may change.

I also want to say I agree 100 percent with your assessment about communication. I thought from the very beginning it should have been OK for the CDC, NIH, and others to say we don't know yet, we don't know yet, we're still doing research. But instead of that, we heard a lot of information that ended up being either incorrect or modified later on, no masking, double masking, no masking if you're vaccinated. And I think to your very well-made point, people become distrusting if the message is constantly being changed, right?

And so one of the things I want to see from our health officials here is, you know, understand that you can say I don't know. This was a disease that we had never seen before and we didn't know—if you think back to March 2020, people thought that you could get it by touching, you know, your groceries at the grocery store. I mean, it was really sort of kind of crazy times. But now we know a lot more about it, and I think that messaging builds confidence in the medical community so that people will be more comfortable taking the vaccine, being, you know, willing to get a booster if necessary. But this constant shift in that messaging makes people incredibly distrusting, and that's why we're seeing, I think, such high numbers.

The other thing I'll quickly add, too, is we mentioned vaccination rates. I think there are two reasons. Certainly not having access is a big deal, especially for low-income families when you have health departments that have been closed or clinics that have been closed only to COVID vaccines, that becomes a problem for children. And then the other piece of it is educating these parents that the vaccines that we've been taking, you know, DPT, the MMR vaccines are safe and effective and that's why we don't have those diseases across the country.

So, my time is expired. I appreciate your indulgence. And at this time I yield back, Mr. Chairman.

Chairman FOSTER. Thank you. And for our Members, there will be a second brief round of questions as well.

And we'll now recognize Mr. Casten for five minutes.

Mr. CASTEN. Thank you, Mr. Chairman.

Dr. Ayala, I have to start with a confession. I've never admitted this publicly, so bear with me. The Harvard School of Public Health has maintained a list throughout the whole COVID pandemic showing the vaccination rate by congressional district, and I have taken sole credit for the fact that the Sixth District of Illinois has consistently been the most vaccinated district in the State, and I really don't deserve that. You're 50 percent of my constituents, so credit where credit is due. You deserve credit for that. And of course you've led on testing as well, and it's—and I—you know, I meant everything I said about how fortunate we are to have you there. I also don't think I'm putting any words in your mouth when I say that both of us probably wish those numbers were higher.

And I want to start just by asking you to reflect a little bit. Throughout—certainly through the first year of this pandemic, there was a—the demand for everything exceeded the supply, whether that was the demand for PPE (personal protective equipment) or for ventilators and then for testing and then for vaccines. And in theory there's an optimal public-health way to allocate those scarce resources. In practice, as you and I know too well, some of those decisions were political. There were situations where, you know, we certainly got in a challenge here as far as intrastate allocations, and then once they were at the State level on the county allocations.

And I wonder now that we're sort of, you know, hopefully on the back end of this, was all of that tension completely inevitable, or do you think there are things that we could have done better at the Federal or State level to ensure that that scarce resource allocation was done collaboratively rather than competitively?

Ms. AYALA. So that's a very provocative question. And I think that to a certain extent when you're allocating limited resources, there will inevitably be contentiousness and unhappiness. However, I think the lesson learned—and I remember the conversations that you and I had—transparency around those decisions at the time, as well as benchmarks or metrics for how the decisions are being made, I think those are the tools that could not eliminate but certainly reduce some of that unnecessary angst.

Mr. CASTEN. Well, hear, hear. We could talk for a long time about that. I want to shift, though, if we can to the mental health issue that's come up a couple times. I think we're all keenly aware of how much we as a people need social engagement and how much we've become a little bit sort of socially crippled for lack of a better word as we've been in our bubbles over the last year.

At the same time, there's a part of me as an American that gets confused and in some ways angry at the fact that the same country that was willing to completely transform the way we travel, our rights to data privacy, enter into 20-year wars after 9/11 is not even talking about the fact that we lost two 9/11's last week. Almost a million Americans. And somehow we've either at best decided that we're just inured to it and, at worst, decided that that's an acceptable price to pay so that somebody's kid doesn't have to wear a mask or that somebody can have the freedom not to get vaccinated because that's more important.

And I don't want to trivialize those mental health issues, but you of course oversee a pretty robust mental health division as well out

in Wheaton, and I wonder how you think about the tradeoff between the public health issues of saving lives and the real mental health issues you see, how you think about that, how you communicate it, how we should think about it.

Ms. AYALA. Sure. So when we talked about—earlier in this hearing when we talked about the impact of COVID on children, I think one of the opportunities that we did not take full advantage of from the public health standpoint in working with families around the need for children to get vaccinated, as well as the importance of masking and some of the others is the impact of the loss of someone close to them. When we look at the reports around children who have been orphaned and lost that primary caregiver, again, the most dramatic losses have occurred in our marginalized, underserved populations. Those children—not that any child needs to, you know, experience trauma to build any sort of character going forward, but those are kids who absolutely need people in their lives who are steady and supportive for them.

I think that—I share your concern that when we talk about the numbers—and in DuPage County alone we have nearly 2,000 deaths that have occurred over the last 2 years in large part unnecessarily and tragically too soon and preventable now that we know that there's—this is a vaccine-preventable disease. I think that to us in public health and health, the most tragic outcome is having a death in an otherwise healthy individual.

And so when we talk about the concerns of economics and concerns about restaurants and bars staying open, I think that we need to take a really deep look at what is important from a community standpoint. And I know I'm over, but one of the issues that we've all talked about is the need for schools to have been open. Without a doubt. However, when we had other facets of our society who were unwilling to abide by some of the prevention strategies so that we could get back—kids back in school, I think that's when we—that's when the priorities of a community are felt more than they're heard.

Mr. CASTEN. Thank you. I yield back.

Chairman FOSTER. Thank you. And at this point we'll start a second round of questions for Members who are interested. And I'll now recognize myself for five minutes.

Dr. EMANUEL, you mentioned three interesting technologies that you thought we should—that we should pursue actively, seroprevalence surveillance, mucosal vaccines, and antiviral cocktails. So, first, in terms of the seroprevalence surveillance, does technology exist to really, you know, take one of these little blood spot tests where you, you know, you prick your finger and put it on something that looks like a business card, you mail the business card back in, and then that can be analyzed for antibodies, for example, that may be present? But is there a way—does technology exist to actually use that sort of test to predict whether or not you're actually immune to a specific variant?

Dr. EMANUEL. It can't predict whether you're immune to a specific variant. You can predict whether you've got antibodies to variants and you don't need to get people to actively prick necessarily. We can use what's called the excess blood from laboratory

tests. We do millions of tests every day in this country, and we can use some of that excess blood to monitor these antibodies.

The other problem I would mention with that is that we have cellular immunity, which is what gives us our long-term immunity against COVID, and that's much harder to monitor in the way that you suggest. But the other technologies we need, mucosal vaccines, pan-coronavirus vaccines, multidrug cocktails, those are all very important and we're doing research. We need to, again, turbocharge the research.

Let me just conclude with one other item, which is not a technology so much as research. You can't tell me, I can't tell you, and no one in the country can tell you what the optimal vaccine schedule is. We have different kinds of vaccines. We probably know that mRNA first and mRNA repeatedly is probably not optimal, but we can't tell you is having J&J (Johnson & Johnson) first and then an mRNA optimal? Is maybe having the new Novavax vaccine, assuming it gets approved, with mRNA, is that optimal? We need research on that, too, because we may actually get better community protection and immunity with a different schedule of just the vaccines we have. And we just don't know what's optimal out there, again, another research hole that we need to fill.

Chairman FOSTER. And one thing that's not really a technical issue but I've been very struck, as all of us have, trying—you know, we're trying to convince people who are hesitant to get vaccinated. And we've all spent hours and hours doing that. And very often at the end of the discussion you haven't succeeded. And then one of the things that I have tried doing is to ask people that if instead of a vaccine it was simply a pill that you took, almost universally people say, oh, yes, sure, I'd take a pill. And so even though it's not a technical issue on the performance of such a vaccine, it seems to me that if we prioritize the development of, say, an oral vaccine or one of these, you know, nasal spritzer things, I think that there might be a huge increase in vaccine acceptance. And is there anything—do any of our witnesses know, has that sort of thing been studied as a technique to get past vaccine hesitancy?

Dr. EMANUEL. I totally agree with you. It's—that's why I call for mucosal vaccines. Having a variety of approaches for people is absolutely pivotal, and you're 100 percent right. People are more inclined to do a pill or a spritz in the nose than they are—for whatever reason, shots have very, very bad overtones for people.

Chairman FOSTER. Yes, I think we're kind of built that way. You know, I recently became a granddad, and so babies will often put stuff in their mouth with no hesitation at all, and I've never seen a baby eager to be injected with something.

Now, in terms of the antiviral cocktails, this is something I've been frustrated by because I don't see, frankly, much Federal action on this. We led a bipartisan letter a while ago that doesn't seem to have had much effect. There—one of the problems, there is no real commercial incentive for the manufacturer of a reasonably successful antiviral to be enthusiastic about sponsoring a cocktail in clinical trials. And it's my understanding that actually held back the development of HIV cocktails for actually years. And so is there any observations that any of our witnesses have about the

importance there or what Congress might do to encourage the development of antiviral cocktails?

Dr. MCBRIDE. I would just say if I could that I think the development of Paxlovid, for example, as an oral antiviral is really a gamechanger. And I applaud Biden's test-to-treat initiative, and I think we need to really surge resources there so that people, as you said, who are either vaccine-hesitant or unvaccinated or vaccinated and still get COVID and are at higher risk for poor outcomes can quickly get a rapid test, show that they're positive, and get the appropriate antiviral treatment to further reduce their risk for serious outcomes from COVID-19.

Chairman FOSTER. Thank you.

Dr. EMANUEL. I do think advanced purchase agreements could incentivize us, and specifically allocating money to conduct rapid trials on multidrug regimens is something we have to prioritize. And I think when you allocate money or appropriate money to the NIH, that's something you ought to put in to force them to do it. They have been resistant to these oral medications right from the start. I can tell you that having had discussions. And that's been a mistake. We have hundreds now in either preclinical or clinical trials of antiviral medications, and we need to turbocharge that, too.

Chairman FOSTER. Thank you. And my time is up. I will now recognize the Ranking Member for five minutes.

Mr. OBERNOLTE. Well, thank you, Mr. Chair. This is a really fascinating discussion we're having, and I'd like to continue the line of questioning about vaccines and vaccine hesitancy. But let me just lead by saying that perhaps one of the things that this has taught us is that we need to think more out-of-the-box when it comes to widespread vaccine availability for people because although I will agree that an oral vaccine would be more accepted than an injectable vaccine, convenience is also important. And I know it's—as people in the space of public health, it horrifies us to say this, but for a lot of people, the necessity of having to go to a healthcare provider to get vaccinated, that's a big step for them. I mean, if you got just—if your insurance company just sent you in the mail the next vaccine dose, was an oral vaccine and they said scan this QR code when you've taken it so that we know you've taken it, we can update your medical records, and by the way, you shouldn't take it if you have the symptoms, you know, I actually think that would go a lot further toward making sure that we have good vaccine penetration.

So, you know, let me ask, you know, along those lines, Dr. McBride, I'll pick on you again here. You said some really interesting things about vaccine hesitancy and the anti-vax movement. And I'll be provocative and say I actually think that the government and government action throughout the health crisis has greatly contributed to the rise of the anti-vax movement. I think that if we had just been more open and transparent with the public about the fact that vaccines are very effective, they're overall safe but they do have risks, and I also think that if we had been more respectful of people's own ability to decide for themselves whether or not vaccines were right for them, that people would be less hesitant here. Do you agree or disagree with that? And what mistakes

do you think that we made during the crisis that might have resulted in greater vaccine hesitancy?

Dr. MCBRIDE. So thanks for that question. I don't ascribe ill intent to our Federal Government. I think we've been building an airplane in the air——

Mr. OBERNOLTE. Well, I can. You don't have to——

Dr. MCBRIDE [continuing]. But I do think——

Mr. OBERNOLTE [continuing]. But I do.

Dr. MCBRIDE. Oh, OK. Fine. Fair enough. And as I said in my written testimony, had our prior President, you know, gotten the vaccine as he did and told people about it, that would have done a lot of good.

I think what—this goes back to, again, messaging and acknowledging uncertainty, acknowledging the truth that we know about the vaccine, and then allowing ourselves, giving ourselves permission to give the public permission to have—to feel reassured. So I have so many patients who are vaccinated and boosted and walking around terrified to see their grandkids, to go back to work when they need to know that COVID isn't going away, tragically, but that the vaccine has taken the fangs and claws away from the virus and that they can then focus on their broad human needs. For example, my patients with obesity, hypertension, substance use disorders, we need to be focusing on those issues and take fear out of the driver's seat from—the way they think about COVID while protecting themselves and their families from this virus.

So the other thing I think we missed the opportunity of doing is we didn't get the vaccines into primary care doctors' offices. Again, trust is the ground game in primary care. And if I had the ability to check—see a patient for their annual checkup and say, oh, hey, by the way, there's this COVID shot, it's excellent, what are your concerns and then have them go get their lab work and their vaccine at the same moment, that would be great. The problem is, as you know, 80 million Americans, according to a recent study, don't have access to a primary care medical home, which is why, again, I think we need to invest in primary care and allow people to have that place to get nuanced information. Because the CDC, even if it was doing the best of jobs in the best of times, can't possibly speak to every American. It can't possibly speak to a vaccine-hesitant person and a vaccinated-anxious person. That's our job, to be the lieutenants of the CDC, to help people get what they need and to get the resources and information they need that reflect their unique vulnerabilities and their unique risk tolerances because there's really no one-size-fits-all prescription for how to manage risk.

Mr. OBERNOLTE. Sure. I completely agree. And I also think—I mean, you've raised an interesting issue, which is we need to be cognizant of behavioral science when we're making decisions about how to increase vaccine adoption. And that's one of the mistakes I think we made. You know, it's—we have a long tradition of anti-authoritarianism here in the United States. In fact, it's kind of part of our national ethos. And, as a parent who's raised a couple of kids, I can tell you if I wanted them to eat broccoli, the last thing I should do is tell them they have to eat broccoli, right? If I instead say, well, OK, you cannot eat the broccoli but you're going to miss

out on something good, they're a lot more likely to eat the broccoli on their own. And, I mean, I really think that there are lessons to be learned there in addressing vaccine hesitancy because those are some of the mistakes I think that we made during this process.

But it's been a fascinating discussion. Thank you, everyone.

Chairman FOSTER. Thank you. And we will now recognize Representative Casten for five minutes of questions.

Mr. CASTEN. Thank you. Two questions, first, one more for Dr. Ayala and I want to get to Dr. Matus before we wrap up here, who has been far too lonely on the screen. The—when this pandemic first started, we had some experts come in—Dr. Emanuel, you may have been one—advising us on how to talk to the public through a crisis and the message that stuck in my head was, for goodness sake, don't be the elected official who some significant number of people didn't vote for and say I'm the one who's right. Get the public health officials to stand up next you and speak to that. And I certainly availed myself of your skills in that department more than once, Dr. Ayala.

The trouble was that when we got home and social media was ablaze with all sorts of completely garbage information that was running contrary to that and we weren't sitting there with the expert on hand. And I'm curious, Dr. Ayala, you must've felt that as someone who was communicating this in your soul, I'm curious what you think we can do better for future pandemics about that role of social media and communication and what advice you'd give to us if we were going in now about how to anticipate that sort of nonsense in the future and inoculate the public against it.

Ms. AYALA. Sure, sure. So I think that although I feel it in my soul, I think one of the ways that I've survived the last two years is to completely divorce myself from reading any social media posts or many social media posts. However, I think that as far as communication goes, I think that when we stay silent around misinformation and disinformation from a public health or a healthcare legitimacy, we undermine ourselves. And so I think that, no, we can't possibly address all of the issues that are brought up on social media. However, some of the points that Dr. McBride, Dr. Emanuel have made about communicating the nuances around vaccinations, around communicating the nuances around the need to—for layered mitigation that, just like there's no one metric, there's no one prevention strategy that is going to be the silver bullet, I think those would have gone a long way. And instead I think we just took, I don't know, high road or didn't want to get involved in those kinds of discussions. But I think it really worked against us. And that would be definitely a lesson learned going forward.

Dr. EMANUEL. Can I raise one—or a few points? First, we have to talk about misinformation. It's not just the government giving information that might not be clear. There was plenty of misinformation out there, intentional deception of people. That—some of it came from foreign actors. We know that, and we need to see this as a national security threat when they can spread misinformation that compromises the public health of the country. And I don't think we've done that and taken it on seriously.

Second, the academic studies at least that I've seen trace almost all of this back to Fox News and to the misinformation Fox News

started, then gets amplified by social media, then comes back to Fox News, and it's a vicious negative circle there. And I think we have to be very clear.

Third, we have to change those algorithms and prevent people from staying in an information bubble. You have the power to do it. It's not infringement of First Amendment rights that people—that the companies just can't give you a loop of the same misinformation you get, that you have to be open to information. Those algorithms are quite dangerous to public health, but they're also quite dangerous to democracy. And I think it's very important for you to take seriously those algorithms. They don't infringe the public free speech rights, but they do allow us to be more in a democracy so we can hear the opposing and alternative views very freely, just as freely as we hear—

Mr. CASTEN. So, Dr. Emanuel, thank you, and I completely agree. It's a rich conversation. I do just want to get to Dr. Matus, and I'm seeing my time run down here.

We had a whole lot of complication early on, to some degree probably still do, with data-sharing. Different hospitals have different data systems. They didn't necessarily communicate properly with the community health centers, with the public health departments. And I realize that sewage testing is not the entirety of that, but I'm curious to what degree your data, which is aggregated, can tie some of that together just from a data perspective.

And then, secondarily, to what degree have you been able to work with that diversity of public health systems to use your data to interface and maybe spot gaps and coordinate data between those if that makes sense in the time we've got left.

Dr. MATUS. Absolutely. Wastewater data has grown from being this very obscure novelty that people found interesting or even funny, to suddenly becoming the new pillar, the most trusted source of truth about what's happening in the pandemic. Just earlier this year during the omicron wave, the wastewater data which we make publicly available took everybody just through our website and social media indicated when the peak of the clinical cases would happen 2 weeks ahead of time. It gave hospitals, especially in the Boston area where there's lots of awareness about this type of information, a 2-week leading time to prepare for the peak. And it was equally useful to know when the peak would happen, as well as to when it would end. And that's the promise. That data can be communicated real-time to everybody involved. And, as you say, the data is seen by the Governor. It's seen by the State's public health department. It's seen by the city-level public health departments from Boston, Cambridge, Chelsea. It's seen by the hospitals in the area. It's seen by the public and commented by the public on social media. And as I see it—and I will just end with that. You know, the poop data doesn't lie. And it's that trust, we need to go back to the basics, and wastewater provides that to the public, a public engagement tool.

Mr. CASTEN. Yes. Ending with a comment about the poop deck is a great way to yield back to our captain.

Chairman FOSTER. All right. Enough of that. I will now recognize Representative Bice for five minutes.

Mrs. BICE. Thank you so much. And I actually just want to pivot back to Dr. Matus. You haven't had the opportunity to talk about some of these other topics. I just want to maybe talk—ask you if you can maybe elaborate on communities that you're utilizing these resources in across the country and how we can educate municipalities and States to really invest in the type of research and technology that you are currently providing.

Dr. MATUS. Absolutely. Something to mention is that of all of the communities that currently do wastewater epidemiology, there is a very big fraction of them that are small towns, rural communities, tribal nations. And we work with them. That's part of the beauty of this technology. All that you need is the wastewater. You don't need any pre-existing infrastructure in those areas in order to understand what's happening. In the State of Oklahoma, as well as in others, we have done plenty of work with those communities. And what we're seeing, what seems to be the most resonating with them is feeling part of this story, telling part of it.

Mrs. BICE. Sure. Is there—what is the opportunity for us to utilize wastewater research in other areas, maybe, you know, are you able to identify variants of COVID? Are you—is it parts per million that you can see the amount of, you know, per capita maybe exposure? Like how does that technology really move us forward?

Dr. MATUS. Yes. The wastewater allows you to understand the level of disease activity in an area, so the trend. You can see if it's going up, if it's going down. Right now, the COVID-19 levels nationwide are quite stable at a low level, fortunately. There's a little bit of an uptick happening but nothing yet too concerning. At the same time and from the same sample we also analyze for the variants of concern, so we do genomics sequencing, which was mentioned earlier today as one of very important tools to pandemic preparedness, and we can understand which mutations are circulating of the known variants, as well as new mutations that we don't understand yet.

And there's very interesting work there, not to mention influenza, other infectious diseases, antibiotic resistance, and something that has been mentioned multiple times during this hearing, mental health. Mental health can also be understood through wastewater, both the opioid side, the stimulant side is all of information that can be collected from the same source.

Mrs. BICE. That's fascinating. And I think that the comment that you made that you can look at variants I think is incredibly important as I think everybody on the panel can agree. This isn't going away, and so being able to recognize that's important—and can you tell us how long it takes you to analyze this to be able to provide the data back to the municipalities?

Dr. MATUS. We provide it, yes, next business day.

Mrs. BICE. Wow.

Dr. MATUS. Wastewater is a leading indicator for what's coming. We have been—you know, it has been officially reported by economic groups, by the CDC how wastewater gives you an early warning about what you're going to see in the clinic when it comes to the spikes but also to the variants. Omicron was detected in wastewater before it was in the clinic in the United States in the last wave.

Mrs. BICE. Why we are not utilizing these types of technologies holistically I think is sort of beyond me, so I'm glad to connect with you, and I appreciate you being on the panel.

Dr. McBride, did you want to maybe chime in there?

Dr. McBRIDE. I just wanted to say how impressed I am by what—your presentation, Dr. Matus, and just to say how excellent a resource wastewater management can be, particularly when we see the harms of all of the—the potential harms of, for example, asymptomatic testing in schools. When we have these technologies like wastewater testing and we have the ability to ventilate buildings, these are invisible and private—they preserve the privacy of the public while, you know, alerting people in advance of their risk and mitigating the risk, whereas when you test someone, for example, an asymptomatic child in the school and then send them home for a quarantine when they aren't even sick, then, you know, particularly in low-resource communities, you put that kid at risk for everything from missed school altogether because they don't have access to the internet to, you know, not getting fed where they—so these invisible interventions, paired with access to primary care to get the nuanced information that you need for your individual risk, when Mariana Matus's wastewater tests go up, I mean, that's really to me the wave of the future.

Mrs. BICE. I love it. Well, thank you so much for our panel being here today and, Mr. Chairman, I yield back.

Chairman FOSTER. Thank you. And I'm struck by the amount of interest in this technology here in a very bipartisan manner, and I'm wondering at some point if you may be asked to actually predict the results of elections based on wastewater samples.

But before we bring this hearing to a close, I want to thank our witnesses for testifying before the Committee today. The record will remain open for two weeks for any additional statements from Members and any additional questions the Committee may ask of the witnesses. And this hearing is now adjourned.

[Whereupon, at 11:32 a.m., the Subcommittee was adjourned.]

Appendix

ADDITIONAL MATERIAL FOR THE RECORD

Executive Summary

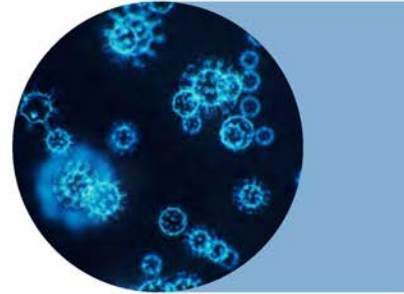
Covid has been raging for 2 years. Multiple variants have emerged. Worldwide, hundreds of millions of people have been infected, millions have died, and untold numbers have developed long Covid. Covid has disproportionately affected communities of color, those living in poverty, and those in less developed countries. Covid has disrupted education and led to significant learning loss. And, there has been tremendous economic dislocation, millions of people thrust into poverty, and the loss of tens of trillions of dollars from the world economy. Importantly, effective vaccines and therapeutics have helped make progress combatting the virus, but cases and deaths still remain high.

As the pandemic enters its third year, two factors have become critical. One is fatigue. People are tired of restrictions used to fight Covid. Simultaneously, the virus continues to surprise experts and make it challenging to anticipate what lies ahead. In all cases, the world must be better prepared.

In 2022, it is possible for a new variant of concern to emerge. But greater population immunity increases the probability of a lower disease burden, lower strain on the health system, and fewer deaths, if waning immunity or immune evasion do not become significant factors.

The United States' pandemic phase—with restrictive public health measures—can end when average daily deaths due to Covid and other major respiratory illnesses decline below 0.5 per 1 million Americans, or 165 deaths a day at a national level. At that point, the United States can transition into the next normal, although individual regions may be able to make earlier transitions, depending on local Covid metrics.

But on March 1, 2022, the nation is not yet at the next normal. The shift to the next normal should not induce complacency, inaction, or premature triumphalism. To rapidly reach and sustain the next normal, the country must implement a comprehensive and coordinated roadmap to both address this pandemic and develop the capacity to confront future biosecurity threats.



The following 12 elements constitute the fundamental core of this Roadmap and are elaborated in this report.

1. Major Respiratory Viral Illnesses

Shift the focus from Covid to major respiratory viral illnesses like flu and RSV infection, with the interim goal of reducing annual deaths below the worst influenza season in the last decade. Even in a pessimistic scenario, the next 12 months are likely to see about half the deaths from Covid compared to 2020 or 2021. But this should not lead to complacency, as unexpected viral changes may occur. There are concrete steps the U.S. can take to increase the chances of this outcome. (*Chapter 2: Possible Scenarios*)

2. Dashboard

Create, maintain, and disseminate a transparent infectious diseases dashboard to guide both the public and policymakers at the national, state, and local levels on the introduction, modification, and lifting of public health measures. The dashboard should also provide guidance on the distribution of therapeutics and other special protections for the immunocompromised, elderly, and other vulnerable populations. (*Chapter 1: Next Normal*)

3. Testing, Surveillance, and Data Infrastructure Increase

Increase surge production capacity for at-home rapid tests to 1 billion per month. Establish a test-to-treat infrastructure that links all testing with high sensitivity and specificity to immediate medical consults and appropriate treatment, clinical trial enrollment, and public health guidance. Invest in a substantial upgrade of the data collection and analysis infrastructure for pathogen surveillance at the local, state, and national levels. Implement standardization and timely collection, analysis, and public sharing of data from expanded and enhanced environmental, genetic, and zoonotic monitoring systems, including those involving wastewater and deer. In addition, establish and sustain infrastructure to rapidly collect and analyze population immunity data. (*Chapter 3: Testing and Surveillance*; *Chapter 2: Health Data Infrastructure*)

4. Indoor Air Quality

Direct the Environmental Protection Agency (EPA) and Occupational Safety and Health Administration (OSHA) to develop standards to improve indoor air quality and protect workers from inhalation exposure. Direct states and localities to use American Rescue Plan and other appropriated funds to upgrade ventilation and air filtration in schools, childcare facilities, and public buildings. (*Chapter 4: Cleaner, Safer Indoor Air*)



5. Vaccines and Therapeutics

Support the development of new, more effective therapeutics, especially multi-drug oral antivirals, and next generation vaccines, especially mucosal and pan-coronavirus designs. Develop a test-to-treat platform to ensure rapid and equitable access to treatments for the most vulnerable populations and reduce disparities. (*Chapter 6: Vaccines*; *Chapter 7: Therapeutics*)

6. Global Investment

Shift the goal of U.S. contributions to the global vaccination effort from stopping infections through population vaccination coverage alone to improving the distribution and administration infrastructure necessary to fully vaccinate the most vulnerable people in low- and middle-income countries. (*Chapter 6: Vaccines*)

7. Long Covid

Rapidly coordinate and expand research on long Covid, to produce data and biospecimens available through open science, with specific emphases on the INSPIRE and RECOVER studies. Aim to generate definitive answers to fundamental questions on frequency, risk factors, prognosis, and the benefits of vaccines and therapies for long Covid, within the next year. Augment social, financial, and health supports for individuals affected by long Covid. (*Chapter 8: Long Covid*)

8. Equity

Better address health disparities by creating a permanent cadre of community health workers to support vulnerable populations highly susceptible to adverse outcomes from viral respiratory illnesses and leveraging trusted community groups such as faith-based organizations. (*Chapter 10: Public Health Infrastructure*)



9. Workforce

Expand and support the public health and health care workforces through improved wages, health benefits (including mental health), tuition assistance, loan forgiveness, and safe working conditions. Incentivize the accelerated adoption of automation for routine chores and paperwork. To institutionalize both virtual care and various forms of home care, extend and expand regulatory policies and reimbursement flexibilities. Ensure that a flexible pool of workers is available in emergencies. (*Chapter 10: Public Health Infrastructure; Chapter 11: Healthcare Workforce; Chapter 14: Worker Safety*)

10. Biosecurity and Pandemic Leadership

Create the post of Deputy Assistant to the President for Biosecurity (within the National Security Council), responsible for preparing for, monitoring, addressing, and coordinating responses to and communications about any biosecurity and pandemic threats. This post should coordinate efforts to counter foreign and domestic sources of anti-science misinformation on vaccines and drugs. (*Chapter 12: Communications and Education*)

11. Communication

Implement a comprehensive, scientifically-tested communication and behavioral intervention infrastructure to increase vaccination, testing, and treatment, especially among vulnerable groups. (*Chapter 12: Communication and Education*)

12. Schools and Childcare

Governments should not close schools and childcare facilities unless all other community mitigation measures fail. Implement policies and programs, such as improved air filtration and expanded school nurse programs, that enable schools and childcare facilities to remain open and safe for in-person instruction and care without the need for special public health mitigation measures. Target program implementation assistance to schools in communities with the greatest need. (*Chapter 13: Schools and Childcare*)



LETTER SUBMITTED BY THE NATIONAL ASSOCIATION
OF COUNTY AND CITY HEALTH OFFICIALS (NACCHO)



March 30, 2022

The Honorable Bill Foster
Chairman
House Committee on Science, Space, and
Technology
Subcommittee on Investigations and Oversight
Washington, DC 20515

The Honorable Jay Obernolte
Ranking Member
House Committee on Science, Space, and
Technology
Subcommittee on Investigations and Oversight
Washington, DC 20515

Dear Chairman Foster and Ranking Member Obernolte:

The National Association of County and City Health Officials (NACCHO), on behalf of the nearly 3,000 local health departments across the country, appreciates the Subcommittee holding the hearing, "The New Normal: Preparing for and Adapting to the Next Phase of COVID-19." The voices of local health departments are absolutely vital in ensuring that we are prepared for and can effectively respond to COVID-19 and NACCHO appreciates the Subcommittee inviting Karen Ayala, Executive Director of DuPage County Board of Health, to testify.

Significant progress has been made in mitigating the health, social, and economic impacts of the coronavirus thanks to public health mitigation measures as well as innovations like vaccines, therapeutics, and tests. Local health departments have been integral to the deployment of these tools and will continue to be for the foreseeable future. Our members provide vaccinations and testing, educate their communities on quarantine and isolation recommendations, collect and analyze data to identify hot spots, and offer essential information and guidance to individuals and the community on how to respond to the evolving pandemic. They have also worked with health care and community providers to build out networks of testing, vaccination, and care for those infected—especially the un- and under-insured. This work has been done despite policy and funding challenges that have impacted their capacity and ability to scale up for future phases of the response and the next pandemic, extreme stress and strain, and increased politicization.

In the short term, the Biden Administration has made clear that it requires additional funding from Congress to continue current response activities and prepare for future variants domestically and internationally. Although the funding requested by the Administration would not directly support the work at local health departments, the consequences of continued inaction by Congress will be felt by all engaged in the COVID-19 response, including our members. Already, the Department of Health and Human Services has had to stop accepting claims for testing and treatment of uninsured individuals from health care providers through its Uninsured Program, and within days, will have to stop accepting vaccination claims as well. As these and other programs are scaled back or halted altogether, individuals will have less access to resources and care they need, and in many cases, our local health departments will be called upon to fill in the gaps left by the disappearance of care options.



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NACCHO appreciates that the Subcommittee has identified data collection and communication as areas of focus for this hearing. During the COVID-19 response, there has often been a strong focus on commodities and logistics that was necessary, but not sufficient, for a successful public health emergency response. For example, significant effort was invested in procuring personal protective equipment, vaccines, and treatments, but a lack of equal focus on the administration, communication, and consumer education—including through the use of local, timely data—meant that those resources could not be most effectively deployed.

This was particularly apparent in relation to COVID-19 vaccines. While there was a strong focus on developing vaccines and shipping logistics, there was not an equal focus on the in-community needs to get the vaccines from vial to the patient. When vaccines were made available, administration systems and processes were not in place to ensure vaccinations could be administered in the community in a timely, efficient, and equitable manner. Moreover, very little federal attention was paid in advance to understand local challenges and lay the groundwork to educate and build confidence in the broader population, allowing mis- and disinformation to spread and impacting vaccine demand. Effective emergency response often requires individual buy-in, understanding, and support from the general public. Future planning and response efforts must focus not just on providing tools to state and local partners, but also on ensuring they can be efficiently deployed into the community. Clear communication from trusted sources and local-level planning are necessary to drive demand and gain community cooperation and acceptance. As we look toward future pandemics, prioritization should be given to efforts to build community trust and outreach infrastructure before crisis hits, including messaging strategies, which can be leveraged during a response. Local health departments are perfectly positioned to lead these efforts, if given the chance by federal partners.

Additionally, the local health department COVID-19 response has been limited by outdated systems. Public health needs a robust, modern, and secure public health information ecosystem capable of sustainment and surge that delivers real-time, accurate, and useful data to public health and policymakers at the local, state, and federal levels. Across the country, state and local public health departments operate a mismatched network of siloed public health information systems, most of which do not talk to each other nor to the health care delivery sector, and all of which are in urgent need of upgrade to prepare for and respond to public health challenges. Congress and the Biden Administration should consider ways to invest in public health data modernization with a particular focus on support for the interoperability of systems across all levels, including local health department access to federal and state systems and improvement of cross-jurisdictional data sharing.

Improving communication and data collection will also require Congress to make long-term investments in the nation's public health response capacity, which has been hampered by a boom-bust cycle of funding – investment spikes during an emergency, but quickly abates as a crisis resolves. The public health infrastructure has seen a 30% decrease of expenditures per capita between 2008 and 2019. Additionally, the local public health workforce capacity has decreased 21% since 2008. Robust investments in public health infrastructure and workforce capacity are needed to ensure the nation is prepared to confront future phases of the COVID-19 pandemic and other public health emergencies.

Sustainable, predictable, disease agnostic investments—such as federal public health infrastructure funding—are needed to allow local health departments to focus on certain skillsets that are critically necessary, like communication, outreach, data analysis, and digitalization, but that local health departments largely lack due to funding constraints that typically tie funding to specific disease states.

Such limiting funding streams hamper health departments' ability to leverage skillsets across efforts or to be nimble to address emerging challenges. Flexible funding should supplement, not supplant, existing programmatic funds including dedicated preparedness and response funding. The recently enacted fiscal year 2022 omnibus appropriations bill took an important first step by providing \$200 million for public health infrastructure and capacity. Congress should build on that initial investment through additional mandatory public health infrastructure funding, such as through the Public Health Infrastructure Saves Lives Act (S. 674). All of these efforts must ensure that money reaches the local health departments efficiently and equitably across all states.

Perhaps most important to the ongoing and future pandemic response is our nation's public health workforce. Alarming, the public health workforce was facing a crisis that predates COVID-19 and it has worsened during the pandemic response. Federal investment is needed urgently to strengthen public health recruitment and retention to ensure we have the right people with the right skills in place to confront ongoing and future challenges. One way Congress can help is through the passage of H.R. 3297, the Public Health Workforce Loan Repayment Act of 2021, which would offer loan repayment to public health professionals in exchange for serving in a local, state, or tribal health department. Federal loan repayment for public health professionals would be an important tool for health departments to recruit and retain top talent and is of particular urgency now to keep skilled and experienced staff who have joined during the COVID-19 response in the field.

Congress and the Biden Administration should also address burnout in the public health workforce resulting from a stressful and unrelenting pandemic response that has only been made more challenging through the politicization of public health measures. Policymakers have rightly taken action to provide mental health and wellness support for *health care* providers; unfortunately, the same has not been provided for *public health* workers who have faced many of the same challenges as their colleagues in health care and other frontline sectors: increased workload, long hours, and threats to their personal health and safety.

The time to make these investments in public health infrastructure and workforce is now, before the next COVID-19 variant emerges or another crisis arises. The stronger our local health departments are before an emergency hits, the better they will be able to respond. Furthermore, investing in long-term public health capacity now will enable us to maintain systems that have been built out during the COVID-19 response and leverage them for future challenges.

Thank you for your continued attention to the COVID-19 pandemic response. NACCHO and public health professionals stand ready to work with the Subcommittee to take the lessons learned from the pandemic and support the important work of local health departments and their staff now and in the future so that all Americans can live in a community with a strong public health system to support them. Please contact Adriane Casalotti (acasalotti@naccho.org), NACCHO Chief of Government and Public Affairs, with any questions.

Sincerely,



Lori Tremmel Freeman, MBA
Chief Executive Officer