

## Interest Group 2: The Future After COVID-19: What Happens When a Species Has Been Immobilized

**Judith N. Wasserheit:** Welcome everyone, I'm Judy Wasserheit. I am delighted that you are all here. I think we have quite a stimulating and provocative session ahead of us. Thanks for joining, and please, let's get started.

Good morning, good afternoon, and good evening, depending on your Zoom point of origin. I'm Judy Wasserheit from the University of Washington, where I chair the Department of Global Health and co-chair our Alliance for Pandemic Preparedness. I have the honor of being the Chair of the National Academy of Medicines interest group on global health, infectious diseases, and microbiology. On behalf of my two very wise, witty, and wonderful friends and vice-chairs, Mike Cohen and Patty Garcia, as well as myself, welcome to this session on COVID-19 and the way forward: what happens when a species has been immobilized?

As some of you may remember, when we Zoomed together almost exactly 1 year ago for our annual meeting last October, it was about 9 months into the pandemic. Vaccines weren't yet available but were well on their way, and SARS-CoV-2 had infected almost 40 million people around the world and killed more than a million according to national surveillance systems. Although we recognized that these were likely to be gross underestimates of the devastating direct health impacts of the pandemic at that time and that these estimates didn't even begin to reflect the equally devastating and potentially longer-lasting educational, economic, and social impacts of the pandemic on individuals, families, and communities—despite these mind-numbing impacts, there was actually a cautious sense of optimism among some, perhaps in part because of the unprecedented speed with which research was delivering vaccines and other interventions.

We focused on the path to reopening in the COVID-19 pandemic. We discussed lessons from four continents and explored emerging research on new and promising interventions. In reality, last October marked the beginning of major surges in cases and deaths in the Americas, Europe, Africa, and the Eastern Mediterranean. The Delta variant was also first identified in India last October, and subsequently spread explosively around the world. As of today, globally, the virus has infected more than 236 million people and killed almost 5 million, almost an eightfold increase in cumulative cases and a fivefold increase in deaths since last October.

The good news is that reported cases and deaths have finally begun to decline globally, although Delta surges are still continuing in some countries. It's likely that over the next 12 to 18 months the COVID-19 pandemic will shrink in size and scope, the health impacts will be more and more limited for populations with access to care, and SARS-CoV-2 infections will become endemic.

However, the COVID-19 pandemic has compromised daily life in every country on this planet. It shut down schools, businesses, travel, and trade around the world. Many people haven't been able to hug grandkids, parents, siblings, or friends for many months.

I think I'm not alone in initially grossly underestimating a wider societal nonhealth or at least nondirect health impacts of the pandemic. Many of these impacts will have long legs. Indeed, some are likely to have more far-reaching effects than the direct health consequences themselves, particularly for those

who are already marginalized because of poverty, race, ethnicity, gender, and other factors that divide us.

Today we're going to consider the profound, multifaceted implications of the prolonged social isolation and disruption human beings in their societies have suffered from the COVID-19 pandemic. Our four distinguished panelists will get us started with 15-minute presentations, during which they'll discuss what we know about these impacts to date and offer provocative predictions going forward from four critical perspectives.

First, Chris Murray will discuss the effect of the pandemic on human health and the global burden of disease. Next, Jaime Saavedra will talk about the effect on our educational systems and the long-term impacts on our children. Then Stephanie Segel will share her insights about the effect on the global economy and how we might expect recovery to unfold. And finally, we'll turn to Erica Charters, who will help us look at what history does and does not tell us to expect—what lessons can be learned from epidemics in earlier eras.

Then we'll shift gears, and Patty Garcia will moderate what I am quite confident will be a very stimulating Q&A session and discussion. And finally, Mike Cohen will bring us home with a brief synthesis and closing comments.

This is the second year that the National Academy of Medicine has convened the main meeting and interest groups via Zoom. We're also delighted to welcome for the second time the public audience to this interest group. A large number of people have already registered to join us. Building on what we learned last year, here's how this is going to work.

National Academy of Medicine members, please type your questions and comments into the chat box. If you really want to ask a question or make a comment verbally, please still type the basic question into the chat box and indicate that you want to speak by also typing "UNMUTE" in capital letters and we'll do it. This will help Patty aggregate related questions and comments so that we can get to as many people as possible.

For our public registrants, you'll be viewing the meeting as a webinar, and live comments by chat, audio, or text are not available in this format; however, if you have any comments or questions for anyone on the panel, we very much want to hear from you. Please send them to the email address that's listed on the webinar page and is also being posted in the chat. Your comments and questions will be collected after the meeting and sent to the appropriate panelist.

Now let's get started. I'm going to give brief introductions for all of our distinguished panelists and for Patty and Mike now so that I don't interrupt the flow.

Chris Murray is Chair of Health Metrics Sciences at the University of Washington and Director of the Institute for Health Metrics and Evaluation (IHME). He's a physician and health economist who has led the development of a range of new innovative methods and empirical studies to strengthen health measurement, analyze the performance of public health and medical care systems, and assess the cost-effectiveness of health technologies. During the pandemic, Dr Murray and his colleagues at the Institute for Health Metrics and Evaluation have provided projections of the impact of the pandemic on the global burden of disease as well as on health systems' capacity in the United States, which have been widely cited by policymakers across this country and around the world.

Jaime Saavedra is Global Director of Education at the World Bank, where he previously directed Poverty Reduction in Equity and was acting Vice President of the Poverty Reduction in Economic Management Network. He rejoined the bank after serving as Minister of Education in Peru from 2013 to 2016. An economist by training, Dr Saavedra has led groundbreaking work in multiple areas, including poverty and inequality, employment and labor markets, and the economics of education. Over the last 20 months, he has added work on the impacts of COVID-19 to his portfolio.

Stephanie Segel is a senior fellow at the Center for Strategic and International Studies, CSIS, where she's focused on economic competitiveness, US–China economic relations, and the role of international financial institutions in the global economy. Until 2017, Ms Segel served as Co-Director of the East Asia Office of the US Department of Treasury, having previously worked in the Western Hemisphere, South and Southeast Asia in international monetary policy offices. She also served as a senior economist at the International Monetary Fund, where she covered a range of emerging market and advanced country economies. Like others at CSIS and many of us here today, she's recently pivoted to focus on the pandemic.

Erica Charters is Associate Professor of the History of Medicine at Oxford, where she also is director of Oxford's Center for the History of Science and Medicine and Technology. Dr Charters is an expert in the history of war, disease, and bodies and is currently coordinating a multidisciplinary project on how epidemics end. Her recent article on the history of science and medicine in the context of COVID-19 provides an excellent springboard for our discussion today.

Patty Garcia is a professor in the School of Public Health at Cayetano Heredia University in Lima, Peru. She's the former Minister of Health of Peru, Dean of the School of Public Health at Cayetano, and former chief of the Peruvian National Institute of Health. An infectious disease physician and epidemiologist, much of Dr Garcia's research has focused on sexually transmitted infection including HIV, particularly human papillomavirus and cervical cancer, as well as reproductive health and medical informatics. During the pandemic, she's played a leadership role in multiple clinical trials in Peru and, more broadly, in the response to COVID-19.

And finally, Mike Cohen is a professor of Medicine, Microbiology, and Immunology and also Epidemiology. He is associate Vice Chancellor for Global Health and Director of the Institute for Global Health and Infectious Disease at the University of North Carolina at Chapel Hill. Dr Cohen's research has focused on the transmission and prevention of HIV with special emphasis on the role of sexually transmitted infections. Over the last 18 months, he and his colleagues have been a critical part of the COVID prevention network in conducting trials, monoclonal antibodies, and other interventions.

So, as you can see, we have an outstanding set of speakers for this session. With that, I'll turn this over to you, Chris, for our first presentation.

**Chris Murray:** In this presentation I'm going to walk through the evidence on what have been the impacts of the COVID-19 pandemic, and I'll briefly give comments in these five areas.

Let's start with the simplest aspect of how much COVID infection has there been, how do we know, and what's that pattern look like worldwide?

The way at IHME that we look at the pandemic is illustrated here for Florida. We do this sort of analysis for about 500 or 600 different jurisdictions, that is either national level, or subnational for larger countries. This summarizes a lot of data. The top left is reported cases in green, over on the next side on the left is reported hospital admissions in blue, and then in the bottom left is reported deaths in red.

Those are all inadequate measures of what's happening because not all cases or infections are reported. Hospitalizations only get the severe cases and, of course, deaths only get at a fraction of infections. So the way we put this together to understand infections around the world is we use seroprevalence data, here illustrated for Florida on the bottom right. The purple points are seroprevalence data corrected for waning sensitivity of antibody tests. I don't have time to go through that in detail. In the middle column are the empirical estimates of the infection detection rate, the infection hospitalization rate, and the infection fatality rate (IFR).

We put all that data together and get the top right, which is our best estimate of daily infections by triangulating cases divided by the infection detection rate, hospitalizations divided by the infection hospitalization rate, and death divided by the IFR. We put that together for each location. We update that weekly; that's posted on our website as part of our analysis. That's how we come up with this view of estimated global daily infections.

Roughly, the pandemic was running at about 5 million infections a day from June of 2020 right through until late January of 2021. We started to come off the Northern Hemisphere seasonal peaks and got down to as low as about 3.5 million infections a day, and then the Delta variant showed up and created enormous transmission in particularly India, leading to a peak of over 15 million infections a day. We've been seeing Delta waves elsewhere, leading to that peak up until August, and now we're currently in a phase of declining transmission. More on that later.

When you put that location-by-location analysis together, this is the map of the fraction of the population that has been previously infected. You can see really high levels of past transmission in Mexico, in Brazil, in Ecuador and Peru, in the Russian Federation, in all of South Asia, and in Southern Africa, and then some parts of the Middle East.

There are places where we just don't really believe the data. They stand out on this map: Nicaragua, Venezuela, no data actually being a meaningful data report for Tanzania or Turkmenistan. But generally, we think this pattern is a reasonable reflection with those exceptions of where there has been a lot of transmission and where there has been much less. The biggest question mark remains sub-Saharan Africa outside of Southern Africa because of the absence of many seroprevalent surveys, which has been a really unfortunate gap in our knowledge.

What about death from all those infections? The way we look at this first is by looking at excess mortality. For more than 200 jurisdictions, we have weekly or monthly death, and those are the basis by which we estimate, by comparing using an ensemble of models what was expected each week or month based on data back to 2010. This data set includes some LMICs [lower- to middle-income countries]—not as many as we would like, but it's certainly, there are some. The recent availability of civil registration data for a number of states in India has certainly helped us understand the magnitude of the Delta surge there. Of course, those data do need to be corrected for underregistration as is true for some of these data for other LMICs as well.

We then have the challenge of figuring out what excess mortality might be in the places without this direct weekly or monthly measurement, which would include most low-income countries where they don't have complete registration of deaths. For those we built a statistical model, and that has things you'd expect to be in there, like seroprevalence, reported deaths, the infection detection rate, and then a host of variables that might affect the likelihood of identifying a case and how well they're treated: universal health coverage, hospitalization rates, prevalence of diabetes, prevalence of obesity, smoking rates, and a host of other variables. Many variables come out to be predictive in this analysis and, at the end of the day, we come up with a predictive equation that seems to be quite good, using out-of-sample predictive validity with about, on average, an 8% error.

What do we find out? We find that there are, up to the beginning of October, about 5 million reported deaths, but excess deaths are probably in the order of 14 to 15 million; so many more deaths. This is driven quite substantially by great underreporting in places like India that had very considerable transmission and associated death.

Because we're estimating for places without the direct measurement, there's a lot of scope for being wrong, but as a rough order, we think that there is many, many more deaths from COVID, from the pandemic, than the official reported data would suggest. A much trickier challenge is to say what fraction of the excess mortality is due to the virus, and how much is due to other pandemic-related changes in behavior, deferred care—a long list of possible mechanisms. We used some statistical models, these are far more uncertain, to try to estimate that and come up with our best estimate of about 9 million deaths are directly due to COVID, which implies maybe as many as 5 to 6 million deaths are due to other factors related to the pandemic.

Here's a map of estimated excess death rate. The biggest impacts in terms of death have been in the southern United States, Mexico, much of Ecuador, Peru, many states in Brazil, southern Africa, and then very much in Eastern and Central Europe, southwestern Europe, Spain and Portugal, and then many parts or many states within India have had excess mortality rates that are in the higher end of the spectrum; with much lower death rates in some select countries. Canada stands out, given the contrast across the border with the US, but there are many examples like that—Norway, Finland, Australia, New Zealand, as examples of, so far, low excess mortality rates.

What about those other pandemic-related mortality? The WHO definition is anybody who has gotten PCR-positive or equivalent tests. There have been detailed data audits looking for this sort of information on death certificates for a number of countries, including Peru, Mexico, and the Russian Federation. Those suggest that not all of excess mortality, particularly in the Russian Federation, is related directly to the virus. That leaves open this idea, that I mentioned before, that there's considerable mortality from other causes.

But we have a real problem just finding what those other causes are. There's a number of published studies that suggest in a particular place what causes may have gone up, but more systematic evidence is still early days. There's only about 10 countries where we've been able to get 2020 cause of death data, and those do not reveal a very convincing pattern across countries.

The one part that is convincing is the marked reduction in flu and measles deaths, and then a more mixed bag around reductions due to RSV. Those reductions seem very real, but which causes went up to

account for the 5 to 6 million other pandemic-related deaths will probably have to wait until we get much more cause of death data for 2020 available for analysis.

One of the key drivers and what's behind our model estimate of 5 to 6 million deaths that are related to the pandemic but not directly caused by the virus is levels of mobility, which now have been well tracked by cell phone usage data. There's questions of selection bias in certain countries, but in general, we've had this very rich resource from a number of vendors about mobility as measured by people's phones moving around. This is the global summary of that data. [There was a] massive reduction globally at the beginning of the pandemic, and then we had reduced global levels, highly variable across countries, right through until May, and then since May of 2021, steadily moving back up to pre-COVID levels of mobility.

The one outcome where this sort of evidence has been nicely summarized is for mental health. Damian Santomauro and Alize Ferrari from the University of Queensland have led this collaboration reviewing the published studies and then making estimates for where we don't have data on the changes in major depression and anxiety. On the right—this paper came out the beginning of October in *The Lancet*—and on the right, the red line is the prevalence during the pandemic of, on the top is anxiety on the bottom row is depression, by age and sex. You can see—the blue line is pre-COVID, the red line is post-COVID—there has been a considerable increment. Another way to see those results is with this population pyramid; the green and blue color is baseline depression and anxiety disorders, green is anxiety, blue is depression. The increment by age and sex that is estimated due to the pandemic is in red for anxiety and purple for depression. So a very substantial estimated increment. The paper outlines many of the limitations of this analysis, so we can't be 100% sure that the magnitude, is as shown, but this is the best assessment that's currently available on what seems like a very substantial contribution of the pandemic to mental health disorder prevalence going up.

To round out this assessment of what has been the impact of COVID given the massive global transmission, a huge increase in mortality, and at least compelling evidence around mental health and likely incurred effects of deferred care and other mechanisms to increase the death rate from a number of causes, where are we headed? Before showing you long-range forecasts, I need to point out that forecasting far into the future is very challenging, not just because of the usual transmission dynamics and how who interacts with whom, those are not always present, but we have some longer-term issues of when and whether there will be new variants that demonstrate considerable immune escape.

How much does the immunity given by natural infection and vaccination wane over time? We know it does for vaccination protection against infection, but we don't yet have a lot of evidence on the waning effects for vaccination for protecting against hospitalization and death. The other thing that we suspect is happening is that governments and individuals will be less likely to be careful—wear a mask, avoid interaction—as transmission goes up. We actually have issues around how much will there be uptake of boosters given vaccine hesitancy in the first go-round? How much transfer of vaccines [will there be] from high-resource settings to low-resource settings?

Bearing all that in mind, here's our long-range forecasts for COVID. The green line is our reference scenario, the numbers that we think are probably most likely true. If we don't have a new variant and if we don't think that waning immunity from natural infection is as big an issue as some have argued, then by April or May of 2022, globally we should see transmission coming down to quite low levels. Of

course, we don't actually believe that is the case because likely variants will come along and there is going to be waning immunity.

For death, similar story. We see the numbers coming down to a quite low level at the global level, dropping down to maybe 1,000 deaths a day or less by the spring or summer of next year. But again, that's without taking into account what is very likely going to be the case, which is that there will be new variants that evolve and there will be waning immunity. Personally, not backed up by a quantitative model, my view is that we will be moving towards a more seasonal model of endemic COVID that shows up each winter season and, combined with flu, puts extra burden on both individuals but also on health care providers as we think towards the future.

Thank you very much for this quick walkthrough of what have been the effects of COVID and what they might be in the near future. Thank you.

**Judith N. Wasserheit:** Chris, thanks very, very much for that superb overview of the health impacts, both direct and indirect. I think the mental health impacts are particularly disturbing because of the likely consequences with respect to both risk for other health problems and in adherence to treatment.

Your forecasts offer very fertile ground for as a point of departure for our discussion.

We're going to turn now to impacts on education, educational systems, and our children and to Jaime Saavedra. So could we go on to that next presentation, please?

**Jaime Saavedra:** Good morning and many thanks to the National Academy of Medicine and to the Interest Group on Global Health, Infectious Disease, and Microbiology for this invitation.

I want to use this opportunity to share with you some insights about what has happened with education during this pandemic. This is the worst education crisis in the last century. The hit on children and youth, as we're going to see, has been tremendous.

Before doing that, let me share with you a bit about where our education systems were before the crisis. In 2019 we came up, the World Bank together with UNESCO, we came up with an indicator that we called "learning poverty," which is the share of 10-year-old children that cannot read and understand a simple text. If you think this indicator should be zero, this percentage should be zero, all children at that age should be able to have these fundamental skills. Unfortunately, before the pandemic in low- and middle-income countries, this number was 53%. That means half of children at age 10 did not have the fundamental skills that they need for a productive life. We're talking about all 10-year-olds; most of them are in school, some of them are not in school, but most of them are in school, so they are in school, but not necessarily learning.

Aspiring to eliminate learning poverty is similar to our goal of ending hunger or ending extreme poverty. Those numbers should be zero. This high learning poverty that we see, this 53%, is really an early warning that all other education outcomes that we care about are at risk: completion of secondary education, access to tertiary education, quality education in general, all goals included in the Sustainable Development Goal 4 are in jeopardy if kids cannot read at age 10.

This is really morally unacceptable. All children have the right to education, an education that provides them with the skills that they need to be productive citizens. But it is also economically unacceptable, because we do have the financial and the technical means in order to eliminate this learning poverty. We know how a good school works. There are resources in countries, but it is really a political commitment that all countries need to engage in order to make sure that all kids have the right quality education. We were far from achieving that, and actually even before the pandemic the trends were not necessarily the right ones. Learning poverty was going down, but it was not going down at a very fast pace.

What was the impact of COVID-19? When the pandemic hit, an important point is that school closures were considered part of the arsenal to fight the pandemic. That happened without much knowledge of the benefits of keeping school closed; it was this intuition that if schools were kept open or universities were kept open, that could contribute to an acceleration of infection rate.

But we didn't know much, and also it was done without much internalization of the costs borne by children and youth regarding not being at school. Actually, one thing is that if we had school closures, if we had closures of 3 or 4 months, but unfortunately children have been out of classrooms really during extended periods.

As you see in that graph, globally the average as of now is about 155 days. In Latin America and South Asia, if we put together complete closures and partial disclosures, really the numbers are above 200 days. In North America, the number is very high, but most of the closures that we've seen in North America had been partial; some states were open, other states were not, some counties were open, other counties were not. In the Middle East, Latin America, South Asia there were 200 or more days of pre-emptive school days closed, and that's about 1 year and even 1.5 years out of school.

A year-and-a-half later, these disruptions to education still persist. As you see in that map, countries in yellow are countries in which we still see partial closures. There are a few countries in orange in which the school systems are still completely closed.

Countries did not stand still. Most of them provided some sort of remote education during school closures, and it was really a multiplatform endeavor. Countries realized fast that not all children had access to Internet. In low-income countries access at home would be 10%, and middle-income countries 50%, in which countries it was much higher. If we talk about low- and middle-income countries it had to be a combination between online, TV, radio, messaging apps, etc. The key point is that the experience that all different children had was extremely different. Some kids will have a broadband connection at home, books, a device, space to read and play while other kids and many, many kids will have nothing of that. So the experience that children have lived during this pandemic across countries and within countries have been extremely, extremely heterogeneous.

Where are education systems now after the pandemic? Our schools are really not out of this COVID-19, but many, many school systems are starting to open again. We have done some simulations to see what would happen with this 53% that I was talking about before with the length of school closures that we have had to end with the quality of remote learning and distance learning that we have seen. Our initial simulations show that this number could be 63%. Recently, with extension of school closures, particularly in South Asia and Latin America, our new simulations show that this number could be even close to 70%.



Academic learning is only just one part. We see many other issues that are impacting young adults and children. We have 24 million additional students that might drop out of the school system; 370 million children have missed a daily school meal because their main meal was at school; 13 million more girls might marry early, particularly in Africa and South Asia; there is a doubling in the rates of depression and anxiety symptoms in children globally. With the losses in learning and with potential school dropouts, we estimate that this generation might be losing about \$16 trillion of future income. I'm not talking about the losses for economies in general, but losses for this generation in terms of future income and future well-being. This \$16 trillion approximates about 12% of global GDP, for you to understand that is really, really, a large number.

The other issue that worries us a lot is that there is an inequality catastrophe ahead of us if we don't do something. An inequality catastrophe across generations by socioeconomic level and by education level. I'm going to give an example of each one.

In terms of what might be happening to this generation, we have some learning data post school closures—not a simulation, but this is real data that starts showing that this generation is experiencing large learning losses. With this real data we see, for instance, that in the actual data in Karnataka in India, only 16% of grade 3 students could perform simple subtraction in 2020, but that was compared to nearly 24% in 2018. In South Africa, grade 2 students have learning losses that are up to 70% of a year of learning. In Latin America, in Sao Paulo, Brazil, its state had measured learning continuously throughout the pandemic; at the end of 2020, students have learned only 28% of what they would have learned if they had had precedential classes.

We need to have more data on this, but we see some reluctance of many countries of measuring learning because news is going to be bad. As I'm going to say later, we really need to have that data, even if they are bad news.

Learning losses are unequally distributed by socioeconomic level. As I said, the experience with distance learning has been very different across different students, from poor students really having no exposure to rich students having some decent online experience. We don't have data yet for poor countries or middle-income countries, but for rich countries, let me give you the example of United Kingdom, there are 50% higher losses in reading in schools serving disadvantaged students. In the state of Maryland in the US, we see that comparing 2021 with 2019, overall reading readiness failed by 35 points; but if we look at disadvantaged students that number went down by 46 percentage points.

In addition to this hit across the generation, across the income scale, experience has not been the same for students in different grades. Actually, it is much worse for the younger kids. Here we have data again for the state of Sao Paulo in Brazil, and we see that the change in scores in grade 5 comparing 2021 and 2019 is 29 points; in grade 12 it was only 11 points. This is something that we see in the in the US clearly as well, with much larger losses in the early grades.

Let me start finishing and wrapping up with some lessons from the pandemic. (1) The first lesson is that we need to close the digital divide. The school systems are going to be more resilient if education can continue at home. All kids need to have a device either for precedential education or for remote learning, and the use of technology can make teachers much more impactful. But at the same time that we need to close the digital divide, another lesson is that (2) education is really a social phenomenon. Education is about the interaction between the teacher and the student, interaction between the

students and her peers. That magic of learning happens when precedential education, universities, schools—they are all the social space. At the same time, we have learned that teachers are really critical, that the fundamental aspect of the education process are those people who coach, who facilitate, who inspire children in their learning process.

As we put these 2 issues together, actually a key lesson for the future, a future that really has been propelled until today, is the need of a balance between technology and the human factor. (3) The other important lesson is that there has to be an understanding of the critical role that parents play in the education of their children. That's very clear for some parents, but it's not that clear for many. It has to be part of public policy to make sure that there is support for parents to really be able to help effectively their children. At the same time, (4) we need to really strengthen the home environment. There are some homes in which there's a computer, there's Internet connection, and there are books, and other homes lack that. Actually, that has to be part of public policy. We do in some countries in which they worry about making sure that all children have books at home. That has any has to be an integral part of public policy, something that we do not see yet in many poor and middle-income countries. This is what would contribute to resilience, to ensure that during the conditions, to make sure that there's a continuity of the learning process from the school to home.

In addition to these lessons that are really are about shaping our education systems for the future, we really need to have urgent action today to accelerate the learning recovery. This year, this year-and-a-half in which millions and millions of kids have been out of school can generate a huge hit on this generation, and we cannot afford a permanent impact on this generation. That means that we cannot just try to go back to school as if nothing has happened. Really, this requires a critical effort of all countries.

First of all, is to bring all children and youth back to school. This is really not trivial, this will require very intensive communication campaigns so that we make sure that, particularly, secondary-education kids come back to school and that we also do not lose many kids, many young people in tertiary education. Second, we need to really measure learning, even if that's bad news. All countries need to know where they are, what has been the magnitude of the shock either for the for the country as a whole and also in each district, in each province. Third, in each classroom, we need to prioritize the fundamental skills of reading and numeracy, and we need to prioritize psychosocial well-being of children. Fourth, we really need gigantic efforts to provide effective remedial learning to help kids to catch up from where they are. Make sure that children are taught at the level they need. It's not a matter of using the textbook of this year. You are receiving fourth graders that might have at this moment the skills of early third grade or of the end of second grade. We need to make sure that we start with them, teaching them at the level that they are today, so they can accelerate their learning. Finally, all this requires a very, very aggressive support of teachers, helping them to address these learning losses and helping them incorporate digital technology.

Many of these actions are something that has been incorporated in what we call Mission: Recovering Education 2021, which is an initiative with UNESCO, UNICEF, and the World Bank, which is basically about helping governments, helping countries in order to tackle this or implement all these policies to tackle the huge urgencies that we have.

I just want to close by saying that we really need to have a sense of urgency. This really needs to be implemented today because we really cannot afford to lose this generation. Thank you very much.

**Judith N. Wasserheit:** Well, Jaime, thank you so much for that terrific and frankly somewhat chilling summary. I think the impacts on our children that you describe are deeply disturbing, particularly because they're potentially so far reaching. I'm sure we're going to return to your framework for urgent action on recovery during the discussion.

We'll move now to the impact on the global economy and to Stephanie Segel's presentation.

**Stephanie Segel:** Hi, I'm Stephanie Segel, and I'm a senior fellow with the Economics Program at the Center for Strategic and International Studies (CSIS). I'm going to present on the issue of fiscal space and creating fiscal space in an era of COVID-19. Let me go ahead and share my screen. This presentation is going to be based on work that I've done along with Steve Morrison, who directs the Global Health Program at the Center, and also work of the CSIS Commission on Strengthening America's Health Security.

The commission has actually worked to introduce fiscal policy into the discussion on health security, kind of appreciating that health and resources to finance health spending are very much connected. If we can say anything positive about COVID-19, it's been that it has forced an appreciation of health as an economic issue. I suspect to this audience that's not new news, but it is true that COVID-19 has really underscored the links between public health and economic outcomes. When I've been asked to speak about the economic outlook coming out of the crisis, I always make the point that COVID-19 is a health crisis that's led to an economic crisis, and therefore, the durable solution to the economic crisis goes back to health.

Part of what we've been underscoring in our conversations has been the very different country capacities to respond to this crisis, but also different country capacities to respond and actually invest in public health and pandemic preparedness. We've seen that loud and clear, or heard that loud and clear, in the current crisis. Because of those very different capacities to respond, we actually have a risk of greater economic divergence between countries, but that also presents an opportunity to invest in public health and pandemic preparedness and actually kind of use this moment and this heightened appreciation of the linkages between public health and economic outcomes to ensure greater international investment.

So, on this point of different country capacities to respond. This chart looks at fiscal policy response by country type. It looks at fiscal policy response by advanced economies on the left, and I've shown the US here as well, and then looking at emerging markets, EM, and then low-income developing countries, which is on the far right. We're looking here at discretionary fiscal responses to COVID-19. These are data that comes from the International Monetary Fund, and they look at both additional spending and forgone revenue—so things like tax relief as well as financial supports that could have a fiscal cost, so think of things like loan guarantees.

On average, for advanced economies you see a fiscal response in the range of 25% to 30% of GDP for advanced economies; that's a huge amount. The United States is right there, kind of in that average, but much more of the response has gone through additional spending or tax relief versus Europe that has had a greater reliance on guarantees, but the amount of support that 25% or 30% of GDP is right where

the US is as well. If we look then at emerging markets, that number, the combined supports between the two, is around 7% of GDP; for low-income, developing countries it's around 2% of GDP. You see clearly the very different capacities to respond to the crisis coming through in the numbers.

We see that divergent response also reflected, as you well know, in vaccination rates. Again, looking at IMF data, and this is interesting. I talked about the opportunity to really link the health discussion and the economic discussion. I think we have one sign of that in the collaboration between the IMF and the World Health Organization, but they have their vaccine supply tracker, so this is not administered vaccines but secured vaccines. The actual country names are too small for you to read, but the point here being that it's the advanced economies, the high-income economies that have secured multiples of their population in vaccine. The line in black there is the United States, and then, as you would expect, as you go down the income scale you move closer to the right. At the lowest end of the scale, those are all low-income countries that have secured at the lowest ends, less than 50% of their population. So again, not delivered vaccines but just secured vaccines. So you see this uneven fiscal response; you see uneven vaccine supply; and then, if we look at vaccines actually delivered and administered, as you would expect, you see the same kind of disparity.

On the left-hand side, we look at the global average, and this is data as of mid-summer so these numbers have improved since then, but you see this big divergence between advanced economies, emerging market economies, and low-income economies. More advanced economies administered vaccines around 35%, in emerging markets around 10%, and in low-income countries below 2%.

And if you link the vaccines to the ability to reopen the economy and get back to regular economic activity, you would not be surprised to see the correlation between vaccines and declines in the employment rate, where you have the greater employment losses coming from emerging-market and developing economies. Even within those countries, some of the more vulnerable groups, the low-skilled workers and women, employment losses actually being greater still.

What does that then mean on a macro level? Here we look at a two-speed recovery. These graphs show what the prepandemic growth in GDP was expected to be; that is the black line. Had the pandemic never hit, what was the growth path for advanced economies; emerging market economies; and low-income, developing countries? And then you compare that with the current projection; that's the blue line. The good news here is that advanced economies by the end of next year should be caught up to their prepandemic growth trajectory. We will have recovered and then some in many country cases, including the United States, actually being above the prepandemic growth trajectory. That's for advanced economies.

In emerging market and low-income countries, you see that gap between the black line and the blue line where even by the end of next year, they will be below where they would have been had there not been the pandemic. The Fund is forecasting that by the end of 2023 is when you'd actually have the catch-up to their prepandemic growth trajectory. Obviously there's a long way between here and there, and actually the achievement of that catch-up. But the fact that there's a two-speed recovery is really not a debate; we see it clearly in the numbers.

So as to this widening divergence, we know already last year we had the World Bank reporting that they observed an increase in global extreme poverty for the first time in over 20 years. We also know that there is slower vaccine rollout and less policy support in low- and middle-income countries. And then we

know that that lower economic activity leads to human capital losses, both in education but also in employment and employment training. We know that there's a large debt overhang in many of these countries; and to the extent that debt is both a stock question but also the ability to service that debt is a question of economic activity, and revenues that are collected the longer that economies are hobbled, the worse those debt dynamics become, and that can then lead to persistent output losses. It's not just a question of getting past this immediate crisis; it's actually, are there are going to be sustained and enduring impacts of the crisis that actually lower potential growth beyond this current crisis?

On the debt point, let me just show you a graph that kind of makes the point of the worsening debt burdens. This, unfortunately, is not limited to low- and middle-income countries but is also an advanced economy phenomenon and as well. We look here at national debt as a percentage of GDP, and we see that across all country groupings, we've had a pretty dramatic increase in national debt stemming from the response to the global financial crisis in 2008 and 2009 and now in response to COVID-19.

Advanced economies haven't actually faced a financing constraint. We still can borrow at very low interest rates, so we have not been constrained by this higher debt burden, at least not yet. But we see in many low-income countries and, if you look in particular at Latin America and at Africa, the color changes going from 2007 to 2020. You have these large increases in debt as a percentage of GDP. In low-income country cases, some of that debt is now being considered unsustainable so they're not actually been able to access financing. Obviously that constrains not only their ability to service that debt but to then meet other financing needs and specifically financing needs for public health and for overall economic support. There is a need to create fiscal space in many of these countries; the question is how.

There have been efforts already in the current crisis to create some of this fiscal space. The most well-known, I think, is the debt-service suspension initiative, which suspends debt service for a particular defined period of time for low-income countries, and the condition being that any debt service that is not paid be redirected to social, health, or other economic spending. In exchange for that, countries will increase transparency, disclose all public sector financial commitments, and also limit further nonconcessional borrowing.

There is some relief there, but that relief is time-bound, as I mentioned. There may be the need, and there is the need in many countries, to actually have more sustained debt write-downs and debt treatments. The mechanisms for doing that are still under development. There is a common framework that's intended to pull a larger group of official creditors into this restructuring process. There are a few countries that have made use of the common framework and are working on getting that sort of treatment, but it's too early, far too early to say that that's been successful. We're kind of waiting to see.

But really there's the need for additional donor support in response to this crisis, and additional donor support being grant support, that many of these countries can't actually take on additional debt. They need grant financing from wealthier countries. That shouldn't come without some strings attached, in the sense that the goal here should not be to create ongoing dependence on donor financing, quite the opposite. Domestic reforms that boost public financial management, transparency of public finances, and actually boost domestic revenue mobilization so that countries can actually finance their own public health spending needs—that actually needs to be part of assistance that's provided to countries. The assistance is provided in support of domestic reforms that are needed for sustainable solutions for public health.

If you can create that fiscal space, then how do you use the fiscal space that you've created? I'm not going to be able to improve upon recommendations that came from the high-level, independent panel subgroup of experts that reported to the G20. They articulated that pandemic security along with the climate crisis as representing the primary international challenge of our time. They identified four major gaps in pandemic prevention, preparedness, and response that include globally networked surveillance and research, more resilient national public health systems, the supply of medical countermeasures and tools, and of course, global governance.

I'll end there on that note of global governance. I'm sure everyone is familiar with the expression of "the pandemic isn't over anywhere until it's over everywhere," and that certainly requires a global response. Thanks so much for your time. I'm really looking forward to the discussion after today's presentations. Thanks so much.

**Judith N. Wasserheit:** Stephanie, thank you so much for that that great overview. The G20 high-level independent panel recommendations certainly give us an excellent springboard for our discussion.

Now we're going to go to our final presentation on what history tells us about how epidemics end. I'm going to turn this over to Erica Charters. Thanks.

**Erica Charters:** Thank you very much. It's an honor to be speaking to you.

This talk is part of a broader project, which examines the large question of how epidemics end, which I'm coordinating out of the University of Oxford. Across the past 12 months, I've been working with around 40 scholars who research a variety of epidemics that have happened all over the world, but who look at them from different disciplinary approaches, so epidemiologists, biologists, archaeologists, historians, political scientists, all to answer this question: how do epidemics end?

What I'm going to present today draws on this preliminary research, but I hope that you will visit the project's web pages. We're going to be releasing their case studies across the next few months.

I have three points I want to make. The first point is that when we compare how much time and attention we pay to studying the origin and the unfolding of epidemics, it's clear that, by contrast, we spent far last time studying the ending of an epidemic. The second point is that when we do focus on endings, it's clear that an epidemic's end is not the same as the end of disease and that there are multiple endings to every epidemic, not only across the world but even within one society. As a result, when we focus on endings, this lets us see that epidemics are not only biological phenomena, but they are also political, cultural, and social phenomena.

My final point is that when we focus on the end part of an epidemic, this reshapes how we think about the history of pandemics. It helps us to move away from a serial narrative of one after another, and it also helps to suggest that we require a more integrated view, both of epidemics and of the relationship between epidemics and society.

First, on endings. I think once you start researching the ending of epidemics, it's striking how little attention is paid to the process of an ending. An example of this can be found in what is really the

seminal account of an epidemic for Western literature and history, which is Thucydides's account of the plague of Athens in 430 BCE. Although much has been written and debated about what disease Thucydides is describing, what's clear is that Thucydides's account is a foundational epidemic narrative. That is, historians have pointed out that later accounts have an eerie habit of repeating Thucydides's account. It appears to shape not only the way that we tell ourselves stories and histories of epidemics, but also it shapes what we look for and what we think is important enough to be recorded as an epidemic unfolds.

It's significant to understand how Thucydides recounts the end of this devastating plague. After he describes the symptoms, the deaths, the social dislocation, the economic devastation, the political and religious upheavals, the disease simply disappears from his text. It's mentioned as all-encompassing, but then it's gone. And I want to underline this: Thucydides is not tracking a decline in cases nor even the process of returning to normality; instead, the disease simply disappears from his narrative. Disease has exited the stage without further comment, and other actors silently take its place. In other words, we the readers know that the epidemic is over, because it's no longer part of the plot.

Now, in many ways this silence is fundamental to the very definition of an end of an epidemic. After all, an epidemic is a crisis, not only a biological one but also a social and political crisis, during which time society's attention is focused on this urgent problem of disease and the drama of its unfolding. The end of an epidemic is, therefore, when the drama ceases, when society's attention is no longer focused on the crisis of disease.

When we examine research and scholarship on epidemics, there's a similar tendency to neglect this end stage. There's a lot of research on origins, on tracing and tracking transmission patterns, and on the climax of an epidemic, but there's little analysis on what it means for an epidemic to end. Most often we see how the ending is relegated to a brief conclusion, or maybe even an afterword, usually titled, "Lessons Learned," and so with the tension already pivoting away from the end itself.

As we can see with Thucydides, in some ways this is the result of the evidence itself. The very definition of the end of an epidemic is when our attention is redirected elsewhere. It's an indication that this urgent problem of disease has been resolved, and when we stop keeping records of the epidemic.

We see this pattern in fields beyond history. In mathematical modeling, as a recent epidemiological modeling paper points out, many works have focused on the growth, peak, and controlled faces of epidemics but much less studied are the tail end dynamics of an epidemic. I think it's interesting to note how in some ways, the statistical charts of cases, the epidemic or the EPI curve that's so ubiquitous in our visualizations of an epidemic's lifecycle, provide the same underlying temporal framework that we see Thucydides's account of a narrative of origin, climax, and then a kind of drift to closure.

This can help us to define how epidemics end. An epidemic is clinically defined as an increase, often sudden, in the number of cases of a disease above what is normally expected. This warrants official attention, if not designation as, in the terminology of the WHO, a public health emergency of international concern. By contrast, when the crisis recedes and the disease is no longer cause for alarm, a society's attention can be redirected elsewhere.

To my second point. When we do focus on an ending, what do we find? Here, a main point to remember is that we need to disentangle the end of disease from the end of an epidemic. A few select epidemics

such as SARS have indeed been declared over when cases among humans ceased. But most epidemics have not concluded with the end of disease; instead, most epidemics have been declared as ended while cases still continued.

If we look at the 2009 H1N1 swine flu pandemic, for example, it was declared by the WHO in August of 2010 to be in what they called the postpandemic period. The WHO noted that this postpandemic period would have cases and outbreaks according to seasonal patterns of influenza. This actually follows long-standing historical practices of distinguishing between an end of disease and the end of an epidemic. So Medieval era medical texts, for example, distinguish between widespread or epidemic outbreaks and individual cases of disease.

Likewise, in England, at the end of its many 19th-century cholera epidemics, these were most often declared through Days of Thanksgiving, but it was clear in the language that the disease had not ended. You can see here the language of these Days of Thanksgiving. In 1849, you talk about the “great decrease” or the “abatement” of cholera.

What this means is that the end of an epidemic is a process, and often even a long, drawn-out, contested process. As an example of this process and the way language is used, we can look at the end of the devastating Ebola virus epidemic in West Africa. It was officially declared over in 2016, but prior to this ending in 2016, Ebola was twice declared over in 2015 only to have more cases observed. In other words, there were three “end” declarations by the WHO and, not surprisingly, the language shifted in each end declaration. The first declaration in May 2015 said that Liberia was Ebola-free; the second one in September 2015 was more soberly reporting an end to Ebola transmission. Then, after it was identified again, finally in January of 2016, much more cautiously the WHO announced the latest Ebola outbreak was over. Of course, as recent research increasingly indicates, it appears that Ebola will continue to reappear.

This means that epidemics, and particularly their endings, can only be understood within a broader context of continuing disease. Influenza A, with its various strains and circulations throughout the world, is a classic example of a disease that rises to epidemic, that is problematic levels, and then returns to endemic or acceptable levels in unpredictable ways ever since it first appeared among human populations in the 1500s.

Given that an epidemic is defined as an increase in incidents beyond usual rates, the end, too, can be clinically defined as the reduction of disease incidence, prevalence, morbidity, or mortality to a locally acceptable level to achieve what is widely described as “disease control.” Yet, as ambiguous terminology such as *acceptable* and *control* demonstrates, this status is necessarily achieved through a process of negotiation between different, if not competing, interests. Particularly, as historical examples demonstrate, an epidemic’s end can be gauged by the resumption of social and economic practices as much as through biometrics.

I would suggest this very process of an end highlights these competing approaches. Discussions on the ending of HIV-AIDS, for example: these are debates as to whether it's more effective to invest in vaccine research, in medical therapeutics such as antiretroviral therapy, or to invest in social and political reforms. These all articulate different methodological understandings of the epidemic.



Such divergent approaches also reflect different global circumstances. What might be feasible in communities with sophisticated health structures cannot be replicated in those confronting limited and unstable medical support, if not also political fractures. What is deemed a locally acceptable level is thus necessarily a process of social and political debate as much as it is about medicine.

More generally, what I want to suggest here is that a focus on ending helps us rethink how we study epidemics and disease more broadly. The end process is not simply the downward curve of an epidemic. Instead, it marks a different way of thinking about the epidemic. That is, a society's understanding of an epidemic is different at the beginning and the climax than it is at the end. When communities are thrown into turmoil and panic at the outbreak of a new disease, when medical communities are convened, when central governments spring into action, when we hunt for the identification of a pathogen, epidemics are understood in clear, biological terms. But at the end stages of an epidemic, the disease is regarded through the filter of political, social, and economic dislocation and these dislocations that have deepened as the epidemic has progressed, articulating the processes by which policy decisions are debated and implemented and the accommodations that have been made between scientific models and human behavior.

What I'm saying here is not just a reminder that the crises of an epidemic—the political, the social, and the economic crises—do not end just because disease rates slow down. Scholars have noted, for example, that most pandemics have ended at different times and in different places. HIV-AIDS, for example, may have ended for most in the global North, but in some ways it's simply moved and continued on as an epidemic for many in the global South. The second plague pandemic, too, receded from Europe while most of the world did not witness anything such as an end.

This framework for disease and epidemics contrasts markedly with how we generally understand epidemics. When we look at this image here, which is from the website *The Visual Capitalist*, which provides data graphics as part of its mission to make the world's information more accessible, you likely haven't seen this particular image but I'm sure you've seen a version of it, maybe even in written form of following this format of listing disease outbreaks, pandemics, throughout the past. This one here starts with the Antonine Plague in the Roman Empire through to the Black Death, smallpox, and cholera, placing all these major pandemics in chronological order. That spiky red ball at the front representing COVID-19, and all captured by numbers of death. Although it might be unnerving in some ways to look back and see these large numbers of who've died from past pandemics, overall, this image of the history of pandemics is generally reassuring when we are positioned at its front. After all, COVID-19 appears at the end of a long list of biological calamities, each of them having been solved. It's presented as yet another test of human and scientific ingenuity.

Each pandemic here is shown as circumscribed and defined with clear contours of their respective ends. Yet if we were to incorporate in our understanding of the ending as a process, we can start to challenge this framework. Plague, for example, was not a discrete disease entity with a clear start and end. It would be much more realistic to portray the second plague pandemic something like this long, wavy line, thicker in some points than others, weaving back and forth, but ever-present, only occasionally rising and exploding above the surface, much more akin to an iceberg in which we only see the tip above water, with the massive disease hidden below.

If we look more generally here, we'll notice that endemic disease appears not at all. Tuberculosis, which would help to explain the pattern of HIV-AIDS, certainly is not featured. In other words, in this

framework, there's no space for interaction between diseases that is so often crucial to understanding the fluctuations of epidemics. Instead, the focus is on epidemics as isolated, discrete events that decisively end throughout time. By contrast, if we incorporate endings and the process of an end, our history of pandemics, I would suggest, would look more akin to this visualization here of a soundwave, with epidemics and society portrayed as a process of co-evolution.

In this framework, diseases interact with one another, but they also interact with societies. Neither is static, and the development of disease and society only makes sense when we model their dynamism together. Long before COVID-19's entanglements with comorbidities, researchers have pointed out that disease fundamentally interacts with other diseases, and epidemics, too, are fundamentally shaped by concurrent and previous patterns of disease along with societal frameworks and practices connected to memories and to fears of disease.

Now this observation is not only historical. After all, we use the past to identify patterns and thereby outline trajectories for the future. By focusing on endings, when the definition and the categorization of an epidemic becomes murky and contested, we can start to see that the categories and periodizations that we used at the outbreak stage were, perhaps, counterproductive.

We understand disease differently at the end stage. If, in the outbreak stage, we could channel that end-stage understanding of disease, it might help us reframe and rethink our long-term approach to managing disease.

Thank you very much.

**Judith N. Wasserheit:** Erica, thank you for that very important perspective on epidemics, and their interactions, and co-evolution with societies as well as with other diseases. In fact, I think it's pretty clear that as we move to the end of epidemics, disease predictably moves into or concentrates in the most marginalized populations, which of course means we have to change our approaches. Your call to reframe and rethink our approaches is actually a perfect segue into our discussion.

I'm going to turn this over to you, Patty.

**Patricia Garcia Funegra:** Hello, and thank you so much, Judy. Thank you so much to all the presenters. It has been a really exciting session thinking about all the different aspects of COVID and what can we see in the way forward.

I just want to remind all the nonmembers, if they have any questions or comments, just put it into the chat box and, if you would like to ask a question or make a comment verbally, please type the basic question and put "UNMUTE," and the team will unmute you and we can have the discussion. Also for the public registrants that are viewing this session, unfortunately, there is no way to send us directly your questions; however, we're very interested on knowing about them. We would like to hear from you, so please send those questions through email. The email is [NAMIG02@nas.edu](mailto:NAMIG02@nas.edu), and all the questions and comments will be collected after the meeting and will be sent to the appropriate panelists. The response will be sent to you accordingly.

Let's start then with some of the questions that we already have collected regarding the presentations. I would like to start with Chris.

Chris, you have talked about transmission; you have talked about debts. How much does the infection detection rate vary during the pandemic and across countries?

**Chris Murray:** Thanks, Patty.

I think because most people focus on, naturally, on reported cases—and only a fraction of actual infections get detected and that's a function of availability of testing—and that availability of testing was very low at the beginning of the pandemic. It increased in high-resource settings, but it stayed low in many countries. So I think people get a little bit misled by the reported cases, because the infection detection rates, as high as 40% or 50% in some high-resource settings whereas it's well below 1% in many countries in Sub-Saharan Africa and in many countries in South Asia, and we only know that because there have been population-based seroprevalence surveys that tell us about cumulative infections, and then you can relate that to reported infections.

Unfortunately, one of the big question marks about the pandemic so far is, just what has been the true level of transmission in many parts of Sub-Saharan Africa, outside of, for example, South Africa, Zambia, and a few other places? It's the dearth of hard data on seroprevalence to tell us what's actually happened and what the infection detection rate is.

**Patricia Garcia Funegra:** Thank you so much, Chris.

Jaime, you have talked about the need of accelerated learning. What else has to be done to be able to achieve that acceleration in learning, and how can we create more resilient schools for future pandemics?

**Jaime Saavedra:** Actually, these are extremely challenging times for school systems and for schools and for teachers, because they will be receiving students, or they are receiving students, that are undergoing much more complicated situations at home—mental health issues, as we have seen—and an extremely long interruption of their studies. The big question for countries is, where to start? Because you cannot just open the textbook and say, okay, let's start in the grade in which you technically, formally you are now. These kids might have left school that's, whatever, third grade and now they will be enrolled in fifth grade, but they don't have the basics to build learning—and learning always builds over previous learning.

School systems will have to find a way to make sure that this generation have, at the end of the day, the same competencies, at least the same competencies as in the previous generation, to the next generation. Hence that implies compressing 3 years in 2 or 2 years in 1. Or, try to use all what remains of the school time of children in order to make sure that they have acquired the same competencies that they would have acquired without this very, very long interruption. That's the key, that's the key factor: how to do that. That requires the streamlining of curriculums, prioritization, changes in school

calendars, changes in methods. And then that requires that we need to provide huge support to teachers. That was true before the pandemic, now that is even more urgent.

One additional point I want to make, Patricia, is that sometimes the school system have forgotten early childhood education. In the literature it was already established that the investments in early childhood education—in pre-K, say, let's limit to the enrollment of kids to institutions in ages 4, 5, and 6—that has the highest social and private return. Much higher as a social and as a public intervention, higher than primary, and primary is higher than secondary, etc. That investment that is the most profitable disappeared completely. That one went, literally, to zero across all countries.

Recovering the lack of experience that you had during your year 4 or 5 or 6 is extremely difficult. Then the teacher in first grade now has to work with a child that has had very, very little exposure to the education system and has a completely different way of interacting. His or her socialization process has been completely different.

Again, the support that is needed for teachers is absolutely urgent. That's something that school systems have to be doing as we speak. It's not the plan for next year; this is the plan, literally, for today.

**Patricia Garcia Funegra:** Thank you Jaime.

Stephanie, in your presentation, you were talking about additional donor support is needed to create fiscal space. Are there any proposals out there regarding this issue, and what are the prospects for gaining traction in the United States among other larger countries? What are the options?

**Stephanie Segal:** Thanks, Patti, for the question.

I think there are a lot of proposals that are out there currently. I mentioned in the presentation the High-Level Independent Panel, the WHO has its own independent panel. I would say the good news is there is agreement on the need to mobilize additional financing, and there's also agreement among the wealthier countries, including in the United States, to prioritize mobilizing additional financing. So that's the good news. I think there's political will behind that additional support.

I think the question then is, which mechanisms? There is a competition for resources. I would say there's also, perhaps, kind of skepticism about how different pools of resources can actually be used in a way that is complimentary so that the benefit from those additional resources are actually working together and being coordinated. That is a challenge that I think needs to be answered in order to actually match commitments to actual delivery of funding.

One last thing I would say on that point actually relates to some questions that I've received just in the chat, is the point about, to the extent there's support to mobilize resources, that there is funding available, how to actually ensure that those resources are used in a way that benefits the countries and benefits populations. That's the link that I mentioned that ties additional financial support to domestic reforms. I think it's really critical to view those two as reinforcing mechanisms, so additional revenues but in support of better public financial management and prioritization of the spending. I think if you can

demonstrate the linkage of the funding to those domestic reforms, you really maximize the chance and the prospects for mobilizing that financing.

**Patricia Garcia Funegra:** Thank you so much.

Erica, in your presentation, I mean of course, this is a question that everybody asks. What can we learn from history? If you want to give the message, how can we learn it? Because it seems that things have been happening all along, and what can we learn from history for the future of pandemics that are to come?

**Erica Charters:** So, in some ways I'm in the luxurious position of saying that historians generally try to say that the we're not sure that we can agree on what we can learn from history. That actually I think historians have a tendency to say that our own urge to think that there's a lesson coming out of everything that's a tragedy or terrible might say something more about us than it does about the experience itself. To me, actually, this urge that we have to see this as something where we're willing to learn something might be an opportunity for us to reflect on our own framing of an epidemic.

I think as a historian of disease, what we tend to emphasize is how epidemics are not and disease is not something that's external to society. An epidemic isn't something that comes down from outer space like an alien and acts on us. It's actually part of society, and so we need to understand how our own interpretation and our kind of urge to have a moral framework comes from our own urge to make sense of what has been a crisis. I think I would, in some ways, almost want us to challenge our need for a lesson. Partly because I think the other point that we can make when we think about disease as being part of society is that epidemics tend to exacerbate preexisting tensions and crises. They don't necessarily create anything anew, and I think that's something where we can think about the language that we use.

Very often, we can see from a long-term perspective that what an epidemic is doing is reinforcing certain attitudes, reinforcing certain views, and sometimes reinforcing certain tensions as well as further exacerbating some of the problems that we've already identified within our society.

**Patricia Garcia Funegra:** Thank you so much. I really love the figure that you showed in which you were mixing not only one disease but other diseases plus other things that happen within humanity.

We're starting to have more questions. I'm going to give this question to anybody from the panel that would like to answer it.

What role does civic society, resilience, and innovations play in addressing different aspects of the pandemic? This can be local philanthropy organizations, food banks, informal primary education initiatives. What is the role that civic society has? I don't know if from the point of view of history, economics, or education, anybody that would like to try and answer.

**Stephanie Segal:** I can offer a nonexpert thought on this, and maybe it kind of links to what Erica was just mentioning in what we can learn on the history of this. I feel like one of the takeaways from this experience is considering ex-ante countries' system and reliance on national- or state-level mechanisms versus what actually exists at the local level. There are going to be others on the panel that are better positioned to think about this, but there needs to be a tailoring of the policy response that fits with the reality of each individual country.

The question I think is a good one. There are going to be certain country's circumstances where civil society and local actors are actually the right place to direct assistance versus in another country's context where there's a federal approach or national approach that's adequate that are best positioned to handle the response. I think, maybe the short answer is that responses need to be tailored to reflect the realities of each individual country.

**Patricia Garcia Funegra:** Thank you, Stephanie. Jaime, do you want to say something?

**Jaime Saavedra:** Using something that, to answer your question, but using something that Erica mentioned that the pandemic reinforced certain views. We have always said that parents and communities are important in the education process. That has always been said. Now, it will be taken into a completely another level.

If we want to have resilient systems, we need to recognize the continuity education process from school to home or from school to community. Hence the role of communities in terms of organizing themselves and the role of parents in being protagonists of the education of their children, now it has been reinforced, and now it's even clearer.

Reinforcing that role, and having communities really worried about education of their children, I think this is a window of opportunity. Will that window of opportunity be used? We don't know. It's not clear to me that it's been used. I do not see across countries the same sense of urgency, for instance, about the understanding of the gigantic hit, the gigantic shock, that this has implied on our kids and our young people.

That's why you see countries in which their return to school has been extremely fast. Many of the OECD countries have tried to return after 3 or 4 months. They say no, this is urgent, we need to go back. Education is a social process; kids need to go back to school. While in other countries, unfortunately, many middle-income countries or low- to middle-income countries is like, well, it's better to have kids at home; the pandemic's too complicated; they will return eventually. Now they're starting to return, but the sense of urgency is completely different.

The role of civil society in terms of pushing governments and saying, look, no, education is critical on one hand; education is a social activity, so schools are needed. Their role is absolutely essential. As of now, it's been very different across countries.

**Patricia Garcia Funegra:** Thank you, Jaime.

Maybe this question goes to Chris. Are there any measures of misinformation on pandemic outcomes, things like resistance to mask or vaccination based on political views or other beliefs?

**Chris Murray:** That's a really interesting one, Patty. If you think about it, there's various groups that have been trying to look at this, I tend to think that we need to go back and look at all the mistakes that the public health community, institutions like CDC made, WHO along the way, being opposed to masks at the beginning, telling people who were vaccinated when the Delta variant was about to arrive that they should stop wearing masks. It's not technically misinformation, but there have been misinterpretations of the data, or as many challenges on that front as all the information that's out there on the Internet around vaccine efficacy and side effects of vaccines, or the benefits of therapies that have no benefits and have harms.

I don't know of any specific metrics around this. I know that groups like Facebook have been trying to think about that, but I don't know of any exact metrics to track misinformation.

**Patricia Garcia Funegra:** Thanks. Myron, you have a question?

**Myron Cohen:** I have two questions. But let me ask Chris a question first because he was just talking.

Chris, in your wonderful comments, you pointed out that the., one of the speakers pointed out, that the reduction in influenza is a palpable, quote, not benefit but side effect. I think most of us believe that side effect is related to masks.

We've kind of shown that influenza can be controlled better by a masked species than by the vaccines we've used. I'm just curious how you weigh that into your end at IHME, that flu benefit.

I'm sorry to put on you on the spot.

**Chris Murray:** No, no. As you know, we've been mask champions from earlier in the pandemic.

We've seen this huge reduction and flu, as you say. We think it's from mask use and, as we look ahead with mask use in most of the world going down—we got down to about 20% in the US in the summer, went back up when people got scared by Delta but only to about 40%, now starting to head back down—so we expect flu to come back. So that benefit was short-lived.

We try to factor that in. We're also trying to, because of demand from health system managers about what will be the double burden of COVID and flu in the winter, we're very much interested in if it's possible to do a better job of modeling the demand on hospitals from both. That's something that we're trying to address.

But I do think the real question that you've raised, Myron, is can we change culture toward seasonal mask use in the future, for those who are at risk, those who are over a certain age or have certain

comorbidities? Because there are very clear, obvious benefits of seasonal mask use, and I think that would be, you know, we could save an awful lot of lives in the long run.

**Myron Cohen:** If flu is more fragile, if flu transmission is more fragile than we thought it was, that's kind of one interpretation. COVID transmission is more robust, but that's a statement, not a question.

Let me ask Jaime a question really, really quickly after his wonderful comments. The thing that, I mean, there's no way to leave there not "chilled," just as Judy said. That's the response.

Getting children out of the household and back to school—you've emphasized that in a very compelling way. However, in especially the more advanced societies is this concern that children will be vectors of continued pandemic spread. How do we ever weigh the costs and the benefit? Vaccines for children are going to be a very, very debatable—that's going to be a robust discussion about, are we going to vaccinate children. I'm just curious how, from the World Bank point of view, you weigh this, because I'm 100% sure you want the pandemic to go away. If you could comment, that'd be great.

**Patricia Garcia Funegra:** And before you say that Jaime, I'm adding a little bit to Myron because I have been here in Peru and one of my concerns is—in the middle of all the cases, knowing that you have an overwhelmed health system—that the fact that children will start going to school means that you have to need transportation and other services, which means, like everybody will be in the streets.

How do you really manage this risk versus benefit in the middle of the peak or in the crisis? Especially when one crisis came after the other one—one wave after the other one?

**Jaime Saavedra:** Thanks Myron and Patricia. It's very different today than it was, I don't know, July or August of last year when we were really navigating an ocean of ignorance, and we really didn't know exactly what was the role that opening school systems would have in terms of spreading more of the virus. But as of now, we do have evidence of many school systems that have opened, in which it's clearly, even they have opened even before the availability of vaccines for teachers, for adults, and there has been no change in the path of the of the pandemic because of the school systems being open. That was a valid question. Well, now we have the data and we have the evidence: that didn't happen.

The US's the school system is open now, right now in September and October. As the school system is opening, the virus is, or the pandemic is at least for now, is decreasing in its intensity. But that's just one example. I mean, we have many other examples of even European countries who opened their school systems between the second and third wave in the Fall of last year, and that didn't have an impact on the pandemic.

Actually the data shows today that the transmission rates among children is low even despite Delta, and also that the death rates among children are very low. The point is that in that regard—and now even having teachers being, particularly in middle-income countries, the possibility of teachers being vaccinated—in that regard having school closed as part of the arsenal of fighting the pandemic.



Obviously I'm not talking about the schools being open as always. It's complicated to implement the social distancing measures; all kids should be masked. So it's not easy. I'm not saying that that's not easy. But then, if countries undertake those complex opening processes, then the benefits on the health side of keeping the kids out of school are very low. The costs of keeping kids out of school, because for children, in terms of losses of learning, in terms of mental health, in terms of lack of socialization, those we know are very high.

That's the issue. That's the issue in terms of now with the evidence that we have today, then in terms of costs and benefits for students and for teachers, the benefits are low, of keeping kids out of school, but the costs are very high.

Despite that we see very different positions across countries. In some countries, middle-income countries, you see a very aggressive return to school, leadership of Ministries of Education have said that we need to return to school, and in other cases, out of basically a paralysis and inaction, say, well, let's wait, maybe next year things might be safer, things are too complicated as of now. So very, very different positions despite the evidence that we have.

**Chris Murray:** Patty, can I jump in on that?

**Patricia Garcia Funegra:** Yes, please, please.

**Chris Murray:** So, first, I agree with Jaime that it's a good idea to open schools when appropriate mitigation is in place. The studies from pre-Delta to Delta aren't not useful right because the Delta variant is so much more transmissible. And we've seen, for example in Scotland, without appropriate mitigation, without mask use in elementary schools, fueling a second Delta wave. So without very clear evidence that school-based transmission, and there's tons of these studies now, can take place. It's not really as quite as simple as saying pre-Delta there was some studies that said there wasn't a lot of transmission.

If you look at seroprevalence surveys, the cumulative infection rate in kids is the same as adults, on average. So you can point to one survey or another, but if you take the meta-analysis of them all, there's no evidence that there's less transmission in kids. It is true that the death rate is much lower, but the question here is the role of children, as in Scotland, of fueling a general increased wave of transmission. But it does seem that, at least in the US and in other countries in Europe, if you have the mitigation in place, you don't. The question mark, the danger there is to make the more general pronouncement that kids don't play a role in transmission or a substantial role.

**Myron Cohen:** I think it's a good thing to argue. Not argue, we like discussions, so I'm going to Jaime a chance to respond further. But I will say one thing, Chris, while I put you on the spot again about something, it's not just about what happens in a community, it's the dose-response curve in a

household. Because risk mitigation in a household in the absence of vaccination becomes extremely difficult. And so, some substantial amount of transmission can be seen in the household.

The question is, a child who comes home with asymptomatic infection, what risks do they represent to a household and multi-generational adults? I mean, this is a tough question because we and others have done a lot of household studies and look for these kinds of dose-response curves.

Again, I think it's very complicated. Everybody on this call probably wants kids back in school; there's no doubt about that. The question is, what are the costs via—the benefits are obvious, too—this debate about the cost extends further.

Jaime, I'm going to put you back on the spot. You can have the last word on this; you get the last word.

**Jaime Saavedra:** This is, as you say, this is where we're battling a war, right here, and battling a war is very complicated. The information that we have in order of what works and what doesn't during this war evolves for a long time, but despite things evolving, we need to make decisions. But it's true, it is very difficult.

Meta-analysis, I mean, are you really varying variants from one month to the other? That's one thing. And second, the other thing is that schools... One thing is that we have the analysis of what happens when schools are opening, but actually other things in the economy are opening as well. One will have to isolate what happens when only school systems open while all other things are either closed or already have opened before.

We see many economies in which you have restaurants, factories, stores, malls opened and school closed. Is then the school system going to be a major factor or an important—or a factor—of then fueling the disease. Most likely not; however, given that we do not have clarity. But it is absolutely essential that when we do that, we need to use masks, we need to use social distancing. The transportation issue is very complex. You will need to make the hard decision and say that kids should go to the school that's closer to home, not to just any school. Is that easy? No, it's not. That's not easy, but we're talking about battling a war here, so no policies here are simple policies to implement.

I think it is doable to implement those sanitary precautions and then, make sure that what happened in, not make sure but minimize the risk that something like the example that was mentioned in Scotland is not repeated.

My point as always is sometimes school systems, yes, but it's difficult to make sure that all kids use masks. Yeah of course, it's difficult but the public policy is full of difficult things. It's difficult to make sure that there's water and sanitation in all schools. Of course, yes, it's difficult but it's not impossible.

There has to be a real effort of countries of recognizing there's huge costs on kids. Then we need to implement those complex policies that will ensure or minimize risks when kids go back to school.

**Patricia Garcia Funegra:** Thank you, Jaime. We're getting the picture, right? There are countries like Peru in which gyms, movies are open, movie theaters are open, but schools are not open yet. So it's like also trying to make more sense about opening of the economy and not opening of schools.

We have reached almost the point of closing this session, but I would like to give you all a last question. You have 2 minutes to answer. Because all of you have highlighted that the impact of pandemics on health, education, ability to work outside the home, and the economy are highly interrelated. What would each of you would say will be the top two things we should do differently in preparing for or dealing with future pandemics?

Maybe we should start with Erica, the historian. Let's go backwards this time. Erica?

**Erica Charters:** So obviously in one way I would say predicting is full of pitfalls. I think, to me, one of the points that, if history is going to encourage us, is to think about humility and the limits of our knowledge, especially our ability to predict. But I think the other point I would say is, when we're in the crisis, it's very hard to know what we think is important. I think one of the points I see, even in the discussion today, is that we're debating about different things that we want to measure. It strikes me that one thing to think about is what we're measuring and what we're focusing on. Because obviously what we measure then determines what we think is important. But there's a variety of things that we could be measuring at the time. And so it strikes me that we, again, we tend to think of this in terms of medical terms, but I think a lot of the talks today reminded us that there's a multitude of things that we need to measure. And if we're not measuring them, then sometimes it takes us quite a long time to realize the impact of what's unfolding.

**Patricia Garcia Funegra:** Stephanie, go ahead.

**Stephanie Segal:** I guess picking up from the last question and then what Erica just said, I think one lesson would be looking and appreciating at the full costs and benefits and trying to put in place an adequate policy response. We've talked about additional costs here, or whether it's related to mental health, but also looking at second- and third-order effects of the enduring costs from the pandemic.

That goes to the second point and the focus on the preparedness and prevention. I mean, we know that the costs from this pandemic will be in the multiple trillions of dollars, and I think trying to address the problem ex-post when really the most efficient way to get at the issue is ex-ante, and really putting the financing into that prevention and preparedness is really where we need to focus the discussion and hopefully focus policymakers' attention.

**Patricia Garcia Funegra:** Thank you, Stephanie. Jaime?

**Jaime Saavedra:** Thanks, Patricia.

There are two issues. One is that we're extremely worried about the inequality impacts that this pandemic will have. As Erica was saying, the pandemic sometimes will force certain tensions, reinforce tensions that we had in the past. And many, many low- and middle-income countries already had

gigantic inequality of opportunities that has been exacerbated by this pandemic in the sense that educational opportunities have been, during the last year-and-a-half in middle-income countries, totally correlated to your level of wealth. So the equalization impact that schools have disappeared. We really need to work in the coming months and years in order to try to ameliorate that impact that this will have, particularly among the poor.

When I say the poor, I'm not talking about the bottom 10%. I say, it's probably the bottom 80% against the top 20%. That is a huge shock that might have impact in the future.

My final point is that in order to address that, two things should happen. One is, we'll need to close the digital divide that we knew before the crisis; now it's even more evident. That has to happen in order to have more resilient school systems.

Second, we need to recognize that education is a social endeavor. The interaction with teachers is what really generates learning. And that requires, then, a completely different level of investment in our teachers. Even if we say at the same time that we need to close the digital divide, the future is going to be about the art of balancing technology with the human factor. The future will be precisely about more empowered and better trained teachers that can use and leverage technology more efficiently.

**Patricia Garcia Funegra:** Chris?

**Chris Murray:** Thanks, Patty.

First, I think that we've learned through the pandemic so far that it's behaviors and what drives human behavior that's the critical determinant of having a big epidemic or a small one. We all tend to focus on the biology, people who do modeling tend to focus on transmission patterns and R0s and things like that. But what really matters in the long run is things that drive people's being careful, wearing a mask, whether they want to get a vaccine, and we need to learn a lot about what drives behavior and why it's been so different in different parts of the world so that we can hopefully have in the next version of a pandemic behaviors that are going to reduce transmission faster.

Second, we've learned the harms of data hoarding by government, including in the US, and we really, really need to somehow overcome the natural instinct of governments to want to not share data with the public or with the scientific community. That just puts blinders on everybody, because we do need everybody in the country and globe putting people's best minds to the task of figuring out how to tackle a threat as it emerges. If we don't have access to data, that just is a super profound problem and one for which I don't see a huge amount of progress so far. Hopefully we will see progress for the future.

**Patricia Garcia Funegra:** Thank you so much to all our speakers. It has been really wonderful.

We have seen what data is showing us about COVID; as it has been said, we can have models, but what we are not doing is understanding what are the behaviors behind the numbers. We have talked about education, which is a critical issue; we need to work on issues like the digital divide, the participation of parents, education as a social issue, and the participation of communities. Stephanie has highlighted the

importance on the preparation to think about financing and to think how pandemics have really widened the divergence in the countries. And with Erica trying to put everything together; it's not that easy to say when a pandemic ends, because the ends can be multiple. You gave the example with Ebola depending on when you think it ends.

In reality, we have to see that the pandemic is not only a biological problem. It exacerbates other issues—social, economical, and problem in discrimination and inequalities that already exists. But from the very beginning, there is a mixture of things going on. Instead of looking at pandemics like just curves of one disease, we need to put together several other factors.

So thank you so much to all of you. And now please, Myron, it's your turn.

**Myron Cohen:** My turn is going to be really, really brief because the room has to close in exactly 3 minutes.

So I'm going to say in the next 3 minutes, first, on behalf of Judy and Patty and I, we want to thank the speakers, and the National Academy audience, and the public audience, who, if they have questions can send directly to speakers of the National Academy.

Let me also thank Jamal Samuel, Julie Lao, and Amici, for all their technical and other help to make this session take place.

What I would say is, just to summarize, is this kind of exceeded our expectations in the sense that we had in one session, all these really smart people talking about Thucydides and debt suspension in the same session. And you know, that's not that often that that happens. I also learned about Mission Recovery 2021, which would never have happened had I not participated in this program, which I think is a really exciting way moving forward.

I think that from Chris's talk—I'm going to end this session on Chris's talk, in a sense—you know talking about methods he supplied, and he's got his optimistic modeling curves, but then he has this giant caveat.

And the giant caveat, have you listened to Chris who I know quite well since we're on committees together, is the caveat: well, the virus, we don't exactly know what the virus is going to do, and our species is very diverse and unpredictable and we don't know what the species is going to do, and it's hard to predict the species' behavior in the context of vaccination and what happens to the virus, so all the curves are, in many ways, dependent on variables that don't exist today. So I think that the, from Chris's talk which is quite brilliant as always, was that what is predictable—and from Erica—Chris, I would say this is going to go from a pandemic to multiple small epidemics to an endemic disease. This is going to happen; we just don't know when it's going to happen.

We don't know exactly where the epidemics are going to be, and we don't know how severe the endemic disease is going to be that we're going to confront as a species.

I want to end exactly here because I know the room closes—I'm done exactly at 119.3—say thank you really all so much for participating, thank Judy for her leadership, and good afternoon. Thanks.