Making Health Measurable:
Using Global Burden of Disease as a Platform to Track Health Performance

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Bill & Melinda Gates Foundation
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Michael K. Young: Good morning and welcome. Today, we mark an important day in our efforts to think about and to improve global health for all people all over the globe. As we release these country-level estimates of the Global Burden of Disease and the risk factor studies of 2010, this is an exciting day in the life of University of Washington, in the life of the Gates Foundation, and, I think, in the life of the world. It's a remarkable development today. I'm Michael Young, President of the University of Washington, and I'm delighted to welcome all of you with us today, as well as our colleagues from England and other places who are with us today via technology. But before we start, I want to thank the Bill & Melinda Gates Foundation for hosting this today, and Bill Gates and the other participants in today's events, and to welcome all of our friends, including those from Washington, DC, and other places who are with us.

Identifying the best strategies to build a healthier world is really an enormous task, one that we have been at for many decades, if not centuries. The Global Burden of Disease project is the most comprehensive effort in history to produce complete and comparable estimates of levels and trends in health care and health outcomes, and to do that on a worldwide basis. These findings detail the causes of death and disability across age groups, across regions, across time, for 187 countries. The Institute for Health Metrics and Evaluation at the University of Washington, directed by Dr. Chris Murray, led this collaborative that brought together a remarkably large community of health experts and leaders in epidemiology and other areas of public health throughout the globe, nearly 500 co-authors from 300 institutions across 50 different countries. What Dr. Murray and his team at IHME have accomplished will provide a platform for better research for the leading causes of death and disability worldwide, but also give us a chance to look at how one most effectively deploys healthcare-related dollars and to measure in real-time the effect of those dollars in health outcomes, as well as to look at ways in which we can link the medical research—everything from genomics to stem cell research to proteomics to everything else—to health outcomes and to places where diseases centralize, and allow us to look at environmental factors that may relate to those diseases, as well as genetic factors, and a whole range of other causal variables. These findings will help influence as well how we teach future generations of healthcare leaders about global health issues, about the challenges that we face, and about ways in which we can make policy, based on data, based on better understandings, and based on real results and real outcomes. So this is a very exciting day in the life of the University of Washington and an exciting day in the lives of all those who care about global health.

This partnership between the University of Washington and the Gates Foundation and all the other 300 organizations who have contributed to this effort has really been an essential part of making

this successful. It was the vision and support of the Gates Foundation, along with the support of the state of Washington, that helped launch IHME at the University of Washington back in 2007. Since then, the Institute has continued to build the framework for a different approach to global health measurement through new research, publications, policy discussions, and as you'll see today, visualization tools that allow us to understand these developments and outcomes in a much more nuanced and acute way. As part of the University of Washington, the Institute continues the academic excellence of university research with the independence and entrepreneurial spirit of a startup company, and that we like very much. The innovation and the imagination of this project will be evident, I think, to all who are here today. University of Washington students, faculty, and staff have the passion, vision, and drive to really make significant contributions in this collaborative, cooperative way, addressing the greatest health challenges of our community, whether that community is across the street or across the globe. At our state's flagship public university, we take seriously our charge to contribute back to those communities, whether they are local or global, and to use the knowledge and discovery that is made available to help those outside the university improve their quality of life. There is no greater project that is more emblematic of that commitment and passion than this project that we are talking about and launching today.

The true work still lies ahead of us. We may know a great deal more than we knew before. We may understand a great many more things than we understood before. Now, the challenge before us is to do something about the things that we now understand better and have a more nuanced and complete understanding of.

It is now my pleasure to introduce Dr. Christopher Murray, who is the director of the Institute for Health Metrics and Evaluation and a professor of global health at the University of Washington. He will walk us through this study today and share with us what he and his collaborators have learned.

Christopher J.L. Murray: Good morning. What I'd like to do is to use both the science behind the Global Burden of Disease 2010 study, the work of this large collaborative, and a suite of visualizations that are live on the web right now—for any of you to use when to leave and for hopefully millions of people around the world to use in the years ahead—to tell a sort of story about what has happened in global health over the last two decades and some of the challenges ahead. It's a story of remarkable progress in many places, it's a story of an unfinished agenda, and it's a story of huge diversity in health patterns at the local level.

So first, let's go back to 1990. This is one tool called GBD Cause Patterns. What I'm showing you here is at the global level. It's just a count of the number of deaths by age. And in each age group, we have broken deaths into 21 broad cause groups. So the big blues over here on the right in the older age groups are cardiovascular diseases, the light blues are cancers, and a big burden from the chronic respiratory diseases, but notice, back in 1990, there were over 12 million child deaths across the early neonatal, late neonatal, post neonatal, and 1-to-4 period dominated by neonatal causes as well as by pneumonia and diarrhea.

If you go forward two decades to 2010, what you see is this dramatic decline in child mortality, where we have reduced the number of child deaths down to, still a huge number, namely just below 7 million, but still a remarkable change globally, a shift in the global death pattern towards older ages. But one of the things in the Burden of Disease study that we try to spend a lot of emphasis on is providing access to different metrics about population health, and counting deaths is a very inadequate way to think about priorities in health or challenges, because a death at age 90 just isn't as important as a death at age 1. And so one way to do that is to look at years of life lost, where for each death we count up the amount of lifespan that that individual has lost. So a child death represents their entire lifespan. So when we switch to a view of years of life lost, what you see is that there's still an enormous burden of years of life lost, despite all the progress in children around the world, dominated by the neonatal causes in blue and pneumonia and diarrhea in the lighter yellow. But you also see, when you look at years of life lost, that around the world there are other things at young-adult age that matter a lot: HIV and tuberculosis in the dark yellow. You see a number of the injury causes, unintentional injuries. Road traffic injuries in purple here are major contributors globally. And so, the years-of-life-lost view does change our sense at the global level.

Another component that goes back to the origin of the Burden of Disease work 20 years ago is an attempt to quantify how much chronic disability there is in the world as well. So if we look at years of life lived with disability and look at the numbers of years lost around the world by age and look at the causes, you see a very different story: that the causes of disability are different than the dominant causes of premature mortality. There are things like mental disorders and substance abuse in light green. Things like the musculoskeletal disorders. Or, for example, this category that includes vision loss, hearing loss, and the anemias. The conditions that cause the disability are quite different than the ones that are causing premature death, and when we put it all together in our metric of DALYs, which is our way of quantifying the total burden of disease, you see this complex picture for the world: A huge agenda around children, a huge volume of burden in young and middle-aged adults, both from premature mortality and from disability.

Now, in this tool, you can choose to look at any set of countries that you want, and so I've preselected here—and you can use the add and subtract to get any group of countries—a set of countries that represents a diverse array of the epidemiological transition around the world: From Japan, with some of the best health in the world, or Australia, almost as good, right through to Niger, which probably has the highest child mortality and the largest residual burden from pneumonia and diarrhea. This is showing age-standardized DALY rates in 1990, and I want you to notice that the y-axis goes up to 100,000 DALYs per 100,000, and in 2010, look at the progress everywhere, because the top of the scale only goes up to 70,000. So even in the worst off places, we've seen marked progress. But what this also shows is there are different levels of progress in different places. A place like Rwanda, second from the right, has now had enormous progress in that 20-year period. You also have extraordinary findings where the US and China now have really commensurate levels of health, and that's a transition that's really quite dramatic over a two-decade period.

Now, if we go and look at a different view—this is a tool called GBD Compare—and I'm showing 1990 at the world-level DALYs, that metric of total burden. And I'm showing the same 21 cause groups that I just had on that previous diagram. Broad cause groups: diarrhea, pneumonia, the other infectious diseases, the nutritional deficiencies, HIV and TB all shown in red. The noncommunicable disease groupings shown in blue: heart disease, cancer, mental disorders. The injuries green. But we can look in this tool at a much finer level of detail, and so on the depth of the cause list, we can drill down and look at quite specific causes. Again, this is the global level in 1990. Pneumonia, diarrhea, the neonatal causes, preterm, neonatal encephalopathy. You can hover over each of these boxes and see exactly what we're looking at. All the specific cancers in this box, with lung cancer and stomach being the two largest, but you can see the role of prostate cancer, kidney cancer, et cetera. The chronic respiratory conditions here, congenital anomalies, and major depression as other examples. Now, from 1990 to 2010, you can visually see the global transition that's underway, the progress that we're making on reducing child mortality and other infectious causes, and the rise of the fraction of the burden of disease at the global level that is due to NCDs.

Now, I can add a map to this and show you on the bottom just how diverse the world still is in terms of these metrics of the epidemiological transition. What you see here, and let's go back to 1990 to get a sense of where we were two decades ago, I'm showing on the map the percent of burden that's from the communicable, maternal, and neonatal causes, and that's ranging from a low in places like the US of 8 percent, or even lower in France of 5 or 6 percent, to places like Niger back in 1990, when 82 percent of the burden is from those causes. In a place like China, you had 26 percent—and if I just click on the map, the top's now going to switch to China—and there's what the burden of disease in China looked like in 1990. Play the movie of time forward two decades, and you see how the burden has shifted in a place like China because of their dramatic progress in public health. But, if we go and look at other countries, still in 2010, there is still a large slice of the world where the dominant sources of burden are the communicable, maternal, and neonatal causes. I'll just zoom in on the map here, and we can look at a place like Guatemala, and there, despite being a country in Central America with a lot of progress from 1990 to 2010, you have a place where 37 percent of the burden—shown up here on the top—is from the communicable, maternal, and neonatal causes, in the red categories. You also notice something interesting about Guatemala. It is one of the themes here on the burden, that countries are very different, that violence is one of the leading causes of burden in Guatemala, up there with a number of other infectious causes along with those injuries.

Now, if we go back to the map at the global level and continue this sort of around the world of the epidemiological diversity, in India, they are about halfway through this epidemiological transition, with about 40 percent of burden from infectious disease, 40 percent from NCDs, and the rest from injuries. Go to a place like Zambia, and you have a burden of disease that is truly still dominated by the communicable, maternal, and neonatal causes, with of course HIV being a really important component. So that's both a cross-sectional view that comes from the study and a time-series view of the story of progress, but still a huge unfinished agenda.

Now, we've built other tools to help people make sense of the pattern of disease in their own country, as well as other tools to help compare themselves to similar places. So here's another tool: It's called GBD Arrows, and it's basically these arrow diagrams with a ranked list of the leading

causes in 1990, connected to the leading causes in 2010 on the right. I'm showing DALYs, but you can look at deaths, you can look at years of life lost, you can look at any age group that you're interested in. You can look by males, you can look by females.

Now let's look at a place like China. So we saw the broad shift in China, but this shows at a more fine-grained level just how so many of the noncommunicable diseases in blue are going up in the ranks, with stroke, ischemic heart disease, and chronic obstructive pulmonary disease in the leading ranks for China, and huge drops for things like pneumonia going from 2nd to 15th, neonatal encephalopathy—a dramatic decline, measles—another example. If we go to Guatemala, which I was showing you a month ago, and look in this view, you see how actually violence is number 2 and is on the upswing there. Despite reductions in pneumonia and diarrhea, pneumonia and diarrhea are still number 1 and number 3. So it's truly a country that has the sort of double burden of both the noncommunicable diseases and injuries as well as the communicable causes. Go to a place like Zambia and you will see that, despite real progress in Zambia, we have HIV/AIDS, malaria, pneumonia, diarrhea, malnutrition, and meningitis unchanged at the top of the list, and you have to go down to the 12th cause of burden before you see something that's not a communicable, maternal, or neonatal cause. So another way for people to explore the findings for their own country. And we have found in testing with people that ranked lists convey information in a different way. It's a sense of priority that's easy to convey to a diverse and broad audience.

Let's go back, and I'll show you a different tool. It's called a heatmap. And the purpose of this is to visually convey differences across countries in what are leading causes, whether they're leading causes of burden or leading risk factors. So the way this tool works is you can pick any set of countries that you want to compare. I've picked a range of countries across the epidemiological spectrum. And depending on the column—let's say we look at Russia, and it is now going to order causes in Russia from their top cause to their lowest cause. The top causes are colored red, and on down. So you can visually see where countries differ in the cause composition. So ischemic heart disease is a leading cause in many of these countries, but it's pretty far down the list in Zambia, Rwanda, and Niger. HIV/AIDS is very far down the list in most of the countries on the far left: Japan, Australia, the US, Mexico, China, and Yemen, but it's number 1 in Zambia and it's number 3 in Rwanda. You can also see how some causes are very local: alcohol use disorders or lung cancer. Violence is very local. Where violence was number 2 in Guatemala, and it's very highly rated in Mexico, but not in any of the other countries. So it's a visual way to see the story, and you can actually go back in time and sort of see how these things change as well, where some causes played a more dominant role across countries.

Another important part of the Burden of Disease Study is that we quantify both diseases and injuries, but also the risk factors that underlie those patterns, and in these tools you can flip between them. So I'm going to go back to 2010 in these countries, and I'm going to look at the risk factors. I've ordered the risk factors, currently by Russia, but let's go back to the global ordering, where the top risk factor is dietary risks, and then high blood pressure, and then smoking, and then household air pollution at the global level. But you can see from the color scheming there's dramatic diversity in the leading risks across a place. So something like household air pollution is not an important risk in the more demographically advanced countries. Something like alcohol use

is very variable, being top in Guatemala and number 2 in Russia. And in a place like Niger, the risks are still things like childhood underweight, household air pollution, suboptimal breastfeeding, and vitamin A deficiency. So it's just another way to explore how a particular place in a particular time is either similar to or different than other places. We have many ways to do that in the tool.

Back to GBD Compare. Here's a view that's sort of the primary interface if you're thinking about what's happening in a country. In the top is diseases and injuries, and it's a square pie chart, where the size of each box is proportionate to the size of the problem—I'm looking at DALYs in 2010—and the bottom is the risk-factor analysis, so you can see both at the same time. If we go and look, for example, at China, and you see the big leading diseases in China—stroke, ischemic heart disease, lung cancer, liver cancer, COPD—and down here, you see the leading risks—dietary risks at the top. If we change this to be percent, maybe the units will be easier to interpret. So 16 percent of the total burden in a place like China is related to diet, high blood pressure next, smoking next, and ambient air pollution, outdoor air pollution—and Aaron Cohen's here from the Health Effects Institute, who was key in that analysis—is the fourth leading risk factor in a place like China.

Now, sometimes people have a hard time understanding the relationship between risk factors and diseases, and so we've tried to make that connection visual and understandable. So here's another way to look at this issue. On the top is that square pie chart, the tree map, but I've shaded each box of this tool now by the fraction attributable to a risk factor. In this case, it's tobacco. And we're back to 1990, and I have a reason for this. On the bottom, I'm showing the percent of the burden of disease attributable to tobacco. Back in 1990 in the US, which is up there, we have the US accounting for 16 percent of tobacco and China accounting for 8 percent of male burden. In 2010, however, the US is dropping and China is increasing, so now we have the extraordinary phase of global health where 12 percent of the burden is tobacco in the US and 12 percent of the burden for males in China is tobacco, so quite far in that transition for countries outside of sub-Saharan Africa. If I switch to looking at child and maternal under nutrition, you see a very different view, where you have places in sub-Saharan Africa, like Niger, where the burden attributable to malnutrition, whether in mothers or children, is still 28 percent of the total burden of disease. So I think what we see in the burden of disease is both the story of success, the story of an unfinished agenda, but also the power of local information that is, we hope, easily accessed, intuitive to a diverse set of users, and that will in some sense broaden the discussion about patterns of health far beyond what's traditionally been the focus of public health specialists. And so our agenda here is both quantification of where we are and where we're going, understanding of the diversity of the patterns around the world, and, very importantly, being able to make this information accessible to change the discourse around the world in different communities about what are their health problems.

Thank you very much for your attention on this tour through the GBD 2010.

I forgot my most important task, which was to introduce Bill Gates, who is an innovator in Seattle.

Bill Gates: Thank you, Chris. As you can see, these GBD tools that are being released today are really quite amazing, and they're going to make a huge difference in the world of global health. I actually took the idea of measurement as the theme for my annual letter that came out in January, and I talked about the fact that, in almost every endeavor, but particularly in health, it's the areas where we go in and do a good job of measurement that we make progress. We see who's doing well, we see who's not doing well, and we come up with the tactics to make very rapid change. In fact, my involvement in global health really goes back to seeing a report that came out of that work that was issued about 20 years ago, called the World Development Report, which was the first one that used this term "disability-adjusted life years." I was completely stunned by the burden of disease in poor countries, to see that diarrhea was killing literally millions of children, and that some of those causes of diarrhea, like rotavirus, were preventable; that is, there was a vaccine that was available in rich countries, but ironically not in poor countries, that could bring those numbers down. And so it was seeing that data, that early visualization that's nowhere near what we've got today, that got the Gates Foundation on the track of focusing on global health. And as we've been going down that path, we've had a chance to fund a lot of studies to go out and measure things, but there's never been anything that could pull the data together, to be the sort of ultimate communication tool for the various debates in the field and the various policy decisions to be made, and now with GBD, we have those tools.

I want to emphasize what a fantastic job Chris and his team have done on these visualizations. You just got a little bit of a sense of how easy it is to navigate around, so this is a fantastic tool when you have somebody like Chris who can tour you around. It's also a great tool to go take yourself and start to do that exploration. They've made it straightforward, whether you're looking to compare different countries, to compare different causes, to look over time. I'd say, in the whole world of data visualization, this is one of the best efforts that has ever been done. In fact, in the health world, I'd say there were kind of three milestones: There was 1993, where we got the World Development Report; there was some of the work that Hans Rosling did to try to show people the transitions we're going through; and now, in a huge way, this is a big milestone that pulls everything together.

There is a lot still to be done, in terms of how this data gets updated. By putting the data in one place, a lot of the experts now will be able to argue over exactly what—particularly, as you dive into the more detailed causes—exactly what new studies are needed to resolve various controversies there, but even just having the tool to trigger that type of thing is very important. For the Foundation, we're often in discussions with countries about what their policies should be. For example, there are many countries in the world that don't yet have pneumococcus vaccine as the standard of care, India being the place where the most children would benefit if they adopt that vaccine. And now, when you have a tool like this, where you can show them—you can even, in this tool, drill down and see the various studies that have been built up to support this information, and so it's not a complicated story. This is going to help us tell that story and get better health policies more rapidly than we've been able to do in the past.

It's also a tool that's going to help inform research priorities. Everybody in this field has very finite dollars, and so looking out and saying, "Okay, what are the trends in these diseases? Where should we put the dollars?" This will be very, very helpful. As Chris said, it's very much a positive story. If

you take what we have as our rallying cry, which is the difference in the health of people in the richer countries versus the poor countries, it's a wonderful story of improvement, headlined by the reduction in under-5 deaths from 12 million down to now a little bit below 7 million. But there's no reason that we can't get it down below 4 million, even 3 million. And so, having a tool like this is a great aid in driving that cause, and also for these rich world diseases. I mean, this is a very global tool, and so it's not as much our focus of effort to look at the changes over time in things like cancer and heart disease, but I'm sure the people who focus on rich world diseases will find it equally valuable.

So I want to congratulate Chris Murray and his team for having done a phenomenal job on this. It kicks off a world where we're really going to be able to talk about our health statistics in a deep way. Thank you.

Rhonda Stewart: Thank you, Dr. Murray, and thank you, Mr. Gates. As you can tell from those explorations of the GBD, there are many different stories to tell with these new findings and many new ways for people to engage with the data. Now we'd like to hear from you. We'd like to begin our first 10-minute question-and-answer session. If you do have a question, please raise your hand and wait for a microphone to come to you. We have staff members with microphones in the back so just raise your hand if you'd like to ask us something. And for those who are watching online, you can also submit questions via our Twitter and Facebook pages.

Question: I'm very curious about the process and the results of these wonderful numbers. How do we know how many people died of cancer in Niger in any given year? Where does that data come from? And how comfortable do you feel relying on those numbers as being the facts?

Rhonda Stewart: Let's take maybe two more questions before we let our panelists dive in.

Question: I want to ask, did you see the correlation between different sets of diseases? So, we talk of tropical infections—how do they impact the NCDs and vice versa?

Question: Amadou Daffe from Coders4Africa. In collecting the data, have you worked with capacities such as, not just from government or anything like that, but people on the ground in countries, especially in Africa, that can help you collect that data or even build tools—tools that allow you, such as APIs and stuff, to push data and get data?

Christopher J.L. Murray: How good is the data? It depends on the place and it depends on the cause—cancer in Niger, probably not so great. And what we've tried to do in constructing this, and what we'll try to continue to do as we go forward with the sort of continuous updating process— which I didn't emphasize at all in the presentation—is that there's a whole series of tools that allow you to explore the uncertainty in the numbers. So the uncertainty in the measurements for ischemic heart disease in the US—pretty narrow; the uncertainty for esophageal cancer in Chad—pretty huge. And so that's one way to try to communicate that to the user. It's a real challenge, communicating uncertainty, and we've built some ways to visualize it, but despite building it, often people don't actually like to see the uncertainty, but it's certainly there. And we try to emphasize it,

and I think in some sense, over time, as we continue to update, how those uncertainty intervals evolve and narrow will be an important metric of how good the data for global health is.

For the question on the correlation, I think there is likely a very strong set of relationships that you can start to see or tease out between maternal or fetal malnutrition and some of the NCDs that come later. You'd need a much longer window of time to see that, because it's at least a 20-, 30-, 40-, 50-year timeframe, but there are certainly hints in the data that would suggest that might be important.

And regarding working with groups in Africa and other places, we've tried, but in the future iterations of this, our goal is to build up—we've had 500 experts around diseases, injuries, and risks—to build up a set of collaborators country by country. So we're really keen to have as much engagement in this scientific collaborative from every country that's interested as possible.

Michael K. Young: Chris, when you first introduced some of this to me, the story about securing malaria death data was really fascinating. That goes, I think, to all of these questions about the degrees of certainty and how one does this and how imaginative you have to be to really figure that out. I don't know if you feel comfortable sharing that, but…

Christopher J.L. Murray: Well, I think what President Young is referring to is that there is a very active scientific controversy about the extent to which adults die directly from malaria. Or less controversial is that malaria is a risk factor for adult death from a host of conditions, like chronic kidney disease, and I think it's an example where the GBD brings into one place the data that's available and then the challenges of interpreting the data, and it'll trigger a whole series of scientific questions that will need new data to really give us the definitive answer. And in the meantime, we have these very big uncertainty intervals that say adults could be dying from malaria in substantial numbers, and that's where we'll need more verbal autopsy data, and better direct measurement of the relative risks related to plasmodium falciparum, for example.

Rhonda Stewart: Other questions?

Question: It's beautiful data visualization. I just wonder, is there a way to delineate between urban and rural? And more specifically, when you think about the peripheral poor slum communities in these highly densely populated cities, they seem that they may get marginalized in this overall view. Beautiful, beautiful visualization, though.

Question: Claire Bonilla, Disaster Response from Microsoft. I concur—I really love the model. I'm actually very interested in applying it to areas outside of even health and global disease; I see a lot of benefit in it. One question I have is, is there also access to data behind the projects that are actually making a difference in some of the catalytic drops or improvements we're seeing in the statistics?

Rhonda Stewart: One more question for now.

Question: Bob O'Keefe, Health Effects Institute. Pushing it a little bit ahead, how do you use the data? How do you take it to the next step to begin to get funders, industries, governments to really

believe in the credibility of these estimates and the relevance of these estimates to their national challenges, and to begin to use them to drive hierarchical action at the national level, to make these real?

Rhonda Stewart: Mr. Gates, would you like to weigh in on any of this?

Bill Gates: Well, the last one—there's a systemic underinvestment in primary health care in poor countries, that is, the ministers of health, in terms of the percentage of budget they get and the type of expertise they get. And when a government does start to pay attention to primary health care, Ethiopia would be an example, this data would be wonderful because you can see when they start to get serious about primary health care, you start to see the improvements. Particularly as we get out to 2015, that's going to be an incredible success story. And the fact that you can then compare other countries, that will get the policymakers, and even the foreign aid donors, to understand that those dollars are incredibly catalytic. So I see the tool as very helpful in taking stuff that, working in this area you just know, but how do you communicate? And this will be very helpful and will affect government budget allocation.

Christopher J.L. Murray: In order of those questions, the urban/rural question—great question. I think it's not just urban/rural. There's sort of locality and other patterns—even within rural areas we see huge disparities. This tool is only at the national level. I think that the technology, the analytic strategy, is easily applied at the subnational level. In fact, I think David's somewhere here in the room, from King County Public Health, David Fleming. And we are trying to pursue a project with King County, with New York City, and with Fulton County to apply these methods to measure the burden of disease in localities, because it's just as relevant to them as at the national level. Similar types of discussions underway with China and with Brazil, and we've already been doing work with Zambia at the district level. So I think there's an agenda there of bringing this to the subnational level. I didn't show all the tools that we're releasing; two of the tools that are up online now are a visualization of the underlying data that goes into mortality measurement for adults and children and the underlying database that took five years to build up of cause-of-death data. So those two are there, you can explore them, you can see what's actually the real data behind the measurements, and more of those tools will be coming as we go into this sort of continuous updating strategy.

And I think Bill has answered the how-to-use-the-data part. Just one comment on that is that—not a developing country, but a high-income country—also today was published a paper using the GBD results to benchmark the UK, because the UK Department of Health saw the results in December at the global and regional level and came to us and said, "We can use this, if you'll give us access to the country-level data, to benchmark the UK versus Europe, the US, Canada, and Australia." And so that's what's actually being published. There's a joint effort by us and some key leaders in the Department of Health. Say, what do these findings mean for the UK? The bad news for them, of course, is that they spend a lot, they have an incredible universal healthcare system, good public health, but they're toward the bottom of the league table for most outcomes in Europe. And the Minster has now issued today a call to action in sort of response to that. So interesting direct uptake. High-income country, but I think it'll serve as a model for that type of discussion that's underway in other places as well.

Rhonda Stewart: A few more questions.

Question: Craig Rubens from the Global Alliance to Prevent Prematurity and Stillbirth. Beautiful data, and I love the tools. What I wondered though is, as you were sifting through all this and saw the data emerging, and the same question to Bill, did you find surprises that now make you pause and reflect on where the GBD goes next and what it needs to focus on that you weren't anticipating before? And the same for what the Foundation may be thinking about in terms of what it's seeing within the data that really are surprising and make them want to pause and reflect on where they go in the future.

Question: Chris, one of the amazing things about this work is this linkage between risk factors and morbidity and mortality. On the morbidity and mortality, you're comprehensive: You get 100 percent of the deaths and 100 percent of the disability. On the risk factors, not. And you include smoking; you don't include rainfall or topography or access to ports or sexual behavior. And I think it would be useful if you could comment on how you have defined the universe of what constitutes a risk factor, and why that's in and others are not in, and what the implications are for policymakers.

Rhonda Stewart: We'll take one more question.

Question: Carlos Pellegrini, Department of Surgery at the University of Washington. Along the same lines of the last question, can you expand to say, how can you use this data to look at health disparities and outcomes within a given country—and I'm talking in particular about ours—where we can see that outcomes are so variable in the application of almost any therapy, depending on the social strata of that individual.

Rhonda Stewart: Mr. Gates, would you like to start with the questions and reflections?

Bill Gates: As you attribute all these deaths to various things, you realize you're just not studying— you're not gathering as much data as you should. So, for example, in pneumonia, there is a lot of uncertainty, as you get down to the base etiology, exactly what's going on there, and so, actually, some studies were started because of GBD that hopefully will give us answers. Chris referred to the malaria issue. As you look at some individual countries, things jump out. Chris showed me cirrhosis in Mexico was disproportionate to what you would have expected there. We have diseases like typhoid or cholera where we have interventions, but it's unclear—it's pretty clear you don't need to give those vaccines to every child in poor countries, but there are probably geographies where we should be using those vaccines, and there's just not enough data right now for those and a few others. And so, we've got to build surveillance networks; we've got to go in and do some additional studies. So yes, the GBD does open up a lot of questions, and it makes you realize, hey, we can answer all these things; why don't we take our final mysteries and make the investments to get the answers?

Christopher J.L. Murray: So let me tackle Stef's question there on the risk factors. There's two dimensions of the risk factors. It's not comprehensive, and somebody tomorrow can come up and say, you know, coffee is the world's biggest risk factor. And so, it'll never be comprehensive in that sense. What we've tried in the study so far is to take an array of risk factors where people have been studying them, and then we used the IARC criteria for evidence, either probable or convincing

evidence, to count them. And I think that's sort of inadequate, in the sense that, I think, going forward, we should sort of take a step back and trawl for a wider range of risks. So that's one dimension. The other one is that, of course, the risks add up to more than 100 percent, and that's an uncomfortable thing. Because science is so focused on getting risk factors for some of the infectious diseases and heart disease and cancer, we have almost no risk factors for other big areas, like mental disorders, substance abuse, musculoskeletal disorders. So we know very little about the underlying risks for them. And so I think that's also just a reflection of where we've invested money in knowledge creation up until present.

On the disparities question, we're very interested for the US in using this sort of approach to eventually have this tool, but for counties in the US, so that you could say, where is it really bad? Where is heart failure really bad? Where is a particular cancer very bad? So that would help in the discussion that needs to happen about why is our health system here so expensive, with relatively poor outcomes compared to other advanced systems. So, not in the tool now, but that's why we're so excited about this pilot project with New York and Seattle and Atlanta.

Rhonda Stewart: Let's take one final quick question before we move on to our panel.

Question: Adrian Davis from the Department of Health and the NHS in the UK. First of all, I'd like to put on record our deep thanks for the work that you've done and for taking the paper forward. It's had an incredible effect, both in terms of galvanizing policy and people to address the issues. So I think, from that point of view, there is evidence and learning from what we've done that can work elsewhere. I really agree with the agenda that people have brought up about getting regional data, maybe some sort of social demographic data, and those sorts of things within it. Clearly, from my point of view, as you know, Chris, some of the data, particularly around, say, hearing and communication and those sorts of softer issues, isn't as hard as that, I feel, with that burden of disability in our elder age; as we get there, we need to concentrate on those issues. The question I'd like to ask is, we all want to know that a policy is going to make a difference, and we want to know what is it, in terms of policymaking—we've heard, I think, from Bill Gates about investment in primary care, and you said about the difference that public health in China made, but how do we capture that health economic data, about where the spending is going that makes the real difference? Is that something that is coming along at a pace as well?

Christopher J.L. Murray: Thanks, Adrian, for the question, and thanks for the comment about the UK paper. The vision for going forward, which I think Trevor Mundel is going to speak about at the end of this session this morning, is to try to capture information in addition to the burden of expenditure in some of these disease and injury areas. I think that'll be interesting. I think it'll raise as many questions as provide answers, and that'll be sort of a step on the road towards a deeper understanding of where is money being successful and where is there an opportunity to invest and where maybe money is being spent on things that could be handled in more efficient ways.

Rhonda Stewart: Thank you Dr. Murray. Thank you, Mr. Gates. Thanks, President Young. I'd now like to invite our policy experts onto the stage, and the last question that we got is a good segue for having them join us, so if I can invite all of you to come up. One of the questions that we're asked most frequently about the GBD is how it can be used to inform decision-making, and the data can frankly be rather overwhelming, and so this is one of the reasons that we've created the new tools that are available on our website. Now, to join us to talk about the ongoing policy dialogue around the GBD are Dr. Ali Mokdad, Professor of Global Health at IHME; Dr. Felix Masiye, Head of the Department of Economics at the University of Zambia; Dr. Rafael Lozano, also a professor of global health at IHME; and Nicole Klingen, Acting Director of the Health, Nutrition, and Population Unit at the World Bank. At the conclusion of the panel, we're going to have a prerecorded video message from Dr. Agnes Binagwaho, the health minister from Rwanda. Dr. Mokdad, if you'd like to get us started.

Ali Mokdad: Thank you, and good morning everybody. As you can tell from my accent, I'm from the Middle East—half of me is from Yemen, another half is from Lebanon—and I've been fortunate to travel through the Middle East lately to talk about GBD. We have had a release collaborating with the EMRO region, Dr. Ala Alwan, in Amman, Jordan, where Chris and I and several people from IHME presented a prerelease of GBD for the EMRO region. There is a lot of excitement about this data and our product for many of these countries, and let me tell you briefly what are the issues that they are coming to us and asking for our collaboration, and we are looking forward to this collaboration and to working in that region.

The first one is they are interested in collaborating with us to improve their health information system, and then they are looking at ways with us to look at what they could do in the short run and in the long run. So to take, for example, in a country like Lebanon, until you fix the vital statistics and the mortality data, we're looking at doing some verbal autopsies immediately in order to get the picture of deaths, for example. And they're interested in our integrated surveillance system, where we are helping them to collect data from surveys, from hospital reporting, to all the data needs for the health information system. Next week, for example, a team from IHME will be in Saudi Arabia to collect data for the National Saudi Health Interview Survey.

The second one is they're coming to us and looking at collaboration to do their own Burden of Disease, and we have colleagues here from Saudi Arabia, where we have a project in Saudi Arabia for five years where we're doing integrated surveillance systems. And we're also doing Global Burden of Disease in Saudi Arabia, but not only national, which came in the discussion after the talk this morning. Not only to provide a national number for Saudi Arabia, but also to provide regional numbers within Saudi Arabia to look at disparities. We're having discussions with Qatar, Kuwait, and other countries in the region in order to work with them on Burden of Disease.

The third one, which is getting a lot of interest and demand, is to look at the economic costs of certain diseases and conditions in the Arab world and in the Middle East region. We have a request from the Kingdom of Saudi Arabia, where the Minister of Health is keen about finding out what is the cost of chronic diseases in Saudi Arabia, and we're working with them to collaborate on

providing these numbers, so people are interested in what the burden is and how much it's costing them to deal with that burden.

The last one is there is a lot of excitement in our region, as you well know, in the Middle East, there is an Arab Spring going on and there is more demand of the data and efficiency, and people are looking at their government now and asking more and more from the governments, where people in the ministries of health, as well as in academia, are looking at our numbers and seeing this is the road map. This is for us where we can see what our burden is and we know what problems we should tackle, what priorities we have using our limited resources, and what should be our expectations, and for the first time for many of these countries, this is a tool that will allow them to answer to the people, their own media, to say we're responsible and we can show you if we intervene in this area, have we been effective or not. So this is the beginning of a lot of collaboration for us on the ground, working with many regions, as you will see from my colleagues after me, but we're looking forward to collaborating with countries in the Middle East.

Felix Masiye: Thank you very much. I come from Zambia, which is one of the countries that was being shown up on the tools, where HIV/AIDS, malaria, and infectious disease remain at the top of our Burden of Disease. Zambia was one of the countries which Chris Murray visited to present to policymakers, researchers, and program partners in Zambia. We had an engaging time to look at the numbers in a visual way, which I think got the public's attention to some of the major health problems we have in Zambia in a way that had never been done before. I remember there was a lady from the Nutrition Commission who said, "Look, according to risk factor analysis being shown, malnutrition in children is right at the top, and yet my department has had no funding for a long time." There was another gentleman from the Mental Health Institute who said that nobody talks about mental health in Zambia, but look at the impact. And so, in general, we have had an extremely engaging time with policymakers and researchers in Zambia looking at some of the new numbers and what they mean for policy at home.

It's interesting that the Minister of Health is almost bombarded with different numbers from different people doing small studies showing impact in particular program areas, but nobody really had an opportunity to bring everything together in the way that this tool has done, and I think that was one of the most exciting things that we witnessed. And so, the University of Zambia is collaborating with the University of Washington through IHME on a number of projects, where we see differences in terms of the subnational patterns of the burden of disease, but also program implementation. Malaria is an example where, although you could see that there's a downward trend nationally, the pattern across districts is very, very different. One of the things that this research brings to the fore is to engage policymakers also from the subnational level, to show and see what the picture looks like, and there is some kind of district league table analysis that's currently underway arising from the work that we've done on malaria in Zambia. The group of stakeholders that we had a year ago when Chris Murray was in Zambia actually had a big input in terms of providing the information that led to the improvement in some of the estimates that you've seen, and I think that I saw that there are some differences between what I saw then and now in terms of the numbers in some of the disease programs. So, I think that it's an opportunity for

IHME to extend the collaboration to country institutions in Africa and see how much input local experts in Africa can make into the GBD.

I would like now to invite Rafael to pick it up from there. Thank you.

Rafael Lozano: Good morning everyone. Thank you so much for being here. First, I have to express what I have seen from my front-row seat in the evolution of the GBD in the last 20 years. My name is Rafael Lozano. I work in the core team. I'm one of the 500 authors of the paper, and I have the privilege to work with Chris Murray and Alan Lopez from the GBD 1990, and since then, I have continued working on this topic. In 1994, I coordinated one of the pioneerings of National Burden of Disease studies in Mexico, and after that experience, I have been invited as advisor to other National Burden of Disease studies in Colombia, in Chile, in Uruguay and Ecuador. The difference between those studies and what we have been able to accomplish with this new study is huge. We have advanced our analytical capabilities by great leaps, we have more computer power, we have produced more accurate estimates for more diseases and risk factors than ever before, and now we have a much better way to communicate the findings through these visualization tools. I would like to take this vision forward in Latin America and create, with other colleagues of the region present in the audience, a collaborate network to do more National Burden of Disease studies.

In our region, we have 600 million people in 32 countries, and the majority of them have good sources of data. It's just a matter of finding the right people for this purpose, and I'm sure there are a number of universities in the region that can do this, and also a lot of interest of the health authorities in the region. Currently, the Minister of Health in Chile is using his own Burden of Disease study to help the health policies in their country. The same thing is happening in Colombia. In addition, Brazil and Mexico are very interested in applying these new techniques at the subnational level. In fact, now the idea is not to know your genomic code--it's more important to know your zip code, because you'll know the disparities that you are suffering.

I also had the great opportunity to share some preliminary results with the several Ministers of Health in Latin American countries late last year at their annual meeting, and I have to tell you that the reactions were very positive and open to go forward with these methods. In fact, they are waiting for a workshop to start doing the local building capacity. Thanks to GBD 2010 results released today, we have a basic platform to start deep discussion about the health priorities by country and make comparisons across time and among countries, to understand better where we are, and also where we can go further.

How will this effort be useful for countries in the region, or what are the benefits for participating actively in this GBD collaboration network? Based on my experience as a Burden of Disease researcher at global and at national levels and a user of the information generated for the Mexican studies, I can see many benefits and opportunities. Not only will we be able to use GBD results to improve decision-making with more accurate and comparable health information, but we also can generate improvements in the health information systems in the correlation of quality of health

data. As everybody knows, better information produces better decisions and goes in the favor of accountability, and it's very important for our society now.

I'm going to be in Mexico later this week for an international conference on public health, and I will have a series of meetings with local health officials there from Colombia, Chile, and Brazil. We will be talking about using the GBD platform to continue measuring levels and trends in health through the region to do the kind of benchmarking that will allow our countries to learn more from each other. We cannot lose our momentum. The opportunity is here. We have done this before, and we can do it again. The combination of high-level interest and important critical mass of researchers can produce good outputs with the GBD metrics in Latin America and the Caribbean. This is a significant stepping-stone for us to collaborate on a much greater scale.

With that, I will turn over to my esteemed colleague, Nicole, from the World Bank. Thank you very much.

Nicole Klingen: Good morning. First of all, it's a real pleasure and honor to be here for this, to celebrate really this fantastic achievement and milestone, as Bill Gates called it, in the way we look at data and the visualization. My name is Nicole Klingen. I'm currently the acting Director for Health, Nutrition, and Population at the World Bank, and I'm really happy to be here. As Bill Gates already mentioned, the World Development Report—that's a World Bank publication in 1993. I joined the Bank in 1995, and it was a very important book, but the more important book is the big, fat Global Burden of Disease book, which is even more important. And so I was a little bit of a victim at that time of the books and the data, producing pie charts, going to countries and having the discussion and the dialogue with countries. "Here you go, this is what this looks like. This is where you're spending money." We're trying to combine with spending—I'll get to that later—and starting really a policy dialogue. I wish I had this tool. I played around this morning (because I knew it was released), and it would have made my life much easier. So, done with the pie charts—now we have a tool. It's a fantastic achievement. We see this tool really as a global public good, and providing what our World Bank President, Jim Yong Kim, calls a milestone in global knowledge and our capacity for evidence-based action.

So, a few weeks ago, we asked Dr. Chris Murray to come to the Bank when we had all the staff that work in human development, in education, social protection, and health. They come together every two years. We asked him to make a big lunchtime presentation, and they were so thrilled. They couldn't wait. So the feedback is thank you very much. We can't wait to use the tool. I think we can use it now in the country dialogue. There's very good reason for this enthusiasm. At the Bank, we see really data-rich frameworks as the key to spearheading more meaningful discussions with countries and development partners on the critical policy and investment decisions to be taken at country, regional, and global levels. It starts with data.

Now, you know, my text here said it starts with good data. Data is never perfect. You'll hear from my accent—I'm not sure if you can identify where I'm from. Typically people say Dutch. I'm Swiss. I'm half Italian, half Swiss. I've been in the United States for many years and at the World Bank for

18. So, no data is perfect. In Switzerland, we don't have perfect data. Nobody needs to tell me this. But when you have the data and you start the discussion, that's where you really move ahead, because you have contestation. It's a good thing. Dissent is good. Conversation is good. Because you're going to improve the data, and you are having an interest in really participating in the discussion, which helps accountability and transparency. So I think, in this regard, this is really phenomenal work.

And what is even better is the visualization. Before, you had all of these numbers in tables, so you had to have the effort to go into these tables and make up your pie charts. Now you have the visual tools which really make it easy to understand what the burden is. So we really are looking forward to working with the tool. At the country level, we're really looking into discussing with countries what kinds of policy implications and investment implications this work has. At the regional level, I think it's important maybe for benchmarking. At the global level, we want to have a discussion on the trends. What I thought was very interesting this morning is you cannot divide the world just in high-income, middle-income, and low-income countries. There will be differences between these categories, and within a country, you're going to also have differences. So this will help us keep this in mind, because we tend to simplify a little bit in categories of high, middle, and low income, and I think that will be a mistake, as we saw from Chris's presentation this morning.

Now, for us at the Bank, the Global Burden of Disease goes well beyond the health sector. We all know health outcomes are not just driven by health sector interventions, and the Global Burden of Disease is really helping us keep that in mind, and also in terms of the risk factors. What we want to really make sure is that people don't fall into poverty due to catastrophic shocks in health expenditures. We also want to make sure that health outcomes improve overall, and the health sector plays an important part, but many other sectors play a very important part as well. So it gives us a powerful asset in the Bank, not just to talk with the Ministries of Health, but the Ministries of Finance and across the government and all the stakeholders in a country. So the discussions are not just going to be with the Ministries of Health, but with the Ministries of Finance and other ministries, such as Transport, such as Agriculture, Water, and Sanitation in the countries where the burden is still driven by these conditions.

Connecting diseases will be really important in the rise of the entities, that is, the ability to transition in what Chris calls a risk transition shift from risk factors linked to poverty to risk factors linked to lifestyle--and I think I'm quoting you correctly, I hope--or other risks such as road safety. If you look at young men, starting in middle-income and high-income countries, you can see that there is a lot of burden there due to road safety. This will require really a multi-sectorial lens, and we need to look at reassessing policy and funding discussions across the development spectrum, and this is what my president, Jim Kim, said as well.

In closing, we're now discovering—I was playing around, so I'm still discovering—this wonderful tool you have given to the world. We are exploring what this tool can do, allowing us to work in ways that we never thought were really possible. We look forward to the not-too-distant future when we can look to the next step, like to see the data disaggregated by income quintile, looking at the expenditures and the financing by income quintile, and really having a discussion of subnational data. National averages are just not as good, and we both agree, and I know you're planning that, so

we really look forward to working together in that endeavor to achieve yet another milestone. Thank you.

Rhonda Stewart: Thank you. Before we hear from Dr. Trevor Mundel, here is a video that Dr. Binagwaho sent us for this event.

Agnes Binagwaho [in video recording]: Dear members of the Institute for Health Metrics and Evaluation, all of your supporters, all academics present, all of the users of your incredible tool. Hello. I'm so happy to have the occasion to interact with you on this great day. It's an important day for two reasons. First of all, the launching of these tools is important, because this tool will allow us to understand who we are in matters of public health and also to compare ourselves with ourselves, what is important across time, and also to compare ourselves with what happens in the region and in other regions. So, if we find some region that makes great progress, we are going to dig in to see what they have done, and it will help and feed our own policies and our own actions and our own monetary evaluations.

So it's not a simple new tool; it's a revolution. It's like the first landing on the moon. It was a little step for a guy named Armstrong, but such a big, giant move for humanity. It was something conceived in a little place in America called NASA, and it has really brought the imagination of the world and just said the sky is not the limit. The galaxy is not the limit. The universe is even not the limit. I think that's the place we are. This tool is not a new tool, but very few people out of the academic world, et cetera, knew about it. Now, I would like all of you to be an advocate of that tool, to make it known, so that people know how it is, how it is made, how to use the outcomes of that tool. But I would like you also to train people in countries like mine, to inform them on how you make it, to try to master that tool, at least to master the understanding of that tool even if they cannot make it themselves.

Of course, like for all tools, there are some limitations. You cannot do it for so many countries, so many diseases, and be accurate for each disease and each country, but it gives an indication of where you are, where you stand. You can triangulate that with other population-based surveys and other surveys and see if it's accurate. And if you teach the people, like people in countries like mine, the significance of each and every part of that tool, we can work with you to improve the tool to make it even more accurate and more usable for us.

So it's a journey of education. It's a journey of information. It's a journey of making evidence the bible of all policymakers. The tool is about that, but we need to improve it all together to see that it's a dynamic thing. Like my friend Rafael used to say, we can improve everything every day to give better evidence to the world, to make better decisions at the level of policy, to make better strategies, better action plans, and with the objective to bring change in the lives of each and every person in this world. So, thank you for giving us a new way to have great evidence. In Rwanda, we have reviewed some of the outcomes. It is great. All of the senior leaders in the health sector from the Ministry and the agencies were really impressed and willing to dig into the tool to understand

better about their own program, and if it's like that in each and every country, my goodness. We are going to have a universal language for scientists, a universal language for policy and decision-taking in the health sector, and our people are going to have better lives. Thank you.

Rhonda Stewart: Now we'll be joined by Dr. Trevor Mundel, who heads the Global Health Program here at the Gates Foundation. He leads the foundation' s efforts in research and development of health solutions, including vaccines, drugs, and diagnostics, and he's been a champion of the GBD since coming to the foundation. Welcome, Dr. Mundel.

Trevor Mundel: Thank you Rhonda, and good morning. I want to add my congratulations to Chris and his team. Not so much for the visualization tool that you saw here today, as pretty and attractive as that is, but really for the analytic framework which you've given us for comprehensively looking at this huge slew of diseases and risk factors, putting it all together in this very consistent frame.

Now, almost as soon as you see this, and I've seen this breaking out over the last year, it really whets your appetite for "What do we do next?" This is a baseline. Once you see that this is really achievable, that such a comprehensive integration of all of this health data really can be done, it comes to mind and you can't resist, what is the slew of the next steps? So I guess that's why I'm in this queue over here. What are the next steps? We've discussed many things, but I'll just highlight a couple that I would love to see, and we have the tools to do it, to put into this next version of the GBD. The first is, why should we be waiting 5 years, 10 years, for this to emerge? The framework, I believe, as big as it is, can be updated with new data in a couple of days. That's what you've got it down to. So when a new piece of evidence comes in, a new big piece of data, we would like to see this put into the system, the button pressed, this updated, and on the portal you can access it. Just some examples: Two very big, important pieces of data. The GEMS study, in which we've looked at the epidemiology of diarrheal diseases in developing countries. The PERCH study, where we've looked at the etiologies of lower respiratory tract infections in developing countries. Two huge pieces of data not in the current version over here. If we went with the usual mechanism, we might wait some years before we would see those integrated into the numbers, and we need them right now, actually. So the next generation of the GBD will be as close to continuously updated as possible.

This also in the measurement in the area gets us away from all the thorny debates that we have about all the surrogates we need to be measuring, because we can't actually track in real-time the things that really matter. So if we could do that, put aside all these issues of what are the input surrogates that we need to be measuring. Another thing: Many of the interventions that we're planning, whether it be a policy, or whether it be new tools, new technology, interventions—these will take multiple years to develop, so we need a better prediction engine. There is a prediction engine that Chris has been using, but I think that there's a lot of work that's been done on how to take a set of data and project forward into the future. And we're talking about a projection which is

10, 15 years into the future, with all of its uncertainties, but we are actually making decisions about investments, major investments at the country level of policy, within the foundation in terms of new programs, based exactly on those projections. So the more accurate those are, the better we can be targeting the future.

The other area, which Nicole and Chris alluded to already, is that we also want to know what resource allocation looks like at the country level. Where are these resources going? Because we want to be able to do cost-benefit analyses. Isn't that sort of fundamental to this enterprise? We can be putting in a huge amount of money, and we've seen from the UK data, and we've seen from other sets of data, that just putting in effort and resources doesn't necessarily equal output and impact as you would like it. So in order to be able to make that kind of assessment, we really need this cost and resource component into the GBD to be able to unify those two.

I could go on with a long wish list of items that that we'd put in, and I'm sure you can add to it as well, but I do want to reflect on one or two other lessons that we've learned from GBD 2010 as it's been rolled out. One is the importance of engaging with people at the country level, to present this data, to get primary data from the countries, to be sure that there's a good alignment and a strong voice at country level for this kind of work, because ultimately, this is where action is going to take place. So we are very committed to working to strengthen the country input into the next version of GBD. Now, the other element of this is that these are estimates. There is an analytic engine over there, and as we all know, those estimates need to be debated. That debate is extremely healthy, in my view, when it leads to better collection of primary data—like in the malaria area it's heading towards—to actually resolve the debate. People have two sets of numbers, two methodologies. We go out, we do an experiment, we get the data, and we resolve it.

There is another path that we've seen that sometimes occurs, which is that groups settle down into factions with different numbers, and that's where the game stays for a prolonged period of time, without the primary data effort which comes in and resolves the issue. So we're also very committed to looking at some way of independently assessing the estimates which come out of our next version of the GBD, so that we can have a really directed and intentional process for resolving disputes about numbers, methodology, which is focused on improving, at the end of the day, the primary data collection. I think in total, at the Foundation, we are very keen to work with the other funders that are in this space to support these elements in the next generation of the GBD, and in fact, I would see that effort as kicking off—as much as this is the presentation of the visualization of what exists right now, but the next generation kicking off almost immediately, in fact today. Thank you.

Rhonda Stewart: Thank you Dr. Mundel. We have time for just a few more questions before we close the program, so if you do have a question, please raise your hand and wait for a microphone to come to you.

Question: My name is Mead Over from the Center for Global Development, and I join the rest of the speakers in congratulating the IHME for this spectacular new addition of something that Chris has been spending—I hope you don't think you've spent your whole life on it. I do want to raise an issue that's related to how the numbers are generated, and maybe Chris can help respond to this, but Dr. Mundel, you made a comment that I thought was very appropriate: It will be very interesting to project forward. In projecting forward, the first, easiest thing to do would be to use the projection models that have already been used to backcast, or to project some of the missing data. For example, esophageal cancer in—I believe you mentioned Chad, right? And I know that some of those models, I believe—or let me say I think I know—that they're based on GDP, that you have income on the right-hand side of many of those projection models. So if that's the case, then projecting forward with that model will be a very important question: How much of the Global Burden of Disease problem would be solved simply by growing countries faster? You can't actually use that projection model, I would argue, because I think that, as it was used to produce the numbers that we have now, GDP was actually a proxy in some sense for many unmeasurable interventions, some of which were health interventions, some were other types of interventions, some were education, for example. But going forward, that would be a big mistake, since those things will not necessarily be correlated in the same way. So I'm asking really to what extent we need to understand the contribution of economic growth and to what extent it would be possible to use your current model to simply turn off the GDP connection, that you've got a coefficient in those regression equations which is linked to GDP. Can you just turn it off and use your model with that turned off to see how the Burden of Disease would look so different today in countries that had not grown?

Rhonda Stewart: Let's take one final question before we answer that one.

Question: From the Mesoamerican Health Initiative at the Inter-American Development Bank, I have two questions. The first one is how this model could be used to field the new targets set for the 2015 Millennium Development Goals. This is an important task we are about to face in other countries and that will define public policy, health policy, and intervention and investments in the regions. The second comment is that Dr. Mundel said that intentionally they will be thinking about developing some plans to continue with new tools and new estimations from this Global Burden of Disease tool, but I'd like to hear what are the plans to—once one sees the tool and the potential use, one might become an advocate, but it's really difficult in terms of leadership, once you are working at the country levels, to see how these kind of tools can really be used continuously to inform decision-making at the policy level. So I encourage you to think about, especially in Latin America, how to introduce, systematically and intentionally, this tool to be used for the political leaders in our countries. There are some structures, informal and formal, that could be useful to do this, like the conference of ministers in the region or through the UN systems, and other important formal and informal leaders. I think it's very important to plan for this. After attending this meeting, I'm going to become an advocate of this, and I will work with the countries who are working and using it, but it's important I think to plan for this for the next few years. Thank you.

Rhonda Stewart: Thank you. Would you like to start, Dr. Mundel?

Trevor Mundel: Yes, and maybe Chris can weigh in on some of the projections in the current system over here, but I would certainly say it's very clear that just general development and growth are critical to what has been happening on the picture of the Burden of Disease. We know, with African trypanosomiasis, for instance, a significant amount of the tremendous progress in re-vanquishing that old foe has occurred because of just development and growth. So I think that that obviously is a fundamental component of the model going forwards. You could say it is interesting as a risk factor, in fact, and maybe Nicole wants to comment on that, but without a sophisticated way of looking at growth and general development, and taking that out of the equation, it'd be very difficult for us to claim that the specific health interventions that we've made really made a big impact, so we have to somehow get that baseline out of the equation.

Rhonda Stewart: Chris, would you like to step up and address that as well?

Christopher J.L. Murray: Very briefly, I think that, Mead, your question actually requires a different set of econometric approaches to disentangle. It's the old issue about causality versus prediction. The models in the background here for the estimation are calibrated to be the best predictors, and we test that using out-of-sample techniques. To get to the causal inference about what's income per se, different types of methods—There's lots of people around the world who are going to start playing with the results to do that. We have people at IHME—Haidong Wang and Joe Dieleman have been doing some sort of system GMM-type estimators to parse out what's technology, what's income, and I think the answer there is, in kids, income isn't that important. In adults, income is much more important, in terms of the progress that we've observed.

Rhonda Stewart: Before we invite President Young back up to close the program, please join me in thanking all of our panelists.

Michael K. Young: I want to thank you all again for joining us, as well as extend deep thanks to all of our partners in this enterprise. I find myself having listened to this discussion wearing my academic hat from time to time and thinking, "This is extraordinary! Look at all the things we can do in the future. Look at the platform this has given us to address some of the most sophisticated, interesting questions," and from that perspective, it's very exciting. But I spent some years in the government, and I occasionally slip on my policy hat, and what strikes me as interesting about this discussion today—Felix mentioned this in his discussion, and Nicole mentioned it as well—that we already can, without virtually any additional data, look at dramatic improvements in health care over the past two decades. That's a roadmap to start doing things that are data-driven and demonstrably clear as ways of addressing some of these most important healthcare issues that face the world. And so I think we certainly have a wonderful agenda for the future, extraordinarily exciting.

We on the academic side are very excited about all the ways in which this tool can be so enormously powerful. But from the policy side, I think this presents an incredible opportunity to look even over the past two decades at what has worked and where it has made a difference and not wait for even additional data to start doing some of the things that are very clear as we see

shifts. We can see in Zambia, for example, the problems of malnutrition and no money in the ministry that addresses that issue, an immediate opportunity for us to think about transforming health outcomes around the world. From that perspective, there is enormous excitement about this project, certainly at the University of Washington, with all the partners we've had an opportunity to work with on this extraordinary project, as well as the visionary leadership of the Gates Foundation and their support in launching this, and most importantly, I think, Dr. Chris Murray. My wife asked me this morning, "Will he get a Nobel Prize for this?" and I said, "No, no. It's much too important."

Thank you for being with us today.