

Comment

The Challenge of Polio Eradication *

*Bill Gates***

Thank you, Jonathan. It is a pleasure to be at the Royal Institution to honor Richard Dimbleby. As I got ready for this evening and learned more about him, I developed a strong sense of admiration.

To prepare for a recent trip to Ethiopia, I read up on the country's history. And I kept seeing Jonathan Dimbleby's name. In 1973, he 'stumbled upon'—those are his words—the brutal famine that Emperor Haile Selassie had been concealing from the outside world. The documentary he produced, *The Unknown Famine*, did what great journalism is supposed to do: shine a light on the dark corners where human misery is hiding.

The images of starvation from *The Unknown Famine* set the world on fire. Television viewers in the United Kingdom and other countries started sending donations—a total of \$150 million—to help alleviate the suffering. When another famine tore through the Horn of Africa a decade later, Michael Buerk and Bob Geldof helped inspire an even bigger public response. These two British-led relief operations set the standard for how we react to global catastrophes. When people saw the famine—actually saw what it was doing to children—they found a way to take action.

I am optimistic about people. I believe a vast generosity is part of our nature. The key question is whether the people who need our generosity become visible, or remain invisible.

For my wife Melinda and me, the problem of global health inequity became visible 15 years ago, when we saw a simple pie chart in the newspaper breaking down the major causes of death among children.

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One of the bigger slices of the pie, representing 500,000 dead children annually, was labeled: rotavirus.

I had never heard of rotavirus. Melinda had never heard of it. It turns out it is the leading cause of diarrhea, preventable with a vaccine that only children in rich countries were getting. Our reaction was somewhere between disbelief and disgust. How could we not have seen even the barest outlines of this tragedy?

That rotavirus slice in the pie chart set us on fire. I was in my early-40s, Melinda was in her mid-30s, I was running Microsoft, and we were starting a family. We had plans to do philanthropy later, when there was more time. But all of a sudden it didn't seem like there was any time to waste. We decided to do everything we could to get the vaccine out to every child who needed it.

Now, twelve of the world's poorest countries are already giving the rotavirus vaccine to children, and that number is scheduled to climb to 40 by 2015. The rotavirus mortality numbers are starting to come down. However, hundreds of thousands of children are still dying from a disease that is both preventable and treatable. The tension between how much the world has achieved and how much is left to achieve is the reason Melinda and I call ourselves 'impatient optimists'.

Tonight, I will talk about the project I am spending most of my time on right now. It is the subject about which I am most impatient and most optimistic: the fight to eradicate polio. Most people in developed countries know of polio as a disease that used to paralyze lots of children. But it isn't merely a historical curiosity—it still strikes children today.

We are working to wipe the virus off the face of the earth, and we have almost succeeded: There are only three countries in the world where the virus is still being transmitted. Fewer than 250 children were paralyzed last year. Stopping these last cases of polio in these last countries, however, is among the most difficult tasks the world has ever assigned itself. It is also among the most important.

The best of who we are—our capacity for innovation, our resilience, our sympathy for each other—has gotten us to this threshold. Disease and poverty and indifference stand in the way.

The fight to eradicate polio is a proving ground, a test. Its outcome will reveal what human beings are capable of, and suggest how ambitious we can be about our future.

When Melinda and I created our foundation, we didn't know very much about global health. We required an education. As luck would have it, one of the giants of the field—one of the men most responsible

for eradicating smallpox—happened to live in Seattle, and he offered to help.

His name is Bill Foege, and he is not only a brilliant epidemiologist; he is a man of great morality. His father was a Lutheran minister. When Bill was choosing a career, he couldn't decide between public health and preaching. His ministerial instincts still come out when he speaks about his health work. He's one of the most articulate and inspiring leaders in a field where matters of life and death tend to be mummified by jargon and statistics. I used to read his speeches to remind me who global health is for.

Here is a passage from Bill's recent book, *House on Fire*: 'In early October 1977, a couple with two small children, both with smallpox, approached the hospital in Merka, Somalia. They asked Ali Maalin, an employee, for directions to the infectious disease ward. A considerate person, he took them to the ward rather than directing them. Although he had been vaccinated, it was evidently not an effective take. Two weeks later, on October 26, 1977, he developed the last smallpox rash that Africa would ever see....' In 1978, smallpox was declared the first disease to be fully eradicated.

Bill Foege has the unique ability to see the forest and the trees, to celebrate the common decency of a man who refused to shun the sick and appreciate the historic majesty of completely eradicating a disease. He continues, quote: 'In medicine, the medical practitioner is obliged to apply the best knowledge of the times to each patient. In public health, the obligation is to apply the best knowledge to the entire human community. The purpose of public health is to promote social justice. By 1978, public health achieved its first complete success in social justice...for current humanity and for all future generations'.

Bill helped me understand that it is possible to eradicate polio by applying the best knowledge of our times and achieve the next complete success in social justice.

In those early years, learning from Bill and many others, we developed three convictions at the core of our work today.

The first conviction: When health improves, life improves, by every measure. Many skeptics will say, 'What's the point of saving a child from rotavirus if she can't get enough food to eat, or read, or earn income?' It's true that we need to invest in important areas like agriculture and education in addition to health, but it's also naïve to act as if these issues are separate. Disease insinuates itself into every aspect of life. It can stunt brain development, inhibit the absorption of nutrition, and weaken the immune system forever. Our goal isn't merely to stave off death. It is to help lift the heavy burden that sickness places on poor

people's existence, so they can seize opportunities in the worlds of school, work, and family. In fact, when parents are more confident their children will survive, they tend to decide to have fewer children, gradually bringing population growth down and leading to all sorts of beneficial effects.

The second conviction: Progress is already happening at an enormous scale. This is my all-time favorite chart. In the year I was born, more than 20 million children under the age of 5 died. Last year, that number was 6.9 million. Keep in mind that the world population keeps growing, so the improvement is even more impressive than it sounds. If the rate of death had remained constant since 1960, 31 million children would have died last year. The tens of millions of lives already saved inspire me to do more because they prove what's possible.

The third conviction: Vaccines work wonders. They prevent disease from striking, which is better than treating it after the fact. They are also relatively cheap and easy to deliver. Yet millions and millions of children don't get them. This is still stunning to me. Before we started the foundation, we assumed all the obvious steps were already being taken, and we'd have to go after the difficult, expensive, or unproven solutions. In fact, our first big health initiative was devoted to delivering basic vaccines. I'm not saying it's a simple matter to reach children with vaccines. It's extraordinarily difficult. But universal coverage with today's vaccines is achievable. It's also possible to invent new vaccines in the future for diseases like malaria. Both these achievements would save millions of lives, and they are a major of our foundation.

Delivering one vaccine in particular, the polio vaccine, is the top goal of our foundation. I'd like to turn now to that vaccine—and to the disease it prevents—and explain why they are my priority.

Polio has been with us for a long time. Archaeologists have found Ancient Egyptian carvings depicting people with withered limbs, walking with canes.

Around the turn of the 20th century, increase urbanization and poor sanitation lead to epidemics of polio that caused not just paralysis, but also extreme terror. When the virus appeared, typically in the summer months, it surged through cities and towns, filling up hospital wards with paralyzed children in a matter of days.

The Irish journalist Patrick Cockburn, who was infected during a 1956 epidemic in Cork, has written about the panic that surrounded him that summer. Quote: 'It was only on 13 June that the first case of polio was reported in Cork city and by early July the number had risen to six. For the first time reports of an epidemic began to appear in the local press. They were usually accompanied by subheadlines claiming that

there was ‘No occasion for undue alarm’ and ‘Outbreak a mild one’. These repeated understatements somehow conveyed the very sense of fear which the newspapers were trying so hard to avoid. By the middle of July the number of children entering the fever hospital in Cork had risen to four a day.... People swimming in the river Lee, which flowed through Cork and received the full drainage of the city, were threatened with prosecution.... A month into the epidemic in Cork, many were convinced that not only were the dire facts of the epidemic being suppressed in the city, but that it had spread to Dublin where people were dying like flies in the fever hospitals’.

That 1956 epidemic was among the last in Western Europe. Jonas Salk’s polio vaccine had been approved the previous year. As soon as Albert Sabin’s oral vaccine became available in 1960, mass vaccination drove infections in developed countries down near zero. The fear, and eventually even the memory, of polio faded away.

Polio wasn’t gone; it just wasn’t so frighteningly visible in rich countries anymore. It became a disease of poverty. In 1988, the World Health Assembly passed a resolution supporting the global eradication of polio. In that year, the virus was circulating in 125 countries, and it paralyzed 350,000 people.

Within eight years of the resolution, most countries had built strong polio programs, and cases were down almost 90 percent globally. We made our first contribution in 1999, and based on the trendlines, we thought we were helping fund the final stages of eradication. In 2000, the virus was circulating in 20 countries. By 2003, that number was just six. In 2005, Egypt and Niger were declared polio-free, leaving only four endemic countries.

But the virus is stubborn. In 2006, people in 13 countries that had already achieved polio-free status were infected by travelers from one of the four endemic countries. In several countries, as far-flung as Indonesia, Somalia, and Yemen, these importations led to large polio outbreaks. It would be five years before India celebrated its last case. And there are still three endemic countries left: Afghanistan, Pakistan, and Nigeria. I can say without reservation that the last mile is not only the hardest mile; it’s also much harder than I expected.

Let me try to express how hard it is to eradicate polio by comparing it to smallpox.

Every single person infected with the smallpox virus gets an unmistakable rash on the skin. The eradication strategy pioneered by Bill Foege was called ringfencing—as soon as you saw a case, you vaccinated aggressively in nearby towns to contain the virus.

Polio, on the other hand, is transmitted silently. Only 1 percent of infected people show symptoms. The other 99 percent are contagious and don't know it.

When symptoms do present, they are not tell-tale. They may start with a fever and headache. A few days later, ordinary muscle aches may get increasingly severe, and the patient's reflexes can start to slow down. Only then does paralysis set in. The point at which a health worker sees a child with paralysis begins a two-week waiting period during which stool samples are collected, sent off to the lab, and tested. By the time the diagnosis is confirmed, the virus may have traveled hundreds of miles in any direction.

So ringfencing doesn't work. Everybody, everywhere, is at risk at all times, unless they're immune. Therefore, the only way to stop polio is to vaccinate a very high percentage of the population, leaving no reservoirs of susceptible people where the virus can survive. The threshold for what is called 'herd immunity' varies by location, but it is never lower than 80 percent and can be as high as 95 percent.

Achieving 95 percent coverage is very difficult. Even rich countries like the United Kingdom only vaccinate 95 percent of their people.

How can much poorer countries possibly achieve a similar level of coverage? Take the example of India, the most recent country to eliminate polio. India started with the same approach as the United Kingdom—vaccinating children when they came into the clinic for routine visits. But too many Indian children never see the inside of a clinic. So the Indian government added a supply-side approach to the demand-side approach—that is, they started going out into communities, finding children, and vaccinating them house by house.

Think about what this requires. India has more than a billion people. Geographically, it is 15 times larger than the United Kingdom. It also features some of the most severe terrain and weather in the world.

Behind me is a photograph taken in Bihar state during a flood in 2007. These health workers walked for miles in water up to their waist to vaccinate children living in a remote area along the Kosi River.

Periodically, they'd reach a village like this one in the Madhubani District. Notice the vaccine box on his head. Not only do vaccinators have to track down every child, but the vaccines have to be kept cold the whole time.

This process doesn't happen just once. It happens constantly. Every child has to be vaccinated three or more times to ensure full immunity. And 75,000 children are born in India every single day. That

is why India's polio program employed 2 million people—almost entirely paid for by the Indian government.

India's accomplishment in wiping polio out of the country in 2011 is the most impressive global health success I've ever seen.

I've just described some of India's challenges. The challenges in Afghanistan, Pakistan, and Nigeria are just as daunting but different.

A decade ago in Nigeria, some leaders in the northern part of the country started the rumor that the polio vaccine reduced fertility in the children who received it. Campaigns were suspended for a year while officials disproved the allegations. A large epidemic sliced through Northern Nigeria, and polio spread back into about 20 nearby countries where it had been eliminated. All those countries had to ramp up again to win the fight for the second time. In Nigeria, the rumors persisted even after the campaigns were restarted, and to this day some parents refuse to let their children be vaccinated.

In Afghanistan and Pakistan, militants in some areas won't give vaccinators access to local children. Even in the places where vaccinators can go, there is no guarantee against the threat of violence.

Usually, when I lay out these facts, I get two questions. First, given all the challenges, is this really possible? And second, should we bother putting in the work it's going to take?

I would like to spend the rest of my time answering these two questions. Yes, we can eradicate polio.... And yes, we should....

When we created our foundation, we included a provision in the bylaws stating that 20 years after we die, the foundation will have spent all its money and will cease to exist. We believe the health inequity between the poorest and the richest can be eliminated during that time. That is why we do this work—because we believe in the power of innovation to solve problems.

After all, knowledge is always increasing. We are constantly inventing new things, and once they're invented, they can never be un-invented. Instead, they keep getting better. The Royal Institution is an important part of this great history of ideas. Here, many leading scientists of the modern age have lectured about their discoveries, building the foundations of our society brick by brick.

It was my belief in innovation that led me to start Microsoft. When I was a teenager, computers were the size of a car, and much more expensive. I used to sneak into the computer lab at a nearby college to get computer time. Now, the concept of sharing computer time doesn't even make sense. In the late 1970s, we had a dream of giving everybody access to computer technology—a vision of a computer on every

desktop. Now there is a computer in every pocket. The pace of innovation is accelerating.

The same is true of polio. It was first recognized at least 4,000 years ago, but it was just 200 years ago we figured out it is contagious. It was just 100 years ago we learned it is a virus. Fifty years ago, we developed the vaccine to prevent it. Twenty-five years ago, we resolved to eradicate it.

I asked the Science Museum if I could borrow this machine to show you what innovation looks like. This is a Smith-Clarke Junior Cabinet Respirator, better known as an iron lung. This version was developed by the British engineer George Thomas Smith-Clarke in 1956.

In addition to paralyzing arms and legs, the virus can affect the nerves driving the muscles that inflate the lungs. In these cases, patients are unable to breathe on their own. Behind me, you can see a photo of what it looked like when an iron lung was breathing for children who were sealed inside it.

For centuries, artificial respiration was a holy grail for medicine. Drowning and gas inhalation were common in the 19th century, but nothing could be done to revive sailors and miners who stopped breathing. One early device seemed to work but required the person operating it to blow into a tube 30 times a minute, or 43,000 times a day.

To test the first iron lung, researchers injected a cat with the South American arrow poison curare until it stopped breathing and then enclosed it in their prototype. The machine breathed for the cat—technically, the air going into and out of the machine inflated the cat's lungs—until the poison wore off. The cat survived, and inventors raced each other to make improvements to the iron lung.

Children who eventually breathed on their own again remember their time in the iron lung with horror. Pondering death, they could see their parents only in a mirror attached above their immobilized heads. But this contraption saved thousands of lives and fulfilled the loftiest aspirations of the medical community.

Now, this contraption, filled with the Sabin oral vaccine, saved millions of lives—and it's the reason the iron lung is now in a museum. That is innovation: when a solution is so powerful that it changes the way we think about a problem—not how can paralyzed lungs inflate, but how can we keep them from being paralyzed in the first place.

Innovation is helping us overcome the obstacles that stand in the way of eradication today.

In the past year, Nigeria started using a new technology in an innovative way to solve an old problem: How do you vaccinate every child when you don't know how many there are?

The polio program uses what they call microplans to assign routes to vaccinators, with the goal of covering literally every speck of the country. The use of the prefix “micro” indicates that the objective is extreme precision, but the maps on which the microplans were based looked like this.

These maps weren’t accurate or detailed enough to drive universal coverage. Thousands of settlements were simply overlooked. Distances could be off by many miles, meaning that what the microplan said was a 20 mile trip and a day’s worth of work might end up being a 40 mile trip and two days-worth. The result was a program that didn’t plan to vaccinate every child—and didn’t vaccinate every child in its plan.

So now, they’re starting to use up-to-date, high-resolution satellite imagery to create brand new maps that look like this. This process has identified thousands of settlements that had been missing from the microplans.

And since these maps show actual distances, vaccinators are now assigned a full day’s work but no more. The question is no longer, ‘How many children are there and where might we go to find them all?’ It is now, ‘How do we most efficiently vaccinate every child on this map?’

Innovations like this are a key reason for my optimism. But innovation has no moral valence by itself. It is not inherently good or bad, just irresistibly transformative. To make sure innovation transforms our world in positive ways, human beings need to point it in the right direction. That takes ‘public will’.

Many organizations helped push the eradication resolution through the World Health Assembly, but the one you wouldn’t expect is Rotary International. Rotary is a service organization with 1.2 million members in almost every country in the world, including more than 50,000 in Great Britain and Ireland.

Rotarians pledge to put service above self, their motto, but they have no specific global health mandate. They are not polio experts. They are regular people who go to work and spend time with their families. For three decades, they have also spent time advocating for polio eradication, raising money to support vaccination, and giving kids polio drops all over the world.

Other partners include the Centers for Disease Control, UNICEF, and the World Health Organization. We rely on them to excel at their jobs. But that is not enough. We also need people whose jobs have nothing to do with the health of poor people to act. That is public will.

Take the example of Nigeria, where the public had been reluctant to vaccinate children after the rumors about the vaccine. I went there for the first time four years ago to meet two groups of leaders: the

religious leaders in the North, who are in the best position to encourage anxious parents to vaccinate their children; and the state governors, who have the power to hold the health system accountable for results.

I met with religious leaders in the palace of the Sultan of Sokoto. They heralded my arrival with blaring horns, and the sultan gave me a white horse as a gift. I demurred because I didn't have room on the plane, though my children do like horses. Then we got down to business and talked polio and other global health issues.

The next day I met with a large group of state governors in Abuja. At the end of our two-hour meeting, they signed a document committing them to the goal of eradication and spelling out their personal obligations.

I see strong commitment from leaders in all three endemic countries. In September, I went to New York to attend a UN polio meeting. Presidents Jonathan, Karzai, and Zardari all came to talk about their commitment to eradication. The fact of their presence, as much as the content of their remarks, showed that the initiative has unprecedented momentum.

Rich country governments need to be generous as well. The proof of great leadership is the ability to be long-sighted and keep the big picture in mind. The UK government's decision to prioritize foreign aid, even in the face of great financial challenges, is exactly the kind of commitment I'm speaking of. In fact, as I travel across Europe making the case for increasing aid budgets, I've never been more proud than I am now of the knighthood I was awarded in 2005.

That leaves one last question to answer: Why is it worth it? Polio doesn't kill as many people as AIDS, tuberculosis, malaria, or rotavirus. It's not even close. So why should the world focus on eradicating it?

There is no such thing, first of all, as keeping polio at its current, low levels. We have gotten to this point because vaccinators are wading through flooded rivers, developing-country governments are investing scarce resources, and the global health community is on high alert. These are not sustainable approaches. If we don't keep investing, cases will shoot back up to the tens of thousands annually in dozens of countries.

Second, success will generate lessons that benefit all of global health. We are on the verge of doing something we've never been able to do before—reaching the vast majority of children in the remotest places in the world. We are building systems, developing technology, and training workers that make it possible to help people who never got any help. When polio is gone, we can use the same systems, technology, and people to deliver other lifesaving solutions, especially routine vaccinations for diseases like rotavirus and measles.

These are practical arguments, and I believe they are convincing. However, the argument that really moves me is more idealistic.

By doing something really hard for each other, we will demonstrate what is best about humanity. And that will inspire us to be more ambitious about what is possible in all our endeavors.

Last month, nine vaccinators in Pakistan were murdered by masked militants at the beginning of a three-day polio campaign. The youngest, a 17-year-old volunteer, received several death threats in the week leading up to the campaign and was forced to move between houses for her safety. She was standing a few feet away from her sister when she was shot and killed.

To me, the nihilism behind these coordinated attacks—seeking out goodness to destroy it—is the opposite of what the eradication fight is about. The vaccinators were trying to stop disease and ease suffering so that people they would never meet could have a better life.

They are heroes, and there are two ways to memorialize them. The first is to do our best to ensure the safety of those who continue the campaigns.

And the second is that we have to finish the task they gave their lives for. I am committed to doing whatever it takes to win this fight.

I do not take this lightly. I am not a wishful thinker. The global polio community has a detailed plan for getting from here to eradication. It is based on a careful analysis of what countries have accomplished in the past, and what still needs to be accomplished in endemic countries in the future.

This plan says that if the world supplies the necessary funds, political commitment, and resolve, we will certify the eradication of polio by 2018.

Funds, commitment, and resolve... These are the key variables.

If the world delivers, then we will eradicate polio within six years. It will be another entry in a long list of improvements to the human condition. We cut the child mortality rate by 75 percent in the past five decades. We cut the poverty rate by 50 percent in the past two decades. We eradicated smallpox. These are mind-boggling successes. Adding the end of polio to the list will be one of the great moral and practical achievements of our age.

Thank you

Source: <http://www.warwickrotary.org.uk/bill-gates-lecture-on-polio-eradication/> accessed 22 February 2013.