



Stanford eCorner

Vaccines Have a Social Problem!

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Francis talks about the social problem surrounding vaccines. People are only scared of a disease and willing to endure vaccination when they see evidence of the disease. Because vaccines are very effective at wiping out diseases, he notes, society does not tend to be interested with vaccines. In general, society neglects preventative activities, but instead invests huge amounts of money when people actually do get sick, he adds.



Transcript

Let me talk about vaccines. For those not from the medical side, vaccines really thicken out immune system to really inform the host, if you will, that you have had the disease without producing the disease and with that, immunity is developed and you're protected from subsequent diseases. And everyone in this room has received large number of vaccines for variety of infectious diseases that were common certainly in my parent's lifetime and during my training. So a lot of these diseases now are essentially eliminated because of vaccines. And so they've been remarkably effective at eliminating disease. Now, the good side of that is they're remarkably effective in eliminating disease. The bad side about that is that they're very good at eliminating disease and when a disease doesn't exist, no one cares about it. All I say is it hurts kids' arms when you get injected. All you have to do is see one case of polio, diphtheria, whooping cough, or any of these diseases that we're protected from, not to mention smallpox, and you would go back over and over again to get vaccines. But when they're not there, the social value then becomes a social harm, that is, it hurts.

My kid cries for a day after he gets a vaccine. They get a little fever, etc. And without ever seeing diphtheria, people don't realize the value of the diphtheria immunization. So it's an interesting social problem and again, it goes back to my tenet as I've learned over the years. And this is something new for me that I should pass onto you is that, we really don't do very well as a society in long-term prevention activities, be it pollution or traffic, or whatever it may be. Things move slowly especially we can't deal with them well and we don't put the resources into take care of them. But we do things from the therapeutic side when people get sick. It's right there, we can invest huge amounts of money. And ultimately that's what drives the pharmaceutical industry and what comes the vaccines as we're talking about. So I'll get into that in a bit.

Just examples here of vaccine preventable diseases. On the left, you see diphtheria, whooping cough, measles, and polio crushing down until the 40's and 50's and then you see the right side here of HIV/AIDS coming up and it always has a dip at the end but it continues to go up. This is mortality, actually death not just cases. And the AIDS continues to be devastating around the world. This is just an example of HIV/AIDS, where it is around the world. I've worked with essentially all the most dangerous viruses during my career. And there is nothing like HIV. There is really no human virus that kills essentially everyone that are infects first of all. So the actual consequences of an infection are heard but worst. It's remarkable how invasive or relatively difficult to transmit viruses.

It only transmits by sex or sharing of blood or mother-infant. It's remarkable how this has invaded populations around the world. And subsequently here in Africa right now, 20% to 30% of the adult population infected with a hundred percent fatal

disease is a huge social problem. And even George W. Bush recognizes at this point. This suggests that an example of the social disruption in Southern Africa, the orphans from AIDS are infected by the year 2010. That one in seven kids under the age of 15 all lost their parent to AIDS in Africa. And for those who've been in developing world when that happens, you're in deep trouble because there is no social network. And those kids on the street have to do other things be they prostitution, or join variety of revolutionary armies and they like to get a job. And they can be influenced and will cause huge problems around the world if we don't take care of it.

But the cost of this just in the direct medical cost alone, for those of you who have been involved in cost-benefit analysis, these are just the cost of the medical care around the world for AIDS patients in '97. And it ignores all the lost income and a social chaos and such things that go with. But \$18 billion a year, it's probably triple that by now. But it's a lot of money just to take care of HIV infected individuals. And the only way to stop the epidemic is going to be with the vaccine where you can train the immune system, to have seen the virus before and when the the infection and the exposure to the virus happens the next time, the body's immune system fights it off and you never see the disease again. The challenges of that, notice I put business first and scientific second, I think there are scientific challenges that we've certainly seen. But I think now with our modern technology, we can build just about anything we want that's a part of the AIDS virus and we should be able to make a good imitation that can protect people from HIV as I will show you later that we did with chimpanzees but have a hard time in humans so far. But I think it's the business should drive that moderately expensive, cheap in terms of the overall AIDS epidemic but moderately expensive process when it comes to a company. And as I show that there's a competing opportunities that will essentially eat up an AIDS vaccine. I'll show you how that's happened.

Scientific challenges are considerable. But I think again, that we can get around that and then ultimately the social value that balances these two, that balances how much money you want to put into scientific research, understand the virology and protection from HIV, and would put a market out there to buy a vaccine should be made. I think it's the greatest challenge and that if there is no social value given to something, industry will not make. If the industry doesn't make it, it doesn't get made by and large. We can do research, we get government research, but as far as product development it really comes from the industry. So if we take \$18 billion a year cost and a little less than \$3.3 billion for developing a vaccine, now it doesn't sound like very much money when you put it into this. But \$300 million, \$280 million have cost us. It's a lot of money especially for any given business and you want to invest that and get a return. But if you could make an AIDS vaccine for \$300 million just for one year's expenditure, we should have 60 some candidates of AIDS vaccines going through this development process. And we should have those candidates actually being tested.

This is what has been referred to as a pipeline of vaccine development or a pipette that's dripping out instead of pouring out. These are the phases of vaccine development: One is safety of the vaccine, phase two is to see if it could cause an immune response, and three is the big one, we actually go out and test it and not risk individual for some get a vaccine and some get a placebo. And right now, there's only been one vaccine, actually two of ours have gone through phase three studies in all the year since 1981 when HIV was discovered. So it's been a truly a pipette as a hose. As far as a quote here that he said this in '99 that, "May be in the next 10 years we work very hard, there'll be three candidate vaccines in phase three." That's about right. I'm afraid they're just aren't that many that have been developed and is that science or is it business? I would say it's probably both. And I think ultimately it's social value for not valuing them and pushing through. This is what it cost you and this is the revenue from the business side. This is really a curve. On the left-hand side of this, the VaxGen going out.

We did private investment and ultimately went public. And these are the funding cycles of VaxGen. It gets up to about, in our case about ultimately 280, including the manufacturing facility. And then you have to have another blip up above that for manufacturing and marketing. And then you see the revenue. First two things in here, one is the green to show you how much it costs to make a vaccine. It is a fair amount of money but not when you look at the overall social cost that HIV/AIDS has. And then you see the others, the delay here. When you invest this, you go for at least a decade or more before you actually cross the profit side and that is if you have to. Everyone here is an investor by and large, someone in your family or some sort of investment is going on when you keep stuff in the bank and that investment is hopefully to have a return.

The faster you get the return, the ultimately less cost it is. When you get this kind of a long-term investment it takes decades and more. It's not very attractive frankly from the investment side. From the community side, it's terribly important to get a vaccine. From the investment side, it's less attractive because it takes you that much time before you get a return on your investment.