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**PROFESSOR:** What I want to do today is to build on the movie and the discussion we had last time. So I think in the movie, a lot of themes appear that are also in the chapter on health, if you've read it. A lot of the themes are kind there, but in sort of some random way.

And in the discussion we have had, we also have elaborated on the themes, but now what I want to do is to try and put them all together in a coherent frame, give you a bit more of specific examples that are in the book specifically. And we're, of course, going to be talking about health in particular with the angle of how people choose which health care to access, how people choose what doctors to see for what, why people are not doing more preventive care in investments, and things like that. Obviously, we are not doctors, so we are not talking about health from the point of view of what could treat people. We are taking this as given, and then wonder how do we get this stuff that can treat people out there in the landscape.

So we start with these things. They are some technologies that are known, that have been demonstrated in [INAUDIBLE] trials to be effective and cheap ways to promote good health. Some examples of that include bed nets to prevent malaria, would include immunization, which costs a maximum of maybe \$15 to \$20 per child, and it's one of the cheapest ways to prevent child death. Breast feeding, which of course is free and is recommended by WHO to be done from one hour after birth until six months, at least in places where the water is not very clean.

Oral rehydration solution, which is basically a mix of sugar and salt that you put in water when they kid comes with acute diarrhea. That's not going to cure whatever caused the diarrhea, but it's going to prevent dehydration, which is the main reason why people die of diarrhea. And bleach, chlorine, that you put in your water.

These are just a few examples of things that have been demonstrated to be effective, and cost-effective, and cheap, and accessible. And one of the major puzzle and frustration that we see in world health is that these investments just don't really reach people, are not really undertaken by people.

And so the question is, why? It's certainly not because they are not useful. They save lives. So you could argue what's the value of a life? Maybe it's not so much worth it. But the value of a life would have been very, very low for these things not to be worth it.

But even if you leave that behind, conditional on surviving, you're going to do much better if you have not been very sick all through your childhood. We've seen that for deworming. We've seen that if kids were dewormed when they were children, they were not sick with worms, they are making 23% more every year, which sounds to be like a fantastically good rate of return. We're talking about the maybe \$1,400 in current dollars over a child's lifetime for an investment of less than \$1.

And the same argument that malaria also makes country's poor and people poor has been made for malaria by Jeff Sachs, and Gallup who was also a researcher at Harvard at the time when Sachs was there at the time, found that if you control for other factors, malarial countries, the countries where malaria is prevalent, have a GDP that is 30% lower than non-malarial countries.

And what are the other factors? They are geography, latitude, the climate, things like that. You can actually see it on a map from Gallup and Sachs where it shows where malaria is prevalent, at least where it was in 1965. And you can see that there is a fair amount of bad luck that is involved with malaria.

If you're in between the topics, you're just much more likely to be infected with malaria simply because this is environment where the mosquitoes that carry the malaria thrive. So there used to be a lot of malaria in Latin America. There used to be malaria in the American South once upon a time, which is somewhat above the tropic. But otherwise, most of the malaria is in Africa, Latin America, India, and Southeast Asia.

Keep this figure in mind, that this is where malaria is important. And now if we look at GDP in 1994-- oh no, that's malaria in 1994-- it got better in Latin America. It didn't get much better in Africa. It got worse in India.

And this is GDP per capita in 1995. And you can see that you have a striking reversal of the colors, which is the countries that are very dark in the malaria picture are now very light in the GDP per capita picture. So the results that he found in the regression, [INAUDIBLE] statistical bells and whistles, is just translation of that picture that basically the dark countries in the

malaria picture are the light countries in the GDP picture. So that is no doubt about this fact.

So on the [INAUDIBLE], this article was very influential. It was published in 2001. Was very influential to bring a push for the fight against malaria as an economic type of intervention that has a decent rate of return. Naturally you should do not for compassion value, but for economic purpose, fight malaria, use bed nets and things like that.

Now some people obviously objected to that, saying, well, that's not necessarily a proof that malaria causes the low GDP. And what else could be going on? What else did they argue was going on?

**AUDIENCE:**

Is it possible that is poor so it isn't able to fight malaria? So it has malaria because it has [INAUDIBLE] below GDP, not the other way around?

**PROFESSOR:**

Exactly. It could be that it takes some money to fight malaria. In fact, that's exactly what Sachs is arguing, that it takes some money to fight malaria, so we need to help the poor country. And in fact, when you look at the countries that got malaria in 1965 and don't get it in '94, or if you look at the country that had little of malaria in '65 and have a lot in '94, this is some kind of tracking pattern.

Basically, it mostly disappeared-- not entirely, but mostly disappeared-- in Latin America between 1965 and 1994, and nothing happened in most of Africa. In India, it actually increased between 1965 and 1994, but the same increase didn't happen in Sri Lanka, which is the little dot that is next to India on the map here.

So why is it the case that given the similar geographic circumstances, in a sense, Latin America managed to get rid of malaria, but not Africa? Why is it the case that malaria increased in India in the same time it reduced in Sri Lanka? That's not entirely explained by geography.

In fact, for the most part, it's not explain by geography. It is explained by the fact that in Latin America, there have been very sustained, large effort to fight malaria that we are going to talk about in a moment. They just basically sprayed extremely aggressively with DDT. They drained the swamps. They did all sorts of things like that which managed to control malaria, and they managed to do it.

And the same thing happened in Sri Lanka. So if you compare Sri Lanka, for example, and Tamil Nadu, which is the part of India that just faces Sri Lanka, for the most part has the same

people-- at least part of Sri Lanka is Tamil, even though they are not very pleased to be there-- in Sri Lanka you had very aggressive control of malaria and pretty much the disappearance of malaria. In the meantime, in Tamil Nadu, right next door with a similar climate, you get if anything an increase of malaria.

And so this is not due to geography or anything. This is due to politics, and your ability to organize your people, and to organize your country, and to get something done. And so it is likely to be the case that if you're able to get something done to control malaria, you're just able to get something done in general. And if you're not able to get something done with malaria, you're not able to get something done in general.

So maybe the same countries-- and this is not only true for Sri Lanka-- that at the same time they managed to control malaria, they were also extremely effective in getting out preventive care for their people, immunizations for their people, preschools, and things like that. So Sri Lanka has a lot of political problems, but from the point of view of a country that delivers social services to their country, it's actually quite effective. So it's certainly the same countries that have managed to control malaria have managed to do other good things, and maybe this is why they have [INAUDIBLE] in 1995. So on its own, this correlation is certainly not sufficient to tell us that there is a cause.

So before moving further, I want to be able to answer this question, which is we know that the malarial countries are 30% poorer than the non-malarial countries. To what extent can we say it is due to malaria, and to what extent is this the reverse causality that the countries that were good at controlling malaria also managed to do other good things?

And we can answer this question precisely by looking at those episodes where malaria was eradicated, because malaria was eradicated by very clear, specific action that was taken at some point in those countries. And there are a series of papers, one on the Americas, which is the one we are going to study now, one on what is called malarial peripheries-- so that's Paraguay, Sri Lanka, and one in India-- that looks at those eradication campaigns and tries to look at what is the impact for a child of having been born in a place that used to be malarial after the eradication campaign rather than before.

So let's look at a very nice study that is the study about Latin America. It's a study by a researcher in Chicago called Hoyt Bleakley, and what he looks at is DDT spraying. This is also interesting because actually the question of DDT spraying is a pretty controversial one today,

because it's now pretty much forbidden anywhere to spray anything with DDT, because it's not very good for you to eat food that has been sprayed with DDT. On the other hand, maybe it's also not very good for you to get malaria.

[LAUGHTER]

**PROFESSOR:**

So there is a little bit of a conflict between those two objectives with a lot of people are saying we should go back to DDT and a lot of people saying no. For example, there is a huge political fight in Uganda between the organic farmers and the rest of the country, essentially. The organic farmers don't want any DDT anywhere near their crop, obviously, because in that case the European community would put a stop on their export to other European Union. And so any effort of eradicating malaria with spraying of DDT has been stopped in Uganda.

But at the time, they were not so worried about that, so there was a big eradication campaign in Latin America that started around 1955 partly with international funding. And so they sprayed everywhere, and they made sure to try and get rid of malaria everywhere. They even sprayed under people's roofs, like in the eaves of a house, the mosquito's nest under the roof. So they went there and put the DDT there, which is probably not excellent for people's health directly, but very bad for the mosquitoes for sure.

What the Bleakley study does is to exploit the fact that if you started in a region where there was not so malaria to start with, then the decline in malaria was lower. So here is one example for Columbia. This is cases of malaria in Colombia by year. You can see that in 1950, you had a lot of malaria cases every year.

The campaign started roughly in 1955. Intensive spraying started in 1958, and you start getting a huge drop in the cases of malaria country-wide. So it's pretty effective. Basically you go from 600 cases, I think it's a month, to about nothing, to close to nothing, and that happened in a very short period of time.

You could look at people born on those times, but of course, other things happen over time, so we don't really want to do that only. But what you can do then is to say, well, now let's look at regions that got more malaria before the campaign, and this is the reduction in the number of malaria cases in those regions. And of course, the more malaria you got, the bigger the reduction, because the reduction was pretty much to zero.

So if you started with 100, you get about 100% reduction, like in this place, Choco. If you

started with no malaria at all, then you get no reduction because there was nowhere to go. It's a little bit like the anemia paper that we saw before. If you started anemic, then getting the pill makes you non-anemic, but if you're non-anemic, you don't benefit. Same thing here.

This graph is by region, so these are all different regions-- Choco, Cauca, Narino, Santander-- these are all regions. And you can see that the regions that had a lot of malaria before the eradication got the biggest reduction between the post-campaign to the pre-campaign. So this is the reduction in cases, and this is where you started from.

So now what it's going to look at is it the case-- take a child who was born and who was still a child before the eradication campaign started, and take a child who was born after the eradication campaign. So take a child who was, let's say, 10 by 1960 and a child who was born in 1962. And the child who is 10 by 1960 doesn't benefit from the campaign whatsoever, but the child who was born in 1962, by the time he's born, malaria is history. So the young child relative to the old child would benefit more in a region where malaria was a big problem than in a region when it was a small problem.

So what he is going to do next is to put on the y-axis here not the reduction in malaria cases, but how much these people make as adult, how much a child born after the campaign makes relative to a child born before the campaign. What is this difference in income between this, and is the difference in income related to the malaria at the beginning. This is called a difference in difference, because you're looking at whether the difference in earning between a young and an old cohort is different in places that start from a higher level. What you are assuming when you're doing that is that there are no other factors that are changing exactly at the same time in the same way, and we're going to see what we can say about that.

Here is this graph that I was talking about for Brazil now. This is the pre-campaign malaria intensity. Don't worry about the axis. It's sort of standardized at zero, so for zero being the median case. And this is the income change of those born in 1960, that is those who were born after the campaign, minus those who were born in 1953. It is their income later. We measure the income much later, in 1980, for example. So in 1980, we measure the income of those born in 1960 minus the income of those in 1953. This is all in log, so it's log income in 1960 minus log income in 1953.

And what we see is exactly what we would expect if malaria does make you poor, which is the people who were born in places like Mato Grosso here where malaria had been a huge deal

beforehand, the young people experience a bigger increase in earnings relative to the old people than people, say, in Bahia where malaria was not a big deal to start with.

Do you understand this graph?

So I'm arguing that nothing else changed between this cohort in a way that's related with malaria intensity, and what could you argue back to me? What is the worry with that assumption?

**AUDIENCE:** There might be a lot of other factors that have changed over time. I mean, if you're born in the '60s, then [INAUDIBLE]

**PROFESSOR:** Yes. so the worry is something else might happen over time.

**AUDIENCE:** I was going to say, sort of similarly that there's probably a third, external factor that's both raising income and decreasing malaria at the same time. Since they have the same effects, it's not necessarily that they're affecting one another. There's a third thing that's affecting both of them.

**PROFESSOR:** Right. So it could be something affecting both of them, so Brazil is just becoming generally richer over time. But this should be something that is affecting disproportionately Mato Grosso than Bahia, right? Because here, I'm not only telling you that income increases between these two cohorts. I'm also telling you that increases faster in the region that had more malaria to start with.

But you could ask me, for example, is it the case that this place was poorer in the beginning, so they had more places to go? As Brazil was becoming richer, the poorer regions were catching up with the older regions, and this is what I see here, just to catch up. So that could be. It's kind of one twist to the point that both of you made, which is as Brazil was growing, maybe it is possible that this region would have been growing more anyway.

Now of course, I'm looking at the income in 1980s, but these are different cohorts, so maybe the same places that had a lot of malaria had people who were not very well educated. And at the same times that I took care of malaria, I also built a lot of schools for them, and I'm seeing these guys are income increased relative to the older ones. It's just because I also built a lot of schools in Mato Grosso. So that would be your third factor that would be differentially important in the region.

So that is obviously a real concern. By looking at changes in income over the importance of malaria at the beginning, we've gone one step towards some credibility. We're still very far from our randomized trial, which would involve randomly treating some people for malaria, waiting 20 years, and seeing how much more money they make like they did with the deworming. Such that it doesn't exist, so we need to try to do the best with what we have.

One way to verify this is that we actually know exactly when people start getting treated for malaria, because the campaign, if you go back to this graph, was quite sudden. In fact, we know the date at which they started spraying, and so we should have a pretty clear idea of which cohort get exposed and which cohort are not exposed.

So instead of doing this kind of graph for a broad cohort and looking at the slope here, I could say, well, let me do a test, for example, if I did the same graph for those born in 1953 versus those born in 1950. If this graph was due to the decline of malaria, what would I expect if I, instead of doing these differences, I did 1953 minus 1950? What should I expect for my line if the only reason why I have an increasing line here is due to the reduction in malaria?

**AUDIENCE:** [INAUDIBLE]

**PROFESSOR:** Yeah. I should expect a flat line, exactly. Because the 1953 kids I exposed to malaria. So are the 1950. So the differences between their income should not be related to how much malaria there is because no one benefited.

Now if instead I'm taking kids who were born in 1950, so in 1970, and I'm comparing them to the wages of kid born in 1965, what should I expect for this line? Now I'm looking at very young kids, kids born in 1970 versus 1965.

So we can go back to this graph here. What's the pattern in malaria cases after the 1970?

**AUDIENCE:** [INAUDIBLE]

**PROFESSOR:** Yeah, there is no further decline because there is no malaria left.

**AUDIENCE:** It should be flat as well, right?

**PROFESSOR:** Exactly. It should be flat as well, not because everybody has malaria, but because no one has malaria. So with malaria, we have a pretty specific pattern as to when I should start seeing an effect. If I'm thinking that the big problem of malaria is when you are very small kids, then I



should start seeing a difference between the children who were born just before and just after the campaign. During that time of the campaign scale up, I should this effect being the larger and larger, but for the young cohort, it should flatten out if I compare very young cohort to somewhat younger cohort but all of them got exposed. And for the old cohort, it should again flatten out, because the old cohort has not yet been exposed.

So I can now say something more specific than why generally the very youngest versus the young are the difference increase in pre-malaria intensity, which could well be correlated with other things happening at the same time.

He's doing that, so let me guide you to this graph. What is this graph? It has the shape that I talked to you about, right? It has the shape of being flat, and then increasing, and then being flat again.

So what is this graph? Each of these points is the slope of a regression of this kind, except that instead of being 1960 versus 1953, it is one year versus the other. For example, this is everyone relative to the oldest cohort. Each dot indicates the strength of the relationship between pre-malaria index and the index for these particular cohorts.

So for example, 1900 versus 1910, 1911, 1912, et cetera. I'm taking the difference between the income of the cohort born, say, 1910 minus 1900, and I'm plotting this graph that is here as a function of the pre-malaria intensity. So each of these points here is a slope of a graph that is this graph with instead of 1960 minus 1953 is, say, 1901 versus 1900, 1902 versus 1900, 1903 versus 1900, et cetera. And this is plotted as a function of the 1901, 1902, 1903, et cetera, the cohort of both.

So all of these cohorts were cohorts that were not exposed, and we basically we see not much of a line. This line is superimposed, but if you see this cloud of dots, the cloud of dots is not increasing. So the difference is not related to the malaria intensity in those places. Those places are generally poor, but it's not correlated with the malaria intensity.

For the younger cohort, we see the slope keeps increasing. The slope keeps increasing, keep increasing, keeps increasing until there is basically no difference between a region that initially had a lot of malaria and a region that didn't have a lot of malaria, and then it flattens again. So these are the patterns that we were expecting to see where between the old cohort and the slightly less old cohort we see no difference until they get exposed to the malaria, and then it increases, and then it flattens again.

So you could do still have the type of factors that you get we were talking about, that maybe they were building schools exactly at the same time, et cetera. But it would have to be relative tricky to follow exactly that pattern where this is the pattern of the malaria campaign going and going and going, and we have the points pretty much following the expansion of the malaria campaign.

This is not complete. You still have to believe that this is the only thing that happens. But it gives you a pretty good sense that it must have been the only thing that really happened for this, because otherwise why would it have this bizarre-looking snake shape?

Are you all OK with this graph? And do find it reasonably convincing? Yes, no? No vote. I find it reasonably convincing, and I'm in the business of doing [INAUDIBLE], so I'm very skeptical of anything that might be a substitute to what I do. But it's hard to imagine another factor that would follow so nicely the pattern of the campaign.

What he does, then, is to run a regression which is based on this idea, and he concludes that a child exposed to malaria in childhood would have an income that's 50% lower than a child who had not been exposed in childhood over their lifetime. So it's even better than deworming, which is not surprising because malaria makes you sicker than the worms.

But this is a very large effect, so it's high, but it's not absurdly high. If you consider that deworming is 23%, we are still in kind of the ballpark of where it makes sense. So it suggests that childhood malaria actually makes you weak for the rest of your life, and again we could calculate what it means for the lifetime of someone, of an income. So if an increase of 23% of income with deworming make you about, I think we had found, \$1,100 richer or \$1,300 richer, this is about twice that over your lifetime. So if these effects are the same in Kenya, it would mean that avoiding malaria in childhood would make you \$2,600 richer for your lifetime.

Which brings the question that Zachary has asked at the end of the deworming lecture, which is if that's so great, why aren't people are doing it? So the question here becomes why aren't countries doing it, and why are people not doing it? So why aren't countries all doing things like Latin America did of intensive campaign to try and get rid of the affliction, so public health kind of measure?

And if they're not going to do it because they all have difference or because there is political, economic consideration that prevents DDT from being used or anything like that, then why

aren't people at least buying a bed net which costs \$7 or maybe \$10 for a family? It would mean the child would have a pretty good chance of being substantially richer over the lifetime. So that's kind of the mystery.

One thing just to close the loop on Sachs is now that you have this estimate, you can calculate what is malaria prevalence, in the countries that have a lot of malaria, how much more these people would make if they didn't have malaria and obtain a number that is comparable to the 30% differences that is in the Sachs and Gallup article. And what you find is a number that is much, much smaller. So you find that Sachs and Gallup completely overestimate the impact of malaria on GDP even though the impact on income is still positive and still quite serious. So you do find it's not 30%. I don't want to give you the number and then it happens not to be the right one, but the order of magnitude is maybe a fourth. But it's still pretty significant and important.

So that gives us this idea of why aren't countries spraying and why aren't people buying bed nets? This question we could ask over and over and over again. I haven't seen a cross benefit analysis of not getting diarrhea all the time when you're a child, but presumably that's something probably similar to the deworming effect because worms are little bit equivalent of diarrhea in terms of getting rid of your nutrition. So why aren't people putting bleach in their water? Why aren't people buying [INAUDIBLE] when they're sick, and things like that. So this is the mystery we have to ask.

What we have already seen in the previous lecture, and also a little bit with nutrition, us that preventive care is characterized by two things. One is it is very low demand, and the second is it is a high sensitivity to prices.

Let me show a graph. This is the highest sensitivity to positive prices, and I'm going to show you in a moment the high sensitivity to negative prices, which are incentives. You've already seen some of these numbers. You've already seen the red dots, which are coming from the Dupas experiment in Kenya, so this is this one. This is the graph for bed nets, so when bed nets are free, you pretty much get them, but when you need to pay for them, a little bit of money like \$0.60, you're less likely to get and use them, et cetera.

What is interesting is that we find the same kind of slope, even steeper, for other goods that are completely different. So you find the same kind of slope for clothing in Zambia where if you ask people to pay a little bit for clothing, they're much less likely to get to it. So when they start

to have to pay \$0.10, \$0.20, \$0.30, the take up reduces a lot.

You're finding the same thing for deworming in Kenya. We actually briefly evoked this when we were talking about deworming when we saw that people in the school where they did the experiment, at some point the NGO who was in this sustainability kind of mood, I guess, decided it makes sense to ask people to pay a little bit do for deworming. So they asked people to pay a little bit, and basically what happened is that the take up went essentially to zero.

Let me try and get the right point. I think this is this one. The take up went essentially to zero when people had to pay just a little bit for deworming.

So you're looking at bed nets. You're looking at clothing. You're looking at deworming. They're all very different products presumably with very different life time benefit, and they pretty much all seem to be on the same slope, which is as soon as people have to pay just a little bit, they don't do it anymore.

So that's on the negative price. Yeah?

**AUDIENCE:** Are some lines steeper because people don't see the value as much in paying for the other things [INAUDIBLE]

**PROFESSOR:** So what is interesting is that except for this one, all of the lines are pretty steep. So the question that we have to ask here is why is that? And one possible reason would clearly be that people don't see the value. I'm going to get to that in a moment.

Before we go to that, let's see the elasticity with respect to negative price, which are small incentives. So one thing that you already noticed is that the rate of immunization is very, very low in some places. It's higher in some others. This is [INAUDIBLE], the places where you saw the movie. After the movie was finished, one thing we noticed is that a big problem seems to be that kids are not immunized. The immunization rate was very, very, very low, less than 5%.

So we decided the try two things. The first thing was that the NGOs [INAUDIBLE] would work with the government to do a monthly camp for immunization. So every month, they would take the vaccines from the government, go to the village, and immunize whoever wanted to come to be immunized.

And on top of this, [INAUDIBLE] also instituted a small incentive to get immunized, so that's a

kilo of lentil. Lentil is a [INAUDIBLE]. It's something people eat as a source of protein, and a kilo of lentil is about half the minimum wage. So this is a small, small gift to go with it. It's not like a large inducement that if it's something you don't want to do it would convince you to do it.

And these were the results. There was also a set of control villages that I'm not showing to you. I'm just showing to you the effect of the incentive. So comparing the camp without incentive to the camp with incentive. Intervention B are the villages where the lentils were put in place, and you can see that pretty much everyone gets the first shot. That's BCG. And the second shot is also pretty similar. From the third, we start seeing a difference, and from the fourth, an even bigger difference, and from the fifth, the biggest difference.

The biggest difference is between the more immunization you need to get, the more the small incentive matter. So it seems that people are not adverse to getting immunized, but they sort of lose interest or something such that the more you get into trying to get them to complete the course, the more the incentive is needed. And this is a reasonably large effect. Overall if you look at the effect on immunization, about 12% of kids who are in one intervention received all the immunization they should get, so 18% versus 38% if they get the incentive.

We have three things that we need to try and square. One is the benefits are very high, two is the demand is very low, And three is the price elasticity is very high, both from the positive side and the negative side. And the question is, how do we put all of these elements together? And the reason it is surprising is that suppose we take as given that the benefits are indeed very high. In that case, if people knew it, if people don't do something, it must mean that they think that the cost is also very high.

Why would they think the cost is very high? Maybe they think it's not culturally appropriate. Maybe they hate to get their kids immunized. Maybe sleeping under the bad nets is extremely unpleasant, or maybe they need the money so much. So if people are very sensitive to the benefits, are very aware of the benefits, the only reason why they wouldn't do it is because they think the costs are huge.

For example, another fact that we see both in rich and poor countries, people are not very likely to get a test for HIV even and maybe particularly if they have put themselves at risk of HIV. And one of the reasons that people say is that people realize that it would be good to know your status, but they are worried. There is a fear of what will you do if you find out that

you're positive. Or there is also the social factor of people knowing that if you go to get tested, it means you've done something not right, otherwise why would you have HIV if you are only faithful to your husband who is faithful to you? So this is an example where the benefits are high and maybe the costs are also high.

But what is surprising is that if people don't do these things because the costs are high, then I should not be able to bribe them to do these things with a small incentive like the kilo of lentil. If people know the benefits of immunization but don't do it because they think that the evil eye is going to be on the kid, then a kilo of lentils shouldn't convince them that, no, the evil eye is going to be good after all. It's something that just doesn't square together. Or if people were so much aware of the benefit, they shouldn't take a bed net when it's free but refuse to spend a few cents for it.

So we can't have these three things be true at the same time, that people realize that the benefits are very high, the demand is very low, and the price elasticity is very high. So it has to be that the benefits viewed from the people is actually not as high as we think they are. And there could be three reasons for that.

One is that maybe people don't care about their health or don't care about the health of their children, and that we already sort of ruled out because we've seen in the movie that people are extremely concerned about their health. They spend a lot of money on it. For example, they spend 7% of their monthly budget on health. That's a lot, and that is something that we've seen in the first lecture. People do spend up to 5% to 7% of their budget on health, the very poor, except in countries like Mexico where there's a good public health system.

So it is not that people don't care about health. We have seen the example of measles. They don't vaccinate their kids against measles, but if the kids do get measles, they spend a lot of money on the hospital and on treatment. So that's not because they don't care about health.

Also when you ask them about what stresses them out, they tend to say that health is the one thing that stresses them out the most. What makes them worried, tense and anxious in the last month is their health, or the health of their kids, or the health of their relatives. So people do care about their health, and they spend money, but they don't spend it on curative care. They do spend it on directive care, not preventive. And they not only spend it on curative care, but on pretty bad ones. We've seen these shots and [INAUDIBLE] and stuff like that.

So we can remove this. So now why do people don't use preventive care? It's not because

they don't care about health, but it's because there's something about preventive care, that either they don't really believe that it works or there's something else, that the perception of the benefits from today is relatively low.

Are government to blame for that? Another possible interpretation is that people are not getting those services because they are not generally available. People don't even know that they exist.

And we've seen in the movie that to a certain extent, we have reasons to blame the governments. Nurses are often absent, not only in India, but everywhere. There was a World Bank survey conducted in several countries, going to the little hospitals where the nurses are, found 35% of them absent. And even when they're there, they don't really spend a lot of time on people, they don't treat them very well.

There is this interesting 3-3-3 rule that Jishnu Das and Jeff Hammer found in India. That's three minutes, three questions, three drugs. That's what you get when you go to see a doctor in a public health facility. They interviewed three minutes. They ask three questions. They usually don't touch you. They ask you what do you have? And then they give you three medicines that you go away with. So that's not excellent care.

And the government doctors usually know more than the private doctors who are not really qualified. They're all much more qualified. If you ask them to rank vignettes, so you show them a scenario of a child comes to the clinic with diarrhea, and you ask the right question to evaluate what is this kid suffering from, what should I do, the public doctors do much better than the private doctors on those tests.

For example, when a pregnant woman arrives with preeclampsia, which is a potentially fatal condition that happens during pregnancy, they are much more likely to diagnose at its start and to say that the right course of action is to send them to hospital. So in principle, they know more, the public doctors, but in practice, they do much less. So even though they know what they are supposed to do, when you actually look at what they do by putting someone to observe their behavior, you realize that they don't really use their knowledge.

So that's a part of the problem. The nurses are not here, they are desultory, they don't really care, but it's not the entire problem. Because if you go back to the immunization experiment that I just showed you where the first treatment was to have perfect immunization camps-- every month, in your own village, with a paraworker that used to go to people and try to

remind them that the camp is coming, and you should bring your kids, and the nurses who were vaccinating the kids were good, caring, et cetera people-- even when you do all that, only 18% of people or 12% of people got immunized.

I think that's actually 18. It's 6 plus 12. 18% of people got immunized.

So the bad services by the government doctor is not the only thing that there is to blame, because even when you provide good services, you still don't get a lot of them in. So supply is not the only reason. Governments are not only to blame.

What are we left with? People don't demand preventive care not because they don't care about health. Not because it's just not available, because they don't demand it even when it's available. So we are left with two possible explanations. One is that they understand the benefits, but the benefits are far away in the future, and they discount those benefits that are far away in the future a lot. And the second is that they don't know the effectiveness of preventive care just because it's very difficult to understand what works, and why it works, and why it doesn't work.

**AUDIENCE:** So in India we saw that part of the reason is also because they believed in religious cures more. Is that true in other countries in the developing world as well? Is that predominantly [INAUDIBLE]?

**PROFESSOR:** No, I think it's true in general that people construct all sorts of interesting beliefs. What is important is that you have those beliefs. On the other hand, if I give you a kilo of lentils, those beliefs are not strong enough for you not to sell them for a kilo of lentils. So I think what is really important is that it's not that people think that immunization is something bad, because otherwise it would be very hard to convince them with small things. It has to be that they just don't think much about it one way or the other.

**AUDIENCE:** I was wondering is there an example of a [INAUDIBLE] if people are embarrassed [INAUDIBLE] assume something that they [INAUDIBLE]

**PROFESSOR:** Yes. That is a very interesting question. For example, you could say if you have a cultural reason not to do something, if you have this social reason that you are embarrassed, if I give you a small incentive, you can just say, oh, I've gone for this small incentive. And in fact, there was a very interesting study that was done which was trying to shed some light on exactly this issue.



It's a study where as part of a survey, everyone got tested for HIV, everyone who agreed. But you didn't need to get your results. If you wanted your result, you had to go pick them up three weeks later at camp. And so, at the end, people [INAUDIBLE] a bottle cap where they got a reward for picking up their tests. It could go from zero to something like \$1 in small increments.

And in addition, the researcher also randomized where they put the tent where you would get your results. In some cases, it was put right in the middle of the village, so very convenient, but very visible so everybody would know that you're going there. In some places, it was put-- because it was random, so it was like throwing a dart on the village and saying we are going to put it there-- it was like in the middle of a field. So a little bit far away, not very convenient, but much more discrete because no one would see you go there.

And what they found is that, number one, people were extremely sensitive to the reward, suggesting that it is not some deep psychological fear that were making them worried to pick up their test, because whatever this fear was could be overcome by \$0.10.

Now it could still be the social thing. So here, what do you think they found with the tent? Do you think more people got their result when it was far away or when it was close by? First, what would we expect under both, and what would we expect under the social stigma story?

**AUDIENCE:** The far away tent--

**PROFESSOR:** That the far away tent would have been more popular. But in fact what they found is the exact opposite, that the far away tent was not popular at all. Nobody wanted to walk more than a kilometer to get their test. And the close by tent was very popular. And furthermore, they also found that the elasticity with respect to this tent was much smaller when there was a gift. So when there was a gift, people did walk a kilometer to get their results, but when there was no gift, people were very sensitive to the distance.

So those suggest that in this case, in Malawi, [INAUDIBLE], neither the social background, not the psychological barrier, were so big, and that if people didn't get their HIV result, it was more due to some form of procrastination or inertia or something like that. And that is something a little bit surprising because anti-retrovirals are available in Malawi, so in principal if you find that you're positive, you can do something. And if you find out that you're negative, then you can try and take some steps to remain that way.

**AUDIENCE:** Is it possible they just value [INAUDIBLE]

**PROFESSOR:** So in this case, it shows that-- so in the case of the HIV, [INAUDIBLE] all this money. Exactly what this means is that it has to be that they value the small gains more than the results of the exam. And this is what is surprising, which is you have to say why is that the case when it is something that it should be so helpful to you to know whether or not you're positive? Or with the lentils, it should be so helpful to you that your kid is immunized.

**AUDIENCE:** Can I ask a followup question? Does that mean that we should reevaluate how we [INAUDIBLE] so you're saying HIV tests could potentially be more helpful because they could be cured [INAUDIBLE]. Shouldn't we be assigning more weight to [INAUDIBLE]

**PROFESSOR:** What we have seen is it doesn't mean that we should put more weight on instant gratification things than we do. What this means, in my view, is that we should understand why there is this disconnect between what doctors know, for example, and what people feel. Because that's kind of the source of the mystery, that there is this big tension, and it has to be about the perception of the benefits. And one aspect of this is this future versus present, and one aspect of this is whether you understand what the benefits are.

**AUDIENCE:** [INAUDIBLE] HIV testing, I think the results make sense just because if your test comes out HIV negative, well then, great. You're just going to go on with your life. And if it comes out positive, is there really that much you can do about it if you're [INAUDIBLE]-- I thought those [INAUDIBLE] were very expensive.

**PROFESSOR:** So, in Malawi and in several other African countries, it's actually available for free. So you can do something. It's not going to cure you, but it's going to greatly improve your life for the time to come. People might not fully realize that.

**AUDIENCE:** I have two questions. [INAUDIBLE] certainty of [INAUDIBLE] if you're getting [INAUDIBLE] a certain cost [INAUDIBLE] really uncertain. And the second question was about with the lentil distribution, can you play with short term kind of [INAUDIBLE] cost? So people can procrastinate indefinitely to always get a pack of lentils when you get a vaccine, but if you only get lentils on the first day of the month, then wouldn't that really lower the cost today relative to tomorrow?

**PROFESSOR:** That's a very good point. Why don't I table the questions until we give a bit more context, and we'll go back to exactly these questions.

They really have two problems. One is that you might not know that it's worthwhile getting your HIV test because you might not know that you are entitled to the drugs or that the drugs will really help you, or you might not know that getting immunized is so beneficial. And the other is the benefits are in the future, the cost is now, and that leads people to procrastinate. Let's go over both things.

The first thing is learning about health care, and we had a little bit of that discussion already last time. But most diseases are self-limiting, that is, they just go away by themselves. You don't know that because how would you know? You start with a theory that someone has told you that as soon as you're sick, you should get a shot to put the medicine right into your blood. And if you don't do that, you won't get better.

And then if the market is unregulated, like it is in a lot of developing countries where anybody can establish themselves as a doctor-- for example, we saw that in India-- then you have a very strong demand for shots and someone who's willing to supply it. You're never going to experiment away from the shots. So every time you're sick, you're going to get a shot, and you're going to get better. And so you're going to think that your theory was, once again, vindicated because you were sick, you got a shot, now you get better. That is going to further reinforce your belief that this was a good theory and further make you very suspicious of not getting a shot.

Now of course, if you experimented once of not getting a shot, you would see, oh, I have gotten better as well. Progressively, your [INAUDIBLE] would move towards something closer to the truth, which is, let's say, 95% of the time you get better with a shot, and 90% of the time you get better without the shot. But if your beliefs were 95% of the time you get better with a shot and 10% you get without a shot, then mostly you're never going to experiment. You're never going to know, and you're continuing with this very strong belief.

So this is for self-limiting diseases. And now if you take a disease like diabetes, or chest pains, or something like that that doesn't go away with the shot, when you go to a doctor and get a shot, it doesn't go, so progressively your [INAUDIBLE] are going to be that everything is useless, at which point you might as well go to [INAUDIBLE]. It might be why we see this paradoxical result of people spending a lot of money on diseases that would cure themselves anyway and not doing really any attempt to treat seriously the diseases that they should treat seriously.

Because the disease that they should treat seriously are beyond the ability of the Bengali doctor to handle, because first order, the Bengali doctor can't handle nothing. So the Bengali doctor end up spending [INAUDIBLE] distributed this antibiotics for diseases that fixes themselves anyway. People don't get any form of treatment for things that they should really try and treat, which would be much more complicated to treat, and you get this no learning equilibrium that is very difficult to get away from.

And it will be harder to attribute it to nothing, so the tendency to over medicate is a very [INAUDIBLE] tendency. And in fact, this tendency to over medicate is not something that you only have in poor countries. In rich countries, when you go to the doctor and they tell you-- like when I arrived in the US, my first doctor visit was you should breathe under the shower, and I was like, what are you talking about? Like in my country, I would have gotten an antibiotic immediately.

So our own tendency is always you must do something about me, like you should be able to do something, not just let it go. And the only reason why doctors don't do it here is because they are under guidelines, and they have regulations from their hospital, from their association, from what they have learned to not do these things.

Now preventive care is even worse because with preventive care you are taking an action today to prevent something to happen in the future, but far away in the future. For example, you breast feed your child so that the child gets stronger in the future and doesn't get sick in the future, or I guess with breastfeeding it's also avoid diarrhea in the meantime. But for immunization, you get immunized, and then you don't get measles at some point. So linking the two is very difficult.

And I think Noah had made this point with respect to deworming, it's even harder when you're immunized against communicable diseases, because even if you do get immunized and people around you don't get immunized, if there are enough people who get immunized, then no one gets measles. So the fact that you got immunized protects other people around you as well, so what you're seeing is that, oh, this whole immunization thing, now I got it, and now, yes, it's true my kid doesn't have measles, but no one has measles, so clearly it is not because I got immunized that I didn't get it.

Now of course, it is because collectively there was immunization around, but it's very difficult to infer. If you remember the results of the deworming study, when people had more friends

around them who got the deworming, they were actually less likely to get dewormed. And one possible explanation is that initially they were convinced by the people that deworming would make their kids less sick, but then they saw all of these kids around them who don't get dewormed and don't get sick either, and so they're saying what is the point? I don't need to do it.

So this is basically not something that we can learn ourselves. In a lot of our own lives, for example if you try to go afield, and you do something, like, for example, plant in rows instead of scatter plant, you see immediately that your plant is doing better. So you can progressively experiment with better techniques, and you will get better at it. So in most of our lives, we experiment things, and we kind of see the results, or at least we have a sense of what the results are, and we can adjust our behavior.

With health, our own experience, or own observations, is very misleading most of the time. We think we can infer from our actions something that we cannot really infer. It's not because of the medicine that we got better. We think we can infer from not seeing a result from immunization that immunization was not working, et cetera. So it is just not possible to learn, because the object is too complicated.

So how do we learn about health? The answer is we don't. Well, you guys might because you've first taken biology, so you have some sense of it. But most of us just don't have anything to do, no real understanding of why medicines are working unless we have red stuff on the side. But still, when our doctor says you don't need an antibiotic to cure that, we trust them. We trust them because they have spent a lot of money and a lot of time getting a health care education, and we believe that there is something into it.

And that trust, same thing with immunization. We get immunized because we are told to get immunized and not because we understand how it works. Not at all. So it's got nothing to do with our education or our superior intelligence.

And in face, this trust is quite fragile. You see it eroding reasonably easily when something happens. so for example, there has been a few well-publicized articles linking the measles vaccine, which is MMR-- Measles something Rubella, MMR vaccine-- and autism. There's been some court cases, et cetera, which have been actually the people who were suing against the vaccine have generally lost.

But despite the fact, there is pretty much ingrained somewhere in the collective mentality the

idea that, in fact, MMR vaccines might cause autism. And as result, there is kind of an epidemic of non-vaccination for measles which has led in some places to measles outbreaks that you didn't used to have before. So these things are actually reasonably fragile.

If you're interested in that, there is a book by a *New Yorker* journalist called Michael Specter called *Denialism* which has a very interesting chapter on this vaccination in the US. And this vaccination in the US story reminded me of polio vaccine in India. Polio vaccine is one thing that for some reason the government of India has decided that they are going to really do, so most kids do get the polio vaccine. But there are pockets where it's not being done, and they tend to be mostly in villages which are refusing the polio drugs, and the reason is that they say it's an attempt to sterilize us.

And why would they have this idea that might sound a little bit bizarre? It is linked to the fact that long time ago, during the emergency period which is a when Indira Ghandi suspended the civil liberty, there was a big drive to encourage sterilization of people who had at least two children. And this big drive took a shape that with sometimes quite unacceptable, including rounding up people who had no desire being sterilized, including lying to people about what was being done to them, et cetera. And this has created this huge mistrust, in particular in the Muslim population, about what government's trying to do to them under the guise of doing something good for them. And so there are regions where people will simply not accept to be immunized.

This is an extreme. Those are two extreme cases where people have a strong belief against. If you do that here in this region, giving people lentils to immunize them will not work. In fact, it might be counterproductive because they might think that you're trying to fool them like they did with the sterilization already.

But more generally, the fact that people are generally indifferent about preventive care might be related to the fact that they don't think there is some grand conspiracy. They just think you're bullshitting them like you always are. And once this trust is eroded, then it's very difficult to go back.

**AUDIENCE:**

I think in America, don't most people figure out all these things about vaccination and preventive care work? There's a reason because they have a family care doctor who tells them? There's some figure of authority that you can trust that tells them that these things work. I'm guessing most Americans don't know how vaccines work.

**PROFESSOR:** That's exactly right.

**AUDIENCE:** So if you have the same thing in India or in Africa, figures of authority that have been mandated by some government agency or some school that tells them that they know about this stuff, telling them that, wouldn't that [INAUDIBLE]

**PROFESSOR:** That's exactly right. The question is, who is this figure of authority? In the US, except for examples like this autism in the US where there was some idea of conspiracy theory, where big pharma is trying to make our children autistic and things like that, except in those cases, we have a basic sense of trust. That if your doctor tells you to do something, you think they must know what it is they're doing. You don't understand what is going on, but you still trust them.

But the problem with a place like India, for example, is whether this authority figure exists or whether they are interested in preventive care. So in India, this sterilization campaign that I was talking about had very, very long-lasting damage of convincing people that the government was quite liable to lie to them on any matter involving health. So people are quite suspicious, and if enough tell them you should get polio drugs, they're thinking he's trying to do something else to me. She's trying to get me sterilized.

So once the trust is eroded, someone who is mandated by the government is someone who a priori you should not believe, so that the government becomes a negative, not a positive.

**AUDIENCE:** So [INAUDIBLE] like a Muslim doctor [INAUDIBLE] saying [INAUDIBLE] the fact that we've been mandated by the government or [INAUDIBLE].

**PROFESSOR:** Exactly. [INAUDIBLE] so you would need also authority figure once you've eroded it. And once you've eroded the trust, it takes a lot of time to rebuild it again, but you can have other authority figures. So in Phuket, for example, in the movie, you remember, there is a doctor from an NGO who is talking about the Bengali doctors sometimes being good, sometimes being bad, and about the kids with the long hair.

So this doctor used to work in a small hospital run by a couple doctors. In this area, everybody was immunized, everybody was always going to them, everybody was getting preventive care because that have established that trust. But the point of it is how do you establish the trust?

They were on a very small area, the government has a lot of power to reach a lot of people,

but once they have misused it once, or twice, or three times, the temptation to use the trust that you have from the people to get them to do things that are not necessarily in their interest is very strong. And once you have done that, then it's difficult to get back.

**AUDIENCE:** [INAUDIBLE] For example, in the movie that we watched, there were a lot of people who would choose to go to the [INAUDIBLE] instead of going to the actual doctor. Is there any initiative where people actually use those entities to actually provide the population with medicine? I know in Brazil, there's parts of it where for a lot of people who were dying with diarrhea, people use like these women that were supposed to be known to help them somehow, and they were more not really like the typical doctor, but they were more like the cultural thing. And [INAUDIBLE] those persons to deliver the [INAUDIBLE] or dehydration solution to actually help those people who were dying.

**PROFESSOR:** Yeah. I think that's a great idea. I think it's been tried. The problem is that then you need to be able to control these people, because they already have some authority, and then you give them some more authority, and then you really are wary of what they start to say. So you don't want to transform them into a collection of Bengali doctors that are going to give them-- if the [INAUDIBLE] start giving antibiotics, then you're in trouble.

But your idea is exactly right, is that basically once you've shut down the traditional channels, which would be your family doctor that you trust, how do you reconstruct some measure of communication that comes from other channels? And these could be the [INAUDIBLE]. These could be television that a lot of people watch.

In Brazil, actually, it's not about health, but it's about fertility. People were all watching the soap opera, and in the soap opera, the cool people have very few children. And there was a study that was done looking at the penetration of the soap opera. It was on network TV, so it's not always available, but it became progressively available in part of Brazil. So you can follow the fertility as it becomes available in the different part of Brazil.

And you observe two interesting things. One is that as it became available, people had fewer kids, and the second is those kids tended to be poor. Like the name of the soap opera heroine, the kids had started to have those names, which is like the other. So other things like that you could try and view imbue. I haven't seen evolutions of trying to get health messages to go through the television, but these are things that you could also try, so use those other channels.



In the last five minutes, I want to say something about the present and the future. That's something we are going to get back again, which is kind of elaborating on the point you were making before. Another problem is that the preventive health cost are incurred today, but the benefits are in the future, and furthermore, as you pointed out, in the uncertain future. Like, it is going to happen later. So even if you know that it prevents getting measles, you don't know whether you would really have gotten measles, and it's in the future, sometime later.

And it turns out, which you can easily verify from introspection, is that human beings-- not only the poor, but the poor, the rich, everyone-- tends to put much more weight on the present than in the entire future. This is something different than your regular discounting that today is more important than tomorrow, and tomorrow is more important than day after tomorrow, et cetera.

This is something that today is much, much more important than tomorrow, and then tomorrow and day after, tomorrow is little bit more important than day after, and day after a little bit more important than the following day, et cetera. But today is much, much more important compared to the entire future in what we're thinking about.

That's true for consumption, so you would like to save for your retirement, but not starting today, starting tomorrow. It's the same with time. I gave you the flexibility of when you're doing essays for this class, but I did warn you that in my experience, a lot of students will decide to do the five last essays because they think from today that it's the absolute optimal thing to do because now you're very busy. But of course at the end of the semester when all the projects are due, and the exams too, you'll have much more time. So this is something that it doesn't take much to realize that there is this problem.

And not only we have this problem, but we are not fully aware of it. Because if we were fully aware of it, you would write me an email and say can I please commit to a schedule of essays and ask Laura or Millicent to enforce them. We realize to some extent, but we overestimate. We're thinking that today, the present is very important, but that tomorrow we will start being reasonable people again.

[LAUGHTER]

**PROFESSOR:** And now tomorrow comes, and tomorrow becomes today, and again today is so important, and we get fooled by ourselves like that repeatedly.

So with the immunization, you can think this can be available every month. So you're today I'm

just so busy, I can't go, but I will go next month. Then next month comes, and then it's next month. And next month is now today, and you're so busy that you can't go. And that's way, you could procrastinate.

**AUDIENCE:** After [INAUDIBLE] an experiment with decreasing incentives? Like if you said people who turn in essays, like the first five would get 10 extra points, and the next five wouldn't get 10 extra points, most people would do the first five essays just to [INAUDIBLE].

**PROFESSOR:** Yeah. You're exactly right. The intuition is exactly right, which is if we suffer from things like that, giving us small incentive to act today rather than tomorrow will help. For example, this idea of saying if you're doing the first five, you're getting 10 extra points for the first five, that helps.

I could also have a disincentive, which is to say you get 10 negative points if you give them later. In principle, if you have some awareness of this problem, you should like this program, because you should like the idea of putting some incentive on yourself to act today rather than tomorrow.

And so with preventive care, the problem is that in the developing world, the costs tend to be higher than for us. With immunization, like not only you have to go, but half of the time she's not there, and all of that. So it's constructed exactly the other way, which is a small cost, everything becomes a little bit more complicated.

In our lives, everything is structured to make the small cost less costly, and also to impose schedule on us. For example, for immunization, you have a calendar that is given by the government that you have to follow. Otherwise the kids can't go to school, but since kids have to be in school, you have to follow that. So it's a form of incentive, very strong incentive, to make it compulsory. And the lentils is saying there is a small cost of going, but in extent of this small cost, you get a small benefit, which is the lentils. And so that can help people to go.

And you're right that combining your two ideas, I could say you're going to get a bigger incentive if you follow the schedule than if you go at any point. And that way, that gives us a strong sense of doing it on time.

So these procrastination issues, combining with the fact that people have probably not a full understanding of the benefits, could explain why we see this huge waste. Because we really have to call this as a waste, all of this. Kids who are not immunized. Kids who are not

dewormed. Kids who drink dirty water, and adults also. And that could come from this combination of not fully understand the benefits, not trusting what you are told, and the disproportionate importance of small cost.

How can we solve it? Well, we can solve it by making things as easy as possible. This is what we benefit from. When you open the tap in your water, there is chlorine that comes, right? You don't have to remember to add the tablet. So making things automatic and defaulted.

And when it's not possible, like you're not a very well organized country like India, giving people small rewards that are offsetting the small cost, if possible exactly in the way that you're talking about it, which is [INAUDIBLE] people to do it later rather than earlier. That means that charging a small amount for goods may be totally counterproductive because you might lose a lot of people when you have your entire infrastructure to deliver the goods. And giving small incentive might actually be productive.

The last word would be-- and that's the question of the bed net that we spent a whole lecture on-- is it going to have some bad effect in the future if people are used to be helped in this way? And I think the answer is two prongs. Some of these problems are here to stay. It's not that we have them today, and it will be better in the future. We always have those problems. That's why immunization in the US is free and compulsory, and it's going to be forever. We're not expecting that one day people will now understand the value and will start doing it on their own.

Secondly is when we think about the dynamic effect, we also have to include learning. And because of the lack of trust and people don't just believe you because you say something, the fact of giving people an occasion to try for themselves by making things very easy and cheap may actually have those dynamic effects that are positive because of the learning. Which is exactly what we saw with the bed nets.

We don't need to go over it again, but with the bed net, people were probably relatively suspicious about the effectiveness of those bed nets. You give them one-- [INAUDIBLE] not willing to pay the cost. You give them one for free, and then they realize the benefits are bigger than what they were, and that can overcome the small cost to get the benefits in the future now that they're convinced that those benefits actually exist.

So we're done with health, and we are going to start with education next time.