

THE DAILY CHECK-IN WITH GOLDMAN SACHS

GUEST: VERONIKA DUBAJOVA, EUROPEAN MEDTECH ANALYST, GOLDMAN SACHS RESEARCH

HOST: LIZ BOWYER, GLOBAL HEAD OF BRAND AND CONTENT STRATEGY

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Liz Bowyer: Hi, Veronika.

Veronika Dubajova: Hi, Liz.

Liz Bowyer: You cover the medical technologies industry for Goldman Sachs Research, and you've been closely monitoring the rollout of the COVID-19 vaccine, which has been distributed at a pace slower than hoped for. Can you give us a sense of what's happening?

Veronika Dubajova: Of course, Liz. And it's an excellent question, and I think before we go into what's happening let's just level set and talk about what a tremendous undertaking the distribution of COVID vaccine is going to be. Just to put this into context, for instance, when you look at the US there's about 250 million adult Americans. And if every single one of them was to get a COVID vaccine, what we're talking about is 500 million vaccinations in a fairly short amount of time. This compares with roughly 160 to 180 million annual flu vaccines that we're doing. So this is a pretty significant undertaking.

And if we think about it from a global perspective, of course, do bear in mind there's 5 billion adults around the world. So again since you are getting two doses of these COVID vaccines, what we're talking about is 10 billion shots in arms. And that's a really, really significant logistical and manufacturing effort.

And when we think about bottlenecks, there are really two areas that we tend to think about, Liz. There is the upstream. So these are all the supplies that we need for the vaccine -- the vials, the syringes, the needles. And then on the downstream side, there's of course the logistics of the distribution and getting those vaccines from the factory into the hospital and into people's arms.

Liz Bowyer: So talk more about the upstream challenges.

Veronika Dubajova: I think on the upstream side really what you have to think about, as I said, is all the supplies. So

what I'm thinking about here is glass vials. These are the vessels that hold the vaccine, and then the syringes and needles which we actually need for the administration. Now, there's some good news on this front. When you think about vials, the good news is that a single vial can hold multiple doses of vaccine. And so again when you reference that 10 billion number that we're thinking about, if every single adult in the world were to be vaccinated, we do think that you only need about 2-3 billion additional vaccine vials to accommodate that because what we are seeing right now is most pharmaceutical companies are putting five or six doses of the vaccine into a single vial.

Now, to put that into context, so there's about 10 billion glass vials that are manufactured each year, and so that 2-3 billion seems fairly achieving, especially given the lead time that the industry has had. Remember, these vaccines have been in development since May of 2020.

On the syringes and needles side, this one's a little bit trickier. You cannot reuse these. It's one syringe, one needle per every single dose. So we do need about 10 billion of these. But again there's been a significant amount of lead time and investment into these.

Liz Bowyer: So it sounds like more of the challenges are focused on the downstream. What's happening there?

Veronika Dubajova: That's absolutely right. And really this is the logistics of getting the vaccine from the factory once it's packaged in vial into the location where it's going to be distributed. And there are a couple challenges here. One is around storage and cold storage in particular for some of these vaccines. And then there is of course deciding who gets the vaccines when and in what form. And there's quite a lot of paperwork and coordination that needs to happen on that front.

Liz Bowyer: So let's take these one by one. Refrigeration, as you mentioned, is one of the biggest challenges. How are pharmaceutical companies handling that?

Veronika Dubajova: So it may be helpful to first explain why refrigeration and cold storage is such a concern or has been such a concern in this process. And really the key reason for that is that the first vaccine that was approved in the US and frankly almost all around the world was the vaccine that's been developed by Pfizer and BioNTech. And this one requires storage at minus 70 degrees Celsius or about minus 95 Fahrenheit. This

is very unusual. This is not a commercial or home freezer that gets you to that temperature. And of course the vaccine needs to be at this temperature for transportation. So that has been something that Pfizer has addressed by developing proprietary storage containers and transportation containers. The good news is that the vaccines that have followed since the Pfizer approval do not require, do not have such onerous refrigeration requirements. So when you look at the Moderna vaccine, what we're talking about is minus 20 degrees centigrade, which is a lot more manageable. And actually the vaccine that has been approved here in the UK but not yet in UK, the one developed by AstraZeneca and Oxford can actually be stored at normal temperature, so 2-8 degree Celsius.

So the more vaccines we get, the more options we have. And I think in particular, a number of the other vaccines that are in development that haven't made it yet to market can also be stored at normal refrigeration temperatures. And this is going to be incredibly important in particular when we think about distribution in emerging markets. But the good news is we have more vaccines that are easier to store. And also even for the vaccines that have more onerous requirements, we have seen companies go through and improve a number of those.

So for instance, at the outset, the Pfizer vaccine could only sit out of the freezer for a day. It can now be out of the freezer for five days before it's used. And that of course makes it much easier to work with.

Liz Bowyer: And what about administration of the vaccine? We've all seen news stories about very different approaches that are being taken.

Veronika Dubajova: Yeah, and I think, Liz, this is really what has been in the news over the past couple of weeks. Again, just to put this into context, if you look at the US for instance, there's about 25 million vaccines that have been shipped out to distribution centers and then to hospitals. But when we look at the data -- and by the way, the data is not perfect -- but there's only about 10 million of those vaccines that have been administered. And we think there's a number of issues here that have played a role.

The first one coordination, right? You have a lot of parties involved. Remember, these vaccines were procured at a federal level. Then they go to individual states. And from the individual states they go to hospitals. And those hospitals in

some cases actually then have responsibility to get them even further out to folks who are going to be doing the administration. And of course there has also been some anecdotal evidence that some hospitals have more demand than they have supply. So we are working through some teething problems, not fully unexpected I think at this point in time. But it has been a big focus.

Liz Bowyer: So talk more about the supply issue.

Veronika Dubajova: Yeah, so we've seen a couple of things here. One is of course, for instance, I'm going to focus on the US. We have seen the government hold back some amount of vaccinations for the second dose. This is pretty unusual. I mentioned this earlier. These vaccines do require two doses, and you need the second dose to be from the same manufacturer as the first dose. So I think the government, in its efforts to be very cautious, held back that second dose. We are going to start seeing some releases of that, and that's going to increase that availability.

The other thing we have seen is of course, as I mentioned, we are starting with vaccinating a very small proportion of the population. We don't have vaccine for everyone right now. There's not enough supplies. And so we are starting with a very selective group. And sometimes the challenge of logistics is if it's a small, selected group is getting enough of those people through the door in the limited amount of time that you have. So in the US, for instance, we're starting with vaccinating primarily hospital workers then health care workers in the community. And then eventually after that folks who are over 65 years old and have an underlying condition. And identifying those people and getting them to the locations where the vaccine is available of course is a little bit of effort.

Liz Bowyer: So that's supply. The other side of the coin is obviously demand, and there's been a real concern about whether enough people will actually choose to get vaccinated. What's the latest there?

Veronika Dubajova: Yeah. And I think, Liz, this has been a subject we have debated a lot in the last couple of weeks. And I think it's a very important question of course as we think about, for instance, achieving herd immunity. And the data points we have so far are a little bit mixed. So anecdotally, and we actually very recently did a call of about 15 hospital administrators from around the country in the US to try to

assess where they are with COVID-19 vaccine distribution. And what we heard from a lot of them is, for instance, front line health care workers, the demand for vaccine isn't particularly high. So among these 15 hospital administrators we talked about, they said only about 30-50% of their hospital staff was willing to get vaccinated. Now, they thought this was really a reflection of the fact that they have a lot of women of child-bearing age, and that's I think a group that will continue to be a little bit more cautious about the vaccine. And the other reason is that they do have populations of color.

Encouragingly, from among these hospital administrators, those who have started vaccinating more broadly in the community -- so again think about health care workers, your primary physician who's in the community, or in some cases people who are 65 years old or older in the community with an underlying condition -- that the demand there is much, much higher. And when we look at surveys that have been done over the last couple of months, they do point to somewhere between 50-60% of the population being willing to get vaccinated. And we would expect actually that number to increase over time because clearly the benefits of the vaccine are very high. And as we get more data and more people have the vaccine successfully we do think that demand will likely follow.

Liz Bowyer: And what about children? What's the latest in the thinking about when there might be a vaccine available for them?

Veronika Dubajova: Great question, Liz. And of course so far vaccines are approved only for adults. And development of vaccinations for children always takes a little bit of time. So there are clinical trials ongoing here, and we do expect some dealt as we move through the year. But do bear in mind, really, the single-most important thing that we have to do given the impact of COVID on all of us is as you know there is a very high relationship between age and comorbidities on one hand and the impact of COVID on one's health on the other. So what we really wanted to do is start off and get those populations who are most at risk vaccinated as quickly as we can. And that should help alleviate a lot of the burdens on the health care system. And that's something that we're watching very closely.

Liz Bowyer: Thanks, Veronika.

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