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EDITED TRANSCRIPT

MRNA.OQ - Moderna Inc Omicron Booster Strategy Update - Corporate Call

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OVERVIEW:

Co. provided an update on preliminary booster data and strategy to address Omicron variant.

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CORPORATE PARTICIPANTS

Lavina Talukdar *Moderna, Inc. - Senior VP & Head of IR*

Paul Burton *Moderna, Inc. - Chief Medical Officer*

Stephane Bancel *Moderna, Inc. - CEO & Director*

Stephen Hoge *Moderna, Inc. - President*

CONFERENCE CALL PARTICIPANTS

Chen Yuan Yang *Morgan Stanley, Research Division - Research Associate*

Elizabeth Daniels Webster *Goldman Sachs Group, Inc., Research Division - Associate*

Huidong Wang *Barclays Bank PLC, Research Division - Research Analyst*

Joseph Robert Stringer *Needham & Company, LLC, Research Division - Associate*

Michael Jonathan Yee *Jefferies LLC, Research Division - Equity Analyst*

Rick Stephen Bienkowski *SVB Leerink LLC, Research Division - Associate*

Simon P. Baker *Redburn (Europe) Limited, Research Division - Head of Pharmaceutical Research*

Tyler Martin Van Buren *Cowen and Company, LLC, Research Division - Analyst*

PRESENTATION

Operator

Good morning, and welcome to Moderna's conference call. (Operator Instructions) Please be advised that this call is being recorded. At this time, I'd like to turn the call over to Lavina Talukdar, Head of Investor Relations at Moderna. Please proceed.

Lavina Talukdar - *Moderna, Inc. - Senior VP & Head of IR*

Thank you, Catherine. Good morning, everyone, and thank you for joining us on today's call to discuss data and updates to our booster strategy against Omicron. You can access the press release issued this morning as well as the slides that we'll be reviewing by going to the Investors section of our website.

Speaking on today's call is Stephen Hoge, our President. Joining Stephen during the Q&A section is Stephane Bancel, our Chief Executive Officer; Paul Burton, our Chief Medical Officer; Jackie Miller, Senior Vice President and Head of Infectious Disease; and David Meline, our Chief Financial Officer.

Before we begin, please note that this conference call will include forward-looking statements made pursuant to the safe harbor provisions of the Private Securities Litigation Reform Act of 1995. Please see Slide 2 of the accompanying presentation and the SEC filings for important risk factors that could cause our actual performance and results to differ materially from those expressed or implied in these forward-looking statements.

On Slide 3, please see the important indication and safety information for our COVID-19 vaccine, which has been authorized for emergency use as a primary series vaccine and booster vaccine in the United States and in many other countries around the world. I will now turn the call over to Stephen.

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Stephen Hoge - *Moderna, Inc. - President*

Thank you, Lavina, and good morning and good afternoon, everyone. On Slide 4, I'd like to remind you of our strategy on the Omicron variant and present some of the recent data we have received on the performance of our various booster strategies against this emerging variant of concern.

So first, Moderna has had a 3-part strategy for addressing all emerging variants of concerns since the early part of 2021. Those 3 elements are: first, testing the prototype vaccine mRNA-1273 both at the authorized booster dose of 50 micrograms and at a higher dose of 100 micrograms; second, we evaluate multivalent booster candidates that incorporate mutations from previous variant of concerns, again, both at 50- and 100-microgram dose levels; and third, we advanced variants of concern specific booster candidates to address emerging threats, including against Delta and Omicron.

Today, we're sharing an update on some preliminary data from the NIH, VRC Duke pseudovirus neutralization assays or PsVNT ID50. It confirms robust Omicron neutralization activity of all the current booster candidate that we've tested.

The authorized booster, which is 50 micrograms of mRNA-1273, increased neutralizing geometric mean titers to 850, which is an approximately 37-fold boost -- over pre-boost levels. The higher dose of mRNA-1273 increased titers even further to a GMT of 2,228, which is approximately 83-fold higher than previous levels. And the multivalent candidates demonstrated neutralizing antibody activities that were similar to the high levels of both the 50 microgram and 100 microgram.

So we will speak more about this towards the end, but based on the strong boosting of mRNA-1273, Moderna will focus its immediate efforts around Omicron on advancing the prototype vaccine mRNA-1273. We're going to continue to advance an Omicron-specific booster in the clinical trials in early 2022. We'll continue to assess the potential of the multivalent candidates for both durability and breadth of variant concern over the months ahead.

So I'd like to now move to Slide 5 and some of the emerging clinical data that we have. First, on Slide 5, I want to present a comparison of our most advanced booster candidates in the validated assays against the D614G viral archetype, the Beta variant of concern and the Delta variant of concern.

On this slide, you'll see the archetype booster -- the archetype titers in the first row, the Beta titers in the second and the Delta titers in yellow at the bottom. I'm comparing here on the far left primary vaccination, the contribution of pre-dose after dose 1 and dose 2 in the 3 columns as well as 2 different booster candidates for which we have this full set of data, mRNA-1273 at the 50-microgram and 100-microgram level.

On the far right, the multivalent booster candidate mRNA-1273.211, which includes both the Beta variant and mRNA-1273, again, at both 50-microgram and 100-microgram dose levels. As you can see, a booster dose of mRNA-1273 in the top row significantly increases the neutralizing titers and achieves neutralizing GMTs 1 month after boost that are higher than the GMT seen 1 month after primary series with gene geometric mean titers of 1,951 as compared to the 1,131 after primary vaccination series. This is the basis of the authorization of the mRNA-1273 booster at 50 micrograms.

Now a higher dose, 100 micrograms of mRNA-1273 does lead to numerically higher geometric mean titers. And that is true for both the mRNA-1273 booster and the multivalent booster to the right. The same is also true that a higher dose will lead to higher neutralizing titers when you look at the 2 assays involving variants of concern.

The Beta variant for the multivalent booster, we have that data now, and you'll see numerically higher geometric mean titers with the higher dose. Similarly, for mRNA-1273 in the bottom in yellow, you'll see that a higher dose of 100 micrograms does lead to higher neutralizing titers against the Delta variant of concern as well.

Overall, the multivalent candidates, as you'll see, achieved similar geometric mean neutralizing titers against the D614G archetype virus in the top row. And further testing is already underway against a panel of variant concerns to understand whether there is a difference in performance against these variants.

Now moving to Slide 6. Here's the preliminary data now adding to that more substantial data we have on Slide 5 on the Omicron assays. Briefly a word about the assays. These are the National Institutes of Health Vaccines Research Center assay, established at Duke Medical Center, and our

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pseudovirus neutralization titer assays. It's on ID50 standard. These remain research assays, and they have not yet been clinically validated, but they are run in the same labs and following the same protocols as the validated assays I presented on the previous slide.

Here, I'm presenting the mRNA-1273 data at both 50 microgram and 100 microgram. You'll note in black, we've included for the samples that were included in this test the D614G validated assay results as well as in red then the Omicron neutralizing titers.

On the left, under each group, you'll see the booster day 1 pre-boost titers. And on the right, you see the booster day 29 or 1 month after booster neutralizing titers.

But first, drawing your attention to the 50-microgram dose level. The 50 micrograms of mRNA-1273 led to a 37-fold boost of Omicron-specific neutralizing titers in these assays. 850 was the geometric mean titer 1 month after boost. This still represents a 2.9-fold lower titer against Omicron than against the archetype virus D614G but nonetheless is a significantly higher result in GMT.

On the right, you see the 100-microgram dose titers. And again, you'll see an 83-fold boost after 100 micrograms of neutralizing titers against Omicron to levels of 2,228. And consistent with the 50 microgram, we still see a threefold lower titer level against Omicron than D614G.

Now moving to the multivalent booster candidates on Slide 7. Again, the same format presented here, and 2 different multivalent booster candidates are illustrated. On the left, you have the mRNa-1273.211 multivalent, which includes the Beta variant and the Wuhan-based mRNA-1273 sequence. And on the right, you see mRNA-1273.213, which includes Beta and Delta. We have 50-microgram, 100-microgram data for the 211 and 100-microgram from early data for 213.

Now again, as you saw before, there's a substantial boost at the 50-microgram dose level of mRNA-1273.211, a 39-fold boost in Omicron titers and a slightly numerically lower difference in the level of Omicron titers versus D614G, only 2.2-fold lower relative to the threefold lower that we saw with 1273. 100-microgram shows a consistent result, which is higher levels of boosting, 141-fold in this case of Omicron titers and a consistent result as well in the approximately 2.3-fold lower titers for Omicron versus D614G.

We only have partial data for the 213 candidate at 100 micrograms, which shows a generally consistent 77-fold boost of Omicron titers after 100 micrograms of mRNA-1273.213. Now I'd like to focus -- we also have announced some data on safety from the 100-microgram dose level of mRNA-1273, which is broadly representative of what we've been seeing across our booster candidates. That data is presented on Slide 8.

So first, looking to the solicited local adverse reactions through day 7. We're comparing here the mRNA-1273 primary series in -- labeled P301 after dose 2 against a 50-microgram booster previously reported and is the authorized dose and the new 100-microgram booster dose of mRNA-1273.

On the left, you see pain and then erythema, swelling and axillary swelling or tendernss on the right. Grade 1, Grade 2 and Grade 3 events are reported in the shaded colors. There were no Grade 4 events in these studies.

Overall, there's a consistent profile across these different nature and frequency of events with a trend towards increased frequency of axillary swelling and tenderness mostly mild or Grade 1 for the 100 microgram booster dose relative to the 50 microgram dose and primary series on the right. Also, there's a general trend towards more frequent adverse reactions in the 100-microgram dose, as you'll note, as opposed to the 50-microgram booster dose. But they are generally consistent with 2 -- with primary series dose 2.

On Slide 9, we have the systemic -- solicited systemic adverse reactions through day 7, again, with a similar layout and presentation of the post dose 2 from Phase III and post 50-microgram boost and post 100-microgram boost results. As you'll see on the chart, systemic adverse reactions are generally consistent with the dose 2 of the primary series, and there is a generally higher frequency of adverse reactions reported for the 100-microgram booster as opposed to the 50 microgram booster.

On Slide 10, I'll briefly summarize our emerging perspective across these data on Omicron booster strategies. So first, the mRNA-1273 results in a significant boosting of Omicron neutralizing titers, both at the 50-microgram authorized dose and at the 100-microgram higher dose level, suggesting good potential cross protection from the current vaccine against the Omicron variant concern.

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Conversely, given the strong boosting we've seen with mRNA-1273, the 37- to 80-fold boosting at the 2 different dose levels, the opportunity for significant additional benefit against Omicron from multivalent boosters is consequently diminished, particularly in the short follow-up tested to date, which is day 29 plus boost. Moderna will therefore focus its near-term efforts on the mRNA-1273 booster as the first line of defense against Omicron.

The higher dose of mRNA-1273 100 microgram versus 50 microgram did result in dose-dependent increases in Omicron neutralizing titers, which is consistent with what has been seen and reported previously against the archetype virus D614G and both prior variants of concern, Beta and Delta. Moderna is going to continue to evaluate an Omicron-specific booster in early 2022, given the concerning immune-escape features demonstrated by this variant of concern as part of a more midterm strategy to address the ongoing pandemic.

With that, I'd like to turn it over back to the operator to address any questions.

QUESTIONS AND ANSWERS

Operator

(Operator Instructions) Our first question comes from Salveen Richter with Goldman Sachs.

Elizabeth Daniels Webster - *Goldman Sachs Group, Inc., Research Division - Associate*

This is Elizabeth, on for Salveen. Just given your strategy and the emerging data that we're seeing play out, what does this mean for the prevention of infections and against severe disease and hospitalization?

Stephen Hoge - *Moderna, Inc. - President*

Thank you for the question. So I think, first of all, the level of neutralizing titers in these assays has not yet been correlated with clinical benefit because these are still research assays. And so we need that important caveat.

However, we do know from the correlative curative risk work and prior published epidemiologic studies that at the mRNA vaccine and the high neutralizing titers we have seen in it have generally predicted or correlated with benefit against symptomatic infection, even asymptomatic infections and certainly severe disease and death. And so seeing that a third dose of the mRNA-1273 vaccine at the authorized dose level can achieve these high numerical titers is quite reassuring that we'll be able to rely on this vaccine to address the near-term surge of Omicron cases. But ultimately, we'll depend upon emerging public health data to confirm that effectiveness in the real world.

Operator

Our next question comes from Matthew Harrison with Morgan Stanley.

Chen Yuan Yang - *Morgan Stanley, Research Division - Research Associate*

This is Charlie Yang for Matthew. So I guess my first question is whether you have tested the sera at a time point beyond 29 days, and you have any sense in terms of the durability of the boost against Omicron? And what if the titers may decay faster than against the Omicron strain?

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Stephen Hoge - *Moderna, Inc. - President*

Great questions. So the booster studies, we are collecting long-term samples. And one of the things that we're going to look at for sure is whether or not there's a difference in durability as we look at the different booster candidates.

And you can, in particular, imagine that the multivalent boosters as you look at 6 months or 12 months might show -- might start to show a difference in the type of affinity maturation, type of durability, therefore, you'd see against variants of concern. We do not have that data at this time.

We only have right now through day 29, which is a relatively short window. But I think it is reassuring for the prior question, if you look at the day 29 neutralizing titers that we see, for instance, post a 50 microgram boost against Omicron, numerically, they're coming in at about 850. And that is consistent numerically with the types of neutralizing titers that we saw against the Delta variant of concern, and I presented on the slides today, approximately 800.

And that is encouraging because we do know that the mRNA-1273 vaccine and booster has held up relatively well in terms of effectiveness against Delta even in the face of that very infectious variant of concern. So I think we're cautiously optimistic given the data presented here that if subs additional labs and additional assays confirm these magnitudes, which should happen over the coming week or 2, that the authorized booster dose of 50-microgram should provide good protection, we would hope, against the Omicron variant of concern because these levels have been correlated or have been consistent with that kind of protection against other variants of concern.

Chen Yuan Yang - *Morgan Stanley, Research Division - Research Associate*

And I guess just a quick follow-up on that. How about in terms of the decaying speed, whether there's any thoughts on that front?

Stephen Hoge - *Moderna, Inc. - President*

Great. Thank you for reminding me. So generally, we have seen and previously presented data across all the variants we've tested through about 6 months. The thing we have generally seen is after primary series, the decay curves are not significantly different between variants of concern.

And put another way, the slope of the decay is the same over time. It is really the -- the altitude of neutralizing titers. The height of neutralizing titers you get to immediately after vaccination that determines how long you're going to be protected.

And that is true post dose 2. We do not have data post dose 3 yet, but there is a belief that it may even do slightly better, the slope may be slightly different after dose 3. What is clear is that when you have a substantial decrease in neutralizing titers, you generally will fall below what we think might be a protective threshold more quickly, perhaps over months instead of over a more desirable year.

We just don't know at this level what to expect, though, because post dose 3, we still don't have a view of those slopes. I do think it's encouraging that the level of neutralizing titers we're seeing here today in the pseudovirus neutralization assay conducted NIH Duke is sufficiently high that we think we're comfortably above what for other variants of concern was a correlative breakthrough risk.

Now the durability of that, I think it's too early to speculate on how long it will last. But again, I think the data -- the magnitude of boosting we're seeing here is quite reassuring.

Operator

Our next question comes from Michael Yee with Jefferies.

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Michael Jonathan Yee - *Jefferies LLC, Research Division - Equity Analyst*

We had maybe a 2-part question. Following along some of the data you just presented and some of the questions you just answered, it seems that 100-microgram boost is significantly higher than the 50-microgram boost. And so logically, perhaps that conveys more protection, but longer protection for the decay, which was just asked about.

So my question is, first, would there ever be any thoughts around that as a boost? But related to that, don't you just think that there would be significant decay over 6, 8, 9 months like we've been seeing previously, and therefore, we would just need another boost next year for whatever variant that would be next year? So that would be a perhaps your strategy requirement for annual boosting. Maybe just put some of those together and make a comment about the thoughts for annual boosting.

Stephen Hoge - *Moderna, Inc. - President*

Great. Thank you for the question, Michael. Both very astute. So I -- so first, on the 100-microgram dose level, we are encouraged that you do see higher titers. 2,000 is actually, if that is validated in other assays, is a quite high titer level that we would hope would provide significant protection.

However, the decision of whether to deploy 100 micrograms or a higher dose is really one for public health agencies at this point. We are just providing the data, and obviously, we'll share it with everybody so they can make that determination.

But as the vaccine is currently approved in many markets, authorized under EUA in the United States, it is in many places where it's approved up to now recommending bodies to determine whether or not a higher dose is appropriate for high-risk individuals. You could imagine that those that are high risk of exposure, for instance, health care workers or those that are at high risk of severe disease even from Omicron even if it tends to hopefully be more mild than Delta that it would make sense to provide a higher level of neutralizing protection.

But again, that is a decision principally now for public health officials. The authorized dose that we have today is the 50 micrograms of mRNA-1273. But of course, we'll be answering questions on that and providing them.

Now as far as the question of decay and does a higher dose leave you longer protection, again, we still don't really know the slope. But it is true that we expect that with this coronavirus, SARS-CoV-2 like you see really endemic coronaviruses and other respiratory viruses, we do expect that there's going to be waning neutralizing protection over time.

And as a result of that and what we think will be a continued series of evolutions of variants from through this -- from the SARS-CoV-2 virus, we do expect that there will be a need in the future for seasonal boosting. And principally, that will be because as we all come in, in northern latitudes in the winter months indoors, respiratory viruses, not just SARS-CoV-2 have an opportunity to repeatedly infect people.

They do over our lifetimes repeatedly infect. And they can have severe consequences, in particular, in older adults and immunocompromised. And so for that reason, we often boost with respiratory vaccines like influenza annually. And we think a similar picture will likely emerge over time with SARS-CoV-2.

The question is will that frequency can be seasonally every year? We think probably yes. And the other question is, who will benefit most from that booster? And we think it is most likely to be those that are at highest risk of severe complications if they develop SARS-CoV-2 infection.

Ultimately, it will fall to recommending bodies, including groups like the CDC, to decide what is recommended broadly for use. But as a sponsor, Moderna is focused on developing that data following the neutralizing titers now post dose 3, as you said, 6 months and 12 months to determine when they do fall to a level that we think would be a concern and will justify further boosting. And we are preparing for a seasonal booster market that would protect those at least at high risk of severe COVID-19.

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Operator

Our next question comes from Gena Wang with Barclays.

Huidong Wang - *Barclays Bank PLC, Research Division - Research Analyst*

I have 3. Maybe the first one, when we look at the Pfizer, they're also using pseudovirus. And when we look at the GMT numbers, what they assume is 398 and then Omicron's 154 one month after third dose. And can you first maybe give us a little bit more color regarding your pseudovirus testing? If we try to do some comparison GMT level (inaudible) number, how should we think about your number versus their number?

And the second question is, do you have the data for dose level 3 versus dose level 2 at a similar time frame post the dose? And then lastly, when we look at the Omicron compared to wild type, maybe that's more like a better comparison. Like Michael Yee mentioned, we also saw that 100-microgram when we look at the Omicron level, it's 2,115, that almost similar or even higher than the 50-microgram 1,799.

And I assume you've done all those experiments at the same time. So it could be very good comparability there. So wouldn't that suggest that 100 microgram at third dose that boosting the protection should be equivalent to 50 microgram with the wild type against the Omicron?

Stephen Hoge - *Moderna, Inc. - President*

Thank you, Gena, for the 3 questions, all excellent. So let me try and work through them, and please catch me if I get anything wrong or if I miss anything.

So the -- so first comparison of the GMTs to other vaccines, specifically the Pfizer vaccine in your question. So the Pfizer-BioNTech data is also a pseudovirus neutralization assay data. But we do not know very much or anything really about that assay.

Ours is run in the same lab, the NIH VRC Duke lab. That is also running our validated clinical assays against the other variants of concern in D614G. And so we do know more about that and do believe that at least methodologically it is very consistent with our other data.

I do not think it's easy to directly compare because these are ultimately different assays. But I would make the comment that there is broad previously published data showing that the higher dose of Moderna's vaccine over the Pfizer-BioNTech vaccine does lead to higher neutralizing titers whether in a primary series or in a booster context.

For instance, the recently published COV-Boost study out of the U.K. shows higher neutralizing titers, including against variants of concern and higher T cells as well from the Moderna booster. And the NIH mix and match study, which was presented a couple of months ago in the preprint's online, again, in head-to-head assay, what you see is higher neutralizing titers -- several fold higher neutralizing titers usually for Moderna, both pre and post boost.

And so it is entirely would be unsurprising that what has been true for the primary vaccination and booster series for archetype virus and for prior variants of concern, including Beta and Delta, when you do head-to-head that it would also be true. It would also -- you would also expect it to be true for Omicron.

And so it's possible that what we will ultimately see when head-to-head data comes out is that with Omicron as with other variants of concern, mRNA-1273 is seeing higher neutralizing titer data. But for now, I just don't feel I can make a direct comparison between their assays and ours. You really need to wait until the test gives you the same results and same study, same assays, I should say.

Second part of your question, your second question, which is do we have data for dose 2 versus dose 3. Some of that data, we do, and we are actually preparing a preprint that will include all of this data and posting online.

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As you can imagine, there's much more data overall. In general, though, some of that data has already been presented and publicly. And so there was -- even Dr. Fauci at a briefing presented some data out of ERC on what things look like post dose 2 in a research version of this assay. It is generally consistent with those results.

And so there's post dose 2, you do see some neutralizing titers in -- against Omicron, but they are substantially lower than against the D614G comparator neutralizing titers. And post boost, you see that substantially close as a gap down to this roughly 3-fold difference.

So in the preprint, we will put that data out there, but I'll just tell you that it is broadly consistent with what has been previously reported and presented even last week by Dr. Fauci from the NIH data. In terms of Omicron versus wild type, so -- and in particular, what do we think about the neutralizing titers of 100-microgram. I think you point to the key question, which is that it is reasonably clear that a 100-microgram dose leads to higher neutralizing titers against Omicron.

And the levels, at least numerically, start to exceed the levels that you see against ancestral variants at a 50-microgram booster dose, which you would think provides good degree of confidence that a 100-microgram will perform well against Omicron perhaps as well or even better than we saw against other variants of concern. I think the big challenge in that conclusion is that we still are learning so much about Omicron that we want to be cautious about drawing too many parallels back to what we saw with Beta and Delta.

There are also variants of concern for sure, and the Delta data is perhaps more predictive. But it is just a conclusion that, ultimately, we as a company do not have hard data on. And so we need to be cautious about the conclusions we draw.

What we can say for sure is that the neutralizing titers are higher, the safety and tolerability profile looks acceptable and that it would be appropriate, we think, for public health authorities to consider that. But I would also just say the other part of that statement, which is it is also clear that a 50-microgram dose of mRNA-1273 gets you to quite reasonable, quite respectable titers. It's 850 titers that are numerically the same as what we saw against Delta after a 50-microgram dose of mRNA-1273 as a booster as well.

And so for many people, it may not actually be necessary that you push titers even higher, maybe for all. And therefore, I think it really is a judgment that public health officials need to make about the relative risk benefit for different populations because the data we present today on the authorized dose 50 micrograms to mRNA-1273 really looks quite encouraging as well.

So could higher be better? Absolutely. Do we have data on that today that allows us to make a conclusive recommendation? No. And will public health officials -- do we recommend public health officials have a look at that? Of course, and I know they are.

Operator

Our next question comes from Simon Baker with Redburn.

Simon P. Baker - *Redburn (Europe) Limited, Research Division - Head of Pharmaceutical Research*

Two, if I may, please. Firstly, late last week, WHO published some preliminary data on T cell cross-reactivity for the Pfizer vaccine, which showed that comparing Omicron with ancestral CD8 response was pretty similar slight decline in CD4 response. I just wonder if you have any data at this admittedly early stage for 1273.

And a broader question. I just wonder if you could update us given the very fast-moving situation we've been in the last few weeks on the order book and capacity situation for 2022.

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Stephen Hoge - *Moderna, Inc. - President*

Of course. I'll leave the second question to Stephane. But the first question, so there has also been a presentation from a number of labs of the cross-reactivity for -- and T cells for mRNA-1273 as well as the Pfizer vaccine and others. Generally, you would expect those to be consistent.

I will note that Moderna has had -- and if you look at the COV-Boost study that was published out of the U.K., Moderna has had numerically higher T cell or cell responses -- cellular responses against Delta, Beta and the ancestral virus relative to those published, but directionally quite similar. And you would expect that there's really not going to be a big difference between the vaccines.

And the reason I would say that is that at the end of the day, we are expressing largely the same spike protein, in fact, identical in many cases, between the different first wave vaccines that have been deployed and including between the Pfizer vaccine and ourselves. And in fact, if you look at epitopes, and there's been quite a substantial publication on this and presentation on this, if you look at the T cell epitopes, they are largely preserved almost 90% consistent between the ancestral vaccine antigen, which is the base of the vaccine and the new Omicron spike protein.

And so for that reason, you absolutely do expect T cell responses to be quite reasonable and robust. And I think that has been what the early data published by others or presented by others has started to show.

If you look at what we're seeing here in terms of neutralizing titers, the data we do have, the day 29 response that you're looking at here, it's quite rapid responses. And these titers are getting to quite remarkable levels. Again, we're talking about 1,000 to 2,000 or 800 to 2,000-fold.

That kind of rapid boostability really does depend on cell health and we say T cell health and does, we think, generally correlate with broad cellular immunity responses. And so I think you are seeing indirect evidence in the data we're presenting today.

I think some other academic labs and others have presented some emerging direct evidence. And I think mechanistically, you would absolutely expect given the degree of sequence preservation that's still quite high for T cell (inaudible) it is really going to be reasonable T cell responses against Omicron. Stephane, do you want to take the second question?

Stephane Bancel - *Moderna, Inc. - CEO & Director*

Sure. So we are providing no update today on the commercial sales for 2022. I will just note that as I'm sure you noticed, we announced recently a new partnership with the U.K. for products for 2022 as well as a firm order for 2023.

We're having quite a number of discussions in the last couple of weeks with a rise of Omicron with countries around the world. And that was before this data was presented this morning.

So as you can imagine, we're going to be quite busy in the coming days and weeks, reaching back again to all the countries and partners we have to make sure that these data are understood, which, as you saw from Stephen's description, are very encouraging and very strong.

On the capacity, we confirm that we have the capacity to deploy 2 billion to 3 billion dose in 2022. As we've said in the past, the swing between 2 and 3 will depend on the product mix between 50-microgram doses and 100-microgram doses. So we'll provide more clarity in the next quarterly release.

Operator

Our next question comes from Tyler Van Buren with Cowen.

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Tyler Martin Van Buren - *Cowen and Company, LLC, Research Division - Analyst*

So can you talk about the potential time line to get an approval of 100-microgram booster dose for the entire population given this data? And then the second question is if there wasn't a large difference in GMTs between the multivalent booster candidates and mRNA-1273, then why do you think the Omicron-specific vaccine heading towards the clinic will be significantly different?

Stephen Hoge - *Moderna, Inc. - President*

Great. Thank you for both questions. So first on time line for approval. We are not at present planning to file for amendment of the authorization or approvals to include the 100 microgram for a booster.

I'll note that in many places, it is 100 micrograms -- well, in all places, 100 micrograms is approved to authorize as the primary series, and we have the 50-microgram booster. But in many places, those approvals, full approvals would allow public health authorities, for instance, recommending bodies to recommend the use of 100 micrograms if they wanted to for high-risk populations.

The determine of whether -- the determination of whether some populations at high risk of severe disease or high-risk infection would benefit is one that we're not -- we don't believe currently we have the data to make. And so we are providing this data to public health authorities so that they can make the best decisions in the face of the pandemic they can.

But ultimately, we will defer to recommending bodies such as the CDC or other -- or their analogs in other countries to determine if they want to take any action with the 100-microgram dose level. I will, as a final comment, note that 100 micrograms as a third dose is authorized for immunocompromised population as a part of their completion of their primary series.

And that the 100-microgram dose here is the same dose that's used in the primary series of 2 -- to the first 2-dose series, and it's in the same presentation in vial. And so we have a 50-microgram and 100-microgram dose in the same vial already in market. And all that's different between the 2 dose levels is the volume of injection.

And so from a logistical and operational perspective, we hope that the option is there. Again, it is now for public health officials to decide if there's any need or desire to use it.

And as I said a moment ago, the data that we showed here today on 50 micrograms is really quite encouraging. So it may be that the benefit is the word that and we -- again, we'll defer to public health officials to make that decision now.

Now on the question of multivalent and Omicron, it's a great one scientifically. I think, first of all, the positive surprise here, I would point to is how strongly mRNA-1273 did to the prototype vaccine against Omicron at a 50 microgram boost level as well as the 100 microgram being higher. And we think that, that augurs well for the ability to cross protect based on that variant of concern -- or sorry, cross protect with the prototype.

It does, in some ways, diminish the opportunity for additional benefit provided by the multivalent. And so what you see with the multivalent is they do quite respectable, I think we would have all been very pleased to be looking at titers of a couple of thousand a week ago.

It is only because 1273 continues to do quite well at 100 micrograms or 50 micrograms that, that seems less necessary today. And I think the fact that, that gap isn't able to arise at day 29 sort of fits the picture immunologically.

If you think about it, if 1273 is able to drive this really -- this nice affinity maturation, the strong, boosting neutralizing titers, again, after a third dose against Omicron, that picture would suggest that, really, that's a good inherent response, a memory response that already exists and is only slightly refined by day 29. And so when you come back in with a multivalent booster, you're going to basically see most of the immune response is that same anamnestic recall response from the original vaccination.

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And that's, I think, why these numbers start to look so similar. It's important to also though say that that's true through day 29. What we do not know is what does that look like 6 months out. Because in the case of the multivalent or an Omicron-specific booster, which is really your question, you may see different affinity maturation.

Again, you're going to present a slightly different antigen. And maybe 6 months out, maybe 12 months out, you will see a broader, more diverse immune response or repertoire, antibody response that's developed against that new antigen. And that may also change the affinity maturation and ultimately, therefore, the potential for durability or future boostability in that immune response.

And these are all speculative statements. So it's a hypothetical of what we might see over the next 6 months. But that's why we emphasize today that we think we need to continue to follow that multivalent platform.

It is not needed to address the current Omicron surge. We feel very confident in mRNA-1273. But we believe we're going to be living with this virus and its strains and variants forever at this point. And we need to continue to think about the best ways to provide the broadest and most durable immune response against future variants of concern as well as those that are currently circulating.

And so it's in that context that we think it's appropriate to study an Omicron-specific booster because it is quite possible given what Omicron has shown us in its ability to escape pre-existing immunity that the best way to achieve durable immunity to Omicron or any of its future progeny will be to boost or add an Omicron booster to a multivalent platform, booster to Omicron or Omicron booster to multivalent platform to try and continue to mature the immune response in individuals and across the population.

So if for that reason that we're going to test it forward, we'll need to look at that data. It is also possible that Omicron continues to mutate and evolve. We've seen this virus surprise us now an unfortunately large number of times in just the first year of -- or second year of this pandemic.

And so we do think it's the better part of valor. It's prudent to advance Omicron-specific booster given what the virus has shown us is this potential for immune escape. Hopefully, that answers the question.

Tyler Martin Van Buren - *Cowen and Company, LLC, Research Division - Analyst*

Yes, very interesting.

Operator

Our next question comes from Geoff Meacham with Bank of America.

Unidentified Analyst

This is Alex (inaudible) on for Geoff Meacham. So we just really wanted to understand how you're thinking about these variant boosters being approved and can they keep pace with these variants as they arise? Is there a regulatory bottleneck that you guys are encountering so far?

Stephen Hoge - *Moderna, Inc. - President*

So I'll take a stab at this, and maybe Jackie can follow on. So first of all, I think regulators are responding as fast as anybody could, as fast as we as a sponsor or other companies are to a very fast-moving picture. I mean, let's just recall that a month ago, we weren't even talking about Omicron. And now we're -- we've got data. And we're evaluating it, and we're trying to make the decision forward.

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It would be unfair to say that they're absolutely inaccurate, unfair to say there's a regulatory bottleneck around these sorts of things. I think the question for us and regulators to engage in -- all sponsors and manufacturers and regulators to engage in over the coming month and year is given the virus is going to continue to evolve, how do we want to think about strain updates going forward?

Now there is very clear guidance on that from the early part of 2021. But I -- we have heard global regulators start to point to the fact that when we start to get very comfortable with the mRNA vaccines, we have now a broad set of data against many different variants of concern. And we've provided increasing data across both multivalent and monovalent boosters that gives us some confidence that we can make, hopefully, these changes without needing to fully study them in the clinic.

That starts to approach a process or procedure that might more -- might look more like flu, where we do update vaccines every year and do not do the whole clinical programs around them. It's early days for those conversations. Again, the data has really emerged from manufacturers over the last few months.

And we believe at Moderna that over time, that will be a viable strategy to make sure that we can more rapidly respond to these variants of concern. But in the case of right now, Omicron like Delta before it really can be addressed by the prototype vaccine mRNA-1273.

And so I don't think that there has been a need yet to provide an urgent strain update. And if you look at the operational challenges around that urgen and emergent strain update, for instance, rolling out an Omicron booster, it would be quite substantial and something you'd only want to do if it was absolutely necessary and if you didn't see the types of neutralizing protection that we've been seeing in these early assays from the prototype vaccine. So something that we don't think is necessary today emergently.

But as you look forward as to the prior question, it makes some sense that we're going to continue to provide sequence updates, strain updates, try to broaden the immunity. And as we do that over time, we'll want to develop a flexible regulatory strategy that align with global regulators that allow them to comfortably review those, but ultimately doesn't maybe involve the same level of testing and starts to look more and more like seasonal flu.

Operator

Our next question comes from Joseph Stringer with Needham & Company.

Joseph Robert Stringer - *Needham & Company, LLC, Research Division - Associate*

Just a quick high-level question from us. Given the emerging data on Omicron here, how do you understand that we'll involve discussion with regulators and such going forward? But just in general, how do you think this recent data will impact sort of the sentiment on boosters in general, both from clinicians and sort of a public sentiment perspective?

Stephen Hoge - *Moderna, Inc. - President*

Let me defer to Paul, if you want to talk about your perspective on that, what you're hearing?

Paul Burton - *Moderna, Inc. - Chief Medical Officer*

Yes. No, thank you. Look, yesterday marked the 1-year anniversary of the authorization of the Moderna vaccine. And vaccines as a whole we know have prevented 1 million deaths and 10 million hospitalizations.

The clear message around the world now, Omicron has brought this home more significantly than we had ever imagined, is if you have not been vaccinated, get vaccinated. And if you've been vaccinated now, it's the time to get boosted, there's never been a better time.

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I think just if that sentiment is widely held, I think also the exceptional safety and efficacy of the Moderna vaccine and the vaccines in general. Think back to when the pandemic started, we had nothing. And then we have great vaccines, but the exceptional vaccine for Moderna, the efficacy it provides is really remarkable.

And so I think there's definitely been an uptick probably driven in large part by this latest fear and the surge of Omicron to get vaccinated again and to get boosted. And I think we're definitely seeing that around the world.

Operator

And our last question comes from Mani Foroohar with SVB Leerink.

Rick Stephen Bienkowski - *SVB Leerink LLC, Research Division - Associate*

This is Rick on the line for Mani. So first, I was curious as to how the continued emergence of SARS-CoV-2 variants and in particular, the speed at which they're rising, how that's influencing the thinking around the selection of a COVID vaccine construct for the pan-respiratory vaccine strategy?

And secondly, just one more question on the topic of longevity of the antibody titer and speed of decay here against Omicron. Can you maybe go into a little bit more detail about the plans going forward for following this cohort of individuals from the boost study, how often you plan to assess the neutralizing titers against Omicron and the timing for when we could see an updated data set?

Stephen Hoge - *Moderna, Inc. - President*

Yes, great questions, both. So maybe I'll take the second one first. So the -- we have been following these booster strategies over time for quite some time here. And so you'll know that the 1273 50-microgram booster cohort that is the authorized dose, those folks were actually boosted almost 9 months ago now in Q2 of last year, 6, 9 months ago. And so very shortly here, we will have the 6-month samples, which will start to give us a sense of how is the prototype vaccine doing in terms of longevity against Omicron out to 6 months, which is one of the benefits of those studies and having conducted them, got them up and running earlier this year.

Some of the other variant booster -- sorry, multivalent boosters as well as a 100-microgram dose data sort of fills in the -- over the course of -- those folks are boosted over the course of the summer. And so it's a little bit further out maybe towards the early spring next year.

And so we will provide updates as we get that data. In general, one of the challenges we have is that we obviously get these samples. And we have something like Omicron happen, and we re-prioritize work to make sure we produce this Omicron data.

And I think the next update that we would want to do, particularly on durability, would involve first wanting to get more experience with the Omicron assays, seeing this compares to other assays out there because those are still some questions that we face around this today. And then testing a higher number of samples so that we can have an even higher degree of confidence in terms of the performance of this.

So I don't want to guide yet on what that timing will be, but I would expect in the early part of 2022 we would be able to look at least at the archetype, so the 50 micrograms of the authorized dose mRNA-1273. And then some time a little bit after that, we might start to see the other booster data.

I think it is that 6-month data for some of the multivalent candidates that might start to provide some understanding of whether or not expanding the immunologic breadth here is of any value.

The second -- the first part of the question was around the antigen selection. And I think we're actively looking at whether or not there is an opportunity to design an even better antigen internally in the research space because over time, we start to see the evolution of the virus for sure.

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And maybe there are going to be opportunities to design a superior antigen or an antigen that provides broad protection against future variants of concern. That is something we're going to evaluate.

For now, the thing that we believe provides that indirectly is a multivalent approach. And so we currently have multivalent candidates in the SARS-CoV-2 space in the COVID space of 2 different antigens that we are studying, as I said, in these clinical studies to understand is it helping us broaden that immunity and will test over the 6-month time horizon, whether that actually is leading to any difference in terms of the durability or in terms of the performance against the full panel of variants of concern. Again, data that we will be developing in the early part of next year.

But there's no reason we'd have to stop at 2. We obviously have a quadrivalent flu, and we're taking that quadrivalent flu to hexavalent. And we have in our Phase III CMV study 6 mRNAs in that. And so it's quite reasonable for us to contemplate expanding beyond that.

The question is just how many candidates do you add, how many antigens you add in multivalent? And ultimately, that will be -- need to be guided by the emerging data on the performance of these initial bivalent vaccine.

If what we find is a bivalent looks like it does really well, then maybe you don't need to go to a quadrivalent. But if you see a bivalent leaves a gap somewhere in the -- against emerging variants of concern across the panel or over time, then you could decide to add a third or a fourth antigen, which might get you a trivalent or quadrivalent COVID booster.

That is data that really matters as we look towards the endemic market because as we look towards that endemic market, we will think you'll want to provide the broadest neutralizing protection and boosting as possible to protect the large number of people for the longest duration possible. And so -- but we will -- and so we are studying it, both in the research space and in the clinical space.

And I think as soon as we have data that helps clarify where we're heading in terms of that broad protection and possible multivalent candidate for seasonal boosting, we will certainly talk to you all about it.

Operator

And there are no further questions in the queue. I'd like to turn the call back to Stephen Hoge for closing remarks.

Stephen Hoge - *Moderna, Inc. - President*

Great. Well, thank you, everyone. I think I really appreciate the questions. I hope the data that we shared today helps reassure folks that the current boosters we have, mRNA-1273 specifically, can achieve really quite remarkable neutralizing titers even at the 50-microgram dose and does present an interesting question about the potential of 100-microgram dose for some high-risk populations.

I would just emphasize the messaging that Paul said a moment ago, which is we believe all data we have suggests that the mRNA-1273 vaccine is highly effective in the real world and will have benefit against Omicron variant of concern. And we would -- we'll be providing this data to public health officials to help reemphasize the benefit of vaccination and boosting with the mRNA-1273 vaccine.

With that, thank you all. Please stay safe, and have a happy new year.

Operator

This concludes today's conference call. Thank you for participating, and you may now disconnect.

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