Moderna Announces Positive Initial Booster Data Against SARS-CoV-2 Variants of Concern

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Single booster dose of 50 µg of mRNA-1273 or mRNA-1273.351 increased neutralizing titers against SARS-CoV-2 and two variants of concern (B.1.351, P.1) in previously vaccinated clinical trial participants

Booster dose of mRNA-1273.351, a strain-matched candidate, achieved higher titers against B.1.351 than a booster dose of mRNA-1273

mRNA-1273.351 and mRNA-1273 booster doses were generally well tolerated

Evaluation of a multivalent vaccine booster candidate, mRNA-1273.211, is ongoing; data expected shortly

CAMBRIDGE, Mass.--(BUSINESS WIRE)--May 5, 2021-- Moderna, Inc. (Nasdaq: MRNA), a biotechnology company pioneering messenger RNA (mRNA) therapeutics and vaccines, today announced initial data from its Phase 2 study showing that a single 50 µg dose of mRNA-1273 or mRNA-1273.351 given as a booster to previously vaccinated individuals increased neutralizing antibody titer responses against SARS-CoV-2 and two variants of concern, B.1.351 (first identified in South Africa) and P.1 (first identified in Brazil). A booster dose of mRNA-1273.351, the Company's strain-matched booster, achieved higher neutralizing antibody titers against the B.1.351 variant of concern than a booster dose of mRNA-1273. A manuscript describing these preliminary results has been submitted as a preprint to *medRxiv* and will be submitted for peer-reviewed publication upon completion of the multivalent mRNA-1273.211 booster arm.

"As we seek to defeat the ongoing pandemic, we remain committed to being proactive as the virus evolves. We are encouraged by these new data, which reinforce our confidence that our booster strategy should be protective against these newly detected variants. The strong and rapid boost in titers to levels above primary vaccination also clearly demonstrates the ability of mRNA-1273 to induce immune memory," said Stéphane Bancel, Chief Executive Officer of Moderna. "Our mRNA platform allows for rapid design of vaccine candidates that incorporate key virus mutations, potentially allowing for faster development of future alternative variant-matched vaccines should they be needed. We look forward to sharing data on our multivalent booster candidate, mRNA-1273.211, which combines mRNA-1273 and mRNA-1273.351 in a single vaccine, when available. We will continue to make as many updates to our COVID-19 vaccine as necessary to control the pandemic."

The initial data is from an ongoing Phase 2 study in which three strategies for boosting neutralizing titers in previously vaccinated participants are being evaluated: mRNA-1273.351, a booster candidate based on the B.1.351 variant first identified in the Republic of South Africa, mRNA-1273.211, a multivalent booster candidate which combines a 50-50 mix of mRNA-1273, Moderna's authorized vaccine against ancestral strains, and mRNA-1273.351 in a single vaccine, and a 50 µg booster dose of mRNA-1273. Today's update includes preliminary data two weeks following administration of a booster dose of mRNA-1273 or mRNA-1273.351. Evaluation of additional samples collected at later timepoints after the booster, the Company's multivalent vaccine candidate, mRNA-1273.211, and a lower dose of mRNA-1273.351 are ongoing and data is expected shortly.

Participants in the Phase 2 study were tested for pseudovirus neutralization (PsVN) titers prior to boosting approximately 6 to 8 months after their primary vaccination series. Although titers versus the wild-type SARS-CoV-2 virus remained high, with 37 of 40 participants having detectable titers, titers against the variants of concern (B.1.351 and P.1) were much lower, with approximately half of participants having titers below the assay limit of quantification prior to boosting. Two weeks after receiving either mRNA-1273 or mRNA-1273.351, PsVN titers were boosted in all participants and all variants tested. Following boost, geometric mean titers (GMT) against the wild-type, B.1.351, and P.1 variants increased to levels similar to or higher than the previously reported peak titers against the ancestral (D614G) strain following primary vaccination[1].

mRNA-1273.351 appeared to be more effective at increasing neutralization titers against the B.1.351 variant when compared to mRNA-1273, as evidenced by higher mean GMT levels already at 15 days following booster dose (GMT = 1400 for mRNA-1273.351; GMT = 864 for mRNA-1273). The relative decrease in neutralizing titers between the wild-type (D614G) and B.1.351 assays also improved with mRNA-1273.351 booster, from a 7.7-fold difference prior to boost to a 2.6-fold difference 15 days after boost, suggesting a potentially more balanced immune response against the tested variants.

Safety and tolerability profiles following third dose booster injections of 50 µg of mRNA-1273 or mRNA-1273.351 were generally comparable to those observed after the second dose of mRNA-1273 in the previously reported Phase 2 and Phase 3 studies. A review of solicited adverse events indicated that the vaccine boosters were generally well tolerated. The majority of adverse events were mild or moderate in severity. The frequency of any Grade 3 solicited local or systemic adverse events was 15% after the third dose of mRNA-1273 and 10.5% after the third dose of mRNA-1273.351. There were no Grade 4 solicited local or systemic adverse events. The most common solicited local adverse event was injection site pain in both groups. The most common solicited systemic adverse events after the third dose of mRNA-1273.351 or mRNA-1273 were fatigue, headache, myalgia and arthralgia. In general, mRNA-1273.351 had a lower reactogenicity profile than mRNA-1273 in this study.

In parallel, the National Institute of Allergy and Infectious Diseases (NIAID), part of the National Institutes of Health (NIH) is conducting a separate Phase 1 study of mRNA-1273.351.

About the Moderna COVID-19 Vaccine

The Moderna COVID-19 Vaccine is an mRNA vaccine against COVID-19 encoding for a prefusion stabilized form of the Spike (S) protein, which was co-developed by Moderna and investigators from the National Institute of Allergy and Infectious Diseases' (NIAID) Vaccine Research Center. The first clinical batch, which was funded by the Coalition for Epidemic Preparedness Innovations, was completed on February 7, 2020 and underwent analytical testing; it was shipped to the National Institutes of Health (NIH) on February 24, 2020, 42 days from sequence selection. The first participant in the NIAID-led Phase 1 study of the Moderna COVID-19 Vaccine was dosed on March 16, 2020, 63 days from sequence selection to Phase 1 study dosing. On May 12, 2020, the U.S. FDA granted the Moderna COVID-19 Vaccine Fast Track designation. On May 29, 2020, the first participants in each age cohort were dosed in the Phase 2 study of the vaccine. On July 8, 2020, the Phase 2 study completed enrollment.

Results from the second interim analysis of the NIH-led Phase 1 study of the Moderna COVID-19 Vaccine in the 56-70 and 71+ age groups were published on September 29, 2020 in *The New England Journal of Medicine*. On November 30, 2020, Moderna announced the primary efficacy analysis of the Phase 3 study of the vaccine conducted on 196 cases. On November 30, 2020, the Company also announced that it filed for Emergency Use Authorization with the U.S. FDA and a Conditional Marketing Authorization (CMA) application with the European Medicines Agency. On December 18, 2020, the U.S. FDA authorized the emergency use of the Moderna COVID-19 Vaccine in individuals 18 years of age or older. Moderna has also received authorization for its COVID-19 vaccine from health agencies in Canada, Israel, the European Union, the United Kingdom, Switzerland, Singapore, Qatar, Taiwan and the World Health Organization. Additional authorizations are currently under review in other countries and by the World Health Organization.

Preclinical data on the Company's variant-specific booster vaccine candidates have been submitted as a preprint to *bioRxiv* and will be submitted for peer-reviewed publication. These variant-specific vaccine candidates include mRNA-1273.351, which is more specifically targeted against the SARS-CoV-2 variant known as B.1.351 first identified in the Republic of South Africa, and a multivalent booster candidate, mRNA-1273.211, which combines mRNA-1273 (Moderna's authorized vaccine against ancestral strains) and mRNA-1273.351 in a single vaccine. The Company's Phase 2 study to evaluate three approaches to boosting is ongoing.

The Biomedical Advanced Research and Development Authority (BARDA), part of the Office of the Assistant Secretary for Preparedness and Response (ASPR) within the U.S. Department of Health and Human Services (HHS) is supporting the continued research and development of the Company's COVID-19 vaccine development efforts with federal funding under contract no. 75A50120C00034. BARDA is reimbursing Moderna for 100 percent of the allowable costs incurred by the Company for conducting the program described in the BARDA contract. The U.S. government has agreed to purchase supply of mRNA-1273 under U.S. Department of Defense contract no. W911QY-20-C-0100.

AUTHORIZED USE

Moderna COVID-19 Vaccine is authorized for use under an Emergency Use Authorization (EUA) for active immunization to prevent coronavirus disease 2019 (COVID-19) caused by severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) in individuals 18 years of age and older.

IMPORTANT SAFETY INFORMATION

- Do not administer the Moderna COVID-19 Vaccine to individuals with a known history of severe allergic reaction (e.g., anaphylaxis) to any component of the Moderna COVID-19 Vaccine.
- Appropriate medical treatment to manage immediate allergic reactions must be immediately available in the event an acute anaphylactic reaction occurs following administration of the Moderna COVID-19 Vaccine. Monitor Moderna COVID-19 Vaccine recipients for the occurrence of immediate adverse reactions according to the Centers for Disease Control and Prevention guidelines (https://www.cdc.gov/vaccines/covid-19/clinical-considerations/managing-anaphylaxis.html).
- Immunocompromised persons, including individuals receiving immunosuppressive therapy, may have a diminished response to the Moderna COVID-19 Vaccine.
- The Moderna COVID-19 Vaccine may not protect all vaccine recipients.
- Adverse reactions reported in a clinical trial following administration of the Moderna COVID-19 Vaccine include pain at the injection site, fatigue, headache, myalgia, arthralgia, chills, nausea/vomiting, axillary swelling/tenderness, fever, swelling at the injection site, and erythema at the injection site.
- Severe allergic reactions, including anaphylaxis, have been reported following administration of the Moderna COVID-19 Vaccine during mass vaccination outside of clinical trials.
- Available data on Moderna COVID-19 Vaccine administered to pregnant women are insufficient to inform vaccine-associated risks in pregnancy. Data are not available to assess the effects of Moderna COVID-19 Vaccine on the breastfed infant or on milk production/excretion.
- There are no data available on the interchangeability of the Moderna COVID-19 Vaccine with other COVID-19 vaccines to complete the vaccination series. Individuals who have received one dose of Moderna COVID-19 Vaccine should receive a second dose of Moderna COVID-19 Vaccine to complete the vaccination series.
- Additional adverse reactions, some of which may be serious, may become apparent with more widespread use of the Moderna COVID-19 Vaccine.
- Vaccination providers must complete and submit reports to VAERS online at https://vaers.hhs.gov/reportevent.html. For further assistance with reporting to VAERS, call 1-800-822-7967. The reports should include the words "Moderna COVID-19 Vaccine EUA" in the description section of the report.

Click for Fact Sheet for Healthcare Providers Administering Vaccine (Vaccination Providers) and Full EUA Prescribing Information for more information.

About Moderna

In 10 years since its inception, Moderna has transformed from a science research-stage company advancing programs in the field of messenger RNA (mRNA), to an enterprise with a diverse clinical portfolio of vaccines and therapeutics across six modalities, a broad intellectual property portfolio in areas including mRNA and lipid nanoparticle formulation, and an integrated manufacturing plant that allows for both clinical and commercial production at scale and at unprecedented speed. Moderna maintains alliances with a broad range of domestic and overseas government and commercial collaborators, which has allowed for the pursuit of both groundbreaking science and rapid scaling of manufacturing. Most recently, Moderna's capabilities have come together to allow the authorized use of one of the earliest and most-effective vaccines against the COVID-19 pandemic.

Moderna's mRNA platform builds on continuous advances in basic and applied mRNA science, delivery technology and manufacturing, and has allowed the development of therapeutics and vaccines for infectious diseases, immuno-oncology, rare diseases, cardiovascular diseases and

auto-immune diseases. Today, 24 development programs are underway across these therapeutic areas, with 13 programs having entered the clinic. Moderna has been named a top biopharmaceutical employer by *Science* for the past six years. To learn more, visit www.modernatx.com.

Forward-Looking Statements

This press release contains forward-looking statements within the meaning of the Private Securities Litigation Reform Act of 1995, as amended, including statements regarding: the Company's development of a vaccine (mRNA-1273) to protect against the SARS-CoV-2 virus, which causes COVID-19; the Company's efforts to develop vaccines and boosters against variants of the SARS-CoV-2 virus; the potential for vaccines and boosters, including boosters designed for variants of concern (B.1.351 and P.1) to increase neutralizing antibody titer responses against SARS-CoV-2 and those particular variants; the need for booster vaccines against the SARS-CoV-2 virus and its variants and the potential dosages for those booster vaccines; the conduct of clinical studies for variant-specific boosters; the duration of protection against SARS-CoV-2 from existing vaccines; the safety and tolerability of the Company's booster candidates; and the ability of the Company's mRNA platform to facilitate the rapid design of vaccine candidates that incorporate key virus mutations. In some cases, forward-looking statements can be identified by terminology such as "will," "may," "should," "could," "expects," "intends," "plans," "aims," "anticipates," "believes," "estimates," "predicts," "potential," "continue," or the negative of these terms or other comparable terminology, although not all forward-looking statements contain these words. The forward-looking statements in this press release are neither promises nor guarantees, and you should not place undue reliance on these forward-looking statements because they involve known and unknown risks, uncertainties, and other factors, many of which are beyond Moderna's control and which could cause actual results to differ materially from those expressed or implied by these forward-looking statements. These risks, uncertainties, and other factors include, among others: the fact that there has never been a commercial product utilizing mRNA technology approved for use; the fact that the rapid response technology in use by Moderna is still being developed and implemented; the safety, tolerability and efficacy profile of the Moderna COVID-19 Vaccine observed to date may change adversely in ongoing analyses of trial data or subsequent to commercialization; the Moderna COVID-19 Vaccine may prove less effective against variants of the SARS-CoV-2 virus, or the Company may be unsuccessful in developing future versions of its vaccine against these variants; despite having ongoing interactions with the FDA or other regulatory agencies, the FDA or such other regulatory agencies may not agree with the Company's regulatory approval strategies, components of our filings, such as clinical trial designs, conduct and methodologies, or the sufficiency of data submitted; Moderna may encounter delays in meeting manufacturing or supply timelines or disruptions in its distribution plans for the Moderna COVID-19 Vaccine; whether and when any biologics license applications and/or additional emergency use authorization applications may be filed in various jurisdictions and ultimately approved by regulatory authorities; potential adverse impacts due to the global COVID-19 pandemic such as delays in regulatory review, manufacturing and clinical trials, supply chain interruptions, adverse effects on healthcare systems and disruption of the global economy; and those other risks and uncertainties described under the heading "Risk Factors" in Moderna's most recent Annual Report on Form 10-K filed with the U.S. Securities and Exchange Commission (SEC) and in subsequent filings made by Moderna with the SEC, which are available on the SEC's website at www.sec.gov. Except as required by law, Moderna disclaims any intention or responsibility for updating or revising any forward-looking statements contained in this press release in the event of new information, future developments or otherwise. These forward-looking statements are based on Moderna's current expectations and speak only as of the date hereof.

[1] https://www.nejm.org/doi/full/10.1056/NEJMc2102179

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