U.S. HOUSE OF REPRESENTATIVES
COMMITTEE ON SCIENCE, SPACE, AND TECHNOLOGY
HEARING CHARTER

The Science of COVID-19 Vaccines and Encouraging Vaccine Uptake

Friday, February 19, 2021
11:00 a.m. ET
Cisco WebEx

Purpose

On February 19, 2021, the Committee on Science, Space, and Technology will hold a hearing to discuss some of the processes and research achievements that allowed for several safe and effective COVID-19 vaccines to be designed, manufactured, and distributed at a record pace. The Committee will also consider how vaccine hesitancy and impediments to access may affect the pace of our national recovery from COVID-19, strategies for increasing vaccine uptake, and how scientists and vaccine developers are responding to new variants of the virus.

Witnesses

- **Dr. Kathleen Neuzil, MD, MPH,** Professor in Vaccinology and Director, Center for Vaccine Development and Global Health, University of Maryland School of Medicine
- **Dr. Philip Huang, MD, MPH,** Director and Health Authority, Dallas County Department of Health and Human Services
- **Mr. Keith Reed, MPH, CPH,** Deputy Commissioner, Oklahoma State Department of Health
- **Dr. Alison Buttenheim, PhD, MBA**, Scientific Director, Center for Health Incentives and Behavioral Economics and Associate Professor of Nursing and Health Policy, University of Pennsylvania School of Nursing

Overarching questions

- What are the safety and effectiveness profiles of the vaccines currently authorized for preventing COVID-19? How do they work?
- How should the federal government direct research funding to accelerate the administration of COVID-19 and other vaccines?
- How will slow vaccine acceptance affect the pace of the national recovery from COVID-19?
- What are the drivers of vaccine hesitancy and what are some evidence-based strategies for improving vaccine uptake?
- What additional research and disease surveillance activities are needed to ensure COVID-19 vaccines are useful against mutations of the SARS-CoV-2 virus?

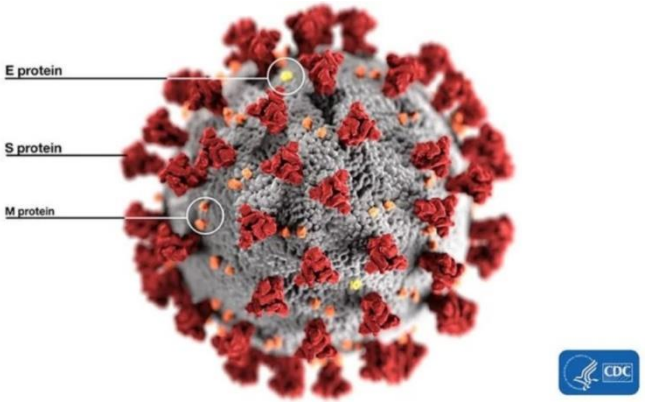
Background

As of February 16, 2021, the Centers for Disease Control and Prevention (CDC)'s Center for Health Statistics has recorded 456,689 deaths due to COVID-19 in the United States,[1] and over 1.4 million Americans have been hospitalized.[2]

As of February 16, two vaccine formulations have been granted an emergency use authorization (EUA) from the U.S. Food and Drug Administration (FDA), allowing them to be distributed for use in the United States to prevent illness from COVID-19. **Pfizer-BioNTech** began its Phase 3 trial of 43,661 participants on July 27, 2020, and concluded the trial on November 18.[3] Its trial results showed efficacy of 95% in preventing COVID-19 after the second dose, consistent across subgroups defined by age, gender, race, ethnicity, body mass index (BMI) and presence of other co-morbidities.[4] Pfizer applied to FDA for an EUA for its formulation two days later, November 20, and FDA issued the EUA on December 11. Pfizer's is a messenger RNA (mRNA) vaccine.

Moderna's formulation is also an mRNA type. Phase I clinical trials for mRNA-1273 began on March 16, 2020, just 65 days after NIH researchers first accessed the SARS-CoV-2 virus sequence.[5] The Phase 3 trial for safety and efficacy, which included 30,000 participants, began on July 27, 2020. On November 30, Moderna applied to FDA for its EUA. Its trial results showed vaccine efficacy against COVID-19 of 94.1%, efficacy against severe COVID-19 of 100%, and no serious safety concerns were identified in the cohort. Moderna was granted its EUA on December 18, 2020. Moderna announced in early January that it would increase production to provide 600 million doses in 2021.[6]

mRNA technology had never been used in a vaccine prior the Pfizer and Moderna vaccines for COVID-19. Unlike viral vector and protein-based vaccines, mRNA formulations do not put a weakened or inactivated germ into a patient. Instead, they teach cells how to make a harmless protein which is the same shape as the coronavirus spike protein, called S-2P – i.e., the protruding red nodes on the now-famous renderings of the viral structure.



The harmless protein triggered by the mRNA vaccine is recognized by our immune systems as a threat, which triggers the production of antibodies that can defend against the real SARS-CoV-2 when it is encountered.[7] The scientific foundation for mRNA vaccines and the strategy for stabilizing the protein of a virus in order to develop a vaccine was laid by researchers at the National Institutes of Health's

[1] https://www.cdc.gov/nchs/nvss/vsrr/covid19/index.htm
[2] https://gis.cdc.gov/grasp/covidnet/COVID19_5.html
[3] https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-conclude-phase-3-study-covid-19-vaccine
[4] https://www.pfizer.com/news/press-release/press-release-detail/pfizer-and-biontech-announce-publication-results-landmark
[5] https://clinicaltrials.gov/ct2/show/NCT04283461
[6] https://www.cnbc.com/2021/01/04/moderna-says-increases-2021-covid-vaccine-production-by-20percent-to-6doses-this-year.html
[77] https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/mRNA.html?ACSTrackingID=USCDC_2067-DM47392&ACSTrackingLabel=Understanding%20mRNA%20COVID-19%20Vaccines%20%7C%20COVID-19&deliveryName=USCDC_2067-DM47392

National Institute of Allergy and Infectious Disease (NIAID) and their partners from Scripps Research, Dartmouth College and the University of Texas-Austin.[8]

As with other, non-mRNA vaccines, the Pfizer and Moderna formulations work by ensuring the body's physical defenses (antibodies) are already in place and prepared to defeat infection before the patient is exposed to the virus, thus preventing symptoms of illness. It is not yet known whether either of these vaccines can prevent transmission of the virus that causes COVID-19, known as SARS-CoV-2, from someone who has been vaccinated to someone else who does not have immunity and may be susceptible to dangerous infection. Clinical trials for both shots that took place in 2020 were only designed to evaluate whether the formulations prevented disease. Pfizer is recruiting volunteers who have been vaccinated to be tested regularly for the virus to see whether its formulation prevents viral transmission as well as symptoms. Until more research is available, public health officials are assuming that vaccinated patients can still receive, carry, and transmit the virus – and as such, should continue wearing masks and adhering to social distancing guidelines. Like all other vaccines approved for use in the United States, mRNA formulations do not use the live virus that causes COVID-19 and cannot give a patient the virus. mRNA vaccines (and any other type of vaccine) do not affect or interact with DNA.[9]

On February 4, **Johnson & Johnson** applied to FDA for an EUA for its single-shot vaccine candidate, which was developed by its Belgian subsidiary Janssen Pharmaceuticals. Phase 3 trials evaluated 43,783 participants, ages 18 and older. The vaccine candidate protected against moderate to severe COVID-19 infection in 72% of patients, was 85% effective at preventing severe disease and provided 100% protection against COVID-related hospitalization and death.[10] Johnson & Johnson reported that unlike the Moderna and Pfizer formulations, the Janssen candidate is stable when stored in regular refrigerators, eliminating special cold chain requirements in the distribution logistics. The FDA Vaccines and Related Biological Products Advisory Committee (VRBPAC) meeting to debate and vote on an EUA for single-shot version of the Janssen candidate will take place on February 26.[11]

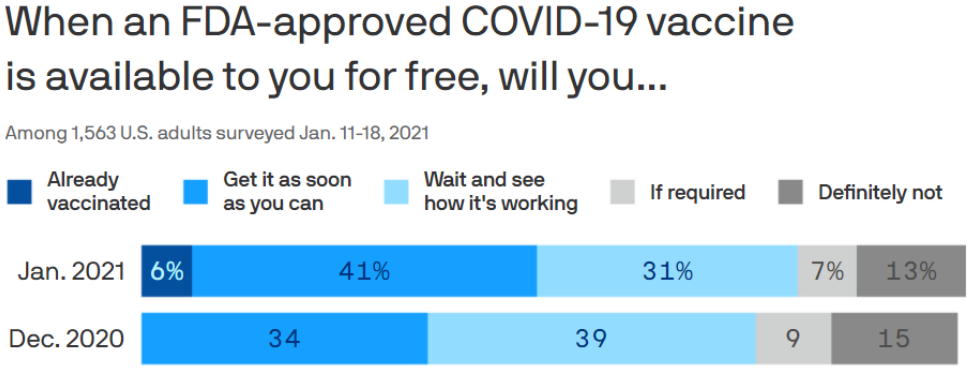
Vaccine uptake

As of February 16, more than 55 million COVID-19 vaccines have been administered in the United States, reaching 11.5% of the population, and 4.2% of Americans have received both doses of either the Pfizer or Moderna regimen. The rate of administration has reached 1.6 million shots per day.[12] In the earliest weeks of commercial rollout for COVID-19 vaccines, demand has far outstripped supply. But as the rate of production increases and new formulations enter the marketplace, vaccine hesitancy may begin to affect the pace and equitability of our national recovery more significantly.

The World Health Organization defines *vaccine hesitancy* as a "delay in acceptance or refusal of vaccines despite availability of vaccination services." Vaccine hesitancy is growing worldwide and was identified

[8] See 2016 Nature Magazine publication, "Pre-fusion structure of a human coronavirus spike protein" at https://www.nature.com/articles/nature17200 and 2017 PNAs publication, "Immunogenicity and structures of a rationally designed prefusion MERS-CoV spike antigen" at https://www.pnas.org/content/114/35/E7348.
[9] https://www.cdc.gov/coronavirus/2019-ncov/vaccines/different-vaccines/how-they-work.htm
[10] https://www.jnj.com/johnson-johnson-announces-single-shot-janssen-covid-19-vaccine-candidate-met-primary-endpoints-in-interim-analysis-of-its-phase-3-ensemble-trial
[11] https://www.fda.gov/news-events/press-announcements/coronavirus-covid-19-update-fda-announces-advisory-committee-meeting-discuss-janssen-biotech-incs
[12] https://www.npr.org/sections/health-shots/2021/01/28/960901166/how-is-the-covid-19-vaccination-campaign-going-in-your-state

by the WHO as one of the top ten global health threats in 2019. For COVID-19 in particular, a Kaiser Family Foundation poll in December found that 27% of Americans "probably or definitely" would not get a vaccine even if it were available for free.[13] The incidence of hesitancy appears to be falling.[14,15] A September survey by KFF found 63% of the American public saying they would "definitely or probably" get a vaccine for COVID-19 if it was determined to be safe and available for free. That number had increased to 71% by December.[16] KFF saw further upticks in acceptance between December and late January 2021.



Reproduced from Kaiser Family Foundation COVID-19 Vaccine Monitor; Axios Chart Visuals.

Public polling also suggests that patients who are unsure about whether they will accept a COVID-19 vaccine greatly outnumber those who refuse the vaccine outright.

However, the incidence of vaccine hesitancy is not evenly distributed across the United States. While vaccine trust is trending in the right direction, KFF found that Black adults (43%) and Hispanic adults (37%) are more likely than white adults (26%) to say they want to "wait and see." Hesitancy in communities of color does seem to be a factor in the larger pattern of racial inequality during COVID-19. Data from early February indicates that White Americans are being vaccinated at rates up to three times higher than Black Americans.[17] Furthermore, several states have reported disproportionately high levels of vaccine refusals – around 50% – among nursing home workers.[18]

Variants in the Virus

Several new mutations of the original virus that causes COVID-19 have been reported around the world. A new variant called B117, which seems to be more transmissible than the initial strain, emerged in the United Kingdom in December. As of January 22, infections with the B117 variant had been detected in 12 U.S. states. A new strain first identified in South Africa, B1.351, caused a regional spike in cases of COVID-19 in January. Virologists have observed that this variant is more contagious than SARS-COV-2 and that it can infect people who already have antibodies from a prior infection. A third variant dubbed P.1 emerged as early as July 2020 around Rio de Janeiro, Brazil.

[13] https://www.kff.org/coronavirus-covid-19/report/kff-covid-19-vaccine-monitor-december-2020/
[14] https://www.axios.com/vaccine-hesitancy-improving-disparities-ff23b84e-b3bc-4370-ab70-8c340d7b5427.html
[15] https://www.kff.org/report-section/kff-covid-19-vaccine-monitor-january-2021-vaccine-hesitancy/
[16] https://www.kff.org/coronavirus-covid-19/report/kff-covid-19-vaccine-monitor-december-2020/
[17] https://khn.org/news/article/black-americans-are-getting-vaccinated-at-lower-rates-than-white-americans/
[18] https://www.npr.org/2021/01/31/962529002/patience-is-key-when-reacting-to-health-care-workers-who-refuse-the-covid-19-vac

As the virus mutates, vaccine manufactures are working to determine the efficacy of their formulations against new variants. Pfizer and Moderna have reported that the effectiveness of their vaccines against the British variant is similar to that of SARS-COV-2, and they are slightly less protective against the South African variant. As a result, companies are working to determine whether booster shots or slight reformulations may be necessary.[19]

The percentage of people who need to be immune to a disease to achieve herd immunity, either through vaccination or immunity developed during an earlier infection, varies as a function of the transmissibility of the disease. For example, to achieve herd immunity for measles 95% of the population must be immune, while for polio that number is 80%.[20] Recent research suggests that 60-90% of a population must be vaccinated for herd immunity against COVID-19.[21] Additional study is needed to refine the estimate.[22] In any event, where more transmissible COVID mutations are taking hold, higher vaccination coverage rates may be needed to achieve herd immunity.[23] The emergence of viral variants increases the urgency to administer vaccines as quickly and widely possible in order to both reduce the spread of these more transmissible variants and to avoid the development of new mutations.

In November, CDC launched a national Strain Surveillance program to identify and track new variants of SARS-COV-2 in the United States by conducting genomic surveillance and sequence analysis.[24]

[19] https://www.nytimes.com/2021/01/25/health/coronavirus-moderna-vaccine-variant.html
[20] https://www.who.int/news-room/q-a-detail/herd-immunity-lockdowns-and-covid-19
[21] https://www.lung.org/blog/understanding-covid-herd-immunity
[22] https://www.news-medical.net/news/20201204/Herd-immunity-threshold-far-higher-than-previously-thought-say-researchers.aspx
[23] https://www.cdc.gov/mmwr/volumes/70/wr/mm7003e2.htm
[24] Ibid.