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## Editorial

# COVID-19 vaccination: science, politics and public health

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The severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) virus genetic code was published online by Chinese scientists on January 10, 2020, and the first scientific articles on COVID-19 came shortly after.<sup>1</sup> The first article in *Science* in February 2020 described the viral spike protein that is now being used as a vaccine antigen to stimulate immunity.<sup>2</sup> The spike protein makes up the projections on the viral particle that allows it to bind to the angiotensin-converting enzyme 2 receptor, enter human cells, and deliver its genome to that cell. The virus then uses the infected cell's molecular machinery to replicate more virus. On March 11, 2020, the World Health Organization recognized the extent of viral spread and declared the COVID-19 pandemic. In the short space of 10 months, scientists built on the genomic knowledge of the virus to develop vaccines that went from clinical trials to being administered across the globe. Several vaccine developers, including Pfizer and Moderna, used a novel approach to stimulate immunity using a messenger RNA (mRNA) vaccine. Moderna was able to begin clinical trials in 66 days after publication of the viral genomic code.<sup>3</sup> Their previous work using the mRNA approach for the Mediterranean East Respiratory virus allowed them to quickly develop the SARS-CoV-2 virus vaccine. Other companies are using different approaches (for example, protein subunit vaccine, attenuated vector vaccine) to develop vaccines against the SARS-CoV-2 virus. COVID-19 vaccine development was crowned as the breakthrough of the year by *Science*.<sup>4</sup>

So how does the mRNA vaccine work? First, it is important to note that the rationale of these novel vaccines is the same as for any vaccine. A COVID-19 vaccine—and in fact all vaccines—alerts the body's immune system to the identity of a virus by presenting some unique identifying feature, often a copy of a viral protein to immune cells. The aim of a vaccine is to create a surveillance force of antibodies and killer T cells that can spot and remove the real virus should it enter the body. The most effective vaccines create “memory” T cells that endure for long periods and are easily activated to eliminate the virus should it be encountered.

The mRNA vaccine is unique in that it is taken up by the cell and uses its molecular machinery to induce accurate expression of the 3-dimensional structure of the folded and glycosylated immunity stimulating protein (spike protein for current SARS-CoV-2 vaccines). The manufactured spike protein then stimulates the production of host antibodies and T cells specifically trained on the spike protein.<sup>3</sup> Antibodies can attach to viral proteins, such as the SARS-CoV-2 virus spike protein, and disrupt viral function and replication through a variety of mechanisms. There are many advantages to the mRNA vaccine approach including rapid development and production and low cost. On the flip side, owing to the fragility of mRNA, these mRNA vaccines must be stored at extremely low temperatures.

The US federal government spent billions of dollars on Operation Warp Speed to support the development and testing of these vaccines. Operation Warp Speed was a collaborative public-private effort engaging the Department of Health and Human Services, Centers for Disease Control and Prevention, the National Institutes of Health, the Biomedical Advanced Research and Development Authority, and the Department of Defense, as well as private pharmaceutical firms.

In October 2020, the ADA House of Delegates passed resolution 20H-2020 stating that dentists should be able to administer critical vaccines, perform US Food and Drug Administration—authorized tests screening for infectious diseases, and perform ancillary medical procedures requested by medical personnel.<sup>5</sup> However, administration of vaccinations by dentists has been and continues to be widely restricted in the United States because of dental practice acts and state dental boards. Many states consider vaccination as being the practice of

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medicine and outside the scope of dental practice, though several states now allow dentists to provide vaccination. In some states, dentists are active in the massive undertaking to vaccinate the US public for the SARS-CoV-2 virus.

On January 4, 2021, the California Department of Consumer Affairs announced that the director waived business and professional codes prohibiting licensed dentists from administering the COVID-

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19 vaccines, thus enabling dentists to administer US Food and Drug Administration–approved vaccines for people aged 16 years or older.<sup>6</sup> This waiver was predicated on the condition that dentists complete COVID-19 vaccination training and that they should be knowledgeable about immunization best practices and understand vaccine characteristics and administration. Online training is available through the Center for Disease Control and Prevention's Web site.<sup>7</sup> My introduction to this editorial was partly to inform readers as to the technology and working of these mRNA vaccinations. I also wanted to share the incredible story of this fast-paced journey of science on the move to improve health.

Most states do not allow dentists to administer any vaccinations, including those for COVID-19.<sup>8</sup> Without question the task of vaccinating enough people in the United States to create herd immunity ( $\approx$  60-70% of the population) is daunting. Increasing the number of clinicians qualified to administer vaccine can only accelerate

the country's path to health. It is therefore imperative for regulators of dental practice in all states to allow dentists to provide vaccines.

The COVID-19 pandemic presents a public health issue of grave consequence with thousands of people in the United States dying every day. Concern over maintaining narrow definitions for the scope of dental practice is outweighed by concern for the public's health. State regulators need to help be part of the solution by lifting restrictions that prevent dentists from joining their health care colleagues in the fight against COVID-19. Dentists should be allowed to get out there and help vaccinate the people of the United States. ■

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