January 14: New SARS-CoV-2 Strains and Vaccination Side Effects

*Today's issue features information from Infectious Disease Specialist **Egon A. Ozer, MD, PhD**, about the new more-virulent strains of SARS-CoV-2. It also includes an overview of vaccination side effects.*

NEW COVID-19 STRAINS

SARS-CoV-2, the virus that causes COVID-19, has been mutating and changing its genetic sequence since the beginning of the pandemic and continues to do so today. More than 29,000 nucleotides in the SARS-CoV-2 genome are evolving at a rate of roughly 22.6 changes per year. This baseline mutation rate marks SARS-CoV-2 as one of the slowest-changing human viruses, and is orders of magnitude behind other viruses such as Hepatitis B, HIV and influenza, which have between a 1,000- to 100,000-fold higher evolutionary rate.

Some of the mutations that have appeared in SARS-CoV-2 during the past year have been quite consequential. For instance, an important mutation in the spike protein gene ("S"), a viral structure known to be important for attachment of the virus to human cells, is thought to have occurred in early February 2020. This one change in the protein sequence, referred to as D614G, was associated with more efficient binding of the protein to cells, as well as increased amounts of virus in the noses and throats of individuals with COVID-19. These two characteristics may have resulted in an increased transmissibility potential for the virus. The possible effect of this change is that viruses with the D614G mutation quickly became predominant and now represent more than 99% of all SARS-CoV-2 viruses around the world.

As SARS-CoV-2 continues to cause infections globally, it also continues to mutate and evolve. Recent variant viruses with specific combinations of mutations of concern to scientists and public health experts have been identified in different countries. One of these variant virus lineages is identified in the lay press as the "UK variant," and also as B.1.1.7 or VUI202012/01. This variant of the virus was first identified in Southeast England on September 20.

The B.1.1.7 variant is unique in that it appears to have acquired a large number of mutations in a short amount of time, which suggests that the virus may have evolved during a prolonged infection with increased evolutionary pressure associated with immune responses and/or medical treatments. Many of the new mutations occur in the spike protein gene and are thought to further enhance the virus' affinity for human cell binding. This variant has attracted attention for the rapidity of its spread in the UK.

Since it was first detected in mid-September, the B.1.1.7 variant has become the second-most common version of the virus causing infections in the UK. During the national lockdown between

November 5 and December 2, researchers reported that this variant increased its spread, whereas all other variants of the virus in the UK decreased in frequency. This has raised concern that variant B.1.1.7 could be more adept at overcoming public health measures, such as physical distancing and masking, although other explanations are possible and require further investigation. Since its peak in late December, infections with this variant have slowly decreased in the UK. The variant has spread beyond the UK to other countries in Europe and also to the U.S., where the Centers for Disease Control and Prevention (CDC) has reported 72 cases in 10 states as of January 11. Despite its rapid spread in the UK, epidemiologic evaluations have not shown this variant to cause more severe disease symptoms.

A separate variant of the virus has recently arisen in South Africa. This variant, identified as B.1.351 or 501Y.V2, was first identified in the country in October. It has since expanded to become the predominant variant causing new infections in South Africa. To date, the spread beyond South Africa has been limited, with sporadic cases reported around the world and none in the U.S. to date. The South Africa variant also has several mutations in the spike protein. Some of these mutations, like N501Y, are shared with the UK variant B.1.1.7.

One spike protein mutation not found in the UK variant, E484K, has raised concern, as it has been connected to possible reduced effectiveness of convalescent serum and monoclonal antibody treatments. When researchers exposed SARS-CoV-2 viruses to these treatments in the lab, they found that some viruses that escaped killing by the antibodies had spontaneously developed mutations that included the E484K mutation. They also found these evolved viruses resisted killing by convalescent serum from other recovered COVID-19 patients, but most sera still had activity against the virus. To date, tests have not found any variant of SARS-CoV-2 viruses that escape the antibody response produced by the COVID-19 vaccines, but studies will be ongoing as vaccination becomes more widespread.

A research collaborative in the Infectious Diseases Division of Northwestern University Feinberg School of Medicine — led by **Egon A. Ozer, MD, PhD**; **Judd F. Hultquist, PhD**; and **Ramon Lorenzo Redondo, PhD** — has an ongoing screening program to perform genetic surveillance of SARS-CoV-2 in Chicago. To date, they have sequenced and analyzed more than 700 isolates dating back to March 2020 to study SARS-CoV-2 variants circulating in the city and are participating in the global effort to track changes in the virus through the sharing of genetic sequences. These efforts have not uncovered either the UK or the South Africa variants in Chicago to date, but we will continue to closely monitor the virus as the pandemic continues.

For more information on emerging variants of SARS-CoV-2, visit the **Emerging SARS-CoV-2 Variant page** on the CDC website and **Tracking of Variants page** on the Global Initiative on Sharing All Influenza Data (GISAID) website.

VACCINATION SIDE EFFECTS

To date, NM has administered 21,826 first-dose COVID-19 vaccines and 11,700 second doses. Adverse side effects — including local reactions such as redness, swelling and pain at the injection site, as well as systemic symptoms, such as fever, myalgias, headache and fatigue — were reported in clinical trials for both vaccines at a higher frequency among individuals who received the vaccine compared to placebo.

Both Moderna and Pfizer-BioNTech data also indicate increased incidence of adverse reactions after the second dose of the vaccine. Pfizer-BioNTech reported the incidence of fever was 3.7% after the first dose and 15.8% after the second. While having adverse reactions post-vaccination

may indicate the robust immune response generated by the vaccine, it is important to note that lack of adverse reactions does not mean that the vaccine is ineffective.

During the first month of vaccine administration, 888 reports of adverse side effects were submitted through the Adverse Reaction Questionnaire available on NM Interactive (NMI). Of those, 127 reports were submitted after the second dose. The most common adverse reactions are pain at the injection site, followed by chills, myalgias and headache. While fever is less frequent, it has been reported in 20% of people submitting the questionnaire following administration of the second dose. Most of these symptoms resolve within 24 to 48 hours.

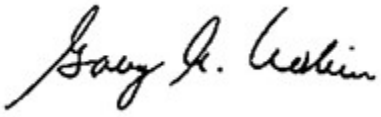
Following the second dose, 29% of individuals reported missing work; however, many of these were due to employees not updating their NM Workforce app for symptom attestation. The app has been updated to distinguish between symptoms that are likely secondary to the vaccine (chills, headache) versus those that may indicate a current COVID-19 infection (fever, loss of taste or smell). For more information about installing the update, please review the **Updating the NM Workforce App** instructions.

Remember, if you have not yet done so, please complete the opt-in/opt-out COVID-19 vaccination form via the NM Workforce app or online at **nmsymptomcheck.nm.org**. Those who have already received the vaccine can help educate their colleagues through a variety of ways:

- Participate in the **"Why I Got Vaccinated"** campaign.
- Debunk myths about the COVID-19 vaccine when you hear or read them.
- Share this recent **HealthBeat article** to help explain the vaccine.
- Encourage colleagues to go to **nm.org/covid-19** for more information and resources.
- Check out the "Doses of Truth" segments on the **Why I Got Vaccinated** page.

Several educational resources are available on the **Vaccine and Treatment Resources page on Physician Forum** and the **Vaccine and Treatment Resources page on NM Interactive** (login required).

Thank you for your continued commitment to our *Patients First* mission, and active participation in the NM vaccination program.



Gary A. Noskin, MD
Senior Vice President, Quality
Northwestern Memorial HealthCare
Chief Medical Officer
Northwestern Memorial Hospital