

[This article was published in the NEMSN Newsletter, November-December 2021.]

# Update: Good, Bad and Ugly of the Covid-19 Pandemic

*by Stephen Naylor Ph.D.*

## 1. Introduction

We have all suffered over the past eighteen months from the trauma, trials and tribulations of the Covid-19 pandemic. The first case officially reported in the USA was on January 19, 2020 when a 35-year-old man was diagnosed in Washington State with Covid-19. The World Health Organization (WHO) declared the SARS-CoV-2 virus infection a pandemic on March 11th, 2020. Today (November 2021) there are approximately 250 million individuals worldwide that have been infected with SARS-CoV-2 resulting in approximately 5.2 million deaths. In the USA about 47 million people have been infected and close to 750,000 individuals have died from the SARS-CoV-2 virus (see <https://coronavirus.jhu.edu/map.html>). The outcry over the effects and consequences of the pandemic has grown voluminous, and origins of the SARS-CoV-2 virus are now hotly debated. Most of the scientific community has suggested that the infection occurred via zoonotic (animal to human) transfer from bats, possibly via another animal (e.g. pangolin) to humans. More recently, a growing number of individuals have argued that SARS-CoV-2 was (accidentally) released from the Wuhan Institute of Virology in China (WIH). In either case, no definitive data exists to confirm or refute the origin of the virus.

A more pressing matter over the past twelve months has been the development of safe and effective treatments for Covid-19. The Trump administration initiated the “Warp Speed” program in which the Federal Government subsidized the rapid development of vaccine products against SARS-CoV-2. This was followed with a successful rollout by the Biden administration of three different vaccine products developed by Moderna, Pfizer-BioNTech, and Johnson and Johnson. To date, about 192 million Americans have been fully vaccinated, representing approximately 58% of the population (see: <https://ourworldindata.org/Covid-vaccinations?country=USA>). This has resulted in a precipitous drop in infections and mortality in the USA. However, this remarkable and successful effort is being challenged by the emergence of SARS-CoV-2 variants (also known as mutations). All infectious viruses can mutate as they undergo their insidious life cycle inside the human host. This can result in new viral strains that may be more contagious, transmissible, or deadly. The current concern is that such a situation may be developing now with SARS-CoV-2 variants. These emerging variants may not be as effectively treated with existing vaccines.

The scientific and clinical communities have made significant progress in understanding how SARS-CoV-2 infects humans. Indeed, to date, there have been over 200,000 scientific/clinical papers published on SARS-CoV-2/Covid-19 in the past 21 months! This virus is one of the most widely studied infectious agents in history, given the condensed period of time. The remarkable complexity of how this virus infects and sickens humans is now much better understood. This has led to the development of effective therapies such as antibodies and vaccines. However, the subtleties and wide-ranging impact on children, young adults, and the elderly are now better recognized and characterized. In children a symptomological variation was identified and named Multisystem Inflammatory Syndrome (MIS-C). In some adult patients who had recovered from the original infection, a secondary set of symptoms referred to as “Long-Haul Covid” was manifested. The past 18 months has seen good, bad and ugly developments as the Covid-19 pandemic continues to ravage and impact us all.

## **2. Origins of SARS-CoV-2 Pandemic**

The scientific literature and media reported in early 2020 that SARS-CoV-2 originated in the city of Wuhan, Hubei Province, China. Conspiracy theories notwithstanding, it was suggested that the virus originated from the “local” bat population and was transferred to humans via another animal species like the pangolin (a scaly anteater). Chinese health authorities noted in either mid-November or early December 2019 (the exact dates are disputed), that there were a small number of unusual infections in Wuhan. An alert was subsequently sent to the World Health Organization (WHO) on December 31, 2019. The Chinese authorities shut down the city of Wuhan, which has frequently been labeled as “ground zero” for the pandemic outbreak. However, subsequent retrospective analyses of blood-donor samples revealed that patients in the United Kingdom and Italy had been infected as early as September 2019, and in the USA as early as December 2019. In addition, Peter Forster of the University of Cambridge published a phylogenetic (comparative genetic map) analysis indicating that the virus did not originate in Wuhan, but in Shenzhen (Guangdong Province, China), where a bat was captured with 96% homology (identical genetic sequence) to the SARS-CoV-2 virus. Whilst the origins and timelines are still uncertain, there was a general consensus that bats were the original source of the virus and zoonotic transfer was the mechanism of infection. This was predicated on the fact that years earlier, a similar infectious agent, the SARS-CoV-1 virus (origin-believed to be bats via civets to humans), caused the SARS outbreak of 2003 resulting in 8,422 infected individuals, and a fatality rate of 11%. Also, the 2012 MERS-CoV viral outbreak (origin-believed to be camels) infected a total of 2,494 patients with a fatality rate of approximately 25%. Other zoonotic viruses include rabies, Hantaviruses, yellow fever virus, hemorrhagic fever virus, Zika virus, Rift Marburg and Ebola viruses, and monkeypox virus, to name but a few examples, thus providing a strong scientific precedent for zoonotic transfer of SARS-CoV-2.

The Chinese government has displayed an intransigency and opaqueness with regard to the origins of the Covid-19 pandemic. This has fueled distrust and stoked concerns that the SARS-CoV-2 virus actually escaped from the Wuhan Institute of Virology (WIV).

Initially, such claims were more geo-politically motivated. However, in May 2021 a group of eminent scientists wrote to the journal *Science* calling for a thorough and objective investigation into the origins of the SARS-CoV-2 virus. They wrote that more careful fact gathering needs to occur, and the “accidental laboratory release” theory needs to be given equal consideration. Simultaneously science writer Nicholas Wade wrote an objective, carefully researched paper suggesting that the evidence supported accidental release of a modified virus (known as a Gain-of-Function virus) that became known as SARS-CoV-2 (see <https://thebulletin.org/2021/05/the-origin-of-Covid-did-people-or-nature-open-pandoras-box-at-wuhan/>). There is a growing belief in the scientific community and in the media that the virus came from the WIV. However, there is no direct, substantive evidence that such an event occurred. The same statement can also be made about possible zoonotic transfer of SARS-CoV-2. Thus the debate continues to simmer, and it is possible we may never know the full truth. What is important to recognize is that all of us were woefully underprepared for such an event. It is also imperative moving forward that infrastructure is put in place now for what is an inevitable next pandemic

### 3. Vaccine Success & Failure

**A. Success:** Vaccines are the gold standard for prevention and treatment of viral infections. Almost all of us have been subject to vaccination throughout our lives. As a child you might have received the Measles/Mumps/Rubella as well as the Polio vaccine, and many adults get an annual Seasonal Flu vaccine. Vaccines typically contain the actual infectious agent that causes the disease. The challenge is to ensure that the vaccine does not harm the recipient, but elicits an immune response to produce antibodies against the pathogen. In order to achieve this goal, the patient usually receives a dead or weakened, less virulent virus. More recently, new approaches using specific strands of DNA or RNA found in the pathogen have been used in order to further minimize the potential of the vaccine to cause an inadvertent patient infection. These types of approaches have been used to develop our current SARS-CoV-2 vaccines. The considerable advantage of such vaccines is that they actually prevent the infectious agent pathology, without the danger of the patient becoming sick. In addition, the vaccine confers some patient immunity that can last from months to years.

There are currently 91 ongoing clinical trials worldwide for a vaccine against SARS-CoV-2. In addition, 22 vaccines have been approved in various countries for use to prevent SARS-CoV-2 infection (see: <https://www.raps.org/news-articles/2020/3/covid-19-vaccine-tracker>). Not all 22 vaccines are available in the USA. For example, the Sputnik V, Sputnik Light (both Russia) and CoronaVac (China) vaccines were rushed through sparsely regulated clinical trials. The FDA deemed these trials as questionable and non-rigorous and classified the vaccines as unacceptable. In the case of the Oxford University-AstraZeneca vaccine some adverse patient reactions were observed in clinical trials. This stopped the FDA from approving this vaccine for use in the USA, but it is widely available in Europe and around the world.

The development of a vaccine can typically take years. But in the USA, given the exigent circumstances and a remarkable partnership between private companies and federal government, three different vaccines were developed in only 18 months. The FDA issued Emergency Use Authorization (EUA) in early 2021 for the Pfizer-BioNTech, Moderna and Johnson & Johnson/Janssen (J&J) vaccines against the SARS-CoV-2 virus. In August 2021 the FDA granted full approval for the Pfizer-BioNTech vaccine use in adults, Moderna has completed a request for full approval, and J&J predicts full approval by the end of 2021. The rollout of the vaccines under EUA led to an initial significant decline in the number of daily infections because about 191 million Americans (close to 58% of population) have now been fully vaccinated.

The three vaccines and their safety and efficacy status are described below:

**i) Moderna Vaccine:** This is a novel mRNA vaccine. It does not contain any part of the original living virus, and thus you cannot get Covid-19 from this vaccine. A strand of mRNA is used to make a harmless, individual piece of the virus known as the “Spike Protein”. Your immune system then makes antibodies against this decoy spike protein. If or when the real virus infects you, the new spike protein antibodies your body has produced recognize and interact with the SARS-CoV-2 spike protein, rendering the virus inactive. This vaccine is given to you as an injection into the muscle. You must receive two vaccine doses administered one month apart. If you are immunocompromised, it is recommended that you receive a third dose of the vaccine at least one month after the second dose. Studies have shown that this vaccine and its route of administration is extremely effective, leading to 94-96% protection efficacy of the patient. All the data indicates that this vaccine is extremely safe. However, patients have reported injection site reactions, which can include swelling (hardness), redness and pain, tenderness and swelling of the lymph nodes in the same arm of the injection. More general side effects can include fatigue, headache, muscle pain, joint pain, chills, nausea, vomiting and fever. There are anecdotal reports that these adverse responses can be more severe in EMS patients. In addition, severe side effects have been reported in a very small portion of the population (less than 0.01%) and include an allergic response to the injection, myocarditis (inflammation of the heart muscle) and pericarditis (inflammation of the lining outside the heart).

**ii) Pfizer/BioNTech Vaccine:** This vaccine was given full approval by the FDA and is now known and marketed as the Comirnaty vaccine. Please note this is identical to the “old” Pfizer-BioNTech vaccine. When a drug/vaccine is fully approved (rather than by EUA) by the FDA, then, by convention, a commercial name is given to the drug/vaccine, in this case Comirnaty. Comirnaty is also an mRNA vaccine and works in an identical manner as described above for the Moderna vaccine. This vaccine is also given to you as an injection into the muscle. You receive two vaccine doses administered three weeks apart. If you are immunocompromised, it is recommended that you receive a third dose of the vaccine at least one month after the second dose. Studies have shown that this vaccine and its route of administration is also extremely effective, leading to 92-94% protection

efficacy of the patient. The safety profile of this vaccine is very similar to that of the Moderna vaccine, with injection site discomfort and other adverse effects, as described in more detail above. For patients still considering vaccination against SARS-CoV-2, there is little to differentiate the Pfizer-BioNTech and Moderna vaccines, with the exception that Pfizer-BioNTech has moved more effectively through the bureaucracy in dealing with the FDA in gaining full approval of their vaccine.

**iii) Johnson & Johnson (Janssen) Vaccine:** This vaccine is different from the Moderna and Pfizer-BioNTech vaccines. In this case a viral vector (Adenovirus 26) has had its DNA genome altered to express the aforementioned spike protein found in SARS-CoV-2. This viral vector (manner in which the DNA is delivered) cannot replicate inside your body but it forces your own cells to produce a version of the spike protein, which your body then produces antibodies against. This vaccine is given to you as an injection into the muscle. However, in this case only a single dose of the vaccine is required. No recommendations have been provided or recommended for immunocompromised patients. Studies have shown that this vaccine and its administration protocol is less effective than the Moderna and Pfizer-BioNTech vaccines with a 70-80% protection efficacy of patients. Recently Johnson & Johnson reported that a second dose of their vaccine leads to approximately 90% protection efficacy of patients, comparable to the two mRNA vaccines. An FDA advisory panel recommended in mid-October 2021 that a second shot of the Johnson & Johnson should be administered at least two months after the first shot.

The safety profile of the Johnson & Johnson vaccine is somewhat different from the other two vaccines. Injection site reactions include pain, redness of the skin and swelling. In addition, general side effects can include headache, fatigue, muscle aches, nausea, fever, swollen lymph nodes, paresthesia, tinnitus, diarrhea, vomiting, and allergic reactions. There is a remote chance that this vaccine can cause blood clots and low platelet levels, particularly in women aged 18-49. This condition has typically manifested one to two weeks after vaccination. Finally, Guillain Barré Syndrome (a neurological disorder in which the body's immune system damages nerve cells, causing muscle weakness and sometimes paralysis) has occurred in some people who have received this vaccine. In most of these people, symptoms began within 42 days following administration of the vaccine. The chance of having this occur is exceedingly low. In addition, please see the FDA website which contains much more information on the three vaccines

(<https://www.fda.gov/consumers/consumer-updates/learn-more-about-Covid-19-vaccines-fda>).

**B. Partial Failure:** The development and rollout of the three Covid-19 vaccines is without a doubt one of the major success stories of the pandemic. This bright light on an otherwise bleak tapestry of pandemic experiences has been somewhat sullied by the lack of clarity on Covid-19 vaccine booster shots. It is important to consider what happens to you once you have received your vaccine. As discussed above, your body produces antibodies against SARS-CoV-2 that protect you from further infection, but for how long? In the case of a polio vaccine, protection is afforded for a lifetime of immunity.

However, it is unclear at the present time as to how long the three Covid-19 vaccines confer protection on an individual. In addition, the SARS-CoV-2 virus is continually mutating to produce new variants (see below), and it is unclear how effective the current vaccines are against some of the more recent variants such as Delta, Mu and Nu SARS-CoV-2 viruses.

The consideration of if, when and why an individual should possibly receive a booster vaccine shot is clearly very complicated. Also, public health officials are trying to make difficult decisions, even though they are missing key data and information about the current three approved Covid-19 vaccines. However, the media, public health officials, local, state and federal government and regulatory agencies such as the FDA and CDC have all contributed to a comedy of errors in terms of “advice” provided to the public. For example, Dr. Rochelle Walensky (Director of CDC) recently overrode a CDC Advisory Panel on the suitability of a Pfizer-BioNTech booster shot for frontline workers. President Biden recently made media headlines on receiving his booster shot. This was in direct contradiction to a published manuscript in the premier medical journal *The Lancet*. The authors of this article argued, “Although the idea of further reducing the number of Covid-19 cases by enhancing immunity in vaccinated people is appealing, any decision to do so should be evidence-based and consider the benefits and risks for individuals and society”. They provided data supporting their premise and concluded, “This is a compelling issue, particularly as the currently available evidence does not show the need for widespread use of booster vaccination in populations that have received an effective primary vaccination regimen”.

More recent data suggests that booster shots may be required six months after receiving your initial vaccination regimen. Pfizer reported earlier this month that the effectiveness of the Pfizer-BioNTech (a.k.a. Comirnaty) vaccine in preventing infection by the SARS-CoV-2 virus dropped to only 47% from 88% six months after the primary vaccination event. They concluded that “...the drop is due to a waning efficacy, rather than more contagious variants”. In a separate Israeli study, it was demonstrated that in the month of September daily average infections dropped from 11,000/day down to 4,000/day. This significant drop was attributed to a nationwide “trailblazing booster jab program” initiated in July of this year. Given the poor, inconsistent messaging and the confusing plethora of poorly informed opinions, as well as conflicting scientific data, how can an individual make a rational decision about getting a booster vaccine shot? Fortunately, the CDC has now provided clear guidance to the US population.

**C. Current CDC Booster Recommendations:** Current guidelines and recommendations by the CDC provide detailed information on booster vaccine shots

(<https://www.cdc.gov/coronavirus/2019-ncov/vaccines/booster-shot.html>). Recent studies have shown that the effectiveness of the vaccines against SARS-CoV-2 diminishes over time. In addition, albeit in a small clinical trial involving the Pfizer-BioNTech vaccine, a booster shot clearly increased patient immune response against SARS-CoV-2. Therefore, the CDC recommends that i) patients 65 years of age and older; ii) patients 18 years old and older with underlying medical conditions such as cancer, diabetes, heart disease and

other conditions; iii) patients 18 years of age and older working or living in a high risk setting where the individual meets numerous people each day (first responders, educators, grocery store workers and others) should all receive a booster vaccine shot six months after receiving their original vaccination. Adverse events associated with the booster shot were similar to that of the primary vaccination. Fatigue and pain at the injection site were the most commonly reported side effects, and overall, most side effects were mild to moderate. Also, it is important to consider that more serious side effects are possible, albeit rare. Please note that the FDA has now issued an EUA for booster shots of all three vaccines from Moderna, Pfizer-BioNTech and Johnson & Johnson.

In late October, after the issuance of the three EUAs, the CDC announced that you can “mix and match” your booster shot. This means that a patient who receives a second (if the initial vaccine shot was from Johnson & Johnson) or third (if initial two shots were from either Moderna or Pfizer-BioNTech) dose can choose any one of the three vaccines as a booster. For example, the CDC authorized the Johnson & Johnson booster shot for people older than 18 years of age, at least two months after the initial shot, and it can be either another Johnson & Johnson dose, or the mRNA vaccines from Moderna or Pfizer-BioNTech. Any person over 65 years of age, or patients with underlying conditions can qualify for a half dose Moderna, or a full dose Pfizer-BioNTech booster shot. However, please note the data is sparse on the effectiveness and safety of the “mix and match” booster program. You are advised to be careful in such choices and consult fully with your physician.

**D. Other than Vaccines:** The primary focus on derailing the Covid-19 pandemic in the USA has been the development and rollout of the three vaccines discussed above. Vaccines act as prophylactics in preventing SARS-CoV-19 infection. However it is important to understand that there are other FDA approved therapeutic drugs now available for the treatment of Covid-19. They include the following:

**i) Remdesivir (Veklury™ – Gilead)** is a broad-spectrum antiviral medication, used in the treatment of Hepatitis C. The FDA approved its use in the treatment of hospitalized Covid-19 patients. Patients are administered Remdesivir intravenously under the supervision of a physician. It should be noted that the WHO issued a recommendation in November 2020 against the use of Remdesivir for treating hospitalized Covid-19 patients. In that same time period, the FDA issued an EUA for a combination therapy of Remdesivir and Baricitimib.

**ii) Molnupiravir (Merck):** In October 2021, Merck released promising study results about an oral antiviral drug to treat Covid-19. Compared to placebo, this antiviral drug significantly reduced the risk of hospitalization and death in people with mild or moderate Covid-19 who were at high risk for severe Covid. If the FDA authorizes or approves this drug, Molnupiravir will be the first Covid-19 treatment that can be taken by mouth early in the course of infection to reduce disease severity. Merck recently filed an EUA with the FDA for use of Molnupiravir against Covid-19.

**iii) Monoclonal Antibodies** are fabricated versions of the antibodies that our bodies naturally make to fight invaders, such as the SARS-CoV-2 virus. Three monoclonal antibody treatments for Covid-19 have been granted EUAs by the FDA. The treatments may be used to treat non-hospitalized adults and children over age 12 with mild to moderate symptoms who have recently tested positive for Covid-19, and who are at risk for developing severe Covid-19 or being hospitalized for it. All three of the FDA-authorized therapies attack the coronavirus's spike protein, making it more difficult for the virus to attach to, and enter human cells.

The monoclonal antibody treatments that have EUA approval are: a combination of casirivimab and imdevimab, called REGN-COV, made by Regeneron; a combination of bamlanivimab and etesevimab, made by Eli Lilly; and sotrovimab, made by GlaxoSmithKline. These treatments must be given intravenously in a clinic or hospital. These treatments are not currently authorized for hospitalized Covid-19 patients or those receiving oxygen therapy. Monoclonal antibodies did not benefit people whose immune systems had already created antibodies in response to the virus. However, a pre-peer reviewed study, published in June 2021, showed promise for monoclonal antibody treatment in hospitalized Covid-19 patients who did not mount their own immune response. Monoclonal antibodies also can be used in combination with corticosteroids, such as dexamethasone, to dampen the immune response in very ill hospitalized patients. Finally, the FDA has granted EUA for tocilizumab (Actemra), a monoclonal antibody that blocks the action of IL-6, and thereby dampens the exaggerated immune system response found in Covid-19 patients.

#### **4. Dangers of Virus Variants**

A new wave of Covid-19 cases has recently swamped the US Health Care System, in the midst of an extremely successful rollout of the vaccine program. What is causing this latest disappointing and demoralizing situation? Public health officials point to the emergence of the new, highly transmissible “Delta SARS-CoV-2 variant”. A variant occurs when the viral particle (known as a virion) infects your cells, hijacks your DNA/RNA machinery and makes approximately 1000 new copies of the virus. In that process mistakes are made in the replication of the new virus particles at the RNA and protein synthesis levels. Upon release of the new variants (also known as mutations) from the infected cell, many of the individual virus particles are dysfunctional and die very quickly. But a very small number have been changed to confer new and advantageous biological properties that allow them to survive and thrive in their human host.

**A. SARS-CoV-2 Variants:** The SARS-CoV-2 virus has produced thousands of variants throughout the pandemic period. However, only those variants that have adverse effects on human health give rise for concern. In the USA, variants are classified as follows: i) Variants being monitored (VBM); ii) Variants of Interest (VOI); iii) Variants of concern (VOC); and iv) Variants of High Consequence (VOHC). Currently, there are no SARS-CoV-2 VOHC in the USA. The preponderance of variants found in the USA are



classified as VBM. Although a number of them, including the Alpha, Beta, Gamma, and Epsilon were originally classified as VOC, they have since been downgraded to their current level. Only one variant, namely the Delta variant, is classified as VOC. A variant is classified as VOC if there is evidence of an increase in transmissibility, more severe disease (e.g., increased hospitalizations or deaths), significant reduction in neutralization by antibodies generated during previous infection or vaccination, reduced effectiveness of treatments or vaccines, or diagnostic detection failures.

**B. SARS-CoV-2 Delta Variant:** In December 2020, the Indian health authorities announced the detection of a new SARS-CoV-2 variant, subsequently named the “Delta variant”. This variant was dominant in India by March 2021 and led to a catastrophic second wave of Covid-19 infections and deaths. Genomic analysis of the Delta variant revealed that changes in the spike protein of the virus had occurred. These modest changes had profound effects. The Delta variant is much more contagious than original SARS-CoV-2 virus. For example, it was estimated that an individual with the original strain would infect 2.5 other people, whereas the Delta variant would spread from one person to about 4 other people. In other words, the Delta variant is twice as contagious as the original virus. Preliminary data also indicates that it causes more severe illness than other variants in unvaccinated individuals.

The Delta variant was first detected in the USA around March 2021. By the end of July 2021, it had become the dominant variant in the USA, with close to 99% of new cases caused by this viral strain. This resulted in a fourth wave of Covid-19 infections in the USA beginning early July. For example, in late June the 7-day moving average of reported cases in the USA was 12,000/day and by July 27th daily average had ballooned to about 60,000/day. Once again this led to state and local medical facilities being overwhelmed (see <https://covid.cdc.gov/covid-data-tracker/#datatracker-home>). Dr. Anthony Fauci (US Covid-19 Task Force member, and Director of NIAID at NIH) recently stated that unvaccinated people are 41 times more likely to be hospitalized, and 57 times more likely to die due to the spread of the Delta variant.

The CDC has stated that the unvaccinated population “remains the greatest concern”. Individuals in this sizeable group are more likely to get infected, and therefore transmit the virus to others. Fully vaccinated individuals are at a significantly reduced risk of infection by the Delta virus. However, it is possible for a “breakthrough” infection to occur, and those people who have been vaccinated and infected can spread the virus, but it appears much less efficiently. The current vaccines (discussed above) are effective in providing protection against the Delta variant, but at a somewhat lower efficiency. The CDC notes that the Moderna and Pfizer-BioNTech vaccine effectiveness dropped from approximately 90-95% to approximately 65% once the Delta variant became the dominant strain in the USA.

**C. Delta Variant and EMS Patients:** The Delta variant is still the dominant Covid-19 infectious agent in the USA. However, current daily numbers indicate that the fourth wave spike has peaked and is now in decline. Many public health officials suggest that

this “boom and bust” model may continue as new variants emerge. But consideration of the UK trajectory of the Delta variant indicates that a different, more troubling model may threaten the USA. In the UK, the Delta variant caused a rapid rise in Covid-19 cases followed by a fast deceleration, and then a subsequent rebound to a markedly increased plateau of daily new infections. In addition, the virus continues to mutate and potentially produce new and more deadly infectious strains. Currently the WHO and CDC are monitoring the Mu variant that emerged out of Columbia earlier this year. This viral strain has been detected in the USA, but does not appear to possess properties that enable it to displace the Delta variant. However, will the next mutation do so?

EMS patients have to consider the many health risks posed by the current Delta variant as well as the possibility of other emergent viral strains. All the available information suggests that individuals who are more elderly, have high-risk comorbidities (referring to the presence of one or more health conditions a person has along with the original diagnosed "primary" disease) and problems with their immune systems should get vaccinated. In addition, the CDC suggests that if your initial vaccine program was longer than six months ago, it may be prudent to get a booster shot. Finally, as a high-risk patient, one should monitor the possible emergence of other SARS-CoV-2 strains and ascertain what the defined status of such a variant is, as defined by the CDC. You can quickly and conveniently obtain information at the CDC website (see: <https://www.cdc.gov/coronavirus/2019-ncov/variants/variant.html>).

## 5. Summary

The past 12 months has provided all of us with numerous challenges associated with the life-altering and life-threatening Covid-19 pandemic. The situation has brought out the good, bad and ugly in all of us, from the individual to the Federal Government and associated institutions. This has included:

**A. Good:** i) Three vaccines have been developed and approved (through an EUA or full approval) in a record setting time period of 18 months. ii) Approximately 191 million Americans have been fully vaccinated. iii) After the vaccine rollout there was a precipitous decline in infections and death rates. iv) The vast majority of individuals complied with mask mandates and practiced recommended social distancing guidelines, adhering to public health policy criteria rather than to politically motivated exultations of “defend personal liberty”. v) Over 200,000 scientific and clinical peer-reviewed papers were published on SARS-CoV-2, providing significant new, comprehensive insights into the pathobiology of Covid-19.

**B. Bad:** i) More Americans have now died due to Covid-19 (about 750,000) than died in the 1918-19 “Spanish Flu” pandemic (about 675,000). ii) Poor, irresponsible rollout of diagnostic testing for Covid-19 patients. iii) Confused messaging of whether patients should receive a vaccine booster shot. iv) Sizeable and entrenched anti-vaxxer subpopulation cohort, leading to potential continued rolling waves of Covid-19

infections. v) Emergence of new SARS-CoV-2 variants are more transmissible and less treatable with current vaccines, leading to new spikes in Covid-19 infections.

**C. Ugly:** i) Due to both political and biological factors, Covid-19 will be with us for many years to come, somewhat akin to the “Seasonal Flu” phenomenon. ii) The relaxing of mask wearing, social distancing and other recommended public health measures lead to wave-after-wave of new Covid-19 infections that overwhelm the medical care facilities. iii) Politicization of SARS-CoV-2 origins, mask wearing, vaccines, or the purported “hoax” of the Covid-10 pandemic have all contributed to the overall poor response of the USA to the Covid-19 pandemic and to one of the highest death rates in the world. iv) No clear plan/message has been articulated as to how to finally break the destructive wave-after-wave phenomenon in the USA. This can lead to a perpetual upsurge-downturn cycle of Covid-19 infections and potential new more deadly variants. v) There appears to be no movement on the part of State or Federal Government to preempt the next pandemic, and incorporate what has been learned from the good, bad and ugly of the current pandemic.

(Please note the opinions expressed in this article are solely those of the author and do not necessarily reflect the views of NEMSN. Readers should consult with their personal physicians as to how to manage the prevention and treatment of Covid-19, as well as about their vaccine decision-making.)