A Thesis Presented to

The Faculty of Alfred University

COVID-19: What We Should Know & How to Return to Athletics Safely

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In Partial Fulfillment of
the Requirements for
The Alfred University Honors Program
May 7, 2021

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Foreword

To be completely honest, if someone told me a year ago that I would be presenting my Honors Thesis on the coronavirus pandemic I would have laughed. To say that this was not how I planned my last year to go would be an understatement. As an athletic training student, I always knew that I wanted to research and present something related to athletes and sport. Originally, my plan was to work with the Men's Soccer team at Alfred University researching hamstring and quadriceps muscle imbalance. Unfortunately, I had to scrap that plan due to the cancellation of sports because of the new COVID-19 pandemic. It also was not safe at that time to be working closely with a large group of players. As the panic set in, I had no idea where to go next. I owe all my thanks to my committee member, Dr. Daniel Curtin, for giving me the idea to research the reason why all of our lives have changed so drastically.

In the beginning of the pandemic, I had no idea what the coronavirus was. I'll admit, I was not aware, nor did I believe that it was as serious as it really was. I'm a 22 year old college student, I knew the virus was most likely not going to kill me so why should I be afraid of it? I quickly had to put aside my selfishness and began to think from a more ethical standpoint. As a future healthcare provider, I knew I was responsible for conducting my own research on the coronavirus and to not make all my assumptions and judgements based on what the media was telling me. I also had to grow as a person and I learned what sacrifice really was. I gave up many important things in my life, graduation included, to ensure the safety of those around me in my community. I could have done the selfish thing that most of my peers did and continued to party, go to the bar, and spread the virus. I feel that my mature decision to give up the things that I wanted to do was the right, morally correct thing to do. In the end, I know that I missed out on

some things that I would have really liked to do. But I knew that if I contracted COVID-19 and gave it to someone that could not fight it and they passed away, the guilt would haunt me for the rest of my life. I can get those nights back with my friends, these people cannot get their lives back.

Researching a newly emerging topic was not easy at all. Data continued to change every day as I was writing. I had to continuously go back and be sure that what I was writing aligned with what new research was supporting. It was also difficult to find credible sources to pull my information from. The media attention COVID-19 received was overwhelming. COVID-19 quickly became something I was very passionate about. My main goal with this thesis was to present the facts. There's so many misconceptions and gossip regarding COVID-19. I wanted to create something that readers were able to understand and comprehend. I take pride in the fact that I was able to discover the facts about this pandemic and that I continue to spread awareness about this issue every day.

The major turning point in my thesis was when the vaccines started to be released for emergency use per the United States Food and Drug Administration. On several different occasions I was able to go to Dr. Curtin's office and assist with distributing and administering COVID-19 vaccines to the community. Not many people can say that they were able to help their community during such a historical event. Looking at those vaccine vials in real life felt surreal to me. I had spent all that time researching about them, I never thought I would be able to see them in person like this. It was also during this time that I was able to witness what the vaccine does to people. I had read about side effects but now I was witnessing them on my own.

Thankfully there were a few shots left over after the clinic, so me and a few classmates had the opportunity to get vaccinated. Getting vaccinated was a choice I was proud to make. I wanted to protect myself but more importantly I wanted to protect those around me, who perhaps are not as strong as I am and cannot fight off this virus. The side effects didn't take effect on me until late that night. The funny thing is, I actually played a softball game that night and hit my first ever home run. Dr. Curtin and I like to joke and say that I got superpowers. While I wish the COVID-19 vaccines actually did give me superpowers, they unfortunately do not. The only thing I received was a headache, chills, and a fever that quickly subsided. These brief side effects were not enough to make me regret my decision to receive the vaccine, I would go back and do it all again if I could. In my discussions with other people about COVID-19, I'm always more than happy to show proof to these anti-vaxers that I received the vaccine and I lived through it. Nothing happened to me and I continue to live a normal life everyday with the consciousness that I did my part to protect my friends, family, and the community.

Someday when I look back on this thesis, I hope to be looking back from a place of normalcy. I hope my thesis can educate at least one person about this terrible tragedy that we all lived through. Maybe students will still remember this event in five years, but in twenty years I want students to be able to pull out this thesis and learn about what this pandemic did to the world, our country, and athletics. Hopefully our country and our world will never have to see another pandemic, but it's highly possible that this could happen again. If another coronavirus pandemic rages again, this thesis will be available for students to read and look back at how our world handled this before. And my hope is that we don't make the same mistakes next time that we did this time. Let this our mistakes now be a learning point for the future.

The contents of this thesis will continue to be a part of my life for years and years to come. As a newly certified athletic trainer, working with positive COVID-19 athletes will be quite frequent during my everyday life. I plan to use the contents of this thesis to help me make clinically educated decisions on how to care for these athletes. One thing that I am certain of, is that the research on this topic will continue to change with time. As a healthcare professional, it will be my duty to follow this research and implement new findings into my practice. The precautions we are taking now may not need to be taken someday. But for now I will continue to follow all protocols and guidelines until science and research tell me otherwise. And I will continue to spread awareness about this virus and what it can really do to young, seemingly healthy athletes.

The completion of this thesis took almost a year. There were many late nights and early mornings as I traveled to Dr. Curtin's office in Wayland, New York quite often to learn and discuss the process of my thesis. It's so rewarding to be able to look back on all of the hard work you've done and to be recognized for completing such a challenging task. As I continue on to graduate school, I plan to take this knowledge and my newly found research skills with me and use them to someday complete a graduate thesis. Completing this project has taught me so much about myself as a person and as a student. And even though this was the most challenging assignment I have done, I'm thankful for this opportunity to help me grow as a student.

Finally I would like to thank all of the members on my committee for making this opportunity possible and for working with me so diligently during such a crazy, outside of ordinary year. My first committee member, Kjersten McKinniss, has been a great mentor to me over the last four

years. She's someone that I look up to and she's the type of athletic trainer I hope to be someday. I'm so thankful that she was willing to be a part of my Honors Thesis. Without her support and advice, I wouldn't be where I am today. I want to give a special thanks to my second committee member, Dr. Daniel Curtin. Dr. Curtin helped me build this thesis from the ground up. I spent many hours in his family practice office revising and discussing all the specifics of my thesis. Anytime I texted or called needing advice, he always answered the phone and has gone out of his way just to make sure that this thesis was possible. I've experienced many bumps over the course of developing this thesis and Dr. Curtin was there to get me passed each roadblock. Lastly, I would like to thank the chair of my committee, Dr. Cheryld Emmons. Dr. Emmons came on as the chair of my committee after some unforeseeable events. She jumped right on board, no questions asked, and using her expertise, helped format the final draft of my thesis. Dr. Emmons did not have to take on such a vital role in such short notice, but I will always be grateful for her generosity and willingness to help. This thesis would not have been possible without her becoming a part of this committee. Kjersten, Dr. Curtin, and Dr. Emmons - thank you for everything you've done for me, I owe all of my success to you three.

Glossary

Term	***Definition***
Anaphylaxis	An acute allergic reaction to an antigen to which the body has become hypersensitive
Cirrhosis	A chronic disease of the liver marked by degeneration of cells, inflammation, and fibrous thickening of tissue
Cyanosis	A bluish discoloration of the skin resulting from poor circulation or inadequate oxygenation of the blood
Dialysis	The clinical purification of blood by dialysis, as a substitute for the normal function of the kidney
Echocardiogram	A test of the action of the heart using ultrasound waves to produce a visual display
Electrocardiogram	A record or display of a person's heartbeat
Hypercoagulability	A state or condition marked by an increased tendency to form blood clots within a blood vessel
Nephrologist	Type of doctor that specializes in disease and conditions that affect the kidneys
Pediatric	The branch of medicine that involves the medical care of infants, children, amd adolescents
Thrombogenic	Tendency of a material in contact with the blood to produce a clot

Abstract

On March 11, 2020, SARS-CoV2 (COVID-19) was officially named as a pandemic by the World Health Organization. The United States began a country-wide quarantine in hopes to flatten the curve, but over a year later, COVID-19 is still a nationwide threat. The development and emergency release of three COVID-19 vaccines in early 2021 has been the first step in the right direction. The goal to achieve herd immunity is currently well underway with over 231 million vaccines administered in the United States. Although progress has been made and scientists continue to learn more about COVID-19, there is still much to discover about the virus and how it affects those who do contract it. In the world of athletics, team physicians and athletic trainers are working to determine when athletes who do test positive for COVID-19 are safe to return to physical activity. Research has shown that even those that successfully recover from COVID-19 can still have long term effects that can often go undetected. These effects can sometimes be life threatening which is why proper care and consideration needs to be taken to help these athletes return to sport without suffering from further injury.

Introduction

Beginning in late 2019, our world was introduced to coronavirus, medically termed SARS-CoV2 (COVID-19). Originating in Wuhan, China, the virus quickly spread to several countries making itself a name as a pandemic. Soon after, around late January and early February 2020, the virus had spread to the United States (U.S.) causing nationwide shutdown of businesses, parties, concerts, jobs, sports, and basically life as we knew it (Baker, 2020). To date (01/28/2021), the World Health Organization reports 100,455,529 confirmed cases and 2,166,440 reported deaths with numbers continuing to rise each day ("WHO Coronavirus Disease (COVID-19) Dashboard," n.d.). Early on, government officials in the U.S. proposed guidelines in hopes to flatten the curve so society could get back to "normal" lives. A mandated quarantine of 15 days was issued by United States President Donald Trump on March 16, 2020 (Mangan, 2020). This came just five days after WHO declared it to be a pandemic (Curtin, 2020). However, this mandate continued to last until April 30, 2020. In which state governors began to impose their own stay-at-home orders. Those orders began to lift May 20, 2020 at varying rates across the country (Elassar, 2020).

The world of sports from pee-wee football to elite world class championships was put at a stand still. It was estimated by ESPN that the nation would likely suffer a 12 billion dollar deficit due to the loss of jobs that the sports community creates (Fainaru, Fainaru-Wada, Purdam, & Barr 2020). Never before had the nation understood just how important sports are and the crucial part they play in our economy and society. Aside from the great revenue loss, there was now an even more important matter posed on sports and its athletes; COVID-19. Because COVID-19 is a new variant of the coronavirus family, not much is known scientifically about it and how it affects a

person. Although scientists and medical personnel work around the clock to discover as much about the virus as they can, there is still much that we have to question. It is observed that COVID-19 affects people who have underlying medical conditions and the elderly population. Most athletes do not fall under these two categories, but instances exist where young, healthy individuals contract COVID-19. The question looms, how can we know when an athlete who has contracted COVID-19 is safe to return to sport participation?

COVID-19 History and Etiology

In contrast to the death toll, most cases of COVID-19 are said to be mild to moderate, similar to the common cold for the average person ("Protect Yourself and Your Family From Coronavirus (COVID-19)," n.d.). Statistics in June 2020 reported that 4.7% of those infected will experience critical illness involving hospital care and advanced life support (Bhatia, Marwaha, Malhotra, Iqbal, Hughes, Börjesson, Niebauer, Pelliccia, Schmied, Serratosa, Papadakis, & Sharma, 2020). However, at the peak of the virus in January and February 2021, the percentage of COVID-19 cases requiring intensive care unit (ICU) admissions rose to 15.9% ("Weekly Review," 2021).

The earliest case of infection was known to be found on November 17, 2019 in the city of Wuhan, in Hubei Province, China, and spread readily afterwards. When people began to become sick, scientists were curious as to what was causing this infection. After further studies they concluded that the virus most likely originated from an animal sold at a market and was similar to a prior coronavirus variant, SARS-CoV, with slightly different characteristics ("Studying the Disease," 2020).

This is not the first time that our world has seen the coronavirus. The virus was actually first discovered in 1967 from samples obtained from sick medical students (Curtin, 2020). In November 2002 - July 2003 severe acute respiratory syndrome (SARS-CoV) appeared infecting only about 8,000 people with 774 deaths worldwide. Symptoms from this virus were very similar to those seen in COVID-19. The very first case was recorded in Guangdong, China in November 2002 and although the virus spread to 29 countries, most cases were seen in Asia ("Civet Cat Slaughter To Fight SARS," 2004). Scientists reported that a possible source of the virus were civets, a nocturnal, weasel-like animal. In response to this statement, Chinese authorities ordered the death of over 10,000 civets ("Civet Cat Slaughter To Fight SARS," 2004). The coronavirus would emerge again in 2012 as the middle eastern respiratory syndrome (MERS-CoV) and would last until 2018 with its peak being in 2015. About 2,500 people became infected and around 900 people would die. Again, these symptoms are similar to COVID-19 symptoms but this time the virus was transmitted from camels to people (Curtin, 2020).

The virus targets the respiratory system causing difficulty breathing, pain in the chest and cyanosis. COVID-19 symptoms are worse in older individuals (85 years and older) and in individuals who have underlying medical conditions such as cancer, chronic obstructive pulmonary disease, cystic fibrosis, immunocompromised, serious heart conditions, and type 1 and 2 diabetes mellitus ("Certain Medical Conditions and Risk for Severe COVID-19 Illness," 2020). The virus affects the respiratory system directly and most obviously. However, the virus does cause potentially deadly side effects in other systems of the body, making it even more difficult to decide when a person is cleared to resume physical activity.

Until a vaccine was released, the Centers for Disease Control and Prevention (CDC) had and continues to suggest guidelines to follow to protect yourself and others from contracting the virus. Steps of precaution included social distancing of 6 feet or more, regularly washing your hands, using hand sanitizer, disinfecting surfaces, wearing a face mask and avoiding large crowds. Although there is no way to guarantee that one wouldn't contract the virus, these guidelines help decrease the chances that one could. COVID-19 positive individuals should be placed into quarantine at their own homes or in a hospital for severe symptoms for now 10 days minimum to decrease the spread. A person may not present symptoms until 2-14 days after exposure and some individuals may be asymptomatic and never present any symptoms. It's important for each person to monitor their own symptoms and temperature on a day to day basis ("Symptoms," 2021).

How COVID-19 Affects The Body

Respiratory System

Injury and illness can affect every person very differently, which makes it hard to say exactly how each person's viral load will affect the body, but commonly it does affect the respiratory system. The severity and lasting damage correlates with the person's preexisting health conditions and the treatment they receive. It's been reported that some people experience severe symptoms, while others are asymptomatic, showing none or a few symptoms ("Coronavirus: Information & Resources," n.d.) The symptoms a person is experiencing will determine their treatment options and their recovery time. COVID-19 infects the upper respiratory system (nose, sinuses and throat) and the lower respiratory system (airways and lungs) by presenting with flu-like symptoms such as congestion, runny nose, sore throat, and sneezing. If the case is more

severe, pneumonia, pulmonary embolisms, and acute respiratory distress syndrome can occur. Pneumonia resulting from COVID-19 is very different from other types of pneumonia. Typical community acquired pneumonia (CAP) focally affects only one lung. The pneumonia that results from COVID-19 diffusely affects both lungs, causing the air sacs to become filled with fluid, making oxygen intake difficult ("COVID-19 Lung Damage," 2021). A study in March 2020, found COVID-19 patients to have abnormal spots on their chest CAT scans and had a higher chance of developing pneumonia in both lungs (Zhao, Yao, Wang, Zheng, Gao, Ye, Guo, Zhao, & Gao, 2020). Most people can fully recover from CAP, however pneumonia associated with COVID-19 is severe, with long lasting lung damage that results in breathing difficulties for months after ("COVID-19 Lung Damage," 2021). Severe cases are deadly because of the mucus buildup in the alveoli that cause difficulty breathing, low oxygen levels, shock, organ damage and blood clotting. Once the virus works its way into the alveoli, by latching onto the protein, ACE2, it merges with the oil-like membrane of our human cells. After this process, the virus releases its genetic material into the healthy cell. COVID-19's genetic makeup is ribonucleic acid (RNA), not deoxyribonucleic acid (DNA). This means that the virus sends molecular messages to instruct the host cell to read the template and translate it into proteins. These proteins will eventually help to make up new virus particles ("How Does the Novel Coronavirus…" 2021). Severe pneumonia cases can develop into acute respiratory distress syndrome (ARDS), which affects the alveoli's ability to allow oxygen to reach the bloodstream. The alveoli sacs fill with fluid and the lungs cannot get enough oxygen to the body's organs (MacMillian., 2020). Most cases do not become severe unless the person has any of these risk factors; diabetes, hypertension, heart disease, lung disease, compromised immune system, elderly or obsese ("Coronavirus: Information & Resources," n.d.).

COVID-19 was also found to be very thrombogenic and known to cause thromboembolic complications, predominantly pulmonary embolisms. Viral infections like the coronavirus, can cause an imbalance in the body's procoagulant and anticoagulant effects. An imbalance between these factors and the immune system can lead to the formation of blood clots in the lungs, or a pulmonary embolism (Sakr, Giovini, Leone, Pizzilli, et al., 2020). This resulted in many early deaths and was the principal reason for why mechanical ventilation was not effective. At the beginning of the pandemic in March 2020, there was a dire need for mechanical ventilators and other personal protective equipment. As the numbers of severely sick COVID-19 patients rose, only a select few companies had the expertise to make these ventilators but there was no way that these companies could keep up with such a huge demand. Automakers even offered to assist, because they thought they may have the capacity to help make ventilators (Ranney, Griffeth, Jha, 2020). However, because COVID-19 patients were dying from pulmonary embolisms and not symptoms associated with acute respiratory distress syndrome, the ventilators were not working and patients were still dying. Eventually doctors realized that mechanical ventilators were not needed. Instead these patients needed to begin thrombolytic therapy as soon as possible to dissolve the blood clots in their lungs (Sakr, Giovini, Leone, Pizzilli, et al., 2020).

Cardiovascular System

It is not frequently mentioned in the media, but COVID-19 can have a very significant impact on a person's heart, causing long term effects that may be difficult to detect. When a person is infected with the virus, an immune response is triggered, which is sometimes too great for the body to withstand. This overactive response can cause hyper inflammation of the heart, as well

as embolisms that would later lead to heart attacks or strokes ("Coronavirus: Information & Resources," n.d.). Patients who were never hospitalized for COVID-19 or never had severe symptoms may develop irregular heartbeats, thrombus, myocarditis, or heart failure. This factor is what makes the virus very frightening because some patients may feel fine after treatment and return to sport or physical activity without knowing the damage caused to their heart, putting them at an increased risk of injury or death.

Myocarditis is inflammation of the heart muscle causing it to become weaker, and disrupts the electrical conduction system, which results in difficulty circulating blood and oxygen throughout the body ("About Myocarditis," n.d.). There are numerous causes of myocarditis, including viruses, medications and bacteria. Common symptoms associated with myocarditis include but are not limited to, shortness of breath, fatigue, chest pain, lightheadedness, swelling in hands and feet, and a sudden loss of consciousness ("About Myocarditis," n.d.)

Other viral infections (echovirus and coxsackievirus) have been known to cause myocarditis, however the coronavirus appears to have a more significant effect than other viruses (Stump, n.d.). Patients with mild symptoms rarely develop myocarditis from COVID-19 but it is not impossible. A study from Ohio State University showed that 15% of National Collegiate Athletic Association (NCAA) athletes who tested positive for COVID-19 later developed myocarditis (Rajpal, S., Tong, M., Borchers, J., et al., 2020). Thus causing a huge concern for athletic trainers, team physicians, and other healthcare personnel working within the athletic population as an athlete could have myocarditis without realizing until they suffer a medical emergency. Today, many universities and institutions have implemented screenings and return to play

protocols to ensure the safety of their athletes. Similar to concussion protocol guidelines, these guidelines were put in place to monitor the athlete's progress through conditioning programs to determine if their bodies, more importantly their hearts, are ready to return to sport competition.

COVID-19 presents with symptoms that mainly involve the respiratory system which is why it was originally thought to only affect the respiratory system. As mentioned earlier, research has been conducted and has led scientists to believe that COVID-19 is in fact more of a vascular disease than a respiratory illness (McCullough, 2020). Within the blood vessels of the body, there are cells that help regulate blood pressure, inflammation and clotting, but these cells also produce the ACE2 protein that the coronavirus uses to gain entry into healthy cells. Once the coronavirus takes over these cells in the blood vessels, the blood thickens and clots which can lead to other illnesses such as heart attacks, strokes, blood clots, and even limb tissue death (McCullough, 2020). Severe COVID-19 cases require patients to be placed on a ventilator. The ventilator creates positive pressure to force air into the lungs when a person is too weak to do so on their own. Dr. Lauren Ferrante from Yale Medicine reports that prone positioning is more beneficial, which is when the patient is lying on their stomach while on the ventilator (MacMillian, C., 2020). Because being on a ventilator requires patients to at least be slightly sedated, patients cannot get up to walk or move around. Sometimes this can be for a period of up to three weeks depending on the severity of the case (MacMillian, C., 2020). Becoming bedridden could possibly lead to that patient developing a pulmonary embolism.

Pulmonary embolisms are caused by a blockage of one of the arteries in the lungs. The blockage is usually caused by a blood clot that forms in a deep vein of the leg, which then travels to the

lungs (“Pulmonary embolism causes,” 2020). Some cases can become fatal, especially if the blood clot goes undetected. A study by Harvard Medical School investigators at Massachusetts General Hospital found that patients with COVID-19 who have high levels of factor V, a blood clotting protein, are at a higher risk of developing deep vein thrombosis (DVT) which leads to pulmonary embolisms (MGH News and Public Affairs, 2020). Researchers conducted a study to analyze the presence of blood clotting factors in COVID-19 patients and patients without COVID-19. It was found that patients with COVID-19 had elevated factor V levels compared to patients who were otherwise healthy (MGH News and Public Affairs, 2020). Senior study author, Elizabeth Van Cott, reported, “Aside from COVID-19, I’ve never seen anything else cause markedly elevated factor V, and I’ve been doing this for 25 years” (MGH News and Public Affairs, 2020). Another research study focusing on venous thromboembolism complications found that severely ill COVID-19 patients had two of the three criteria of Virchow’s Triad (Tal, Spectre, Kornowski, Perl, 2020). Virchow’s Triad determines a person’s risk of developing venous thrombosis using three factors: hypercoagulability, stasis, and endothelial injury (Kushner, West, Pillarisetty, 2020). Prone positioning during ventilation places the heart at a hydrostatic level above the head and extremities which can lead to a reduction in venous return causing stasis and the prothrombotic changes caused by inflammation can lead to hypercoagulability (Tal, Spectre, Kornowski, Perl, 2020). Perhaps patients with COVID-19 may not benefit best from being placed on a ventilator, especially if the lack of physical function leads to the development of a pulmonary embolism, increasing their risk of death.

Nervous System

Everyday new research is being published and some of that new research includes COVID-19's affect on the brain. Some people, usually in the more severe cases, experience neurological symptoms such as loss of smell, inability to taste, muscle weakness, numbness of the hands or feet, dizziness, confusion, delirium, seizures and stroke ("COVID-19 Basics," 2021). Experts are not entirely certain on how the virus is affecting the nervous system but they believe it may be due to the infection, effects of inflammation, and low oxygen levels to the brain or the body's carbon dioxide levels ("COVID-19 Basics," 2021).

Renal System

Early into the COVID-19 pandemic, it was not thought that the kidneys would be damaged unless a person had underlying medical conditions such as diabetes. Data from May 2020 showed that over a third of the patients admitted to the hospital for COVID-19 developed acute kidney injuries, with 35% of those patients needing dialysis (Argenziano, Bruce, Slater, Tiao, Baldwin, et al., 2020). John C. Sperati, a nephrologist at Johns Hopkins University, explained that the kidneys are so vulnerable due to the viruses ability to directly infect kidney cells, low oxygen levels in the blood, blood clots, and fallout from the cytokine storm caused by the virus ("Coronavirus: Kidney damage caused by COVID-19," 2020). A cytokine storm can have detrimental effects to COVID-19 patients. Whenever a patient's inflammatory levels rise significantly, they can enter into what's called the cytokine storm threshold. This is when the body's inflammatory system begins to work overtime in order to destroy the virus proteins, but at the same time is also damaging the body's own healthy cells (Lipton, 2020).

Gastrointestinal System

Originally, gastrointestinal symptoms such as nausea, vomiting and diarrhea were not thought to be associated with the coronavirus. However, evidence has been found that the coronavirus can cause acute pancreatitis and diffuse diarrhea (McCullough, 2020). Data from March 2020 described an elderly patient presenting with diffuse, bloody diarrhea and symptoms of COVID-19. After some differential diagnosis laboratory tests, SARS-CoV-2 RNA was detected in the patient's feces. SARS-CoV-2 targets viral receptors, ACE2, which are commonly found among type II alveolar cells, esophagus epithelial cells, and both small intestine and colonic cells. These findings suggest that SARS-CoV-2 is able to access entry into the gastrointestinal host cells, causing digestive symptoms in COVID-19 patients (Carvalho, Alqusairi, Adams, Paul, Kothari, Peters, DeBenedet, 2020). The coronavirus comes from a family of single-stranded RNA viruses that include mumps, measles and the Epstein-Barr Virus. Each of these viruses can cause viral pancreatitis, which makes logical sense as to why the coronavirus can do the same (Aloysius, Thatti, Gupta, Sharma, Bansal, & Goyal, 2020). How COVID-19 affects the liver still remains a large mystery to scientists and the CDC. Some COVID-19 patients have been found to have elevated levels of liver enzymes, but scientists are not sure if this is caused from the coronavirus directly or from the infection that results from contracting the coronavirus. It cannot be said for certain that those patients who have chronic liver diseases like cirrhosis or hepatitis B are at a higher risk for liver damage, although the hypothesis is logical (McCullough, 2020).

Long Term Effects

Most who contract the coronavirus that present with symptoms, are sick for a couple weeks and soon after return to normal health. However, 10-30 % of infected patients can continue to

experience symptoms up to weeks or months after contracting the virus. These individuals are commonly referred to as long haulers ("Mysterious Ailment, Mysterious Relief…" 2021). A list of common long term symptoms include but are not limited to: fatigue, shortness of breath, loss of taste and smell, cough, joint pain, chest pain, difficulty concentrating, depression, muscle pain, headache, intermittent fever, and heart palpitations. Some serious long term effects include but are not limited to: inflammation of the heart muscle, lung abnormalities, and acute kidney injury, hair loss, smell and taste abnormalities, difficulty sleeping, depression, and anxiety ("Long-Term Effects," 2020). There is no sure way to know who will recover quickly or who will suffer these long term symptoms, as the virus affects each body differently. An observational study was conducted to determine how COVID-19 vaccines are affecting long haulers. It was found that those who received the vaccine had small improvements in their long covid symptoms. Patients who received the vaccine saw a 23.2% increase in symptom resolution eight months post-infection compared to those who did not get the vaccine that saw a 15.4% increase in symptom resolution (Arnold, Milne, Samms, Stadon, Maskell, Hamilton, 2021). Several theories exist as to why the vaccine may be helping those long haulers. One theory suggests that some patients may never fully rid their bodies of the virus, so some virus fragments remain causing long-term symptoms, which the vaccine is able to provide the body with enough "power" to rid itself of those ("Mysterious Ailment, Mysterious Relief…" 2021).

The Post-COVID-19 Athlete

In August 2020, a former Florida State basketball player named Michael Ojo died after he collapsed while training in Serbia. It was previously reported that Ojo had contracted the coronavirus but had recovered and felt okay to practice. The cause of death was ruled a heart

attack. He was only 27 years old ("Associated Press," 2020). Even seemingly young, healthy athletes can succumb to the coronavirus, which makes returning to sports much more difficult and more concerning.

An ESPN article recently published, mentions the Buffalo Bills tight end, Tommy Sweeney, will miss the remainder of the National Football League (NFL) season after a cardiologist diagnosed him with myocarditis. This makes Sweeney the first NFL player this year to be diagnosed with this condition (Louis-Jacques, 2020). Another professional athlete is dealing with myocarditis as well. Eduardo Rodriguez, pitcher for the Boston Red Sox, was diagnosed with COVID-19 in the beginning of July 2020. He was cleared to return to play but was never reactivated on the lineup after he developed myocarditis and was forced to miss the remainder of his season (Speier, 2020). As athletes return to play they should be aware of these symptoms; shortness of breath with exercise or lying down, chest pain, swelling of ankles, heart palpitations, lightheadedness or dizziness.

COVID-19 With Respect to Athletics

Almost all sports from the youth level to the elite levels saw their sports seasons end back in March 2020. Since then some levels and certain sports have been allowed to resume practices and even competition. We're seeing the greatest amount of normalcy in elite sports such as the NFL, NBA, MLB, MLS, etc. but less normalcy in college, high school and youth sports. Many fall sport seasons have been cancelled at the college and high school level, but some sport seasons still continue depending on their geographical location and case severity in the area. Sports with the lowest risk of contracting COVID-19 include non-contact sports such as golfing,

swimming, running, skiing, field events and weightlifting. Moderate risk sports include close contact sports such as baseball, softball, gymnastics, basketball, ice hockey, field hockey, tennis and volleyball. The highest risk sports include contact sports such as football, lacrosse and wrestling ("Here's the Risk Level of Each School Sport in Return From COVID-19," 2020). Low level risk sports are more likely to resume practices and competition than high level risk sports but that could vary depending on the location of the teams and if COVID-19 cases are high in that area. As various sports begin to resume play, some guidelines should be followed to ensure the safety of the athletes. These guidelines include but are not limited to, temperature checks before each practice or competition, wearing masks when social distancing is not possible, practicing in small groups at different times, limited or no spectators, limited or no travel for competition and signed waivers informing the athletes of their risk to resume sports ("Here's the Risk Level of Each School Sport in Return From COVID-19," 2020). The National Library of Medicine has released factors to take into consideration when sporting events return in the future. These factors include future vaccination programs, screening spectators and athletes, analysis of sporting venues for capacity and social distancing capabilities, local healthcare infrastructure, local and COVID-19 statistics and restrictions, athlete fitness and risk assessment, and travel arrangements for competition.

The NCAA supports the CDC's guidelines on wearing masks and social distancing during all athletic activities. In the event that a team member tests positive, the use of masks and social distancing will help reduce the risk of spread to the rest of the team members ("COVID-19 Coronavirus," 2021). Evidence also encourages athletic activities to take place outdoors if possible or indoors with good ventilation to help reduce the risk of spread ("COVID-19

Coronavirus," 2021). Once activities are safely able to resume the NCAA stresses the need for proper acclimatization to training. The NCAA's Interassociation Recommendations: Preventing Catastrophic Injury and Death in Collegiate Athletes discusses the need for a 7-10 day transition period for student-athletes to safely progress through the physiologic and environmental stresses that are contingent with athletics ("COVID-19 Coronavirus," 2021). Following these recommendations is another way to prevent sudden death in both athletes who have and have not tested positive for COVID-19. In accordance with federal, state, local, NCAA, and conference guidelines, institutions and universities may also formulate and implement their own guidelines and recommendations to follow.

Before diving into how COVID-19 affects athletes, we must first define the term athlete. JAMA Cardiology defines athletes as, "individuals who place a high premium on training, competition, and sports achievement" (Kim, Levine, Phelan, et al., 2021). After an athlete has tested positive for COVID-19 and has completed the necessary quarantine and recovery guidelines, they may begin to return to their sport. This may be the most problematic component of the virus in athletics. A common misconception is that because a person is symptom free and feels "okay" they are cleared to return to full sport participation, which could potentially be very dangerous as the virus has the potential to cause damage to the heart, known as myocarditis (Dean, Jackson, Paridon, 2020). The athletic population consists mostly of participants less than 20 years old, while less than 10% of the total athletic population consists of participants over age 50 (Eime, Harvey, Charity, Casey, Westerbeek, & Payne, 2016). Because the athletic population consists mainly of younger individuals, the effects of COVID-19 will hopefully not be as severe or life threatening as it is for individuals that are older. Of course, rare instances occur where a younger

person suffers severe symptoms and those with underlying medical conditions are also more susceptible to the virus' effects. The American College of Cardiology defines severe cases as those who have become hospitalized, have had an abnormal cardiac test, or children who have been diagnosed with multisystem inflammatory syndrome (MIS-C), which presents similar to myocarditis and should be treated as such (Dean, Jackson, Paridon, 2020). The recovery timeline for pediatric patients with COVID-19 is shorter, with most of their symptoms presenting similar to those of influenza, allergic rhinitis, and streptococcal pharyngitis. Overall the pediatric population has accounted for the fewest number of COVID-19 cases in the U.S. ("Care for Children," 2020).

Detecting myocardial injury in athletes tends to be challenging (Kim, Levine, Phelan, et al., 2021). Early in the pandemic, hospitals were using cardiac troponin levels and noninvasive imaging to determine the damage the virus had done to the heart (Kim, Levine, Phelan, et al., 2021). Cardiac troponin are regulatory proteins that control the calcium interaction between actin and myosin filaments in the heart's muscle, known as the myocardium (Sharma, Jackson & Makan, 2004). Elevated cardiac troponin levels are often indicative of damage to the heart, including a myocardial infarction (heart attack). However, in COVID-19 positive athletes, elevated cardiac troponin levels can be a red flag for myocarditis or other myocardial injuries (Sharma, Jackson & Makan, 2004). An athletic person may also present with elevated cardiac troponin levels because bouts of exercise can actually lead to transient elevation of cardiac troponin levels, which would present a false positive of myocarditis in an athlete who is COVID-19 positive (Sharma, Jackson & Makan, 2004). Therefore, solely relying on cardiac troponin levels as an indicator of myocardial injury in athletes with COVID-19 can be

inaccurate. Cardiac magnetic resonance (CMR) imaging may be more useful in detecting myocardial injury. Numerous studies have been conducted determining the relationship between CMR findings and myocardial injury in older adults, but unfortunately there are little to none on young athletes. This lack of a CMR baseline for young athletes leaves researchers at a loss on how to determine when to be concerned for myocardial injury after COVID-19. A cross-sectional case series focused on U.S. collegiate athletes who were asymptomatic or presented with mild symptoms after being diagnosed with COVID-19. All athletes showed normal electrocardiogram results, normal cardiac troponin levels, and normal echocardiography results. However, a 15% prevalence of CMR findings met the criteria for myocardial injury. With the lack of a CMR baseline, or control group, researchers cannot conclude that athletes who had asymptomatic or mild COVID-19 symptoms will eventually develop myocardial inflammation or injury (Sharma, Jackson & Makan, 2004).

Return To Play

Before the beginning of each sport season, athletes are instructed to complete a pre-participation exam (PPE) with their primary care physician or with their team physician. PPEs can vary at each institution but all consist of the basics: family and medical history, general health screening, cardiovascular screening, neurologic screening, orthopedic screening and mental health questionnaires (“Pre-Participation Examinations,” n.d.). These PPEs are usually not repeated throughout the rest of the sport season, but with the recent coronavirus pandemic, the American Medical Society for Sports Medicine and the American College of Cardiology have begun recommending additional protocols to be put in place for COVID-19 positive athletes returning to play (Stump, n.d.). The new recommendations also vary at each institution but should consist

of a physical examination, electrocardiogram (EKG), blood tests, or an echocardiogram (ECG) (Stump, n.d.).

Pediatric return to play guidelines are similar to those for adult aged athletes. Those who were asymptomatic and athletes with moderate symptoms who are younger than twelve years old do not require extra testing considerations to return to play. Athletes older than twelve years old with moderate symptoms and athletes with severe symptoms will be required to have an ECG test and physician clearance before returning to play. See Appendix A for a full return to play protocol for pediatric athletes.

Alfred University COVID-19 RTP Protocol

The Alfred University Sports Medicine staff has developed a return to play protocol for their athletes who have tested positive for COVID-19. Alfred University requires each athlete who has tested positive for COVID-19 to complete the six phase protocol before they can return to any team practices, workouts, or competitions. The sports medicine team has also created a questionnaire to assist with accurate documentation of COVID-19 positive athletes, their treatments, and current return to play status. See Appendix B for the full COVID-19 return to play protocol.

Vaccine: The Way Forward

Receiving the COVID-19 vaccine has been a very controversial topic in today's media. However, the vaccine may be the best answer to society returning to normal again. The CDC supports the COVID-19 vaccine stating that, "getting the vaccine will help protect you, help protect others,

and help end the pandemic" ("Weekly Review," 2021). Herd immunity is crucial to combating infectious diseases like COVID-19, which can only be achieved with an effective vaccine. Herd immunity, as defined by the American Lung Association, is when large percentages of a population become immune to a disease and therefore indirectly protect those who do not have immunity (Hill, 2020). Illnesses that were once responsible for millions of deaths each year such as, measles, mumps, diphtheria, polio, and chickenpox, have all achieved herd immunity through vaccinations (Hill, 2020). Today, we rarely see cases of these illnesses, except for areas that have lost herd immunity due to anti-vaccine protesters. Anti-vaccine protesters and conspiracy theorists lead the discussions about not getting the vaccine and how the vaccine is not safe to take. Director of the University of Minnesota's Center for Infectious Disease Research and Policy, Michael Osterholm, reports that, "As more seniors receive their first covid shots, many will inevitably suffer from unrelated heart attacks, strokes, and other serious medical problems - not because of the vaccine but, rather, their age and declining health" (Szabo, 2021). As of today (3/29/2021) three vaccines have been authorized from Pfizer, Moderna, and Johnson & Johnson. Astrazeneca and Novavax are still working towards releasing their vaccine in the U.S. but continue to distribute doses in the United Kingdom ("Different Vaccines," 2021). Both the Pfizer and Moderna vaccines have an efficacy rate of about 95%, while the Johnson & Johnson shot has a 72% efficacy rate (Montanari, 2021).

Pfizer-BioNTech and Moderna

One of the first companies to make headway in the COVID-19 vaccine was Pfizer. On December 11th, 2020, Pfizer and BioNTech were authorized by the U.S. Food and Drug Administration (FDA) to begin delivering the first doses of their COVID-19 mRNA vaccine for emergency use

("Pfizer and BioNTech Celebrate Historic First Authorization in the U.S. of Vaccine to Prevent Covid-19," 2020). On this historical day, healthcare workers and the elderly began receiving their first doses and would then receive the second and final dose 21 days later ("First People in the US Receive Pfizer's COVID-19 Vaccine," 2020). The Pfizer-BioNTech vaccine is recommended for people ages 16 and older and contraindicates those with severe anaphylaxis to any ingredient in the mRNA vaccine from receiving the COVID-19 vaccine ("Pfizer-BioNTech," 2021). Patients have reported immediate allergic reactions, hives, swelling and wheezing, and severe allergic reactions, requiring the use of an EpiPen or hospital visit. These allergic reactions were to polyethylene glycol (PEG) or polysorbate, which is not an ingredient in the COVID-19 vaccine but is similar to PEG which is in the COVID-19 vaccine ("Allergic Reactions," 2021). During clinical trials common, mild side effects such as chills, tiredness, headaches, and pain, swelling and redness at the site of injection were reported but went away in a few days ("Pfizer-BioNTech," 2021).

On December 18th, 2020 the FDA approved the second vaccine designed to combat COVID-19 ("Moderna Announces FDA Authorization of Moderna COVID-19 Vaccine in U.S.," 2020). This vaccine was approved for use in people 18 years and older and also contraindicated for people with allergies to PEG or polysorbate ("Moderna," 2021). Moderna's vaccine also had mild side effects reported during the clinical trials, such as fever, chills, tiredness, headaches, and pain, swelling, and redness at the site of injection ("Moderna," 2021). Moderna and Pfizer's vaccines have many similarities. Both vaccines use the mRNA technique which, "teaches our cells how to make a protein that prompts an immune response without using the live virus that causes COVID-19" (Bunis, 2021). They both also have similar side effects and both require a series of

two shots to be fully effective. Both of these vaccines also have their differences as well. Pfizer can be administered to patients as young as 16 years old, while Moderna only administers to patients as young as 18 years of age. While they both require a two shot series, Moderna requires the shots to be 28 days apart and Pfizer requires their shots to be 21 days apart. The Pfizer vaccine requires that it be shipped in special containers with dry ice to maintain a temperature of -94℉. The Moderna vaccine can be shipped in a standard freezer to maintain a temperature of -4℉. Pfizer vaccines can be placed in a refrigerator for up to five days and Moderna vaccines can be kept in a refrigerator for up to 30 days. Pfizer vaccines must be administered after it thaws, between 30 minutes and two hours. Moderna's vaccines can be used within twelve hours after it thaws. This difference is crucial because if vaccines are not kept at the correct temperature they won't be effective. Administrators must be aware of the type of vaccine they're using, as well as it's stipulations in order for it to remain effective. The Moderna vaccine may be more practical in smaller communities and rural areas because it does not need to be transported in special cargo or stored in such extreme cold temperatures ("Moderna," 2021). Another difference is that Moderna's vaccine comes ready to be administered, but Pfizer's vaccine must be diluted with saline before injection. This is not uncommon and poses no complications when administered correctly (Bunis, 2021)

Both Pfizer and Moderna's vaccines are messenger RNA vaccines or mRNA vaccines. mRNA vaccines are different from traditional vaccines because they do not contain live germs. Instead they trigger the cells in our bodies to make a protein to produce antibodies that help protect us from infections when the actual virus enters our body. The instructions that the mRNA gives to our cells, creates a spike protein, which is found on the virus that causes COVID-19. After the

cells create the spike protein, the body recognizes the protein and begins making antibodies to strengthen the immune response. Now that the body has learned how to protect itself, the risk of future infection is low ("mRNA Vaccines," 2021).

AstraZeneca

Based out of Cambridge, United Kingdom, AstraZeneca was approved for emergency supply of their COVID-19 vaccine in the United Kingdom on December 30th, 2020 (Kemp, 2020). This vaccine can also be administered to individuals 18 years or older and contains two separate doses for the vaccine to be effective. The AstraZeneca vaccine is engineered a bit different from both the Pfizer and Moderna vaccines. This vaccine uses a dead virus, the adenovirus, to trigger the body's immune response to prepare to fight the coronavirus if necessary (Covid: How Does the Oxford-AstraZeneca Vaccine Work?" 2021). In their clinical trials, no severe cases and no hospitalizations more than 14 days were reported after completion of the second dose (Kemp, 2020). However, more recently, cases of rare blood clots in the United Kingdom are emerging. Out of the 20 million doses administered, 79 people experienced these blood clots after the first dose, while nineteen of those people died (Covid: How Does the Oxford-AstraZeneca Vaccine Work?" 2021). The type of clot developing is called a cerebral venous sinus thrombosis (CVST), which forms in the large veins in the head, and although extremely rare, are most common in young women (Covid: How Does the Oxford-AstraZeneca Vaccine Work?" 2021). The European Medicines Agency has determined that the benefits of the vaccine outweigh the risks and that no specific risk factors such as age, gender, or medical history exist ("EU Drug Regulator: Unusual Blood Clot …" 2021). Despite the scare, the AstraZeneca vaccine is the second most used vaccine in the world with 71 countries utilizing it ("Covid: Germany Limits Use of AstraZeneca

Covid Jab for Under-60s," 2021). No direct links have been made between the vaccine and CVST, but certain countries like Canada and Germany have increased their age limits for the vaccine to 55 and 60 years old, respectively. The reasoning for this is because the cases of CVST were mostly in young women ("Covid: Germany Limits Use of AstraZeneca Covid Jab for Under-60s," 2021).

Johnson & Johnson

Determined to be the third COVID-19 vaccine approved in the U.S., Johnson & Johnson applied for Emergency Use Authorization (EUA) and was eventually granted approval on February 27, 2021 ("Johnson & Johnson COVID-19 Vaccine Authorized…" 2021). The company has completed its clinical trials in the U.S., Latin America, and South Africa where its effectiveness was 72 percent, 66 percent, and 57 percent respectively (Machemer, 2021). Compared to the two other vaccines authorized in the U.S., the Johnson & Johnson vaccine has a lower efficacy rate. Johnson & Johnson conducted clinical trials in South Africa and Brazil where coronavirus variants appeared (Bai, 2021). In order to statistically compare the three vaccines, each of the vaccines' clinical trials should be completed in the same regions, at the same time, and within the same population. Even though Johnson & Johnson's efficacy rate is lower than Pfizer and Moderna, that does not mean that their vaccine is not as effective. The Johnson & Johnson vaccine is slightly different from the other two vaccines approved for use in the U.S. Instead of receiving two doses a month apart, this vaccine only requires one dose that can be stored in a regular refrigerator for up to three months. Johnson & Johnson's vaccine also fights and protects against the coronavirus much differently than the Pfizer and Moderna vaccines. The coronavirus itself is covered in protein spikes that are used to gain entry to our cells, so the virus can get

inside and take over (Corum, Zimmer, 2021). Johnson & Johnson decided to take a different approach and use double-stranded DNA in their vaccine versus the single-stranded RNA that Pfizer and Moderna used. Inside the Johnson & Johnson vaccine, there is the adenovirus, which is a common virus that causes illnesses such as colds and the flu. This is not dangerous to the healthy cells because the adenovirus was engineered to not be able to replicate once inside of another cell, therefore they cannot cause illness (Corum, Zimmer, 2021). Johnson & Johnson already have a vaccine that uses this technique approved for combating Ebola. This approach is not the first of its kind as AstraZeneca in the United Kingdom also uses the adenovirus in their COVID-19 vaccines. Once the adenovirus is inside the body, it gains access to the cells using its proteins. When the adenovirus gets inside the cells, it travels to the nucleus to release its DNA into the nucleus, where the gene for the coronavirus spike protein is read and copied into messenger RNA (mRNA). This process is called transcription. First the DNA's double helix is unwound to expose its nucleotide sequence. RNA polymerases are the enzymes that transcribe the DNA into RNA by using a process called base pairing. At the promoter, RNA polymerase attaches to the DNA and begins transcribing by elongating the new RNA strand with new nucleotides. Transcription ends after termination. Now mRNA has been created and is ready to be translated. (Alberts B., Johnson A., Lewis J., et al., 2002). Once the mRNA leaves the nucleus, it is read by the cell's ribosomes, and assimilation of the spike proteins begin. These spikes are then recognized by the immune system which activate the immune cells causing the immune system to act strongly. After the vaccinated cell dies, the spike proteins it leaves behind are digested by an antigen-presenting cell. This antigen-presenting cell displays these fragments which are then detected by helper T cells who raise alarm to other cells to help fight the infection. B cells, which are immune cells, latch onto the spike proteins and begin secreting

antibodies to fight the spike protein. The antibodies attach to the coronavirus spike proteins when it enters the body and blocks the spikes from attaching to healthy cells, therefore preventing infection (Corum, Zimmer, 2021).

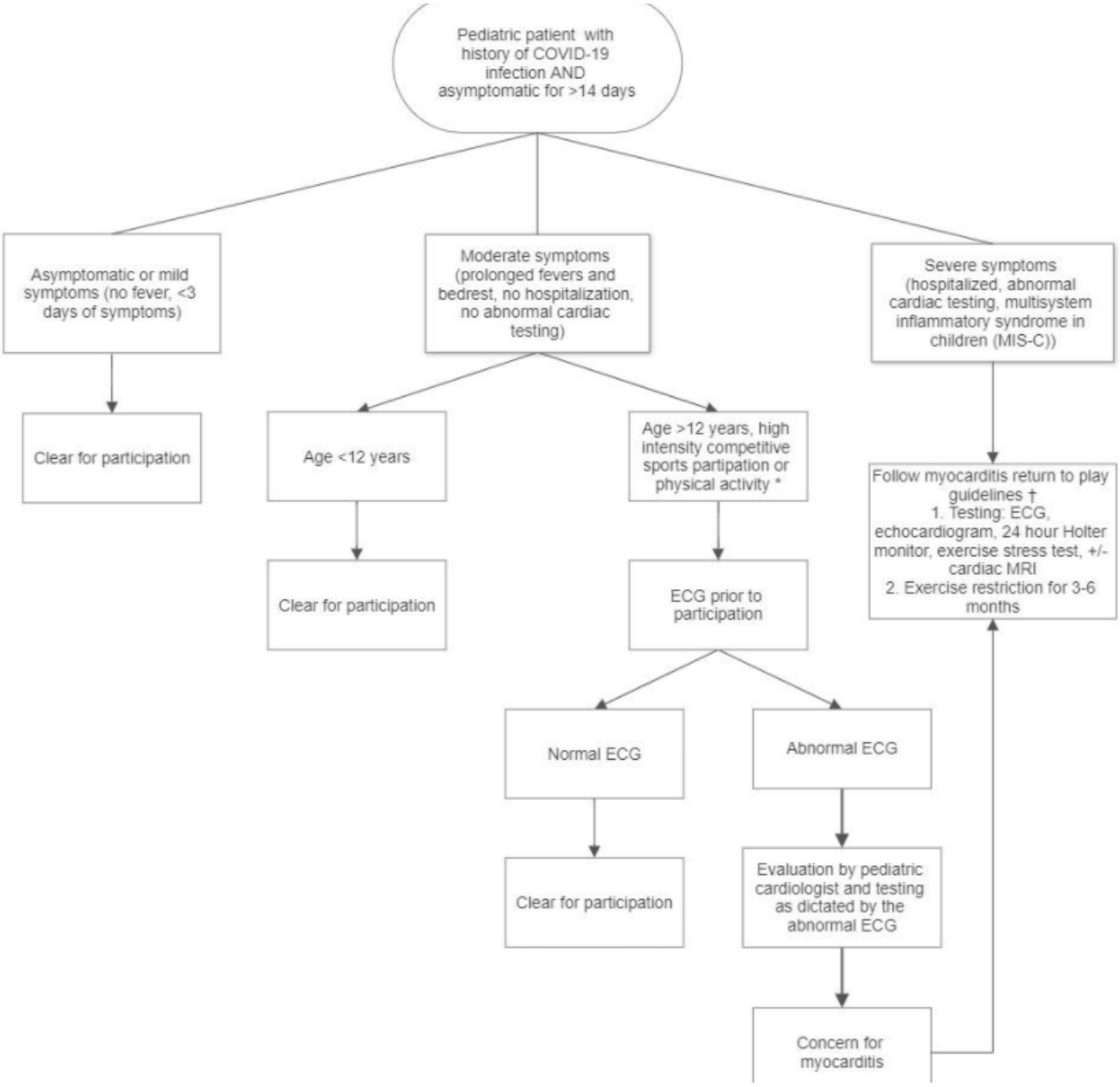
Discussion

After only about one year into the coronavirus pandemic scientists have only scratched the surface on what there is to know about COVID-19. Studies and case series have been completed but more long term information is needed. A longitudinal study is beginning in San Francisco where about 300 adults who have tested positive for COVID-19 will be analyzed over a course of two years to determine how long adverse effects and symptoms may last (Couzin-Frankel, J., 2020). Research still does not show how often one would be required to receive a COVID-19 vaccine nor does research show if the virus a vaccinated person spreads is as severe as the virus a non-vaccinated person spreads. At this stage of the pandemic, only time will tell us these answers. All the formulated COVID-19 vaccines have not been out for even a year yet with the first clinical trials beginning in July 2020 (Sierra, 2021). Even though Pfizer and Moderna vaccines have been proven to be effective for at least six months, experts cannot be certain how long their effectiveness will truly last (Sierra, 2021). While Dr. Monica Gandhi of UCSF Health reports that, "all...COVID-19 vaccines are also producing a high level of T cell immunity, which is effectively fighting variants," Albert Bourla, CEO of Pfizer, states that "there will 'likely' be a need for a third dose somewhere between six and 12 months in additional to an annual COVID shot like the flu shot (Sierra, 2021).

In the meantime it is critical for individuals to stay up to date on all guidelines issued by the CDC, including the continuation of wearing masks and socially distancing. As we begin to see parts of the U.S. begin to relax on these guidelines, individuals must remain vigilant of themselves and those around them. Those individuals who have been diagnosed with COVID-19 at some point must also keep a careful watch on their health, especially those with underlying medical conditions. Although the virus is not commonly severe among the athletic population, those athletes who test positive for COVID-19 must also monitor their symptoms and follow a gradual return to play protocol under the supervision of a professional healthcare provider.

Appendix A

Return to Play After COVID-19 Infection in Pediatric Patients



(Dean, Jackson, Paridon, 2020)

Appendix B

Alfred University Sports Medicine COVID-19 Return to Play Protocol

Alfred University Sports Medicine requires any student athlete diagnosed with COVID-19 in any capacity to be evaluated and cleared by our Sport Medicine Staff before beginning the COVID-19 Return to Play Protocol (RTPP). The Alfred University Sports Medicine RTPP has been developed based on current research and will be updated as additional information becomes available.

WHOM:

- Individuals who test positive ***with or without*** symptoms based on nasopharyngeal PCR testing will be quarantined per University and CDC guidelines for 14 days. Saliva testing then enter Return to Play Protocol
- Individuals who test positive ***with or without*** symptoms based on saliva testing will be advised to have a confirmatory second nasopharyngeal PCR test. If the second testing is negative, they will be considered negative. If the **second test is positive,** individual will be quarantine per University and CDC guidelines for 14 days and enter Return to Play Protocol
- Individuals who test positive ***with or without*** symptoms based on antibody testing will be advised to have a confirmatory second nasopharyngeal PCR test. If the second testing is negative, they will be considered negative. If the **second test is positive,** individual will be quarantine per University and CDC guidelines for 14 days and enter Return to Play Protocol
- Individuals who report not experiencing symptoms but report close contact with a confirmed COVID-19 case should stay home and quarantine per University and CDC guidelines for 14 days then enter Return to Play Protocol

CLEARANCE

- In order to return to play, all individuals will first meet with the team physician. Individuals will need to bring documentation of their COVID19 test (nasopharyngeal, saliva, and/or antibody)
- Individuals will then complete a screening questionnaire as it pertains to symptoms they may have had, how the illness was handled, and ongoing symptomatology.
- It may be recommended that the individuals have a cardiac work up. Based on the recommendations of the American Academy of Cardiology, an ECG (electrocardiogram) and cardiac enzyme serum testing is recommended for certain patients including but not limited to those who have moderate symptoms, prolonged fever and/or bedrest. Additional cardiac screening is recommended for patients who have more significant symptoms and/or have been hospitalized. Once these tests are done, clearance will be granted.
- Once clearance is granted by the team physician the individual will then begin Return to Play Protocol

(Alfred University, Department of Athletic Training, Policies and Procedures, 2021)

Alfred University COVID-19 RTPP

The Alfred University Sports Medicine COVID-19 RTPP consists of phases that must be completed before the athlete may resume full interscholastic athletics. That includes any voluntary or mandatory practices, weight room activities, and or competitions. The COVID-19 RTPP is outlined below:

Phase	**Description**
1	Athlete has been symptom free for 14 days Medical clearance by Team Physician Activities of Daily Living do not cause excessive fatigue or breathlessness
2	Athlete remains symptom free 15 minutes of aerobic exercise (walking, light jogging, stationary cycle, no resistance training) at <70% of MHR Athlete completes above criteria without excessive fatigue or breathlessness
3	Athlete remains symptom free 30 minutes of moderate activity (e.g. simple movement activities such as running drills) at <80% of MHR Athlete completes above criteria without excessive fatigue or breathlessness
4	Athlete remains symptom free 45 minutes of sports aerobic activity (including warm up) at <80% of MHR Athlete completes above criteria without excessive fatigue or breathlessness
5	Athlete remains symptom free 60 minutes of sports specific aerobic activity (including warm up) at <80% of MHR Athlete completes above criteria without excessive fatigue or breathlessness
6	Athlete remains symptom free 60-90 minutes of sport specific aerobic activity (including warm up) at >80% of MHR Athlete completes above criteria without excessive fatigue or breathlessness

(Alfred University, Department of Athletic Training, Policies and Procedures, 2021

ALFRED UNIVERSITY COVID19 FORM

Name of Patient: _____

COVID19 Diagnosis **YES NO**

- ❏ Positive COVID-19 diagnosis via Nasopharyngeal Swab with no symptoms.
  - ❏ Date _____
- ❏ Positive COVID-19 diagnosis via Nasopharyngeal Swab with symptoms.
  - ❏ Date _____
  - ❏ Medications _____
  - ❏ Hospitalized YES or NO
  - ❏ Seen by Medical Provider
- ❏ Not experiencing symptoms but reports close contact with a confirmed COVID-19 case.
  - ❏ Date of Contact _____
- ❏ Experiencing symptoms and reports close contact with a confirmed COVID-19 case.
  - ❏ Date Symptoms Ended _____
  - ❏ Medications _____
  - ❏ Hospitalized YES or NO
  - ❏ Seen by Medical Provider

Signature _____ Date _____

Head Athletic Trainer	Team Physician:
Name:	Name:
Signature:	Signature:
Date:	Date:

(Alfred University, Department of Athletic Training, Policies and Procedures, 2021)

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