

Good afternoon. I'm Commander Ibad Khan, and I'm representing the Clinician Outreach and Communication Activity, COCA, with the Emergency Risk Communication Branch at the Centers for Disease Control and Prevention. I'd like to welcome you to today's COCA Call, Evaluating and Supporting Patients Presenting with Cardiovascular Symptoms Following COVID. All participants joining us today are in listen-only mode.

Free continuing education is offered for this webinar. Instructions on how to earn continuing education will be provided at the end of this COCA Call.

In compliance with continuing education requirements, all planners and presenters must disclose all financial relationships in any amount with ineligible companies over the previous 24 months, as well as any use of unlabeled products or products under investigational use. CDC, our planners, and presenters wish to disclose they have no financial relationships with ineligible companies whose primary business is producing, marketing, selling, reselling, or distributing healthcare products used by or on patients. Content will not include any discussion of the unlabeled use of a product or a product under investigational use. CDC did not accept financial or in kind support from ineligible companies for this continuing educational activity.

At the conclusion of the session, the participant will be able to accomplish the following. Describe cardiovascular symptoms and complications associated with post-COVID conditions. Determine which clinical assessments and tests are needed for a patient with cardiovascular symptoms. And apply health equity considerations to clinical care, activity management and reconditioning of long COVID patients.

After the presentations, there'll be a Q&A session. You may submit questions at any time during today's presentations. To ask a question using Zoom, click the Q&A button at the bottom of your screen, then type your question in the Q&A box. Please note that we often receive many more questions than we can answer during our webinars.

If you're a patient, please refer your questions to your healthcare provider. And if you're a member of the media, please contact CDC Media Relations at 404-639-3286 or send an email to media@cdc.gov.

We have introduced self-knowledge checks throughout this presentation. We hope you enjoy these opportunities to assess your understanding of today's sessions. Please do not type your answers into the Q&A box as this may disrupt the Q&A portion at the end of our session.

I would now like to welcome our presenters for today's COCA Call. We're pleased to have with us Dr. Miriam Nji who is a medical epidemiologist on the Post-COVID Conditions Team in the Chronic Viral Diseases Branch at CDC's National Center for Emerging and Zoonotic Infectious Diseases. Dr. Alba Azola, who's an assistant professor and the codirector of the Post-Acute COVID-19 Team Program in the Department of Physical Medicine and Rehabilitation at Johns Hopkins University School of Medicine. And Dr. Jonathan Whiteson, who's a medical director of Cardiac and Pulmonary Rehabilitation, and codirector of NYU Post-COVID Care Program at Rusk Rehabilitation NYU Langone Health. It is now my pleasure to turn it over Dr. Nji. Dr. Nji, please proceed.

Good afternoon. Today I'll present an overview of post-COVID conditions as an introduction of the main presentation on evaluating and supporting patients with cardiovascular symptoms and complications following COVID-19. Next slide, please.

Broadly speaking, post-COVID conditions, PCC for short, is an umbrella term used to describe the wide range of new, returning, or ongoing health problems people can experience four or more weeks after SARS-CoV-2 infection, including by patients who had initial mild or asymptomatic infection. They are associated with a spectrum of physical and mental health consequences.

These conditions are heterogeneous and attributable to different underlying pathophysiologic processes. Post-COVID conditions are being referred to by a wide range of names including post-acute sequela of SARS-CoV-2, PASC for short, or long COVID. Throughout the presentations, my colleagues and I we use these terms interchangeably. Next slide, please.

CDC has proposed a framework for thinking about the types of conditions that occur following COVID-19. On the left are processes that occur as a result of being ill and hospitalized or receiving treatment. On the right are consequences that are more specific to infection with SARS-CoV-2. These conditions frequently overlap and patients may experience them in any combination. Next slide.

It is clear that anyone with history of SARS-CoV-2 infection can have new, persistent, or worsening symptoms. The diagnosis of PCC does not rely on having a positive test for SARS-CoV-2. Even those patients who were presumed by a clinician to have COVID can present with lingering symptoms. These conditions can also occur regardless of severity of acute infection, including in those with initially mild or asymptomatic infection. Patients in all demographic groups and previously healthy persons may also report persistent symptoms. However, it is worth noting that there are certain groups that are disproportionately affected, such as persons with severe initial illness, female sex, preexisting conditions, older age and infection without prior vaccination. Next slide, please.

People who experience post-COVID conditions commonly report general symptoms, such as fatigue that interferes with their daily activities, symptoms that get worse after physical or mental effort, and fever. COVID may also cause direct organ damage, leading to systemic symptoms. Cardiovascular and respiratory symptoms may include difficulty breathing, cough, chest pain and palpitations. Symptoms related to the digestive, neurologic and other systems may also occur. Next slide.

The US Census Bureau in collaboration with multiple federal agencies launched the household poll survey to generate data on the impacts of COVID-19 on American households, including estimates of those suffering from long COVID. In the most recent data from this summer, of US adults who ever had COVID, 17% currently report symptoms consistent with long COVID. These reports differ by select sociodemographic characteristics and disability status. We see that the prevalence of long COVID is higher among females, with about 20% of females reporting persistent symptoms compared to 13% of males. Non-Hispanic Asian adults are less likely to report persistent symptoms compared to non-Hispanic white, non-Hispanic Black and Hispanic.

In addition, adults with disability have higher rates of long COVID compared to their counterparts without a disability. Next slide, please.

Another study by CDC used a model-based approach to provide estimates of point prevalence of activity limiting post-COVID conditions among US adults. On November 1, 2021, 3 to 5 million persons had activity limiting PCC.

Among persons with SARS-CoV-2 infection, 8.3 to 13.8% had activity limiting PCC. Of course, just like other models, this study had some limitations, and the data from the study should be interpreted in the context of those limitations. Next slide, please.

Despite high burden of PCC, we know that symptoms can improve over time. The decay of symptom prevalence has been observed in several studies such as the UK Coronavirus Infection Survey. When most patients recover in four weeks, and the proportion reporting symptoms decreases between four to 12 weeks. Improvement slows around week 12 following infection. It was also noted that there were no sex differences in the disease course, even though women tend to report more symptoms in general. Next slide.

The impact and consequences of post-COVID conditions may include significant morbidity, ranging from mild to incapacitating, with reported limitations in activities of daily living and increased utilization of health resources. The extent and duration of disability as stated with persistent symptoms is still being studied. We continue to learn about the impact of post-COVID conditions in different sociodemographic groups. It is also suspected that existing health disparities for COVID may persist with post-COVID conditions. Next slide, please.

So let's pause briefly and check our knowledge so far. The question is, who can present with persistent symptoms following COVID-19? And the options are A, patients with severe disease. B, older adults. C, those with asymptomatic acute infection. D, patients with underlying medical conditions associated with risk. And lastly, E, all the above. A few seconds to note your responses. Next slide.

The correct answer is E, all the above.

Anyone can present with post-COVID conditions. Even though certain patient factors such as severity of illness, preexisting health conditions and older age associated with increased risk of persistent symptoms, it is evident that anyone with previous SARS-CoV-2 infection can present with post-COVID conditions. Next slide.

Let's move on to cardiovascular complications after COVID which is the theme of today's call. There is growing evidence that cardiovascular symptoms and disorders can occur following infection with SARS-CoV-2.

Commonly reported symptoms are chest pain, dyspnea, and palpitations. The symptoms could range from mild to incapacitating, and patients hospitalized during acute illness are at higher risk. Also, certain cardiovascular disorders may occur in the post-acute period. A study in Nature estimated the risk and 12-month burdens of incident cardiovascular outcomes, using national

data from the US Department of Veteran Affairs. Compared to controls, there was an increased incidence in cerebrovascular disorders, dysrhythmias, ischemic and non-ischemic heart disease, heart failure, and thromboembolism. The risk was high regardless of demographic and other preexisting cardiovascular risk. Next slide.

The pathogenesis of cardiovascular sequelae could be explained by several factors. Shown on the slide are some mechanisms as illustrated by a review paper published in the British Medical Journal. In the heart, cytokine-mediated inflammation can cause myositis and cardiomyocyte death.

Subsequently, long term inflammation and associated cellular damage can lead to fibrosis. In addition, autonomic dysfunction can cause complications such as Postural Orthostatic Tachycardia Syndrome. More information on cardiovascular complications will be provided by our next presenters. But before that, I wanted to provide some additional resources. Next slide.

So on the CDC website, there is information for clinical providers on how to support and care for patients with post-COVID symptoms. And I'm going to go ahead and highlight a few points from the guidance. Most commonly, post-COVID conditions can be diagnosed and managed in primary care settings. A majority of cases can be diagnosed based on history and physical exam alone, as routine tests may be normal. For the first four to 12 weeks, clinical providers are encouraged to consider a conservative diagnostic approach.

However, symptoms lasting beyond three months should prompt further evaluation. And more importantly, providers are called upon to listen to and validate patients' experiences, in addition to partnering with patients to identify achievable health goals. Next slide.

So the next three slides will highlight some of the work other federal agencies are doing to address post-COVID conditions. In April of this year, President Biden issued a memorandum which charged the Secretary of Health and Human Services with coordinating a government-wide response to long COVID and the longer-term effects of COVID-19.

The reports cover three large populations, those with long COVID and associated conditions, those with behavioral health concerns -- so that will include both mental health and substance use challenges. And lastly, those who have lost either a family member, caregiver or loved one to COVID. Fourteen government departments and agencies collaborated to draft this report, and the process was informed by listening sessions with community members, patients, public health partners, and healthcare and research partners. It culminated in two reports released on August 3, 2022. And these reports are available on [covid.gov](https://www.covid.gov). Next slide.

So the first report is the Services Report, which is broad in intent and outlines federally funded mostly preexisting programs for individuals experiencing long COVID, and those impacted by the long term effects of the pandemic. It is a consumer facing tool that catalogs more than 200 federally supported services, which also includes resources or healthcare personnel caring for individuals with long COVID. We strongly encourage you to share the resources with your patients. Next slide.

And the second report is the National Research Action Plan on Long COVID, which proposes a comprehensive research strategy with a focus on equity to inform the national response to long COVID. The plan is relevant to healthcare and service personnel, public health partners, long COVID patients and advocacy groups, pharmaceutical companies, state policymakers, foundations and other funders of research, and the general public. This plan outlines over 72 active research programs. And one of such programs is the NIH Recover Initiative that has multiple cohorts and several studies involving adults and children.

It also has over 40 studies of the underlying biology responsible for long COVID. There's currently a great need to enroll people who have had a recent positive test result for SARS-CoV-2. Please refer those patients to the NIH portal to enroll in a study in their community. For reference, the NIH portal can be found on recovercovid.org. Next slide.

Thank you so much for your attention. I'm going to pass it over to Dr. Azola.

Thank you. My name is Dr. Alba Azola, and I wanted to start by saying that the findings and conclusions in our report are those of the authors and not necessarily represent the position of the CDC. Next slide.

So Evaluating and Supporting Patients with Cardiovascular Symptoms Following COVID-19. We're going to go through an overview of the clinical presentation, the workup and management of these patients and rehabilitation management. Next slide.

Next slide.

As we heard from the previous speaker, there are millions of Americans that have survived COVID. And we estimate that about 10% of those that were affected with COVID may continue to have symptoms and struggle for months with declined function. Next slide.

Our learning objectives include to identify and diagnose cardiovascular symptoms and complications of patients with long COVID. We're going to use the PASC consensus guidance statement recommendations to assess patient with cardiovascular symptoms. We're going to identify appropriate treatment for PASC-related cardiovascular problems, and identify health equity considerations and examples in PASC-related conditions. Next slide.

Our consensus guidance statements are part of a larger effort from the multidisciplinary post-Acute Support of SARS-CoV-2 Collaborative at the Academy of Physical Medicine and Rehabilitation. The consensus guidance published today include management of fatigue, breathing issues, cognitive symptoms, and the one we're going to be sharing today, cardiovascular symptoms and complication. Soon to be published are the autonomic dysfunction, and the pediatric management. Next slide.

So the way our consensus statements were created, it was a collaborative discussion between multiple, over 40, post-COVID clinics in the US. And it's made up by psychiatrists and cardiologists, neurologists, other specialists that were involved in the multidisciplinary management of post-COVID patients. So initially, we have a collaborative discussion, in terms

of what the symptoms are that the patients are presenting. We identify specific writers for a writing group that will target different symptoms. And at the same time, the equity considerations panel is going through the same type of discussion. We present the initial topics to be addressed to the collaborative at large, including patient perspectives.

And from that we are able to vote on the different statements that are going to be addressed. And statements that have 80% consensus were retained. Statements that had 60 to 80% approval were discussed at the larger collaborative and refined. And then we would go to a second larger collaborative to look at the more synthesized items that we were going to discuss. And we make finalization and consensus both on those items that we want to discuss. Next slide.

So cardiovascular symptoms and complications after PASC are common. It's true for both hospitalized patients as well as those with milder disease. Most patients reporting cardiac symptoms will complain of chest pain, dyspnea on exertion, palpitations, and it's a frequent reason for patients to seek out care even in the emergency room. Next slide.

The incidence of cardiovascular complications has been described to be myocardial injury from seven to 40% of patients, acute heart failure, and about 23 to 33% of hospitalized patients. Right ventricular systolic dysfunction, right ventricular dilation, as well as arrhythmias like atrial fibrillation or flutter being the most common arrhythmias observed. And also 15 to 21% of hospitalized patients had venous thromboembolisms. Next slide.

The long-term effects of COVID in the cardiac or vascular system are certainly being studied and have been related -- their severity or increase in risk on the population has been related to the severity of illness.

So we know that there's an increased risk of developing cerebrovascular disorders, including dysrhythmias, inflammatory heart disease, ischemic heart disease, thromboembolic disorders, as well as myocardial infarction. And as you can see, the patient population that had ICU level of care had the highest increase in risk of this event, followed by the patients that were hospitalized but did not require ICU. But what's really notable is that the patients who had mild disease that did not require hospitalization also have a significant increase in the risk of cardiovascular complications. Next slide.

When we are assessing patients that present with cardiovascular complaints, we want to first review the predisposing comorbidities such as CAD and diabetes, and any events or cardiovascular events that had happened in the past.

And then we also want to get a sense for the severity of the acute illness, whether it was mild, moderate, severe. Did it require ICU? Did it require mechanical ventilation or ECMO? And what was the timeline for the symptom evolution? What symptoms resolved? What symptoms persisted? Next slide.

When we're completing the history for the patient, we want to know what are those most common new or worsening cardiac symptoms? Is it chest pain that comes with activity, palpitations? Have they have experienced any near syncopal episodes or actual syncopal

episodes? Are they experiencing exercise intolerance? And the initial lab work should include general blood work, electrocardiogram, echocardiogram, and chest imaging and other cardiac workup. And we want to take a thorough medication history to know which medications could be impacting some of the symptoms, signs, and symptomatology that the patients are presenting with. Next slide.

Next slide.

In terms of patient history, again, we really need to tease out what is triggering and alleviating this symptom, and what is really getting in the way of function, right, what's limiting their activity? So what is bringing on those symptoms? What is the frequency that the symptoms present, the intensity and how they have found the alleviating factors for the symptoms. Next slide.

We recommend clinicians conduct a thorough examination of the cardiovascular system. This includes routine vital signs, pulse oximetry, auscultation of the heart and lungs, and checking for peripheral pulses and bruits, and any signs of overload, volume overload. Next slide.

For individuals that present with the complaint of dizziness and lightheadedness, or syncopal, pre-syncopal episodes, it's important to further tease out what is the perceived dissonance. Is it lightheadedness? Is it a room spinning sensation? What exactly they're experiencing during that episode, and that can help us guide the workup, whether it should be cardiovascular or whether there's a central etiology that warrants a specialist referral that could be contributing to this symptom presentation. Next slide.

So an important point when assessing cardiovascular complaints in past patients is that we need to differentiate cardiovascular from autonomic dysfunction. We recommend that we check on patients with cardiovascular symptoms and orthostatic blood pressure and heart rate. So their response to being supine and standing position. If there's an abnormal response noted, that can give us a clue that the patient may be having autonomic dysfunction. Also a history of the symptoms being reproduced by change in position. So in these patients that we can identify those factors, we recommend continuing a 10-minute active stand test, where we have the patient stand for a period of 10 minutes and repeat blood pressure and heart rate response during that time.

We're going to be looking at changes in heart rate that are abnormal, like elevation of heart rate greater than 30 beats per minute or drops in blood pressure. But something that is really important is also the reproduction of symptoms. In some patients with the orthostatic challenge, they may also show symptoms of sweating, flushing, changes in color of the hands and feet with vascular congestion, kind of purplish, reddish hue. So those observations can really help us determine whether this patient should be continuing workup for autonomic dysfunction. Next slide.

We recommend that clinicians obtain standardized measures of activity performance, and really to compare the patient's functionality to normal control values and also to help guide the initial activity prescription. We also want to repeat those standardized test and follow up visits to quantify functional change and guide progression of activity prescription. A key point in exercise

or activity prescription on patients is that not all PASC patients can tolerate activity the same way. There's a subgroup of patients with PASC or long COVID that are not able to tolerate increased activity and experience exacerbation of symptoms that we call post-exertional malaise. This can entail a flare of body myalgias, arthralgias, severe debilitating fatigue, and a host of neurologic symptoms.

These symptoms can present anywhere from 12 to 48 hours after the inciting activity. So it's really important to note that in this patient population, the activity prescription needs to take post-exertional malaise into consideration. Next slide.

So a self-knowledge checking question. Common cardiovascular symptoms in patients with PASC include A, chest pain. B, palpitations. C, exercise intolerance, and D, shortness of breath, or E, all of the above. I

'll give you a few seconds to note your answers. Next slide. So the answer is E, all of the above.

Patients may experience cardiovascular symptoms after COVID. Most commonly, we see chest pain palpitations, exercise intolerance, and shortness of breath. Next slide.

What tests can be done to differentiate cardiovascular from autonomic dysfunction? A, routine vital signs. Orthostatic blood pressure and heart rate response in supine and standing positions. C, echocardiogram. D, chest imaging. Or E, do nothing. I'll give you a few seconds. Next slide.

The answer is B. Orthostatic. blood pressure and heart rate response and supine and standing positions can be very telling and guide the clinician to think of autonomic dysfunction versus cardiovascular issue. So first, we recommend checking the orthostatic changes by measuring the blood pressure and heart rate in supine and standing. And then, given the result of that study, we can proceed to a 10-minute stand test as well. Next slide.

I will pass this onto Jonathan. Thank you.

Dr. Azola, thank you so much. I'm Dr. Jonathan Whiteson.

In the assessment of cardiovascular complications in PASC where the diagnosis is uncertain or symptoms are progressing or severe, referral to a cardiologist for a more detailed assessment should be considered. Practitioners should also consider the value of ordering the following tests -- a CAT scan of the chest to visualize lung fields, looking for fluid overload, pulmonary inflammation or fibrotic changes. A coronary CT can also evaluate for coronary artery disease. A cardiac MRI can be used to visualize the cardiac structures including heart valves, the myocardium looking for myocarditis, and the pericardium looking for pericarditis, or a pericardial effusion. A cardiac stress test can be used to evaluate for the presence of ischemic heart disease, arrhythmias and myocardial function. A cardiopulmonary exercise test provides similar results to a regular stress test, and in addition provides data on cardio metabolic function, the aerobic fitness level as measured by VO₂, oxygen consumption, as well as dynamic lung function. Next slide.

The treatment recommendations for cardiovascular complications includes the management of risk factors for cardiovascular disease, including dyslipidemia, diabetes, hypertension, overweight and obesity, sedentary lifestyle, tobacco use, and depression. It is recognized that these cardiovascular disease risk factors are also risk factors for more severe acute COVID and a greater incidence of long COVID. So this presentation delivers an ideal opportunity to identify cardiovascular disease risk factors, to implement management strategies, and also to positively influence COVID risk factors and COVID outcomes. Management of risk factors begins with their quantification, trending values, and then lifestyle interventions in conjunction with medication management if values are markedly off, or if lifestyle interventions do not significantly improve the values. Next slide.

When cardiovascular risk factors and cardiovascular complications have been identified in PASC, education plays a significant role in management and improving outcomes. Lifestyle modifications include pacing and energy conservation considerations to prioritize tasks and simplify schedules that are otherwise too fatiguing, too tiring and possibly unmanageable. Diet and nutrition considerations include optimizing dietary intake to improve modifiable risk factors for cardiovascular disease, as well as improve PASC symptoms. A mediterranean style diet rich in fruits, vegetables, mono- and polyunsaturated fats, whole grains, nuts and seeds, and minimal processed foods, saturated fats and simple carbohydrates, has been suggested.

This diet style supports heart health by positively impacting modifiable risk factors like diabetes, dyslipidemia, and hypertension. It is rich in antioxidants and anti-inflammatory agents that may contribute to the improvement in ongoing inflammation and immune dysregulation, possibly contributing to PASC. It is also recommended to avoid alcohol and hydrate adequately with water. Activity and exercise are essential for heart health and should be encouraged. Progressing activity from activity levels tolerated at presentation to the recommended daily activity and exercise levels requires individualized consideration of post-exertional symptom exacerbation, as described in a previously published consensus management statement published by the APM&R PASC Collaborative on Fatigue.

Medication management of cardiovascular risk factors and cardiovascular disease may be essential for some individuals with PASC. Education on the indication for the medication and the need for compliance with medication regimens is indicated. Risk factor education is also essential to support compliance with management regimens for each risk factor. Lack of knowledge of risk factors and their impact on cardiovascular disorders contributes to poor management compliance. With consideration of the disease process, we must recognize that PASC is a relatively new entity, and individuals with PASC experience their individual symptoms and symptom complexes differently.

That being said, there are some common trends in overall PASC symptomatology, often following a variable course, fluctuating in symptom presence and severity over time, possibly days, weeks, or months. Some individuals with PASC demonstrate post exertional symptom exacerbation. But encouragingly, many individuals with PASC over time do demonstrate a clinical improvement and eventual resolution of symptoms with a return to pre-morbid wellbeing and function. However, it is noted that some individuals with PASC continued to have significant symptoms and functional limitations long term. Discussing the broad landscape of the

clinical courses of PASC and indicating and encouraging likelihood of improvement in symptoms and function can be reassuring to individuals with PASC and cardiovascular disease. Next slide.

Treatment recommendations for cardiovascular complications in PASC in individuals diagnosed with new or worse complex arrhythmias, structural heart disease, coronary heart disease, and/or ventricular dysfunction includes evaluation and management in conjunction with a cardiologist. It is likely that individuals with preexisting heart disease will already be under the care of a cardiologist. Ongoing care as the patient is managed and stabilized can be in a shared model with the emphasis shifting back to the primary provider. Next slide.

Individuals with a recent history of cardiac events and diagnoses including myocardial infarction, stable angina, coronary intervention, systolic heart failure, heart surgery, including coronary artery bypass, heart valve or replacement, heart or lung transplant qualify for and should be referred for cardiac rehabilitation. Cardiac rehabilitation is a powerful tool in the management of cardiovascular disease and associated functional limitations, and is appropriate for individuals who had COVID or who have PASC with cardiovascular disorders. Cardiac rehabilitation combines 36 sessions of progressive aerobic exercise with risk factor modification, nutrition, cardiovascular education and psychosocial support over the course of three to four months, and with a view to lifelong compliance. Short-term outcomes of cardiac rehabilitation include improved risk factors for cardiovascular disease, improved cardiopulmonary fitness and overall strength and endurance, improved knowledge and patient confidence and self-efficacy. Long-term cardiac rehabilitation is evidence-based to reduce recurrent cardiovascular events, hospitalizations, healthcare cost and utilization, as well as reduced mortality rates.

Unfortunately, cardiac rehabilitation is a grossly underutilized intervention, with up to 80% of eligible individuals either not referred or not participating. That being said, we should be vigilant in evaluating patients with cardiovascular complications from acute COVID and in PASC for their eligibility for cardiac rehabilitation and refer them through as indicated. Of note, when referring or prescribing cardiac rehabilitation, consider that some individuals with past have post exertional symptom exacerbation. And in those individuals, either waiting till this has significantly improved or resolved, or significantly lowering the cardiac rehab exercise intensity and rate of progression is indicated. An individualized risk benefit approach by clinician and patient is recommended. Next slide.

Athletes should be evaluated, counseled, and guided on a stage return to play and sports performance. Caution should be used when prescribing return to play in sports performance in individuals with post-exertional symptom exacerbation. Taking into account that athletes who have not exercised become deconditioned and untrained, some degree of post-exertional fatigue and muscle soreness is typically expected during the retraining process and should be discussed with the athlete for reassurance. Individuals returning to play in sports performance should be monitored closely for post-exertional malaise and other tasks symptom exacerbation, such as a sense of fever, myalgia, joint stiffness, brain fog.

These symptoms are often out of proportion to the preceding dose of activity or exercise. And this could be consistent with myalgic encephalomyelitis, chronic fatigue syndrome and requires a

reduced dosage of exercise or abstinence from exercise to minimize or resolve the symptoms. Athletes may resume exercise training when the following criteria have been met. In those with a recent SARS-CoV-2 infection who are asymptomatic and have abstained from exercise for three days during self-isolation. Those with recent SARS-CoV-2 infection who experienced mild or moderate non cardiopulmonary symptoms which have resolved.

And those with remote infection greater than three months ago without ongoing cardiopulmonary symptoms and require no additional testing. Athletes who report ongoing cardiopulmonary symptoms, those who develop new cardiopulmonary symptoms after resuming exercise training, and all those requiring hospitalization with heightened suspicion for cardiac involvement should undergo testing with EKG, cardiac troponin, and echocardiogram and be managed accordingly. Additional testing may include maximal effort exercise stress testing, and ambulatory rhythm monitoring in athletes with persistent cardiopulmonary symptoms and normal cardiac MRI findings or cardiac MRI findings of previous myocardial or pericardial involvement once the act of myocarditis has been excluded. Athletes diagnosed with myocarditis should undergo a resting echocardiogram, 24-hour Holter monitoring and an exercise 12 lead EKG within three to six months following illness and prior return to sport. Athletic training may be resumed if ventricular systolic function has normalized, serum markers of myocardial injury, heart failure and inflammation have normalized, and clinically relevant arrhythmias on Holter monitoring and graded exercise 12 lead EKG are absent. A period of relative rest should be dependent on clinical severity and duration of myocarditis or associated illness. An athlete should undergo periodic reassessment following return to sport for the first two years, owing to the risk of silent clinical progression. Next slide.

There is a need to support equitable access to rehabilitation care for individuals with cardiovascular complications and PASC. The American Academy of Physical Medicine and Rehabilitation has stated that equitable access to care includes a timely and local patient access to multidisciplinary care, addressing inequities in the US health system that result in diminished access to sustained quality care because of structural racism or socioeconomic factors, and strengthened safety net care including disability evaluations and benefits. Next slide.

Examples of health equity considerations include biologic sex. Biologically female adults have differences in cardiac risk factors compared to male adults. For example, biologic females go through menopause with ensuing hormonal and other physiologic changes affecting risk for cardiovascular disease. And pregnancy has been reported to be a risk factor for more severe COVID-19 infection.

Sex-related disparities have been reported, and female adults may be underdiagnosed and undertreated for cardiac conditions, including referral for cardiac rehabilitation. It is important for clinicians to be aware of the potential for underdiagnosis or misdiagnosis and ensure that this group receives optimal care. Next slide.

Another example of health equity considerations is noted in racial ethnic minority groups. Individuals who identify with groups that have been historically socially or economically marginalized may be at higher risk for COVID-19 related morbidity and mortality.

Historically, marginalized racial ethnic minority groups have higher rates of COVID-19 infection and lower rates of access to healthcare services, and these disparities are influenced by social determinants of health. The North American COVID and STEMI registry demonstrated ST segment elevation myocardial infarction in COVID-19 positive patients disproportionately involved individuals from racial ethnic minority groups with diabetes. And individuals from racial ethnic minority groups have been reported to have lower referral rates to cardiac rehabilitation than people classified as white or Caucasian. Treating physicians should determine what type of rehabilitation interventions or programs will be most beneficial, as well as considering other factors such as cost and availability. Every effort should be made to close gaps in health disparities, and ensure optimal care for people who identify with racial ethnic minority groups. Next slide.

In summary, cardiovascular symptoms and conditions are common in COVID-19 and may persist in individuals with PASC. A thorough evaluation for risk factors in the presence of pre-existing or new cardiovascular diseases recommended in conjunction with a cardiologist. Management includes lifestyle changes, risk factor modification, cardiovascular disease management, including testing, medications and referral to cardiac rehabilitation when indicated. Healthcare disparities impact outcomes for individuals with PASC and cardiovascular conditions and must be sought and managed appropriately. Next slide.

This consensus guidance statement also serves as a call to action. Prepandemic data trends project a significant rise in cardiovascular disease over the coming 30 years. These projections have been further influenced by the COVID pandemic. People infected by COVID and/or affected by the pandemic have been generally less active, have gained weight, experienced increased stress, demonstrate poor attendance to healthcare settings, and have had poor adherence to risk factor management.

There are significant health disparities noted in trends in cardiovascular risk factors and cardiovascular disease prevalence, as well as in COVID-19 prevalence, especially regarding racial, gender, and disability status. For instance, these pre-pandemic data indicate that rates of cardiovascular disease and risk factors for cardiovascular disease will decrease amongst Caucasians over the coming decades, but significantly worsen amongst Black and Hispanic groups, so potentially widening the racial healthcare and health status divide. Our guidance statement is not just about managing individuals with PASC and cardiovascular symptoms and cardiovascular disease, but it is about setting affected individuals on a better health trajectory and supporting them into the future to optimize health, function, and quality of life. Next slide.

Considering the future and future directions, we hypothesize that improved control of cardiovascular risk factors is likely to reduce the severity of and improve outcomes in COVID-19. And data is still being collected to support this. PASC-related cardiovascular complications are relatively common in individuals infected with alpha and delta variants of SARS-CoV-2 COVID-19, and unvaccinated individuals are at a higher risk of cardiovascular complications. It is yet to be seen if PASC-related cardiovascular complications will differ in those infected with different variants such as Omicron and in those who are fully vaccinated.

And finally, health disparities are noted to impact the risk of SARS-CoV-2 infection result in more severe infection and a greater likelihood of PASC are also risk factors for cardiovascular disease. It is yet to be seen if efforts to improve health equity in vulnerable populations will have a positive impact on cardiovascular complications in PASC.

I thank you for listening, and now back to our moderator.

Presenters, thank you for providing this timely information to our audience. We will now go into our Q&A session. Please remember to ask a question using Zoom, click the Q&A button at the bottom of your screen, then type your question. As you can tell, we often receive many more questions than we can answer during the time permitted by our webinar. So for our first question, during the discussion of the initial evaluation and assessment of cardiovascular symptoms, it was mentioned the need to differentiate between central or peripheral etiologies that warrant specialist referral.

Can the presenters please elaborate on this?

Yeah, thank you so much. This is Dr. Azola. When it comes to what we were trying to convey in that slide is that patients may use the word dizziness, but they may be experiencing different things. And in the case that the patient reports that dizziness is a like a room spinning sensation, so you're thinking more of a vertiginous dizziness, then we would have to look into whether the dizziness is from a central etiology like CNS, central nervous system, or peripheral, such as BPPV, for example, to make sure that we can make the proper referrals.

Thank you very much. That's very helpful clarification. Our next question is along the lines of symptoms as well, and it asks specifically about exertional symptoms. So when testing exertional symptoms, do the presenters recommend a cardiopulmonary exercise test to be done every few weeks?

This is Dr. Azola. We do not recommend cardiopulmonary testing every few weeks. Tools such as the 30-second sit to stand test could be used. There are several other tools to assess exertion and activity tolerance.

Go ahead.

This is Jonathan Whiteson. I'll add to that as well. Many sites don't have access to cardiopulmonary exercise testing. And while it is really a gold standard to really understand the cardiac, pulmonary and metabolic fitness systems, as Dr. Azola said, there are other tests which are able to be done in the office setting and/or physical therapy setting, including a well used and standardized test, which is the six-minute walk test.

And that's much more readily available. If there is access to a cardiopulmonary exercise testing, that can be done but typically not repeated on a regular basis, maybe every six months or every year to monitor progress or lack of progress in terms of cardiovascular fitness.

Thank you very much. Our next question asks, have you noticed a similar incidence of cardiovascular symptoms in pediatric patients as you have in adults?

This is Jonathan Whiteson again. Typically our group treats adults with cardiovascular complications and with PASC. There is a separate group that has been looking at the pediatric population, those results will be -- or that guidance statement will be published. So for the purposes of today's talk, we focused on adults only.

Thank you for that delineation. Appreciate that. Our next question asks, did you see the increase in right ventricular dysfunction result in increased cases of pulmonary hypertension?

Again, that's an excellent question. This is Jonathan Whiteson answering again. And this is still to be evaluated.

Again, let me clarify the data presented was dated that it was collaborated and brought in from research studies that were done from around the country, not necessarily the research and data done from the past collaborative group. That there may be increased incidence of pulmonary hypertension is still yet to be elucidated and published on, although one could expect with cardiovascular disorders and especially with thromboembolism, that we will see an increased incidence of pulmonary hypertension in the future.

Thank you very much. And our last question that time permits us to ask is a bit more general and asks, in the review of the data, did you see any correlation between asymptomatic COVID patients and the likelihood or risk of developing long COVID?

This is Miriam and I'm going to take that question. So we do have data that even asymptomatic patients can go on to -- patients that have asymptomatic acute infection, that is, can go on to have symptoms beyond the acute phase. So the answer to that is yes, there's some evidence in published studies that is showing a lot of evidence, showing persistent symptoms in patients that were initially asymptomatic.

Thank you, Dr. Nji. And I want to thank everyone for joining us today with a special thanks to our presenters Dr. Nji, Dr. Azola and Dr. Whiteson, for answering our questions and for sharing their expertise and time with us today.

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Again, thank you for joining us for today's COCA Call, and have a great day.