DPM NEWS

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Nitrous Oxide

On *page 4*, Dr. Galton provides insights and updates on analgesia that could give you some ideas about the direction of pain management into the future.

Midazolam

Dr. Cushman gives us a refresher on the cause and treatment of seizures on *page 7*.

Marijuana

Beginning on *page 8*, I provide an overview of two interesting journal articles, one about marijuana smoke and the other about "Long COVID".

From everyone at the Division of Prehospital Medicine, Happy Holidays and best wishes for the new year!

https://www.holycitysinner.com/wp-content/uploads/2018/12/santa-ambulane.jpg

Eric Rathfelder
Editor-In-Chief

Diagnostic Error and the Lift Assist

Maia Dorsett MD, PhD

I have heard the adage that EMS clinicians do not diagnose and can state firmly that I disagree. Not only do I disagree, but I think quite the opposite is true: diagnosis is one of the *most* important functions of a prehospital clinician.

The Oxford dictionary defines diagnosis as "the identification of the nature of an illness or other problem by examination of the symptoms." Without a working diagnosis for the patient, how do we provide the patient with the correct treatments? Patients present with any one of a myriad of chief complaints and it is the role of the prehospital clinician to determine, based on patient assessment, the most likely or concerning cause of the patient's symptoms and initiate appropriate patient management.

Upcoming Events

Melinda Johnston

For more information about any event listed below, please visit the training calendar at MLREMS.org

January

9 - EMS Journal Club

23 - MLREMS Council

23 - REMAC Case Conf

February

18/19 - PHTLS

27 - REMAC Meeting

March

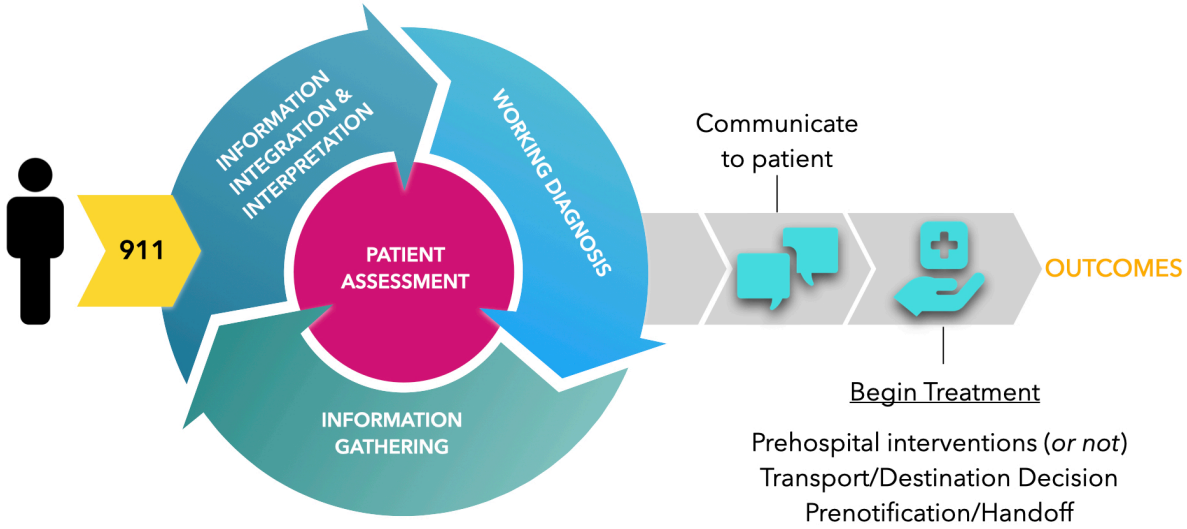
20 - MLREMS Council

For example, BLS providers faced with a patient who is having difficulty breathing may identify anaphylaxis and determine that the patient should be treated with IM epinephrine or diagnose an asthma exacerbation and initiate bronchodilator therapy. When faced with a patient with weakness, difficulty speaking, altered mental status, dizziness or fall, they may identify a high probability of stroke to initiate the cascade of events (rapid transport, appropriate destination and hospital prenotification) that facilitate the patient receiving timely care for their presenting condition and ensuring the best possible outcome. ALS providers diagnose patients with an even broader array of conditions and treat based on what they think is most probable.

Might we never arrive at the diagnosis? Of course. Even as an EM physician with access to a broad array of diagnostic tests, I often do not arrive at a definitive diagnosis. Might we be wrong? Of course. Diagnosis is a complex problem and in fact, diagnostic error, defined as "the failure to establish an accurate and timely explanation of the patient's health problem or communicate that explanation to the patient" accounts for the greatest proportion of harm to patients in healthcare.[1] On the surface, this makes sense. With the exception of emergency stabilizing measures, such as treating respiratory failure with assisted ventilation, the failure to make an accurate diagnosis in a timely manner decreases the chance that treatments provided are tailored to the correct problem.

To understand how diagnostic error occurs, we should first examine the diagnostic process. [Figure 1]

Figure 1: The Diagnostic Process



Modified from: Committee on Diagnostic Error in Health Care; Board on Health Care Services; Institute of Medicine; The National Academies of Sciences, Engineering, and Medicine; Balogh EP, Miller BT, Ball JR, editors. Improving Diagnosis in Health Care. Washington (DC): National Academies Press (US); 2015 Dec 29. 2, The Diagnostic Process. Available from: https://www.ncbi.nlm.nih.gov/books/NBK338593/

In EMS, the diagnostic process starts with the call to 911 and the information that is relayed to dispatch and then subsequently from dispatch to the responding EMS clinicians. If you think about it, you begin thinking of what might be wrong with the patient from the moment of dispatch. Your approach to the call, including your response mode, expected resources and plan begin from here. This information can be tremendously helpful. However, you must also be aware of the bias that exists based on this information. For example, dispatch to a geriatric ground-level fall with no priority symptoms - aka the expected lift assist – comes with it low acuity bias, the expectation that nothing serious will be wrong with the patient. In the absence of keeping an open mind and a commitment to thorough patient assessment, diagnostic error is highly probable.

The next step of the diagnostic process is information gathering (i.e. evaluation of the scene and history taking) and patient assessment. This process leads to the synthesis of the information into a presumed diagnosis, which allows treatment to begin. For example, if you respond to the ground-level fall and identify that the patient tripped on a throw rug and now has a painful, shortened and internally rotated right leg, you would rightfully draw the conclusion that there is likely a hip fracture and treat appropriately. If on the other hand, you determine that the patient has been feeling ill and urinating frequently over the last two days and their legs gave out on them when they tried to stand, you might rightly suspect an underlying medical illness such as an infection. You may find that the patient's legs slipped forward as they stood to get out of bed as they were unable to reach their walker. What is the diagnosis here? There are a host of reasons for poor mobility and frailty in the elderly. The question is whether in this patient, with a diagnosis of a geriatric fall syndrome secondary to poor mobility, is safe to be at home or needs additional resources. That diagnosis requires additional assessment such as whether they are able to get from sitting to standing independently and ambulate well with their walker.

Importantly, diagnostic error is increased in situations of high uncertainty, unfamiliarity with the patient and in conditions of high stress, workload and distraction[2], making the practice of prehospital medicine particularly susceptible. While prehospital medicine is particularly susceptible to diagnostic error, EMS assessment plays a critical role in the diagnostic process. All clinicians, including those who work downstream of EMS in the hospital, integrate prior information into their decision making process. This creates the conditions for "diagnostic momentum", where a prior diagnosis is accepted without sufficient reassessment or skepticism. Even more so, many patients who are cared for by EMS, such as those with lift assists and subsequent refusals, are not evaluated downstream by another clinician who reassesses the situation. That is not to say that all these patients should be transported but it does elevate the role of the prehospital clinician and demands a thorough assessment prior to the treatment plan of "safe to leave at home". As the point of first, and sometimes only, medical contact, prehospital clinicians have a critical role to play in ensuring diagnostic safety.

Interestingly, the lower perceived acuity of some calls, the more important the assessment is in determining whether a concerning diagnosis is present. The diagnosis is often more obvious in patients who are obviously ill and these patients are also more likely to get rapid assessment and intervention by downstream hospital clinicians. It is the perceived low acuity calls with non-specific complaints - weakness, lightheadedness, fall – where the diagnostic skills of prehospital clinicians have a capacity to make a tremendous amount of difference. It is these patients where missed diagnosis results in non-transport or a disposition to a hallway or waiting room.

In 2017 a paper was published entitled "Morbidity and mortality associated with prehospital 'lift assist' calls"[3] which challenged the prehospital community to consider the burden of diagnostic error in this population. The paper found that of patients who called 911 for a lift assist, ~ 1 in 5 were transported to the emergency department, ~1 in 10 were admitted to the hospital and ~ 1 in 100 died within the next two weeks. In the MLREMS region we have examined these outcomes but in the shorter time frame of 72 hrs. Locally, approximately 1 in 10 patients have a repeat dispatch within 72 hrs and are transported ¾ of the time on the repeat visit. Most of these transports result in hospital admission with a prolonged length of stay and < 50% probability of returning directly home after hospitalization. Given that lift assists make up about 4% of our call volume, this gives us a tremendous opportunity at all levels to address diagnostic error for a very vulnerable group amongst the patients we serve.

So how do we reduce diagnostic error? As discussed above, we believe that, in part, it is by improving our patient assessment. Consequently, we are developing a regional assessment and documentation tool for these patients and *we are actively recruiting those who are willing to pilot it and give us feedback.*

The diagnostic process places enormous responsibility upon EMS clinicians to perform thorough patient assessment which is not just a responsibility but also an incredible opportunity to do good.

Interested in working on the Regional Lift Assist Quality Improvement Project? E-mail Maia: *Maia_Dorsett@URMC.Rochester.edu*

1. Committee on Diagnostic Error in Health Care, Board on Health Care Services, Institute of Medicine, The National Academies of Sciences, Engineering, and Medicine, *Improving Diagnosis in Health Care* (National Academies Press (US), Washington (DC), 2015; http://www.ncbi.nlm.nih.gov/books/NBK338596/
2. P. Croskerry, Perspectives on diagnostic failure and patient safety. *Healthc Q.* **15**, 50–56 (2012)
3. L. Leggatt et. al. Morbidity and mortality associated with prehospital "lift assist" calls. Prehospital Emergency Care 21(5): 556-562. (2017)

Multimodal Analgesia

Christopher Galton MD, NRP, FP-C

For a few different reasons I have been looking at the analgesic data at my agency over the last few months. One thing really stands out. Providers put a serious effort into reducing each patient's perception of pain or noxious stimuli. I was beaming with pride, but I'm never satisfied. The day your medical director becomes satisfied that your agency is doing everything right should probably be their last day as your medical director. One of the important parts of our job is to ensure that our agencies continuously look to improve the clinical care that we are providing. Satisfied is another word for stagnating in my thesaurus. So let's talk multimodal analgesia and how we can provide better care to our patients in and around MLREMS.

Our patients are calling us to help treat the symptoms of their individual medical emergencies and provide a safe mode of transportation to a destination facility where definitive care is offered. When things get really busy, like they have been for awhile now, it's easy to get into the "you call, we haul" mentality. That way of thinking perpetuates burnout and it makes it too easy to forget that providing symptom relief to our patients is much more valuable to our own mental health than just transporting them. When you leave a patient feeling much better than when you met them, job satisfaction follows.

Analgesia is low-hanging fruit and multimodal analgesia is really low-hanging fruit for almost every patient we interact with.

Let's look at the *Adult Pain Management* guideline from the NYS EMS Collaborative Protocols and evaluate just how seriously we follow it. At the CFR and EMT levels, we check vitals, manage the airway, and initiate oxygen therapy. Many of you have heard this pitch before, but I describe oxygen as a powerful pain relieving gas. I say this because I am providing supplemental oxygen to areas of the body that are not getting enough currently and ischemia typically causes pain. I would not tell patients that I expect it to relieve their pain completely, but it is the first tool of many that we will use to help them feel better. Simple statements like that go a long way when delivered correctly. I can't tell you how many people start taking one liter tidal volumes through the nasal cannula after I tell them how it works to make them feel better.

I'm an anesthesiologist that has every tool you could imagine available to treat every different cause of pain that you can think of. With that arsenal of tools and the volumes of knowledge that I have stuffed away between my ears, I still start nearly every treatment plan with non-invasive therapies like positioning, ice, and heat. When did a pillow become an evil device that doesn't belong on EMS stretchers. I can't speak for you, but when I'm tired or not feeling well and want to rest, the first thing I look for is a pillow. Putting your head on something soft and comforting when your leg is broken, you have significant abdominal pain, or when your chest hurts makes a difference. I know ice and hot packs can be hard to come by these days, but asking the patient if some gentle warmth or cooling would help not only shows you care, but also can have a significant analgesic effect. These are all simple BLS techniques, but are frequently overlooked and even less frequently documented as therapeutic interventions.

Continuing on the journey through the analgesia guideline, we would start an IV, then consider nitrous oxide. Many of you have not had a chance to utilize nitrous in your practice. I have never met a prehospital clinician that had access to nitrous oxide that did not love it. Who wouldn't love an analgesic setup that is self-administered? If any of you look at pain data from hospitals, patients that have patient-controlled analgesia (PCA) infusions or patient-controlled epidural analgesia (PCEA) infusions routinely have the highest satisfaction scores. Having our patients be satisfied with their experience is near the top of the list of priorities for prehospital clinicians. Nitrous oxide is the only self-administered analgesic setup that we have access to, but we don't use it in this region. I know the setup is a bit cumbersome because it requires both O2 and nitrous tanks, along with the 50/50 mixer, but this region has a perceived need for type III ambulances. If we are going to use the excuse that we don't have the room, maybe we need to look harder at what we are carrying in our overstuffed type III ambulances. Nitrous oxide has a lot of great potential for our patients if we can get past the perceived logistical concerns.

Does your agency carry acetaminophen or ibuprofen PO? No, I'm not talking about your secret stash that you keep in your personal bag for when you wrench your back lifting an obese patient. I mean in the medication bag with the intention of administering it to your patient? I do not have the MLREMS data, but I can tell you that MFC started stocking IV acetaminophen in Feb of 2021. Since that point we have 263 administrations without any known significant side effects and significantly improved pain scores as part of our multimodal analgesia pain control. In my liver transplant ICU, I administer acetaminophen to patients with end stage liver disease very safely. It's really hard to find a patient that a single dose of acetaminophen will harm. It acts synergistically with other agents very effectively. Even if you don't

think it will offer immediate benefit to the patient during your transport, set them up for success and give them a NSAID.

Now we have reached the paramedic portion of the guideline and it's time for me to air my dirty laundry. My agency has not done good enough administering ketorolac since we started stocking it on the aircraft in June of 2021. We only have 14 administrations and I view this as an area that we can significantly improve on. We are starting an "awareness" initiative this December to remedy that problem.

The collaborative protocols give paramedics a choice of IV analgesic agents between morphine, fentanyl, and ketorolac. Here is my bit of advice for this situation. If the patient meets criteria for ketorolac, give the ketorolac instead of the other two. You probably just jumped out of your chair thinking Galton just told us to hold the opioids in favor of the ketorolac. In my experience as an anesthesiologist, most patients prefer ketorolac over opioids if they have had both in the past. I specifically remember a post sternotomy patient that consistently turned down opioids, but was so happy when the nurses came into his room every six hours with his ketorolac dose. Combining PO or IV acetaminophen and IV ketorolac is a powerful synergistic combination.

I know you are thinking "if I give the ketorolac, then I can't give fentanyl or morphine without calling medical control." You guys have been at this game for a while and you know how to game this guideline better than I do. If you give ketorolac, then call medical control for opioid orders vs giving opioids and then calling for ketorolac orders, which do you think you will have more success with when your goal is to give both? Give the ketorolac and call in five minutes for the opioid orders. Most medical control physicians will think it's silly that you are calling them about it.

Remember there was a time where every opioid administration required on-line medical control orders. The concern that medical control physicians had with EMS giving moderate to higher doses of opioids on standing orders has been resolved with thousands upon thousands of safe standing order administrations. My hope would be to get this guideline changed in the future so ketorolac is separated out from the opioids and giving them together becomes an automatic for paramedics when there are no contraindications.

Wrapping up the tour of the pain management guideline is ketamine. I'm not going to spend the entire article discussing ketamine since that would be like beating a dead horse. I will however remind you that a 25 mg dose of ketamine given slowly (30-60 seconds) is a very potent analgesic. I know that many of you contact medical control and have marginal success when requesting orders for ketamine. Although you might not have success every time, understand that times are changing and EMS utilization of ketamine for analgesic purposes is rapidly increasing. In ten years, I think we will be looking back at ketamine and wondering why it was a call in order for analgesia when it can be safely given as a standing order. At MFC, we average just under 100 administrations annually, less than half of which are exclusively for analgesia. We can do better here and so can you and your agency.

After attending some recent conferences, the future is wide open. The possibilities range from EMS administration of suboxone or capsaicin, all the way to regional anesthesia. Looking to the future with new toys and techniques is always exciting. Let's start with controlling the things we can and being more aggressive the all the tools currently available to us.

Thanks for all the great work you do for the citizens of our collective communities. If you have any questions or comments about this column, please reach out to me at christopher_galton@urmc.rochester.edu.

Seizures

Jeremy Cushman MD, MS, EMT-P

Last issue we talked about the Differential Diagnosis and I used seizures as an example, let's take a few minutes to dig deeper into the management of that condition.

Seizures are fairly common, accounting for about one in 25 requests for EMS and nearly one in 10 Americans will have at least one seizure in their lifetime. The vast majority of seizures are self-limiting, last for less than two minutes, and present a very low risk for the patient. Most isolated seizures are related to an underlying illness or injury such as fever, head injury, drug effect, hypoglycemia, or alcohol withdrawal. Far less common is epilepsy which is defined as recurrent, unprovoked seizures due to a primary brain disorder; thus not every seizure is an indicator of epilepsy, but epilepsy is defined by recurrent seizures.

There are a number of different types of seizures, which can be broken down into generalized seizures and partial seizures. Generalized seizures affect the entire brain and are characterized by an altered level of consciousness. Tonic-clonic seizures are the most common generalized seizure characterized by a loss of consciousness and full body rigidity (tonic phase) and rhythmic contractions (clonic phase). Another example of a generalized seizure is an absence seizure (previously called petit mal) whereby the patient stares and stops responding appropriately, but often does not have any abnormal motor activity. Partial seizures can present with unusual feelings or sensations, or rhythmic convulsions of one area of the body, such as an arm or leg.

Status epilepticus, defined as a seizure lasting more than five minutes, or recurrent seizures without a return to baseline between episodes, is life-threatening. Status epilepticus can result in hypoxia, metabolic acidosis, hyperthermia, aspiration, pulmonary edema, and brain injury – therefore early termination of seizures is critical. Generally, if the patient is still seizing by the time I get on scene, they are in status epilepticus and rapid administration of a benzodiazepine such as midazolam (Versed) is critical. Status seizures are much more difficult to control the longer they last.

As indicated in the last issue, there are a number of causes of seizures, and although initially the majority are managed with benzodiazepines, it's important to consider the differential diagnosis in the seizure patient to identify the causes, and potential treatments. As a refresher, I often use the "AEIOU TIPS" mnemonic to help drive my differential: Alcohol (withdrawal), Epilepsy, Insulin (hypoglycemia), Overdose, Underdose (not taking anti-epileptic drugs), Trauma (head injury), Infection (meningitis, febrile), Psychogenic, Stroke. This differential helps identify some of the key questions you should try to obtain answers to while taking history for someone with a seizure; for example, any recent trauma, illness, alcohol use, etc. Evaluation of blood glucose is mandatory, but since the patient is often seizing or post-ictal, oral glucose is almost never appropriate because of aspiration concerns.

Management of seizures is relatively straightforward. In addition to the important historical features identified above, it is also important to identify the time of seizure onset. Again, the longer the seizure, the greater potential for complication. Although ABC's are important, for the actively seizing patient the single most important intervention is medication administration which is best given intramuscularly; only after IM midazolam administration would IV and BG determination be appropriate. ***For an actively seizing patient, the key is getting benzodiazepines on board as soon as possible***. Often simple airway adjuncts such as a jaw thrust and supplemental oxygen are all that is required for your ABC's. Equally important is protecting the patient from injury by removing objects that could harm or padding the areas surrounding the patient. A physical exam to include pupillary assessment and a thorough evaluation for signs of trauma or focal neurologic deficits are important given that both trauma and stroke can be precipitants of a seizure.

A post-ictal state will often follow a seizure and will present as a period of deep sleep, confusion, combativeness, poor short-term memory, or irritability. The post-ictal state should slowly improve and if the patient remains unconscious or is severely obtunded after 30 minutes this is cause for concern. Given the frequent confusion after a post-ictal state, I always make it a point of repeatedly re-orienting the patient. An example would be "Ma'am, you've just has a seizure in your house. I'm Jeremy, a Paramedic here to help you. We're taking you to the hospital in an ambulance to get you checked out and to make sure you're OK." And then I repeat it a couple of times as they start coming around to re-orient and calm them. The post-ictal patient generally requires only reassurance and supportive care but occasionally supplemental oxygen, suction, or positioning are indicated.

Keep in mind the different types and causes of seizures and be sure to obtain what information you can about the circumstances of the seizure while on scene. Make sure that benzodiazepines are administered as soon as possible to the actively seizing patient and don't forget to prepare and be supportive during the post-ictal phase. Hopefully this article will help you brush up on the 4% of EMS calls that are seizure-related.

Article Reviews - Marijuana and Long COVID

Eric Rathfelder, MS, EMT-P

Using marijuana is now legal in about half of the United States, with many more states allowing specific formulations for medicinal purposes. While legalization is a recent development, there are data that show it has led to an increase in reported marijuana use in states and countries where it has been legalized. After decades of public policy advocacy on the harms of cigarette smoking, and more recently vaping, could it be that smoking marijuana does not produce some of the same health concerns? I recently read an article, "Chest CT Findings in Marijuana Smokers" published in *Radiology* that came to some interesting, and concerning, findings. The article is short, easily understandable, and readily available for your perusal here: https://pubs.rsna.org/doi/10.1148/radiol.212611.

The study authors, from the Department of Radiology at Ottawa Hospital General Campus, conducted a retrospective case-control study of patients who received a chest CT. The researchers determined which patients were non-smokers, marijuana smokers, or cigarette smokers and correlated their chest CT findings in areas such as emphysema, airway changes, and non-lung findings. They found significantly higher incidence of emphysema, bronchial thickening, brochiectasis, mucoid impaction, and gynecomastia in the marijuana smoking group versus the non-smoking group. There were also higher rates

of emphysema in the age-matched marijuana smoking group versus tobacco-only group. Markers of airway inflammation were higher amongst marijuana smokers than in tobacco-only smokers as was prevalence of gynecomastia.

These results raise concerns only about the negative health implications of smoking marijuana visible on a chest CT scan. Most of the of the recent discussion surrounding how marijuana is viewed and treated has been from a legal and public policy perspective but I think it would be useful to carefully consider the public health implications as well.

Murtha L, Sathiadoss P, Salameh J, et al. Chest CT Findings in Marijuana Smokers. *Radiology* 2022; 000:1-7.

Another article that caught my attention was one which employed an interesting method to suss out whether the perceived effects of "long COVID" are unique to individuals who have been diagnosed with COVID-19. In fact, as I read this study I got the impression that the authors felt much of the previous writing on "long COVID" or what they refer to as "Post COVID-19 conditions" (PCCs) was a bit irresponsible for not including an appropriate control group for comparison. So, Wisk et al. (2022) set out, "To compare patient-reported outcomes of physical, mental, and social well-being among adults with symptomatic illness who received a positive vs negative test result for SARS- CoV-2 infection." This is another article that is accessible and easy to read even for us non-physicians and non-PhDs. It can be found here at *JAMA Network Open*: https://jamanetwork.com/journals/jamanetworkopen/fullarticle/2799116.

In this study, researchers enrolled 1000 patients who were experiencing symptoms indicative of a COVID-19 infection. Each patient received a FDA-approved COVID test to determine if he or she had a COVID infection of another type of Upper Respiratory Infection (URI) or similar illness. Patients in both the COVID-positive and COVID-negative arms of the study completed a baseline survey with questions meant to capture data on their physical function, anxiety, depression, fatigue, social participation, sleep disturbance, and pain interference. The survey was repeated at three months from enrollment.

Overall, the researchers did not find a higher incidence of problems at the three month mark in the COVID-positive group compared to the COVID-negative group. In fact, in some of the benchmarks, the group with non-COVID infections experienced a higher rate of sequelae that would typically be associated with, and attributed to, the impact of "long COVID". Wisk et al. (2022) warn us, "These findings emphasize the importance of including a concurrent control group when studying sequelae of COVID-19 illness."

Wisk L, Gottlieb M, Spatz E, et al. Association of Initial SARS-CoV-2 Test Positivity With Patient-Reported Well-Being 3 Months After a Symptomatic Illness. *JAMA Network Open*. 2022;5(12):e2244486.