# Episode 89: Understanding Immunity

**Chris Dall:** [00:00:06] Hello and welcome to the Osterholm update COVID-19, a podcast on the COVID-19 pandemic with Dr. Michael Osterholm. Dr. Osterholm is an internationally recognized medical detective and director of the Center for Infectious Disease Research and Policy, or CIDRAP, at the University of Minnesota. In this podcast, Dr. Osterholm will draw on more than 45 years of experience investigating infectious disease outbreaks to provide straight talk on the COVID-19 pandemic. I'm Chris Dall, reporter for CIDRAP News, and I'm your host for these conversations. Welcome back, everyone, to another episode of the Osterholm Update podcast. After weeks of skyrocketing national case numbers, the much awaited decline in the Omicron fueled surge appears to have begun in the United States. Though cases are still rising in a handful of states, new daily infections nationwide are down 35% over the past week. Hospitalizations remain high and the number of COVID-19 deaths is higher than it's been since last winter, when the vaccine rollout was just beginning. But there does appear to be some light at the end of the tunnel. Of course, as has been the case throughout this pandemic, the good news doesn't last for too long. Now we have a sub variant of Omicron to deal with. Today on the podcast, we're going to discuss what's going on with Omicron here in the United States and around the world, and we'll lay out what we know about the Omicron sub variant BA.2 and the impact it could have. We'll also talk about the latest data on the efficacy of booster shots, answer a COVID query about natural immunity, and share the latest beautiful play submission from one of our listeners. But before we get started, as always, we'll begin with Dr. Osterholm's opening comments and dedication.

**Michael Osterholm:** [00:01:46] Thanks, Chris. And welcome back to all of you to another weekly edition of the podcast. This week, we will attempt to provide what I'm afraid will be a lot of information, but hopefully in a manner that is understandable and one that actually is useful to you in trying to understand where you're at these days. I want to start the show with some good news. That's always a good way to warm up for a podcast hour. And that is to report that today here in Minneapolis, we have nine hours, 53 minutes and 47 seconds of sunlight, which is a very rapidly growing number in terms of weekly sunlight. Last week it was at nine hours and 36 minutes. Just in the one weeks period, we've gained seven minutes and 47 seconds of sunlight. And we now have an additional one hour and seven minutes and 37 seconds of sunlight since the winter solstice. So hold on, it's coming. I know for many of you throughout the United States expecting major snowstorms this weekend. You know, I can only remind you it's going to get lighter. Let me just make one point really very clear as we go through today's podcast that there is one very, very central point. And yet it seems to be one that for some reason we have not been able to overcome as an obstacle. And that is getting people vaccinated. You know, I hear people talking all the time now that this is not a pandemic of the unvaccinated and from an infection standpoint, that's absolutely true. But if you look at it from the standpoint of who becomes seriously ill, hospitalized and dies, this is a pandemic of the unvaccinated and it clearly is, and we have to understand that. Here we are in this country, almost two years into the pandemic, a year into the availability of vaccines, and yet only 63.8% of the U.S. population that are eligible to receive two doses of vaccine have. Only 41.7% have received that third dose that we've noted over and over again is so important. And what's even more disappointing is the fact that among those who have received two doses of vaccine, only 41% have received that third dose. These are not people who are vaccine hesitant or vaccine hostile. They already got their first two doses. And yet we can say time and time again getting that third dose. Some call it a booster, I don't want to call it a booster, it really is a three prime series vaccine that we should all acknowledge. I don't believe you're fully vaccinated until you have those three doses. If you're immune compromised, I don't believe you're fully vaccinated until you have your fourth dose. And yet we can't get people vaccinated. That is what's happening today, and I'll be talking more about that as we go. One of the notes, I just want to make that there was a very interesting analysis done this past week by the group at Financial Times led by John Byrne Murdoch, And they actually looked at what would the pandemic look like in the United States if in fact, we had the same vaccination levels that we see in Europe? The Financial Times group concluded that the number of COVID patients in U.S. hospitals on January 19th would have peaked at 91,000 instead of 161,000 if the U.S. had the same rates of vaccine coverage in each age group, as did Denmark. It would have been 100,000 patients hospitalized in U.S. hospitals if we had matched the UK vaccination levels and 109,000 if we had matched those rates seen in Portugal. Think about that. All these other countries, while they were severely impacted by COVID, it was substantially less so than the United States, and it could be directly related to one thing. Why can't we continue to get more people vaccinated and even to that extent, fully vaccinated with all three doses and for the immune compromised all four doses? So I think this is still going to be a challenge and it's going to continue and we'll talk about that today. And it's in that light I want to leave you with the dedication for today's podcast. To me, I'm dedicating this to all of you who are tired and confused. I'm one of them. What is the acceptable behavior in our society today? Should I be out and about in groups of people? Do I go to a public spaces? Do I wear some kind of respiratory protection? What kind? Of course, you know my answer to that in terms of the N95 respirators. But people are trying to find their way. They're trying to basically navigate really getting what I would call the elephant through the eye of the needle. And today we'll try to talk a bit about that where we're at, what we need to think about, what does our future look like. So this is dedicated to all of us, all of us right now we're are tired, we're are confused and even in some cases, feeling angry. So stay tuned. I hope that we're able to provide you with useful and meaningful information.

**Chris Dall:** [00:06:54] Mike, as we're seeing here in the U.S., many countries that have been hit by Omicron are now seeing cases starting to decline, although the pattern of decline appears to vary by country. But we're also seeing the American sub-variant BA.2 growing in some countries, notably Denmark. What do we know about BA.2 and do we know if it's going to have an effect on the way the Omicron surge plays out?

**Michael Osterholm:** [00:07:16] Well, that's a great question, Chris. And let me just remind everyone that this is another example, this discussion right now of this 210 mile an hour curve ball that gets thrown to us and we have to be prepared for these, we know they're coming and they may be difficult to handle, but we've got to. And this is exactly one of those. Before I do my best to weigh in into this, I have to say that the weekly nature of this podcast, in a sense, has compelled me to at least try and compartmentalize the dozen of fire hoses of information that we've been drinking from 24-7. In some ways, this has been helpful since I think it can be easy to get caught up in the day to day changes and at least for a while, lose sight of the bigger picture. However, at the same time, it seems like your question which covers those bigger picture items gets harder and harder to answer each week. Chris, so I hope you know that as a university professor who's written a lot of graduate level exams for years and answered questions from the media my whole career. Your question, unfortunately, is right on the mark. So where are we now? We seem to have found ourselves once again in a potential transition phase. And having read countless articles and op eds published over the past couple of weeks and having had many discussions with trusted colleagues, I feel like I'm either out of the loop, experiencing deja vu all over again, or I've gotten much better at my job. I'm not sure which of those apply. I've seen story after story of experts or countries essentially declaring that Omicron is the final dying breath of this pandemic. Now, maybe it is, I'm not sure, but I doubt it. Maybe their crystal ball isn't caked in five inches of mud like mine, but I feel like I've heard these informal declarations of victory so many different times. And while I hate to rain on anyone's parade, I'm not sure how much certainty can be conveyed at a time like this. I'll be discussing this more in several of the points that we take on later in the podcast. So why do I say this? Well, first, remember that most of the world has really only known about Omicron for just over two months. In fact, in a WHO press briefing on Tuesday, Director General Tedros mentioned that 90 million cases have been reported worldwide in the 10 weeks since Omicron was first identified. To put this into perspective, that's more global cases in 10 weeks than we saw in all of 2020, the first year of the pandemic. So if ever there was a reminder of the role that emerging variants can play, I think these last 10 weeks should stand out loud and clear. Now that being said, while 10 weeks isn't all that long in the grand scheme of things, we've learned quite a bit about the variant in that time. Clearly, it's incredibly transmissible. In addition, we've learned that the mutations it has, particularly on the spike protein, have allowed it to better evade immune protection than some of these previous variants of concern, like Alpha and Delta. Data from countries like Italy in the U.K. has shown a significant increase in the number of reinfections reported among those who have been previously infected but remain unvaccinated. In addition, I've covered in previous episodes the effectiveness of the vaccines in preventing symptomatic infection and has clearly taken a real hit with Omicron, which in some cases was overlaid on top of waning immunity. Now, fortunately, an additional dose of vaccine can restore a good amount to this protection against infection, which I'll cover in more detail later on in this episode. Notably, although Omicron can clearly slip past the protection against infection better than Delta, the good news is that the defense many of the vaccines offer against severe disease and death is still holding up quite well. Again, while this is largely true for those who have had two doses of vaccine, the data clearly show even further and significant protection against those worst outcomes in individuals who have received that additional third dose. Just this past week, the CDC reported on a new study in which the Los Angeles County Department of Public Health used COVID-19 surveillance and California immunization registry data to describe age adjusted 14 day cumulative incidence and hospitalization rates during November 7th, 2021 to Jan. 8th, 2022. They looked at COVID-19 vaccination status and variant predominance. Of note for the 14 day period ending Dec. 11, 2021, the last week of Delta prominence, if you were fully vaccinated with that third dose added, you were 83 times more likely to be protected against hospitalization during the Delta period, 12.9 times more if you just had the two doses. But if you looked at the December 12th to January 8th time period, if you were unvaccinated, you were 23 times more likely to be hospitalized than someone with those three doses. If you only had two doses, you were 5.3 times more likely to be hospitalized if you're unvaccinated and that's against Omicron. So it's been very clear that the vaccines are holding up, particularly as you add that third dose of vaccination in. Finally, I think that the body of data up to this point continues to support the fact that Omicron infections result in lower rates of severe disease and death due to a noticeable reduction in virulence compared to previous variant strains. However, as always, that's not to say Omicron is incapable of resulting in these very serious outcomes. And like I've said many times, it's improved ability to transmit can just as readily offset the reduction in serious illness for any one individual, which we've clearly seen in the U.S.. I know I've covered a lot of that information in previous episodes, and I think there are still a number of questions that need to be answered. You can see the progress that's been made since the variant first emerged. Of course, if you've listened to the past few episodes, you know that we've also spent time trying to anticipate what the descent from an Omicron peak might look like. Well, lo and behold, it looks like another 210 mile an hour curve ball is headed our way. This time it's actually a sublineage of Omicron known as BA.2. As I mentioned last week, this sublineage designation means that it's a product of the Omicron family, almost like a sibling. Up to this point, we've really seen a total of three Omicron sublineages. So although we've used the family name Omicron for most of the past 10 weeks, a vast majority of the world's cases were actually caused initially by just one of these siblings, known as BA.1. However, to the surprise of many, another Omicron sibling, BA.2 is showing up in a growing number of countries and appears to be displacing the original sublineage. Now, if you compare the two sublineages, you can see that they share a number of those mutations that really distinguish the Omicron family. Nevertheless, there are a few dozen unique mutations that make the two quite different, and a number of them are located in parts of the virus's genome that provide the blueprint to keep pieces like the spike protein. So although they're from the same family, they're also very different. Well, as many of us know, just because you have brothers and sisters doesn't mean you're the same person as they are. In fact, there can be some pretty significant differences. My sibs would probably tell you that with me, the same can hold true in the viral world. As I mentioned last week, a report from Denmark's National Health Agency stated that the differences between BA.1 Omicron and BA.2 Omicron is actually greater than the differences between the ancestral strain from Wuhan and with the Alpha variant. So in a way, we're almost dealing with a new variant, which means we've got to figure out how and why the BA.2 variant is seemingly out competing its sibling. Again, this is where those buckets that define variants of concerns come into play. Frankly, I would not be surprised if in the days ahead, we actually rename the Omicron BA.2 as its own distinct variant. You mentioned Denmark in your question, Chris. Well, they provide some interesting insight on Omicron. Fortunately, Denmark has been one of the world's leaders in sequencing cases of the virus, so you can get a pretty good sense of how this has been playing out there. If you look at their data, you can see that the first case of BA.1 or the original Omicron variant appeared around the third week in November. And although it represented just a small fraction of the country's cases at the time, it overtook Delta as the dominant variant just after mid-December, so four weeks later. By the end of December, nearly three out of every four cases in Denmark were BA.1. However, since that time, its prevalence has been steadily declining, and now it sits closer to one in every five cases there. The remaining four out of five are now BA.2. Interestingly enough, if you look at the prevalence of BA.2 in Denmark, you can see that they actually reported a case the last week of November, so only a week after the initial detection of BA.1. And while there's a clear rise in the number of BA.2 cases, its initial growth was as dramatic as its predecessors. In fact, it really took off right when BA.1 became dominant. So that passing of the baton could surely be playing a role in Denmark's somewhat prolonged surge and with some hints of a possible peak in cases now emerging six to seven weeks after it began. Now we're seeing evidence of similar situations playing out in a number of other locations, with cases of BA.2 growing steadily in places like Norway, Singapore, South Africa, the U.K. and now even the U.S.. In India and the Philippines it appears to now be the dominant variant. And all of these places had that initial wave of BA.1. So the growth advantage of the BA.2 sublineage over its siblings isn't exclusive to Denmark, but one of the key questions we have to figure out is what exactly is causing this advantage. Early data from places like Denmark and the U.K. looking at the rates of secondary transmission in household contacts, i.e. what percentage of contacts to cases in the home become infected, and they have now published these data. Both countries found that contacts of BA.2 cases were more likely to become infected than contacts of BA.1 cases. In the U.K. report, which analyzed data from late December and early January, 13.4 % of household contacts to BA.2 cases were infected, compared to only 10.3% of BA.1 contacts. So 13.4% of the contacts it became infected when exposed to a BA.2 case, and only 10.3% of the context of a BA.1 case became infected. The study out of Denmark showed that 39% of BA.2 contacts in a household setting were infected, versus only 29% with BA.1. So these preliminary results support the apparent advantage in transmission. However, at this point, it's still unclear if this advantage is a function of inherent infectiousness, additional immune escape, or if possibly even both are playing a role. According to the UK data, which is still preliminary due to the limited number of BA.2 cases at the time of this analysis, there was no significant difference between the two sublineages when it came to the effectiveness of vaccines against symptomatic infection. Meaning, as we initially saw with Omicron receiving a second dose of vaccine more than six months ago, provides only limited protection against symptomatic illness, while the third dose can restore that protection to even 60 or 70%. At the same time, the study out of Denmark, which has yet to be peer reviewed, determined that at least in the household setting, the two appeared more capable of causing breakthrough infections than the original Omicron sublineage. However, individuals who were fully vaccinated and especially those who received an additional dose remained less likely to be infected compared to those who are unvaccinated. Finally, when a breakthrough infection with BA.2 did occur, the risk of transmission to household contacts was significantly lower than what they found with breakthrough infections of the original sibling BA.1. In other words, assuming this holds up, vaccinated cases of BA.2 appear less likely to spread the virus compared to vaccinated cases of BA.1. I know that's a lot of data and even a lot of caveats, so I apologize the details were confusing, but the key point is having three doses of the vaccine can still play a very big role in reducing your risk from becoming infected with either of the Omicron sublineages. In addition, if you happen to become a breakthrough case with BA.2, the vaccines can help reduce the chances of infecting those around you. And last, based on everything we've seen to date in countries like Denmark and India, the risk of severe disease doesn't appear to be noticeably different between those two sublineages. In fact, although hospitalizations have grown in Denmark as a result of the case surge, the number of patients being treated in an ICU has actually dropped from a peak of 82 in early January to 31 as of this Monday, the lowest level since early December. Of course, we know every country isn't like Denmark, where four in five residents are fully vaccinated, more than 60% of the entire population has received that third dose. In fact, most countries aren't. So I think that's important to keep in mind in the weeks ahead as we learn more about this new member of the Omicron family, BA.2. A key piece of that goes back to what we've talked about in recent episodes involving the understanding of any delay in the descent from an Omicron Peak could be costly, especially in those places that don't have the vaccination rates like Denmark. Unfortunately, in countries like South Africa, the growth of BA.2 appears to be resulting in these delays, with cases actually trending slightly upward over the past week. As of Tuesday, average daily cases in the country were just over 3,200, so more than 10 times higher than they were prior to the Omicron surge. So while it took them less than a month to go from 300 cases a day to more than 23,000 cases a day, it's been a month and a half since that peak was reached, and you can see where they're at now. Anyway, I think this is just another one of those stay tuned moments. Clearly, we have a lot more to learn about this sublineage and what it really actually means going forward. At the very least, I think its emergence and growth supports the notion that the road to recovery from peaks could be fairly bumpy and slow going. And to me, it's just another reminder of how quickly things can change. Although I think it's unlikely that BA.2 will result in widespread surgeries as dramatic as those seen with BA.1 or the original Omicron sublineage. I continue to believe that it's far, far, far too early to disregard the potential impact that future variants, including BA.2, can and will have. Some might think that's pessimistic, but in two years time we've seen three highly successful variants of this virus emerge in Alpha, Delta, and Omicron. Four, if you separate out BA.1 and BA.2, and with Omicron, we know that there's been absolutely no shortage of opportunities for the virus to replicate, whether it's in humans or other animal species. So while I completely understand that everyone's sick of this and wants to be done with this pandemic, I don't think a strategy of happy talk and rose colored glasses will get us there the fastest, if at all. Instead, I think we will be much better off focusing on how do we continue to develop the tools that we have now into even better tools. How can we improve our vaccines? What are we going to do to improve personal protective equipment, quality and use? What are we going to do to make sure that those who are infected can quickly be tested and receive very powerful antivirals? We need to have a much better plan of attack for the future. That's what will really address these 210 mile an hour curveballs.

**Chris Dall:** [00:24:03] So here in the U.S., as odd as it would have once seemed to say this, a seven day average of more than 430,000 new daily cases seems like a reason for optimism, given that we were averaging more than 750,000 daily cases just a few weeks ago. Is there a reason for optimism?

**Michael Osterholm:** [00:24:21] Well, Chris, if there are any listeners who are still with us at the end of last week's podcast, I wouldn't be surprised if they found some humor in this question. Hard to find humor at a time like this, but let me offer up my thoughts on where I think we're at nationally and try to tie in some optimism when and wherever possible. To begin with, your question really gets at the all too familiar concept of shifting baselines that we've been talking about for more than a year now. And while some listeners might never want to hear me mention the term again, I think our current situation really showcases the impact it can have on the public's perception of risk and where we stand with the virus. Interestingly enough, a survey released on Monday out of Monmouth University found that although many Americans are still concerned about COVID, 70% of the respondents agreed it's time to accept that the virus is here to stay and move on with our lives. That, by itself is a certain type of baseline. Clearly, case numbers in many parts of the country are falling, and there's no denying that the current average of 424,000 cases a day is an improvement from where we found ourselves several weeks ago. So in that regard, we have to be pleased that things have been improving, and I don't think it's at all misguided or wrong to feel that way. But at the same time, it was only a few months ago when this number would have seemed impossibly high. Remember, you're talking about cases reaching levels more than three times higher than we saw at the height of our previous record high peak last January, which surpassed 250,000 cases a day. If we reach that same level now, it would be viewed as a good sign. So you can see how it doesn't take all that long for our perspective to shift and forgetting about previous baselines. The same thing is true with hospitalizations. Again on January 20th, exactly two weeks prior to the day that this episode is being released, there were a 158,000 people in this country hospitalized with COVID, 158,000. As of this Tuesday, that number stands at 126,000. So clearly that's a major improvement. But prior to Omicron, that number had only surpassed the 100,000 mark twice. Once during the previous record January surge of last year, when it peaked at just below 133,000 and at the height of the country's first delta surge, when it reached 102,000. With ICU admissions, we are also seeing progress. The number of patients being treated in an ICU with COVID has gone from 26,500 to just over 23,000 in the past couple of weeks. Now, fortunately, we appear to have gotten by without reaching that all time high level hit in last winter surge, which approached 29,000. But I don't think that that warrants applause. We still surpassed the peak hit during our first delta wave this past September. And as I mentioned last week, coming that close to levels reached at a time when vaccines were essentially a non-factor is remarkable and frankly so disappointing. However, in the context of where we were just two weeks ago, I think we can all agree that any progress is good progress. Unfortunately, the one area we have yet to see any progress is the daily death toll of this virus. In just one month, average daily deaths in the U.S. have more than doubled, going from less than 1,300 a day in early January to more than 2,600 a day now. Again, the only time this number has been higher was a year ago, when it hit 3,300. Of course, recent improvements in hospitalization and ICU admissions likely and hopefully means that this average won't hit that record high. However, like I said last week, the fact that we're seeing this number even after vaccines have been available to all adults in this country since last April, is frankly a tragic commentary, to say the least. So it's really been a mixed bag of emotions. On the one hand, we're seeing growing evidence of improvements in many parts of the country. On the other hand, I know that the situation in most of these places remains extremely difficult, especially from a health care delivery standpoint. At the same time, what makes this even more challenging is knowing that many of the outcomes could have been prevented. As I previously noted, the Financial Times in its analysis demonstrated what it could look like in the United States for COVID if we had immunization levels similar to that of our neighbors in Europe. Think of what difference that would make. Surely it would have impact the ability of health care workers to provide the level of care that they've very much capable of under less chaotic conditions. Instead, we reached the point where numerous health care systems and states have had to implement crisis standards of care just to cope with the surge. We went from bending to breaking. For the sake of these health care workers, I certainly hope the situation in this country only improves moving forward. I'm optimistic that progress in the way of things like treatments, including the approved antivirals and monoclonal antibodies that remain effective against Omicron, will eventually be a major major help. I'm also encouraged by the growing support I've been seeing for the pursuit of new and improved vaccines, especially one that would provide high and durable levels of protection against many or even all of the current and emerging variants. Do note that unfortunately, these vaccines will still be some years away, but I do have hope and believe they will be coming. So there's that optimism. But alongside that optimism is the understanding that all of these things will take time and they won't happen on their own. As we've seen with vaccines, simply having access to them isn't enough. It's obviously important, but you need the system in place to distribute them and the people willing to receive them, the people willing to protect their own lives or that of their loved ones. And that's not just true for the vaccine hostile crowd. Remember more than half of fully vaccinated Americans per the definition of two dose and who are eligible to receive that additional third dose have yet to do so. That being said, Chris, this may come as a surprise to some. I would actually consider myself an optimist, but my approach is inspired by the world renowned optimist himself, Ebenezer Scrooge, who said, "Are these the shadows of the things that will be? Or the shadows are the things that may be only?" So ultimately, we'll see in the coming weeks how the country's recent progress plays out and what impacts BA.2 might have. But like I've said before, complacency is not an option. We must be prepared for the next variant that could again be another 210 mile an hour curve ball.

**Chris Dall:** [00:31:22] These next few questions are going to be under the umbrella of immunity. And I know we've talked a little bit about the vaccines and boosters, Mike, but I want to get a little more into it. And I want to start with a question about COVID-19 vaccine booster doses, which, as our audience might recall, there was some debate around in the fall. So how effective have the booster shots been?

**Michael Osterholm:** [00:31:42] Well, Chris, let me just come back to the very concept of what a booster shot is. As you know, I have been lobbying for quite some time to eliminate that language and to basically add the third dose as a necessary part of the prime series, meaning I don't consider you a fully vaccinated until you've had that third dose. Now that surely is not the case yet. I hope the CDC changes that. I think it's very important because I think it does leave people feeling like if I've got the two doses, I'm in good shape. The third dose is just a top off. No, it's not. And as you heard me speak earlier about the data from L.A. County, even looking at the pre-Omicron, post-Omicron arrival there those third doses played an important role in reducing the rate of hospitalizations and people who had infection. Well, I think it's also very, very true that we have to get that fourth dose into those who are immune compromised, moderately or severely compromised. So to all of you listening, my heart goes out to you continually because I know the challenges that you're experiencing of feeling safe in public places and the fact that you're still wondering how well your fourth dose will work. Well get it, because what data we have says it works pretty good. But so let me let me just do a brief overview. I know that this has been controversial, but I think it's becoming much less controversial. I think the data are so overwhelming that it's hard for even those early naysayers to now not acknowledge the importance of these third doses. You know, we already know these vaccines are remarkable tools in preventing hospitalizations and deaths. And while the data is becoming increasingly clear that these vaccines need to be considered a three dose series, let me just walk through again what we have. As I just covered with regard to the L.A. County data looking at that period of time from November 7th, 2021 to January 8th, 2022 it was very clear that those individuals who were fully vaccinated with a booster, the three dose had a substantially substantially increased protection against both hospitalization and against infection compared to those who were not vaccinated. Even if you look at those who were, using the CDC definition of two doses, fully vaccinated, there was still substantial protection and it was reduced against Omicron. But it was still notable in that a 23 fold protection against hospitalization if you had all three doses versus not being vaccinated. So we have to realize that while these are not perfect, they are surely, surely very important in terms of what they can do to reduce the likelihood of infection, serious infection, hospitalizations and death. In another CDC data set that was released, it looked at vaccination status for the week ending in December 4th, which at that time was the most recent data they had. It showed that unvaccinated people were dying of COVID at a rate 97 times higher than fully vaccinated people who have received that third dose. So in this case, think of that 97 times higher likelihood of dying of COVID not being vaccinated versus having all three doses. There's very few things in medicine that can give you that kind of result. If we compare unvaccinated people from that week to those who have not received a booster dose, the number drops significantly, with unvaccinated people dying at 14 times higher rate than the 97. This means that the individuals that received that third dose were dying at a rate seven times lower than those who are fully vaccinated by the CDC definition, meaning they had not yet received that third dose. So it also points out why the third dose is so very, very important. The impact of the third dose increases with age. In the 50 to 64 year old age group for that week in the CDC study, fully vaccinated people that had received a third dose were at four times lower risk of dying than those who have not received that third dose. And in the 65 year old age group and higher, they were at seven times lower risk than those who had not received a booster. This is before Omicron became a dominant strain in the U.S., but we are surely seeing the data emerge from other countries that suggests that these third doses are just as important, just as I pointed out in the L.A. County data. Early estimates from the UK found that two doses of vaccine were 40 to 70% effective in preventing death from Omicron variant when it was six months or more after receiving the second dose. But the addition of a third dose vaccine made it 85 to 99% effective in preventing death from Omicron within three months of receiving that third dose. So just think of the additional benefit you get, not just from being vaccinated but that third dose. Recent data from Switzerland also suggests that boosters play a very large role in preventing death from the Omicron variant. In the week ending on January 15th, fully vaccinated people in Switzerland that had not yet received a third dose had a COVID death rate four times higher than those that received the third dose. In Chile, the rate is almost seven times higher. If we just focus on the third doses and look at the reduction in severe infections, hospitalizations and ICU data, we actually have more information than the CDC report that I just discussed in L.A. County. Canada is now seeing similar trends to that that have been documented in L.A. In the last 120 days. In Alberta, people over the age of five that have received two doses of vaccine are being hospitalized at twice the rate per 100,000 population as those who have received three doses. Again, twice the rate for just that one additional dose. The rate of ICU hospitalizations was three times higher for those with two doses, compared to three. There's also data suggesting that this isn't just because those who received that third dose have received a dose of vaccine more recently than if they hadn't. If you look at the most recent UK data who are at 10 to 14 weeks out from their most recent dose of Pfizer vaccine, there's still a 55% effectiveness against hospitalization from Omicron variant if the most recent dose was their second. But 75% effectiveness if that most recent dose was their third. So again, remember that means for those individuals who were at least 10 to 14 weeks out from their recent dose. So this third dose has staying power. If we look at data regarding symptomatic infection, we see similar trends as we did with the severe disease. You look at the CDC data for the week ending December 25th, unvaccinated people had almost four times a higher rate of infection than vaccinated people that have received the third dose, but only two times higher rate of infection than those who had not received a booster dose. In the UK if we look at data regarding individuals that are 10 to 14 weeks out from their most recent dose, the Pfizer vaccine is about 30% effective against symptomatic Omicron infection. However, if we look at those who received three doses of Pfizer vaccine, the protection against symptomatic illness was over 40% and over 60% effective for those who received two doses of Pfizer, followed by a dose of Moderna. This means that even those that are not particularly at risk for severe disease and death can benefit from this third dose as they appear to still be effective against all infections. Let me just say a couple of words about kids. Some have suggested that children and young adults do not need a third dose due to the low risk of severe infection. But I believe this is simply not the case. Well, you may not have as much age group specific data on the effectiveness of third doses in children, since these doses were just recently approved for 12 to 15 year olds in the U.S., we have no reason to believe that this would be drastically different from any other age groups. And one thing is very clear these booster doses are safe. There's been a lot of discussion about the risk of myocarditis after mRNA vaccination, particularly in young males. We already know that there is a higher risk of developing myocarditis following a COVID infection compared to following a COVID vaccination. A report published in September in the CDC's Morbidity Mortality Weekly Report found an incidence of 150 cases of myocarditis per 100,000 patients. Again, 150 cases per 100,000 patients with COVID infection. This is 16 times higher than the incidence of myocarditis in those that did not have COVID infection, which was about nine cases per 100,000. So that's the background rate nine cases per 100,000. The incidence of myocarditis in males 16 to 19 in Israel following their second dose of an mRNA vaccine, was about 15 per 100,000, just slightly above the nine case per 100,000 baseline. But as you can see, the risk is still far lower of experiencing myocarditis after vaccination, than the incidence in those with COVID infection even in this age group, meaning that this myocarditis risk is no reason not to get the vaccine and is definitely not a reason not to get a third dose. In fact, the incidence of myocarditis after the third dose of vaccine in 16 and 19 year olds dropped to 6.5 per 100,000 a lower incidence than we saw after the second dose in that age group. The incidence following the third dose of vaccine is even lower for 12 to 15 year olds. As of December 15th, out of all the over 6,000 12 to 15 year olds in Israel that had received a third dose, there has been no reported cases of myocarditis following the third dose. So what's the bottom line? It is clear and compelling that people who have had their three doses of vaccine are at a much lower risk of being hospitalized and dying from COVID, including that with the Omicron variant. I will add that we have only limited data on the two dose issue with the J&J vaccine, and for many of you who feel like your vaccine orphans out there, what data we do have in a more limited way supports that that second dose that you receive is also very critical. We want and need much more abundant data on what's being experienced by those who received the J&J vaccine, and we'll do everything we can to try to get that information to you in the near future. So the bottom line message, Chris, these third doses are important. CDC needs to understand the importance also of sending the message of this importance by making the basic recommendation, this is a three shot vaccine.

**Chris Dall:** [00:43:04] So what about a fourth shot, as we discussed a few weeks ago, Israel is now administering fourth doses to those over 60, and the CDC recommends a fourth dose for the immune compromised, as you previously noted. Do you think a fourth shot is on the horizon here for older adults, or maybe additional age groups?

**Michael Osterholm:** [00:43:23] I think this really is unclear. And what I mean by that is the data are compelling that those who are immune compromised, even moderately so, do mount immune responses that we don't see after three doses in many cases. What I think is unclear is we can't continue to boost our way out of the COVID pandemic. It just won't happen. We already see the challenges we have right now with those individuals in the United States who have received the two dose approach, who we have strongly encouraged to get the third dose and have not. Over half of that population who are eligible have not gotten the third dose. They're not vaccine hostile. They're not vaccine hesitant in the sense that they've already been vaccinated with two doses. Why? And I think that it is going to be a major mistake if we think that we can vaccinate our way through a consecutive series of booster doses. What we have to look at is also how that plays out throughout the rest of the world. Imagine trying to vaccinate everybody in the world every six months. That's not going to happen. And so I think we are really at a point right now where I urge the those individuals who are immune compromised to get the fourth dose, and we're going to have to really study this very carefully. What will be our strategy going forward? Ultimately, again, we need vaccines that may provide more durable protection that will keep from having waning immunity become an important factor, and we'll have a wider breadth of protection against even new and yet undiscovered variants. So at this point, I think we don't need to continue to pursue a fourth dose approach as a country and, for that matter, around the world until we better understand what the implications are. Unless you are immune compromised and then I think at this point, this is a very important recommendation, and I urge that these individuals actually do receive that fourth dose.

**Chris Dall:** [00:45:31] So this brings us to our COVID query segment, and this week we have a question about natural immunity from Howard, who writes "In an op ed piece in The Wall Street Journal on January 27th, Dr. Martin Makary of Johns Hopkins faults the CDC's interpretation of data on natural immunity from infection and made the following statement, The CDC study and ours confirm what more than 100 studies on natural immunity have found: the immune system works. The largest of these studies from Israel found that natural immunity was 27 times as effective as vaccinated immunity in preventing symptomatic illness. Is Dr. Makary correct?"

**Michael Osterholm:** [00:46:08] Well, anyone who has listened to this podcast over time knows that, and I've made every effort to put forward a positive and hopefully affirmative message about what can be done, what needs to be done. You know, I've not been afraid to take on critical issues with honesty, but hopefully never with a sense of a gotcha kind of approach that we see so often today in our world of public information. But this is one case where I do have to provide context that I think is really important. You know, I have talked about the challenge over the course of the past two years and particularly the last year of living in a world of talking heads. I count myself one of them, so I'm pointing the finger at myself. But you know, we have a limited number of people who are very public, who are in the media who make very, you know, sometimes dramatic statements about what will or won't happen. They make claims that then no one ever goes back to find out. Did those claims ever really materialize? Were they right or were they wrong? If they were wrong, and you're wrong x times in a row, when do you actually add question to the credibility of those claims? You know, I've said time and time again, you can feel free to go back and look at my record. You know, I whether it's, you know, looking at the darkest days of the pandemic from a year ago, any number of issues, respiratory protection, et cetera, you know, we'll stay by what we've said. But I I just want to set the tone for Marty Makary's piece because Marty has been one of those talking heads out there, and he's very vocal about what he says. Well, here is a piece that Marty wrote of which I could find a number of other ones just like this. This is actually from February 18th, 2021 one year ago almost, published in The Wall Street Journal, and the title was "We'll All Have Herd Immunity by April." He said in large part, natural immunity from prior infection is far more common than can be measured by testing. And he went on to basically say that a crucial fact that was being ignored is that cases had just come down off of that high January peak because so many people were now protected. And he went on to claim, and I quote, "there is reason to think the country is racing towards an extremely low level infection as more people have been infected, most of whom have mild or no symptoms, there are fewer Americans left to be infected. At the current trajectory, I expect Covid will be mostly gone by April, allowing Americans to resume normal life." Heard that before? How well did that work out for him? It didn't. And, you know, Marty has been one of those people who has said consistently, you know, things like this that have not been challenged subsequently. And so I only put this out there because I think that this is unfortunate. And the fact of his January 26th piece in the Wall Street Journal, "The High Cost of Disparaging Natural Immunity to COVID" is very similar in keeping with what he did in this piece. He was wrong then, and he's wrong on this piece here. And what I mean by wrong is that it's not just putting forward data and then having that unknown be part of that data mix and just acknowledging that, but he takes a point of view and you'll find whatever data selectively support his point of view. And ignore data that clearly are compelling, that don't support that point of view. That is a form of bias that in our business and science is just unacceptable, simply unacceptable. And if you look at what he laid out in this piece trying to make the case that natural immunity, which I'll talk about in a moment because I don't know what natural immunity actually is, really is in fact so important that it's much better than being protected by the vaccine. And he basically has selectively picked the kinds of studies that would support this point of view. I, for one, am agnostic on this issue. I will take whatever kind of protection we can get. I just want to be able to describe it. I want to understand it, and I'll explain in a moment why that's so complicated. In the piece in The Wall Street Journal, he lays out the fact that there are these hundred studies on natural immunity have been found. Well, I got to tell you, we've all been looking for him. We've been combing everything we can. We can't find any hundred studies out there at all. I'd like to know what he's talking about. We also know that the largest of studies that they describe from Israel, which reported this natural immunity 27 times as effective as vaccinated immunity. I could go through and point out a number of serious flaws in this study. And this was sent out as a preprint last August and still not published. I wonder why that is. And had he really looked carefully at this study, the study design was such that it was a very selective study design where the group of people who are among the vaccinees versus the who were not were very different groups of people. And even in the analysis, you can't account for what that means. Why do people get tested? If I'm someone who has previously been vaccinated and I get ill and I think that maybe I could get infected, do I get tested more than somebody who's already had Covid, who now feels totally protected and doesn't go get tested if they have another mild illness? So the only point I want to make is is that at the outset, those data are largely meaningless. They're not helpful. They're just not helpful. And the point that he makes does not at all address that. So I discount what Marty has laid out here. And again, not because I have a point of view that I want, quote unquote natural immunity to be important or not be important. But for the sake of trying to understand what this is all about. Let me just share with you a sense of what we're talking about when we talk about the concept of immunity. It's very, very complicated. It is more complicated than rocket science. Trust me, it is. And I'm not an immunologist and I will never pretend to be one. But I sure try to know as much as I can about viral immunology, and I spend a lot of time talking to the viral immunologists, who I really believe understand as well as anybody what's going on. First of all, you have to understand the immune response. I don't know what natural immunity is. Epidemiologically, there's a term for natural immunity, meaning I got it from actually being infected by the infectious agent. But there's actually nothing unnatural about being vaccinated if the immune response is very similar to that of what you get, if in fact, you get infected by that infectious agent. So I just want to be clear on that. Somehow natural comes across as being a better type of immunity. If you could begin to understand the network of what happens in your body when you are insulted by an infectious agent or a vaccine, the pathogen or whatever antigen, the piece of the virus or bacteria that's in the vaccine is introduced into your body. Immediately, you have an initial reaction called an innate immune cells reaction. Innate immune cells basically are nonspecific. They go for anything that's foreign in terms of your body, and that is often a helpful response, an initial immediate response, but not sufficient to eliminate whatever that pathogen that infectious agent is. That's where you need basically the adaptive immune response, which is very specific. It has memory cells, it remembers, and that's where you actually start to see a then the division between what we call B cells and T cells. B cells are those that cells that make antibody that then can be brought to play with the antibody attaches to that foreign invader, which then allows T cells to engulf it. It's a whole number of things that begin to happen with this very complicated immune system. And the reason I bring this up is because this is one of the challenges we have today. We do not understand yet many of the aspects of what the immune response that is necessary to prevent infection or prevent severe infection. As I pointed out, right now, protection depends on the coordination of B cells and T cells. The antibody response includes total antibody, neutralizing antibody, binding antibody. So when people say, well, do you have antibody or not? You know, what kind? What does it mean? Do you have memory B cells? Do you have memory T cells that can quickly remember that that was a bad thing you didn't want to have? And because either previous infection or vaccine related immunity kicks right in. At this time, there is no specific antibody test or antibody threshold that can clearly determine an individual's risk of infection or serious illness. So when I hear people talking about this issue about which you want natural or otherwise vaccine immunity, you know, we don't even know what it means yet. We don't understand. We do not have a quota of protection, which is the definition of if you have this much antibody, you have this many T cells, then you have a level of protection. And we do have those largely for childhood immunizations, for other immunizations. If you have this kind of level of antibody of this type, we know that you have a very high level of protection. We don't understand today necessarily about waning immunity. For some infectious agents, we see waning immunity, a sense where you're protected for some time. Today if one were to become infected with norovirus infection, that virus infection that causes a severe GI disorder. You know, we can show that you have some immunity for up to two years after that infection against future ones. But then you wane. The immunity wanes and you're vulnerable again. We don't understand what that means, whether it's from a vaccine or from natural infection. Then we don't understand among those who have actually been infected, what role does the seriousness of the illness play in that immune response? And there are some data today that support the more seriously ill you are, the more likely you are to mount a much more vigorous immune response. If you've had monoclonals that may dampen the immune response you get, so now you have to look at, well, wait a minute now you had infection, but now you had monoclonals. What does that mean? So I think that it's not a simple situation of being able to just go in and define this is immunity and somebody wants to do that. So when I watch these debates in Congress between Tony Fauci and Rand Paul and others about, you know, natural immunity, it's so unfortunate because it's so much more complicated than that. And I know Tony knows that he's a world expert in this area. But to hear people try to basically distill this down, do I have antibody from my previous infection? Is it more protective or not? Well, let me just summarize some of the better studies that have been done. There's not hundreds of them, as Marty said, just simply not true. If you look at one that was done from January to September of 2021 in nine U.S. states looking at both Alpha and Delta, unvaccinated people with previous infection were over five times more likely to have a positive COVID test compared to vaccinated people with no previous infection. So meaning that if I had previous infection but unvaccinated, I was more than five times more likely to actually develop infection. Well, that would suggest the vaccine was more protective and it was against Alpha and Delta. Again, you'd have to look at over time what would waning immunity mean, so you have to adjust for that. If you look at from May and June of 2021 in Kentucky against Alpha variant among people with a previous infection, unvaccinated people were 2.3 times more likely to be reinfected compared to fully vaccinated people. Again, people with previous infection but unvaccinated were2.3 times more likely to be reinfected compared to vaccinated people. Again, what the data are supporting here is that the vaccine related immunity appears in these to be superior to what we see with having been infected and develop immunity from that infection. Well, there's a series of other studies here, and it's not all straightforward. I'll be the first to admit that. A study from May 30th to June 5th, one in California and one in New York, the same time periods both dealing with Alpha variant. In the California study, Covid-19 cases were 2.5 fold higher among unvaccinated people with the previous diagnosis, compared to vaccinated people with no previous diagnosis. So again, here you now had individuals basically with reinfection. COVID-19 cases where 2.5 fold higher among unvaccinated people with a previous COVID infection compared to those with no previous diagnosis but vaccinated. If you look at the New York data, COVID cases were 1.6 times higher among unvaccinated people with a previous diagnosis compared to vaccinated people with no previous diagnosis. Again, additional studies supporting the superiority of the vaccine related protection. If you look from two other studies done from November 14th to November 20th, both again in California and New York, but this time against Delta, now we see something different. Covid cases were three point fold lower among unvaccinated people with previous diagnosis compared to vaccinated people with no previous diagnosis just the reverse. Well, guess what? In New York, the same thing happened at the same time against Delta. So here we have these two different variants. And in this case, it does appear that COVID cases, for example, in New York in November of 2021, were 4.7 fold lower among unvaccinated people with a previous diagnosis, compared to vaccinated people with no previous diagnosis. What this all really comes down to is we're still learning, and it is one where we should be acknowledging the contribution to protection that in fact, we get from having previously been infected. But that's not what you want, how you want to get your protection because you run the risk every time of getting that kind of protection of also having a serious, life threatening illness, why the vaccine is superior. If one looks at what happens with immunity from the various doses here, a new report literally just in the last month from the Imperial College in London, estimates that the risk of reinfection with Omicron variant is 5.4 times higher than that of the Delta variant. This implies the protection against reinfection by Omicron afforded by past infection may be as low as 19%. So these are people in England who are not vaccinated, who actually were reinfected with Omicron, 5.4 times higher risk with Omicron than with Delta. So now the variants play another role. If one looks right now, what's happened in the United Kingdom? They reported out this past week that one tenth of all of their COVID cases are reinfections, meaning people who have previously been infected not yet vaccinated again. One tenth of all their cases are reinfections from people previously infected. So I just point this out because it really begs the question of what is the correlative protection? What do we need to know to know how protected we are? So Marty's point about the 27 fold is just plain wrong, but he's been wrong in the past too in a big way. If you look at where I sum this up, the immune response following vaccination and infection is very complicated. It is complicated. We're still trying to understand what it means. Clearly, both infection and vaccination play a role in immunity and clinical outcome, and it is clear that that clinical outcome is going to also be important with the amount of time since you were infected and the amount of time since you were vaccinated. How many doses of vaccine you had, potentially how serious your illness was and which variant you're interfacing with. So there's no number here. You just can't say you're X percent or Y percent likely to be protected or not. It's very complicated. So when I conclude that SARS-CoV-2 immunology in humans is really more complicated than rocket science, I mean it. I really mean it. And I think that that's the message we have to get across. So we have to continue to study immunity from infection. We have to continue to understand immunity from vaccines. You just heard me a moment ago, talk to the fact that I don't think we can keep boosting our way out of the issue with vaccines. If, in fact, waning immunity is important. So at this point, he's not right. Ok. Definitely. It is important to recognize and to understand the role that we see with infection and protection, just as it is with vaccination. Right now, I'd rather take my gamble any day with getting protection from a vaccine than getting protection from an infection that ultimately could kill me.

**Chris Dall:** [01:04:13] And now it's that time of the podcast where we have a lighter moment. So Mike, where is our latest beautiful place submission from?

**Michael Osterholm:** [01:04:22] Well, thanks, Chris. I love these moments where we're able to talk about very personal places and what they mean. And what I'm going to share with you today is a place and the inward Pacific Northwest and it comes from Ed. He wrote, "Dear Dr. Osterholm, having listened to your thoughtful, informative podcast ever since they began, I wanted to share my beautiful place with you via photos I took a week ago and some more from September. These acres of conifer forest surrounding my home here in the island Pacific Northwest have long been a sanctuary for the bear and cougar and all the other wildlife whose tracks I see in the winter snow and the soft earths of spring. For the bald eagles and the owls and the hawks who soar high overhead. The challenges of our time still intrude here, even with wildfires each summer, and a local population that remains mostly unvaccinated even now. But these woods have been my sanctuary, too, as I've walked and worked and meditated beneath the big pines, fir and larch that were just saplings during the influenza pandemic of 1918. They were here long before me, and I'm doing what I can to give them a chance to still be standing after I'm gone." Well, thank you so much for your very, very kind comments, your very thoughtful picture that you painted in the minds of all of us that will be clearly supplemented by looking at these beautiful pictures. I've had a chance to look at them and they are really special. So I wish you peace and thank you very, very much for sharing this beautiful piece with all of us.

**Chris Dall:** [01:06:02] And for our listeners out there, if you want to send us your beautiful place submission, please email us at osterholmupdate@umn.edu. So Mike, what are your take home messages and closing thoughts for today?

**Michael Osterholm:** [01:06:15] Well, Chris, I know I packed a lot of information on this podcast, and I'm sorry that it's so dense for some of you who find this hard to listen to. Hopefully, the actual transcript will be more helpful, but it was really an important episode from the standpoint of clarifying some of the challenges that we have right now, trying to adjust what kind of glasses we should have on our nose, what color they should be, and how high the magnification should be. And let me start out by just saying, number one, we are not done until we're all done, and I don't know when that's going to be. I want so badly to be able to proclaim the pandemic is over. I want so badly personally to be able to regain a part of my life that I've lost for the last two years, both in physical and in psychological terms. I want to go back to my travel. I want to go see the world. You know, I was on the Today show in New Zealand earlier this week, a morning talk show similar to ours here in the United States. And I could only remember my wonderful day at the Occidentale Bar in Auckland. I want to go back there so badly, so I want to have us move on, but I'm a realist. Just as I said a year ago to you at this time when it was not popular that I thought the darkest days of the pandemic could be ahead of us. I don't know what the future is going to bring. We've got to move on. We can't continue to live our lives in fear, we have to be responsible. So I continue to fear myself that we will find this somewhat quiet time, at least nothing else based on the baseline discussion I said today, it might be a time that a year ago we would have thought was a tragedy. Today we accept it, but I worry that we're going to get to that and forget about all the other preparedness that we need to continue to do. We need to get more people vaccinated. We need to be able to get better vaccines. We need to improve dramatically our testing. We need to deal with the shortage of health care workers around the country, around the world for that matter. How do we supplement their training potential, their salaries, etc. We need to work on the drug availability. How do we make these drugs quickly available to those who are infected? I don't want any of that to stop. We have to continue to do that, and there will be a tendency when we're all so tired, we'll just want to walk away from it. The second point I can't say this any more clearly. I feel like a broken record. Vaccines, vaccines, vaccines. I've shared so much data with you today, clearly clearly establishing the power of these vaccines to reduce serious illness and hospitalizations and most of all, deaths. So I'm no realist. Why we haven't got more people vaccinated is complicated and not just in this country. It's around the world. But that doesn't mean we give up. We have to keep working. And finally, I worry that this unfortunate debate about natural immunity is akin to arguing about how many angels can dance on the head of a pin. Immunity is immunity. How we acquire it surely can have an impact on how well it works, how long it works. That's all true, but we need to get off this debate about I'm either for natural immunity or I'm against it. We in public health have to acknowledge that previous infections do provide some immunologic protection, but you can't assume that it's necessarily as robust as vaccination or that it too has long term protection that vaccines might not offer. We have a lot more to learn here, and I wish we could do it in a non-judgmental, open way to say, how can we best understand our protection? I'll start off again, first of all, saying we've got to make three doses the actual standard. Fully vaccinated is three doses, if you're immune compromised four doses. I will also say right at the outset that we should be trying to understand what kind of immunity we get from a previous infection. I think over the course of the next few months, we're going to see more data coming out about possible quotas of protection, meaning what level of certain kinds of immune response do you have to have to have a good indication you may be protected against future infection or at least severe illness? Well, if we have that, then we can start to also mark over time, what does it mean for somebody to be protected? Imagine right now with flu vaccine, we never make the assumption you're protected more than a year. You may have some, but we don't assume that we vaccinate you every year. Nobody goes and measures antibody to say, Well, are you protected this year or not? Then we'll vaccinate you. We're going to have to get into that mindset with this disease and what happens. So I think those three pieces, we're not done until we're done. Vaccines, vaccines and vaccines. And we got to get over this unfortunate debate about natural immunity. Well, this leads me to my final moments here. The part of the podcast, frankly, I think I love the very most. And and for some of you, I know this is not in keeping with the scientific data you're looking for. For others of you ,this is your relief. This is your dessert. I have again gone back to the goodies, but oldies and picking out one that actually may be the most memorable of all of my lifetime songs because it was one of my very first. I can still tell you as a young boy in front of my black and white TV in Waukon, Iowa every Thanksgiving weekend watching the famous Wizard of Oz. Man, that was something. And then when I had a classmate that got one of the first color TVs in our town to actually be able to watch it go from black and white to color. Oh my. That was an experience second to none. So what I've picked is a song that I used previously on November 25th, 2020 Episode 33: A Thanksgiving Perspective. I'm sure by now you know what that song is "Over the Rainbow." It's a ballad composed by Harold Arlen with lyrics by Yip Harburg. It was written for the 1939 film "The Wizard of Oz" and was sung by actress Judy Garland in her starring role as Dorothy Gale. It won the Academy Award for Best Original Song. It became Garland's signature song. As you know, about five minutes into the film, Dorothy sings the song after failing to get Auntie Em, Uncle Henry, all the farmhands to listen to her story of an unpleasant incident involving her dog, Toto and the town's spinster Miss Gulch. Auntie Em tells her to find yourself a place where you won't get into any trouble. This prompts her to walk off by herself, musing to Toto someplace where there isn't any trouble. You suppose there is such a place, Toto there must be. It's not a place you can get to buy a boat or buy a train. It's far, far away. Behind the moon, behind the rain, at which point she begins singing. Today, I hope we can feel that place. We need it. For those that are tired for those that are confused. For those that might even be angry, I hope today you can really feel what it's like to be over the rainbow. "Somewhere over the rainbow, way up high, there's a land that I heard of once in a lullaby. Somewhere over the rainbow skies are blue, and the dreams that you dare to dream really do come true. Someday, I'll wish upon a star and wake up where the clouds are far behind me. Where troubles melt like lemon drops away above the chimney tops. That's where you'll find me. Somewhere over the rainbow, bluebirds fly, birds fly over the rainbow. Why then? Oh, why can't I? If happy little bluebirds fly beyond the rainbow, why, oh why can't I?" Over the rainbow. Well, thank you all again for being with us this week. I can't tell you how much we appreciate all your feedback. I also just want to remind all of us that this is not just an esoteric issue of numbers. You know this, but it deserves reminding. These are our moms and dads or grandpas and our grandmas, our sons and our daughters, our friends, our neighbors. I personally, in the past several weeks have had several people I know who have died of COVID more than I probably had in the past six months. That's a stark reminder of what this does. It reminds us of the pain. So thank you again for being with us. And I want to encourage you one last time, please. This week, do something for someone, be kind, something you wouldn't have otherwise done. I promise you, it'll make them feel very special. And you know, it'll make you feel special. Be kind. It's hard to do sometimes. Oh my, it's hard to do. But when you do it, so be safe. Be well. We'll be back next week. I know some of you have been commenting on my voice lately. I have become progressively hoarse over the last months. Talking way too much so. But we're going to try to struggle through this podcast each week. You know, of all the things I can do to rest my voice not doing this podcast won't be one of them, so I'll try to try to get through. And so thank you again to the podcast group. Chris, thank you. And most of all, to all the listeners out there. Thank you. Be safe and be kind.

**Chris Dall:** [01:16:06] Thanks for listening to this week's episode of the Osterholm update. If you're enjoying the podcast, please subscribe, rate, and review, and be sure to keep up with the latest COVID-19 news by visiting our website CIDRAP.umn.edu. This podcast is supported in part by you, our listeners. If you would like to donate, please go to CIDRAP.umn.edu/donate-now. The Osterholm update is produced by Maya Peters, Cory Anderson, Angela Ulrich, Meredith Arpey, and Sydney Redepenning.